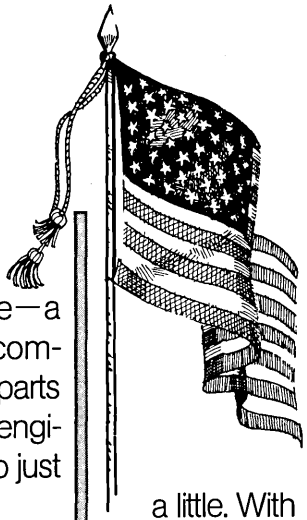
DATAMATION '73®

November

DISPLAY TERMINAL SURVEY

also... what's really wrong with software, certification
pros and cons, security vs. performance tradeoffs...

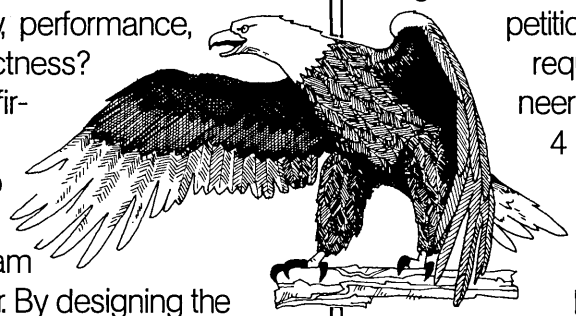
How the ADM-1 Terminal became the American Dream Machine



As an OEM or end user, what would you want in the ultimate display terminal? All the standard cliches—low cost, reliability, performance, compactness?

Affirmative?

So we put the dream together. By designing the entire circuit on a *single board*—not 3 or 33 separate boards. We used quick-service socketed IC's. Components that provide 5000 hours of mean-time-between-failures (250% better than the pack). A microcontroller with a 600 nsec cycle time—a full generation ahead of competition. Spare parts requirements engineered down to just 4 packages.



So the dream became reality. Priced down in the under $2000 range.* With a full 53-key TTY keyboard, 960 or 1920 characters on a 12" screen. Baud rates from 110 to 9600. Full editing. Dual intensity protect mode. And it's 100% American made.

So dream a little. With the Lear Siegler ADM-1, you can afford twice the terminal capacity.

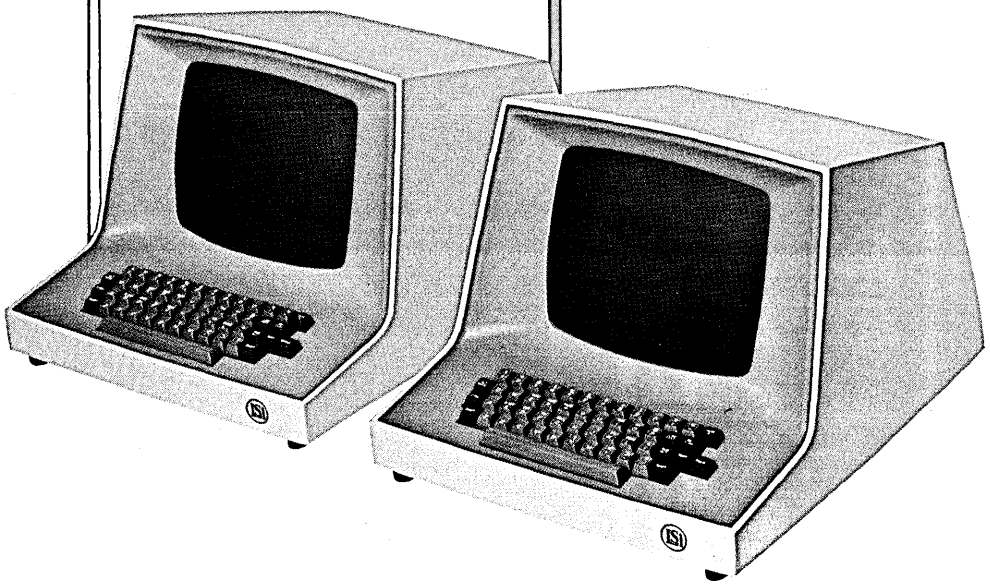
*OEM Pricing Available

LSi

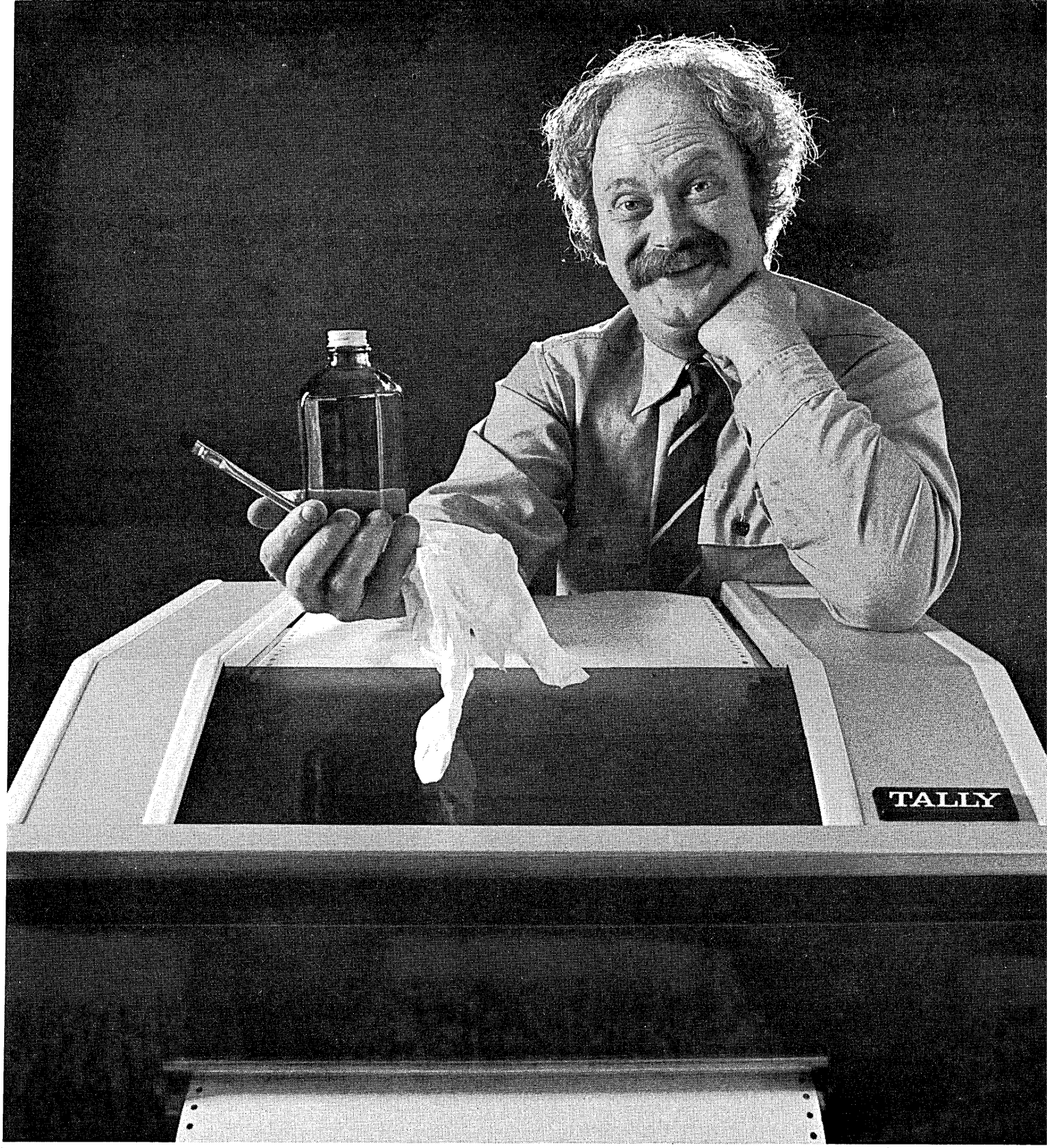
LEAR SIEGLER, INC.

ELECTRONIC INSTRUMENTATION DIVISION

714 N. Brookhurst St.
Anaheim, Calif. 92803
(714) 774-1010



CIRCLE 1 ON READER CARD



How to maintain the Tally printer

Just clean it. Occasionally—like every month or so. Easy. No lubrication. No adjustments. No grief.

Our elegantly simple print mechanism is so reliable that we guarantee it for one full year. Our original 1000-hour predicted MTBF now looks a little conservative.

No wonder the Tally printer is becoming the first choice of computer manufacturers and users who demand reliability. If you're looking for an impact printer that can churn out 200 lines per minute day in and day out without fuss or failure, see your Tally man, now.

CIRCLE 4 ON READER CARD

TALLY®

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

WHEN IT COMES TO COM, YOU CAN SPEND A LOT OR YOU CAN SPEND A LITTLE.

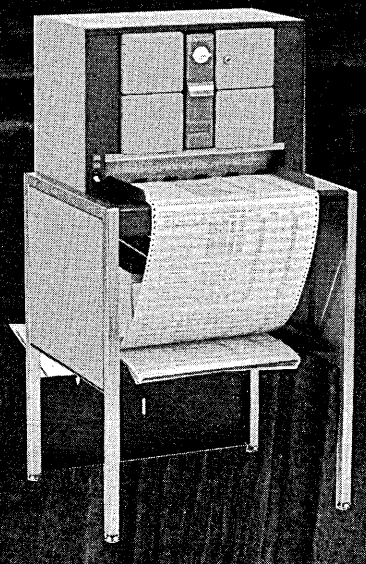
If money is no object, then get the best computer output microfilm system you can buy.

But if money is an important consideration, then get the most for your money. A Bell & Howell Inter/COM Microfilm Recorder.

The Bell & Howell Inter/COM unit films continuous forms onto microfilm at 5,000 lines per minute. To give your operation all the benefits of computer output microfilm. So data can be stored in less space. With faster retrieval. And more efficient distribution.

Our Inter/COM recorder also has a built-in hand-feed shelf and stacker. This permits double-duty operation, since the unit will now record all your legal-sized documents, too.

The Bell & Howell Inter/COM Microfilm Recorder. It's the lowest cost fanfold recorder available. Just call your Bell & Howell representative. And ask him how economical it can be.



BUSINESS EQUIPMENT GROUP
6800 McCormick Road Chicago, Illinois 60645

BELL & HOWELL

CIRCLE 13 ON READER CARD

DATAMATION®

NOVEMBER, 1973
volume 19 number 11
This issue 120,632 copies

60 **Software: A Qualitative Assessment, or The Man in the Middle Speaks Back**
GERALD H. LARSEN. A refutation of the views of Barry W. Boehm as heard in our May issue.

71 **Alphanumeric Display Terminal Survey**
RICHARD A. MC LAUGHLIN. A short discussion of the types of products available, with the specifications of 79 lines of interactive terminals from 54 manufacturers.

97 **Certification: A Suggested Approach to Acceptance**
ROBERT N. REINSTEDT and RAYMOND M. BERGER. Any attempt to institute a certification program before a firm foundation of job analyses and qualifying factors is laid, will be doomed to failure.

101 **Certification—Evolution, Not Revolution**
JOHN A. GUERRIERI, JR. Contrary to the beliefs of Reinstedt and Berger, highly reliable certification testing has been in effect for a decade. Evaluation and upgrading are a continuous process.

110 **Security vs. Performance**
DENNIS R. CHASTAIN. Scrambling devices, identification checks and subversion tests are all part of a security environment.

118 **Genesis, Release 2.5**
MICHAEL L. COLEMAN. The Creation . . . It was good.

123 **ACM '73**
ANGELINE PANTAGES. The ills of statewide computing networks, virtual system benchmark tests, data base systems, and "cash cards."

134 **News in Perspective**

ANTI-TRUST 134
INTERNATIONAL 138
RETAILING 142
PRIVACY 148
WALL STREET 151
COMMUNICATIONS . . 153
EDUCATION 153
BENCHMARKS 155

187 **The Forum**
Dick Brandon warns that computer market dominance should not be curbed by an arbitrary breakup of IBM.

Also . . . The time has come to standardize the diagnostic and error messages in COBOL and FORTRAN.

About the Cover
The design by our art director is based on a CRT's dot matrix. Photographer Tom Mareschal provided the multi-lens view.

departments

Calendar 13
Look Ahead 17
Letters to the Editor 25
News in Perspective 134
Hardware 158
Software & Services 164
Literature 168
People 173
Books 179
Index to Advertisers 182
The Forum 187

DATAMATION®

EDITORIAL STAFF

Editor	Robert B. Forest
Articles Editor	John L. Kirkley
International Editor	Angeline Pantages
Communications Editor	Phil Hirsch
Technology Editor	Richard A. McLaughlin
Industry Editor	W. David Gardner
Products Editor	Michael William Cashman
Copy Editor	Merrill Press Cherlin
Calendar Editor	Carol A. Constantian
Letters Editor	Angela V. Smith
News Editor	Tom McCusker
Bureau Managers	
San Francisco	Edward K. Yasaki
Los Angeles	Edith D. Myers
Washington, D.C.	Phil Hirsch K. Endres
New York	Angeline Pantages
New England	W. David Gardner
Correspondents	
Minneapolis	James K. Johnson
Southwest	Robert F. Alexander
Europe	Pearce Wright
Australia	Frederick A. Bland
Editorial Advisor	Robert L. Patrick
Technical Advisor	Lowell Amdahl
Contributing Editors	Paul Armer, Howard Bromberg, Philip H. Dorn, Louis B. Marienthal, Ray W. Sanders, Milton R. Wessel, F. G. Withington

EDITORIAL OFFICES

Headquarters: 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Phone (213) 559-5111. **Eastern:** 35 Mason St., Greenwich, CT 06830, (203) 661-5400. Lakeside Office Park, 599 North Avenue, Wakefield, Mass. 01880, (617) 246-2121, 9805 Singleton Dr., Bethesda, MD 20034, (301) 530-7271. **Southwestern:** 2711 Cedar Springs, Dallas, TX 75201, (214) 744-0161. **Western:** 61 Renato Ct., Redwood City, CA 94061, (415) 364-3171. **Foreign:** 65, Hill Road, Chelmsford, Essex, England, 64/90 Blues Point Rd., McMahons Point, NSW 2060, Australia.

GRAPHIC DESIGN & PRODUCTION

Art & Production Director	Cleve Marie Boutell
Production Manager	Marilee Pitman

CIRCULATION

35 Mason Street, Greenwich, CT 06830

Circulation Director	Suzanne A. Ryan
Marketing Research Director	Douglas De Carlo
Publisher	James M. Morris

Circulation audited by Business Publications Audit BPA

Member ABP American Business Press, Inc.

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

DATAMATION is circulated without charge by name and title to certain qualified individuals who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $18 annually in the U.S. and Canada. Reduced rate for qualified students. Foreign subscriptions are available for £12.50 or for the equivalent of $30 U.S. in most West European currencies. Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA13QT, England. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, OH and Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000, Greenwich, CT 06830.

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

This is the only computer access terminal that gives you check cashing, credit authorization, data capture, and electronic funds transfer.

AMCAT I. The only one.

AMCAT I performs these four functions not now available to you in a single terminal.

Credit Authorization. Positive credit approval in seconds. It's an OCR quality imprinter. Reads embossed characters or magnetic stripe cards. And offers numerical display and message indicators.

Electronic Funds Transfer. Following a business transaction, funds are automatically transferred from buyer to seller, with complete privacy and confidence. Banks can now offer complete funds transfer service without paper.

Data Capture. During credit approval, all information is transmitted to the computer to speed billing and processing. Also, AMCAT I can be used for controlling inventories and paying bills while continually providing updated information on how a business is being run.

Check Cashing. AMCAT I allows checks to be verified at the bank and approved . . . providing security to the merchant and the customer. And it expands the number of locations where checks can be accepted.

There's a lot more you should know about our new AMCAT I. So before you buy a terminal that doesn't do the whole job, let us show you one that does.

Data Systems Division,
29100 Aurora Road, Solon, Ohio 44139.
Tel: (216) 248-7930

AMCAT I.
The only one.

ADDRESSOGRAPH MULTIGRAPH®
DATA SYSTEMS DIVISION

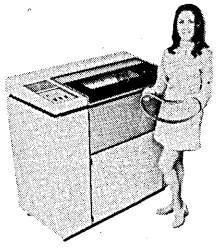
Model 2230

remote-batch, reservation, and intelligent terminal systems, as well.

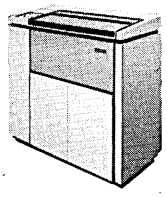
The Model 2230 is the first of a whole new family of low cost, 2200 Series printers. Simplify your new system with "the simple printer" from Data Products Corporation, the largest independent manufacturer of line printers.

Contact us today!

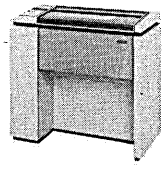
And here's our complete line of printers, simply stated:



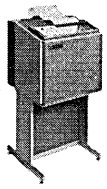
Model 2550: 132 columns. Speeds of 1200 or 1500 lpm. Uses our new, friction-free, horizontally moving Charaband print font. Ideally suited for high-volume EDP applications.



Models 2440, 2470: 132 columns. Speeds from 700 to 1800 lpm. Use in high performance remote systems and data processing applications.



Models 2410, 2420 - Trouble-free design. 132 columns. Variable speeds from 245 to 1110 lpm. Use in small/medium-sized computers and data communications terminals.



Model 2310 - Compact, low cost, 80 columns. Speeds from 356 to 1110 lpm. Use on-line with small computers or off-line with tape readers, card equipment, and terminals.

Model 2910: Speeds from 356 to 1110 lpm. 80 columns. Militarized teleprinter for ruggedized applications, designated TT-624 (V) 1/UG. "MIL-spec" qualified for shock, vibration and RFI.

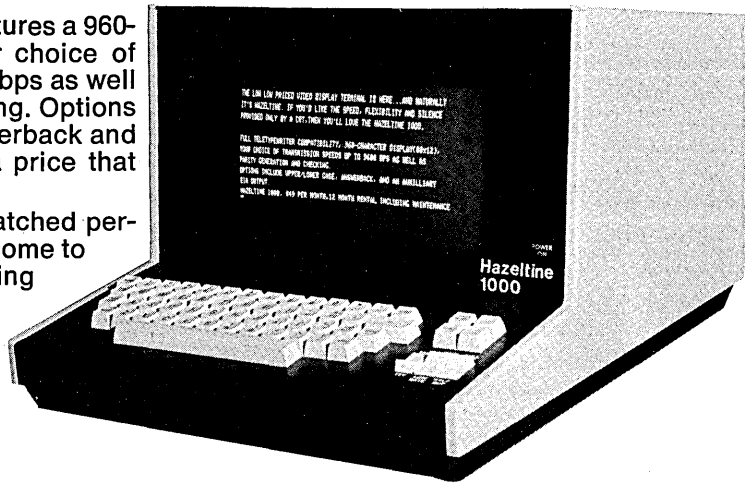
The Leaders in printer price/performance

DATA PRODUCTS

We would suggest you compare the Hazeltine 1000 with other teletypewriter-compatible CRT Terminals at its price* ...if there were any.

The Hazeltine 1000 Terminal features a 960-character display (80x12), your choice of transmission speeds up to 9600 bps as well as parity generation and checking. Options include upper/lower case, answerback and an auxiliary EIA output. All at a price that fits easily into your budget.

And of course you get the unmatched performance and reliability you've come to expect of every product bearing the Hazeltine name. For an on-site demonstration, call your Hazeltine representative.



Hazeltine 1000 * $49 mo.

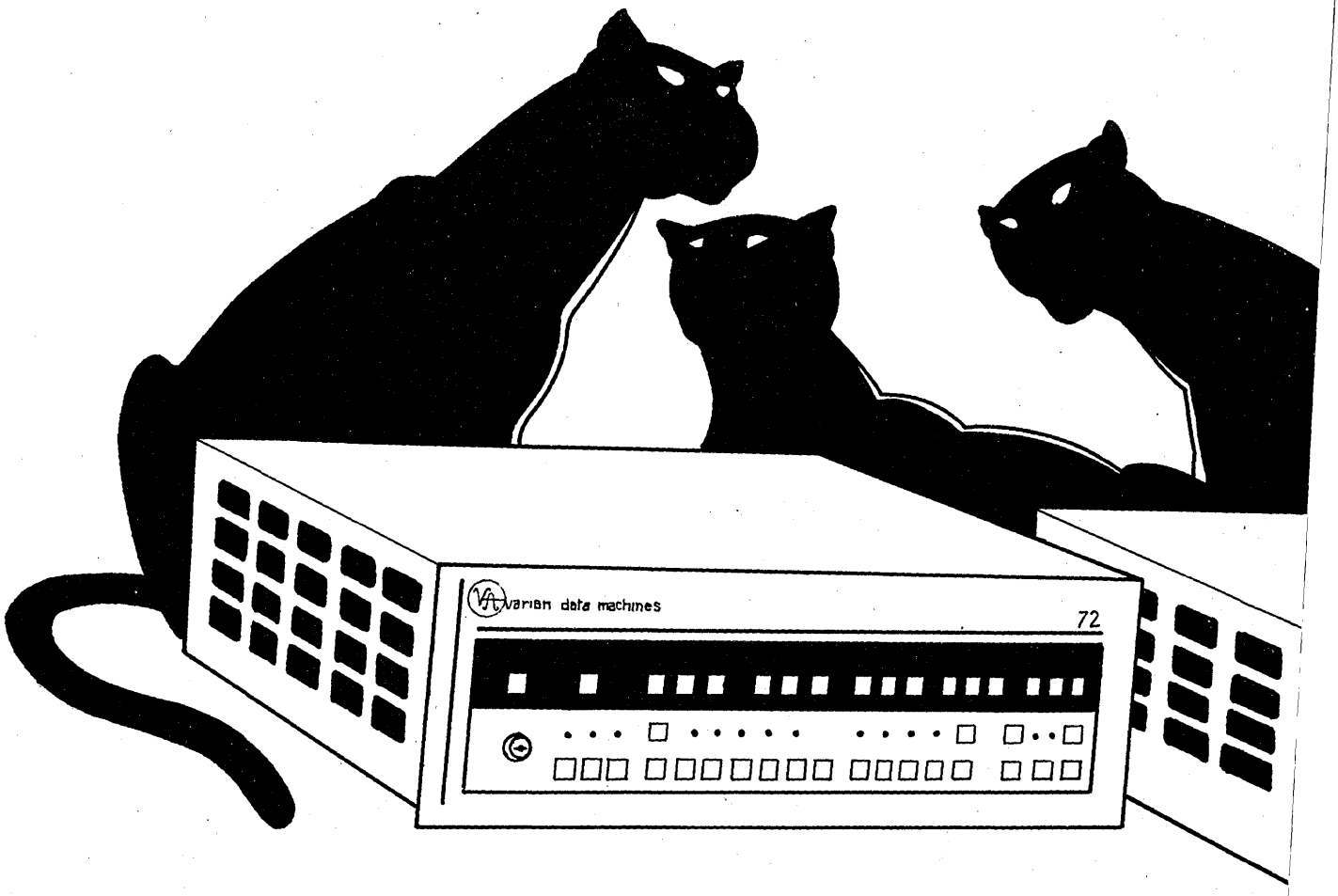
12-month rental, maintenance included.

Hazeltine Corporation COMPUTER PERIPHERAL EQUIPMENT GREENLAWN, N.Y. 11740 (516) 549-8800 TELEX 96-1435

EAST: NEW YORK (212) 586-1970 ☐ BOSTON (617) 261-5867 ☐ EDISON, N.J. (201) 828-5678 ☐ PHILADELPHIA (215) 676-4348 ☐ PITTSBURGH (412) 343-4449
WASHINGTON, D.C. (703) 979-5500 ☐ ROCHESTER (716) 852-6570
MIDWEST: MINNEAPOLIS (612) 854-6555 ☐ CHICAGO (312) 986-1414 ☐ CLEVELAND (216) 734-5363 ☐ DETROIT (313) 355-3510
SOUTH: DALLAS (214) 233-7776 ☐ ATLANTA (404) 252-2045 ☐ GREENSBORO, N.C. (919) 855-0307 ☐ HOUSTON (713) 783-1760 ☐ ORLANDO (305) 423-1201
WEST: SAN FRANCISCO (415) 398-0686 ☐ DENVER (303) 770-6330 ☐ LOS ANGELES (213) 553-1811 ☐ SEATTLE (206) 242-0505
IN CANADA: CAE ELECTRONICS, LTD. (514) 341-6780
FOR WORLDWIDE SALES INFORMATION CALL: (516) 549-8800

HAZELTINE AND THE PURSUIT OF EXCELLENCE

Introducing the Varian Family of Mini Killers.



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

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

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

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

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

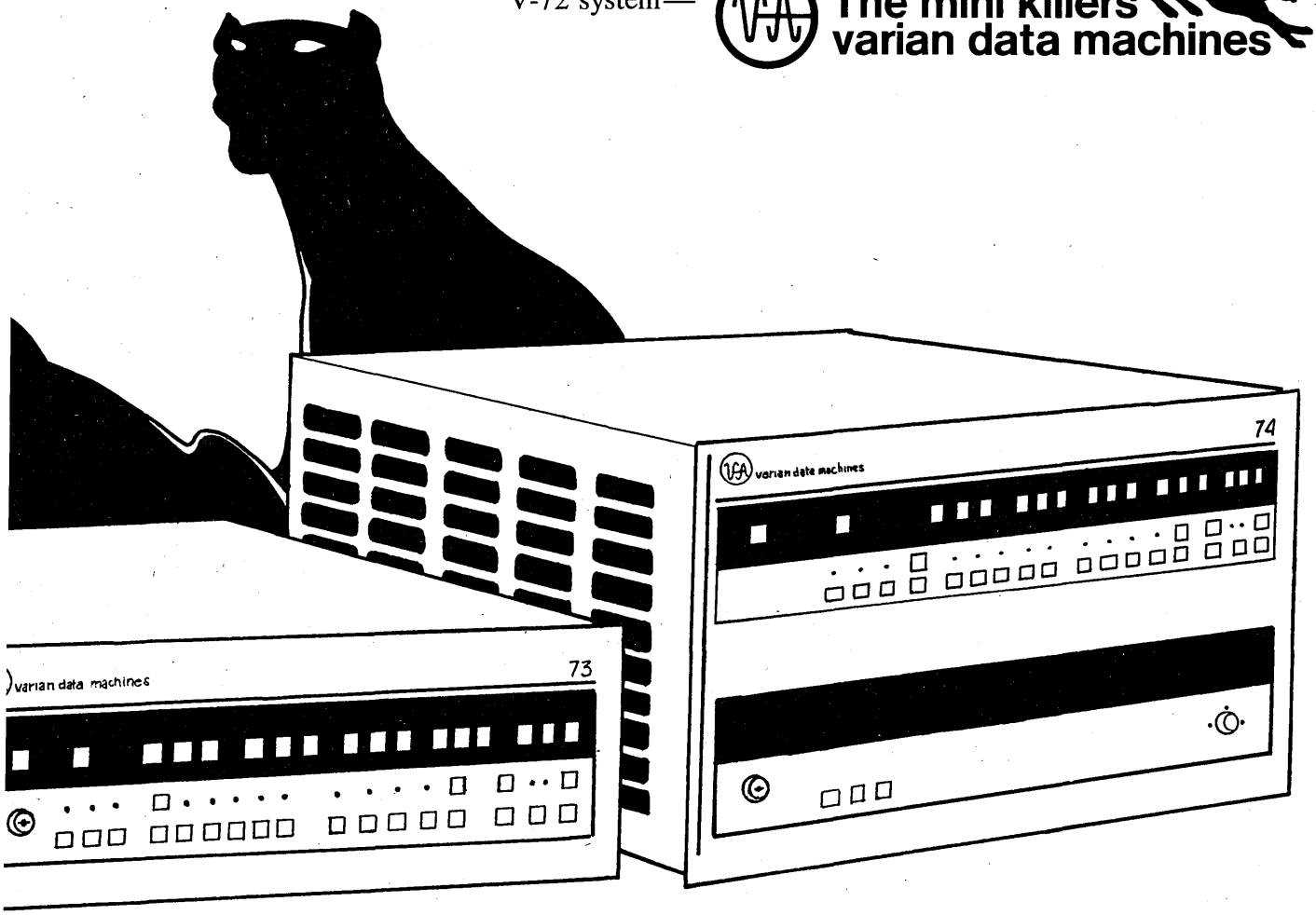
Building blocks that make our systems not only easier to understand, but easier to configure. It boils down to getting a system tailor-made to your own needs at off-the-shelf prices. Invest in only what you need technologically at the time. And when your needs change, invest in more capability to upgrade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

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

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

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

The mini killers
varian data machines



Now a Single Documation Reader for All Three

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

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

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

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

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

Documation. Our name tells you what we stand for.

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

CIRCLE 21 ON READER CARD

Calendar

DECEMBER

Fourth Conference on Computer Audit, Control, and Security, Dec. 3-5, Chicago. The focus of the program, sponsored by the Institute of Internal Auditors and Automation Training Center, will be "the integrity of information systems using computers." Topics include: control, audit, and security of on-line and data base oriented business systems; computer fraud; system development appraisal; and the use of the computer in auditing. Fee: $270. For registration information contact: D. Eugene Shaeffer, The Institute of Internal Auditors, 5500 Diplomat Circle, Orlando, FL 32810. For program information contact: Harold Weiss, Automation Training Center, Newton Bldg., Reston, VA 22090.

Data Network Design Course, Dec. 3-5 (Dallas) **Feb. 11-13** (New York), **Mar. 18-20** (San Francisco). This American Management Assns. course is geared to data communications managers, senior systems analysts, network specialists, senior programmers, and other computer and systems professionals directly concerned with the design or on-going administration of data communications systems. Fee: $410, members; $470, others; discounts for company teams. Contact: AMA, 135 W. 50 St., New York, NY 10020.

National Transportation Forum and Exhibit, Dec. 4-5, Washington, D.C. "Interfacing Transportation Data Systems" is the theme of this year's forum, with exhibits, of the Transportation Data Coordinating Committee. Representatives from government, legislative, shipper, carrier, and university communities will make presentations on requirements for the future, on progress in the application of modern technology to transportation data handling functions, and on new advances in communications technology. Fee: $65. Contact: TDCC Headquarters, 1101 17 St., N.W., Washington, DC 22036.

IEEE Conference on Decision and Control, Dec. 5-7, San Diego. Topics include: control and decision-making under uncertainty; optimization; control of large-scale systems; linear and nonlinear system theory; distributed-parameter system theory; adaptive and learning systems; pattern recognition and feature extraction; automata theory; and applications of system techniques to such fields as data processing, energy management, health care systems, telecommunications policy, transportation planning, education, criminal justice, and economic systems. Fee, including Proceedings: $40. Contact: Robert C. Kolb, Naval Electronics Laboratory Center, Code 3300, San Diego, CA 92152.

First Annual Symposium on Computer Architecture, Dec. 9-11, Gainesville, Fla. Sponsored by the IEEE Computer Society, the ACM, and the Center for Information Research, this symposium will consist of technical sessions on: system architecture, multiprocessing systems, parallel processing, software and hardware, fault-tolerant design, computer architecture education, modular design and multiprogramming, and computer description languages. Fee: $30, members; $40, nonmembers. Contact: J. Lipovski, 229 Larsen Hall, Univ. of Florida, Gainesville, FL 32601.

National Conference of the College and University Systems Exchange (CAUSE), Dec. 10-12, New Orleans. The theme of this conference on administrative information systems is "A Future Look at Information Systems in Higher Education: Yesterday's Solutions Are Tomorrow's Problems." Fee: $50, members; $60, nonmembers; subtract $5 for payment before Dec. 1. Contact: Charles R. Thomas, CAUSE, 737 29 St., Boulder, CO 80303.

JANUARY

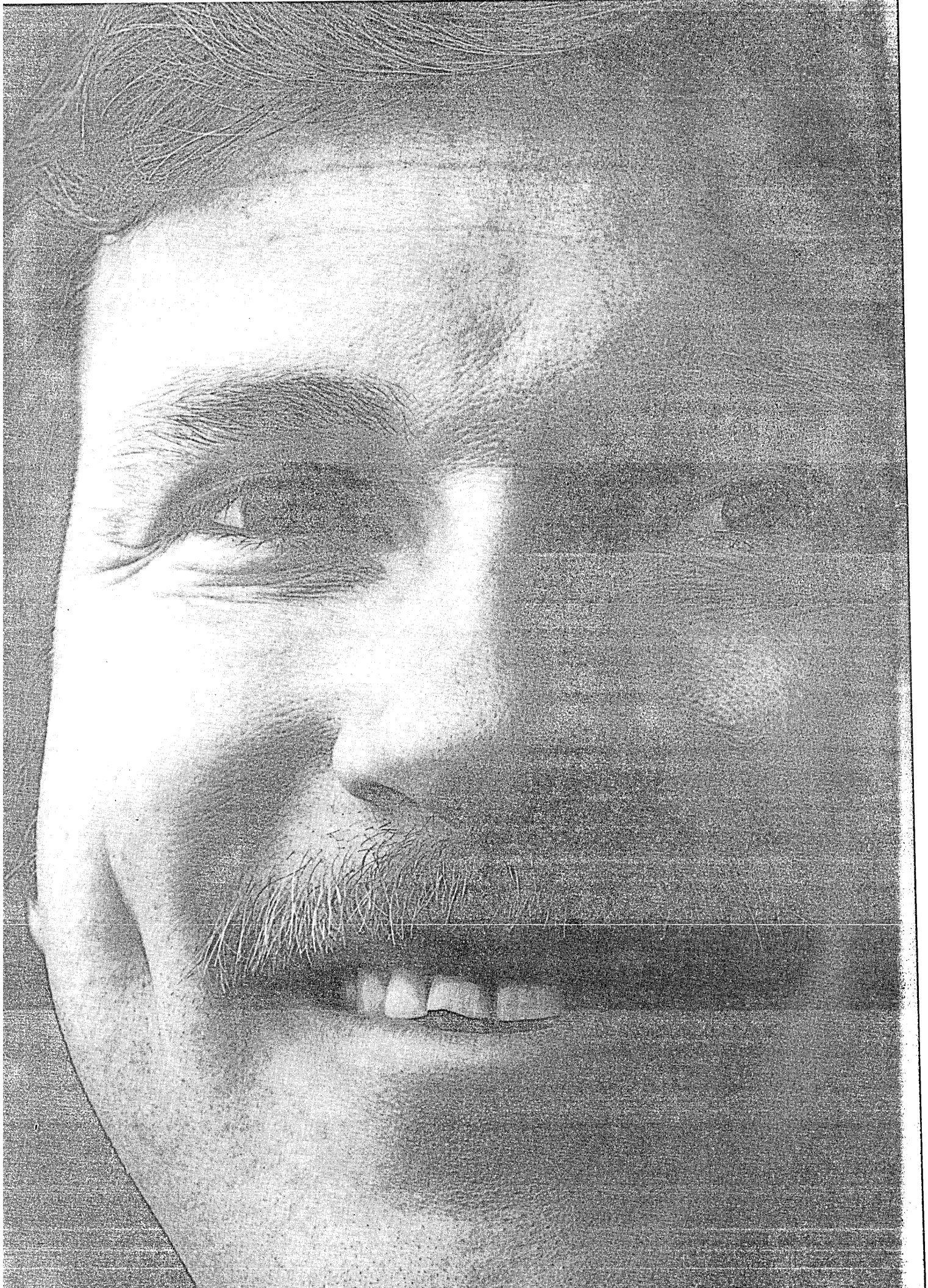
Winter Simulation Conference, Jan. 14-16, Washington, D.C. This is the seventh in a series of annual professional meetings (with sponsors ACM, IEEE, SCI, SHARE, TIMS) dealing primarily with the techniques of discrete simulation computer applications. Topics include: data base and management information systems, hardware configuration, minicomputers and microprogramming, job scheduling and application modeling, virtual and paging software, and simulation languages. In addition, a variety of simulation applications, such as financial decision making, medical systems, and environmental systems, will be discussed. Fee, including Proceedings: $70, advance (payment before Dec. 15); $90, at conference (if available). Contact: Fred C. Ihrer, Comress, Inc., Two Research Court, Rockville, MD 20850.

National Microfilm Assn. Mid-Winter Meeting, Jan. 16-18, Houston. The program, for both novices and experts in micrographics, will have three general sessions focusing on: micrographics and COM as integrated systems, the paper shortage and its impact on microfilm, and the effect and purpose of foreign manufacturers. There will be additional sessions on such topics as: the distributive networks of computers and how microfilm relates, financial markets, and the emerging technology of the laser. Fee: $55, members; $70, nonmembers; after Jan. 2, add $5. Contact: John Bidwell, National Microfilm Assn., Suite 1101, 8728 Colesville Rd., Silver Spring, MD 20910.

Symposium on the Management of Data Elements in Information Processing, Jan. 24-25, Gaithersburg, Md. This symposium on problems faced by the data manager in the design and maintenance of automated systems is sponsored by the National Bureau of Standards and the American National Standards Institute's committee on representations of data elements. Topics include: automated data element dictionaries, data element management successes and failures, data management and programming languages, and the economics of data as contrasted to program and equipment investments. Fee: $45. Contact: Hazel McEwen, NBS, Washington, DC 20234.

FEBRUARY

National Communications Week Convention and Exposition, Feb. 19-22, St. Louis. On the theme "Gateway to Communications Alternatives," this event of the Communications Systems Management Assn. will provide information on all aspects of the communications industry, with emphasis on customer-owned telephone systems and cost-saving programs for communications. In addition to the equipment exhibit, the program will include industry seminars, user panels, specialists panels, combined groups, and membership activities. Fee: $125, members; $150, nonmembers; after Dec. 31, add $10. Contact: Ms. Lee Schaal, CSMA, 1102 West St., Suite 1003, Wilmington, DE 19801.



A very smart engineer introduces a very dumb terminal.

Why is he smiling?

Consul 580. The Dumb Terminal. No editing. No formatting. No graphics. No polled environment. No built-in modem. No multiple operating modes. And strictly Teletype® compatible. In short, a very dumb CRT terminal.

Yet only an engineer as smart as John Jacobs could have designed it.

Paradoxical?

Hardly.

It takes a smart cookie to bake a simple cake.

John's credentials?

His pre-580 innovations still stir the industry's imagination. The Consul 880 CRT terminal with its patented $200 graphics option, and dual intensity formatting. The 28 lb. portable Envoy CRT terminal. The revolutionary black-on-white screen. The polled series "A": 96 terminals can be daisy-chained together without a cluster controller. And the dumb terminal?

It's brilliant.

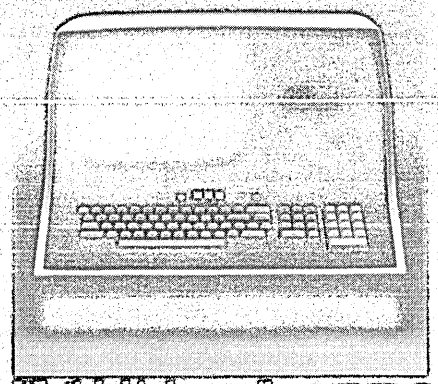
John made it simple so it would sell for $1795.* Here's what your bucks buy.

The most reliable TTY compatible terminal on the market. Cursor controls. Scrolling. Printer interface. XY addressing. Computer-controlled keyboard lock-out. Five switch-selectable speeds and 24 lines with 80 characters each.

Consul 580. Dumb?

Not necessarily. And that keeps John smiling.

ADDS Applied Digital Data Systems, 100 Marcus Blvd., Hauppauge, New York. 516-231-5400

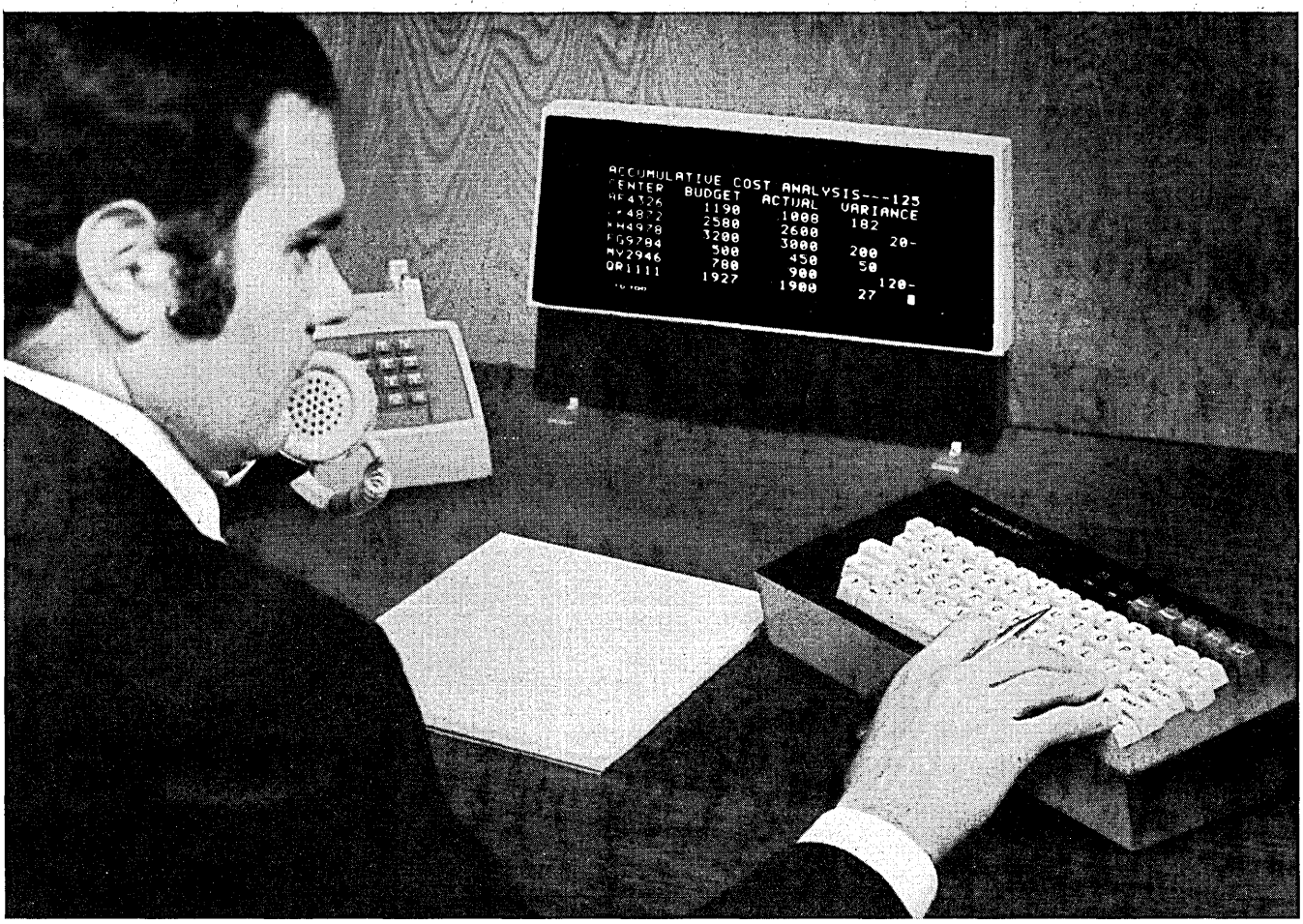


What's behind our smile.
Applied Digital Data Systems Inc. ADDS

*$1295 in OEM quantities of 100.

CIRCLE 7 ON READER CARD

Extend the power of your computer to the people who need it...



with Burroughs TD 700 Input and Display System.

The new TD 700 is as easy on the eyes as it is on the budget.

It uses Burroughs SELF-SCAN® technology to display data in large, clear characters that are easy to read—even from a distance.

It's low in cost. TD 700 economy, compact size and modularity open up new areas of application in hospitals, financial institutions, hotels and motels, manufacturing plants, order entry departments, credit authorization departments, remote data entry departments, and even executive offices.

The TD 700 also introduces new flexibility in data input and display systems—

- Because it's compact and modular, it can be installed almost anywhere.
- A broad choice of optional features lets you "build" the input and display system that fits your particular requirements best.
- It can be mixed with other Burroughs terminal systems because it utilizes common data communication procedures. The TD 700 also offers data transmission speeds from 75 to 9600 bps.

For more details about this exciting new development in on-line data input and inquiry display, call your local Burroughs office today.

Burroughs

Look Ahead

JUSTICE NOW FOR IBM?

IBM has an avid fan in Acting Attorney General Robert H. Bork, who, ironically, has ultimate responsibility for directing the Justice Dept.'s anti-trust case against IBM. After the case was filed, Bork, an expert in anti-trust law, went on record in Fortune magazine on the case. In discussing IBM's then practice of bundling software and hardware, Bork wrote: "Does the selling of computer and software together improperly inhibit the ability of rival computer makers to compete? Of course not...it is impossible to see the practice as a means of improperly preventing competition, and with that idea out of the way, the government's suit (against IBM) stands revealed as an attack on outstanding commercial success as such." With such comments on the record, there is some question whether Bork will pursue the IBM case with zeal.

CDC THINKING BIG AGAIN -- IN BANKING

Supercomputer builder Control Data has entered the bank automation business with a super size project to automate front and back office operations of the 170-branch Union Bank of Switzerland. More than 150 programmers are understood to be developing the integrated system called TOOS (Transaction-Oriented Operating System) which will handle 40 transactions a second, to be tested by the bank next spring. Two Cyber 73s, front ended with three dual Cyber 1000s, are being used in the system which the bank has been developing since 1965, first as a joint effort with Univac and, since 1970, with CDC. The ambitious project embraces not only teller transactions, but 34 back office programs as well.

ICL EYES CDC-NCR VENTURE

That new advanced systems facility operated jointly by Control Data and National Cash Register could get additional members. One hot prospect: the U.K.'s ICL. ICL's Managing Director, Geoffrey Cross, was seen in Minneapolis recently, and, as one CDC man put it, "He wasn't here to watch the Vikings play football." One impetus for ICL to hook up with the U.S. endeavor would be the advantage of making the move before ICL becomes completely hardware and software committed in its still unannounced new line of computers to be called the New Range. Meanwhile, the British giant is coyly flirting with the idea of invading the U.S. market with its 2903 small-scale business system.

IBM'S 3740: INFERIOR OR NEGLECTED?

IBM's 3740 data entry system hasn't been moving fast enough so the computer colossus is taking steps to make it sell. First, IBM has been designating an increasing number of sales people to peddle the product. More important, perhaps, IBM has slapped unit quotas for the system on its U.S. branches. All this indicates that the diskette data entry system hasn't exactly been selling like hotcakes. IBM has devised a complicated sales quota and point system to encourage its salesmen to push the diskette to customers with IBM's old 029 keypunch, but to hold back on customers who have taken IBM's newer 129 buffered keypunch.

IBM salesmen get full quota and point credit for selling the 3740 diskette when it replaces 029s, but only the difference between the price of the diskette and the 129 when they sell the diskette against

the latter device. Reason: The 029 keypunch is more vulnerable to competition.

The burning question, of course, is why isn't the 3740 selling well? Some say it's an inferior product and users know it (key-to-disc competition likes to refer to the 3740 as IBM's key-flop system.) Others, however, say the 3740 is a fine product that will take off, and that the chief reason it hasn't sold well to date is that salesmen are too busy pushing big ticket items and are neglecting the 3740. We'll see.

A CONCESSION FROM MA BELL

Ma Bell threw in the towel just before press time and said it would supply local loops to Microwave Communications, Inc. and other specialized carriers, including domestic satellite operators, under interstate tariffs filed with the FCC. The phone company has delayed filling several MCI local loop orders, arguing that it first has to file intrastate tariffs and get them approved (see p. 153). Presumably, these delays will now end. Meanwhile, by insisting that intrastate facilities used partly for interstate service are subject to federal rather than state jurisdiction, the Commission has undercut North Carolina's attempt to ban foreign attachments and reverse the Carterfone decision. AT&T, although submitting to the FCC's request regarding local loops, said it is "reserving...our right to contest the Commission's jurisdiction in future regulatory or judicial proceedings."

WHO, ME INFRINGE?

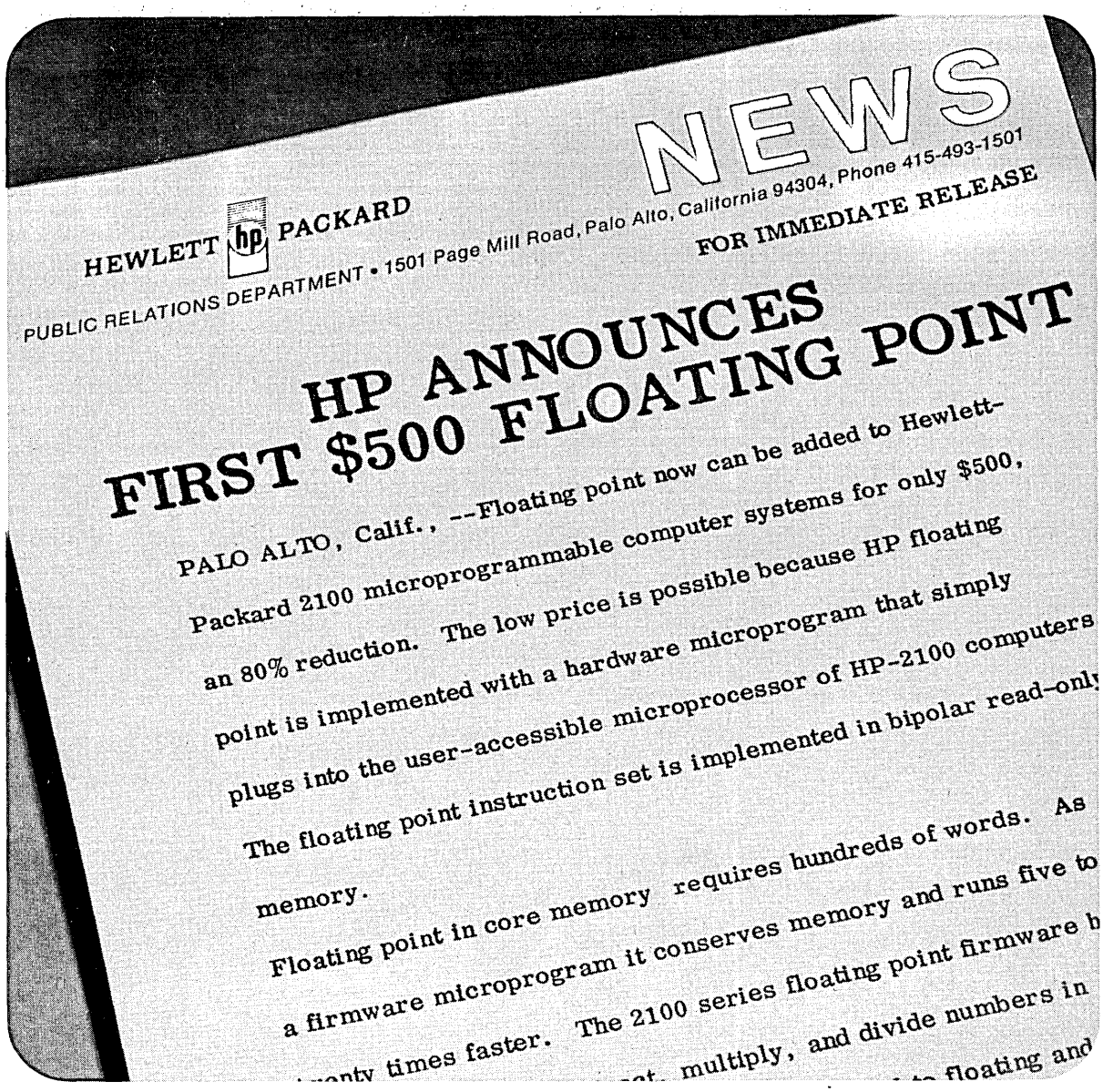
A Canadian software house, Xoma Ltd. of Montreal, has been issued a Canadian patent for its commercial accounting and management information and retrieval package (Xomax), which it says is so basic that 90% or more of all Canadian computer users are using some of its now patented features. David M. Homa, Xoma president, said that within the broad range covered by the term accounting, the patent covers such basic techniques as error detection for input analysis, use of implied accounts, date sensitivity, and ability to distinguish between types of accounts. He believes the patent, no. 935922, is the first granted anywhere in the world for commercial accounting software. Xoma has had an application pending in the U.S. since 1969 for a similar but stronger patent. Late last month the Xoma staff was busily tracking down suspected infringers to ask them to make licensing arrangements.

GROUP THREE REGROUPS -- INTO INFORMATICS

Group Three sounded at first like a noble experiment. A for-profit user group that would not be the slave of the manufacturer, it offered to System/3 users a chance to join a club in which they received discounts on gear and software and supplies, free technical advice over a WATS line, and a monthly magazine. But the subscribers didn't rush into the fold. And one angel, ex-IBMer Tom Levin, who bought himself a title and a job in the company, wound up in a power struggle with founder/president Dave Ferguson. Another backer, Pat McGovern, president of International Data Corp. and publisher of Computerworld, also was less than enchanted with the company's progress.

Along came Informatics seeking an entry into the huge (20,000 installations estimated by year-end) System/3 marketplace. At press time the two firms were close to terms. Group Three, which now has

(Continued on page 177)



NEWS

HEWLETT hp PACKARD

PUBLIC RELATIONS DEPARTMENT • 1501 Page Mill Road, Palo Alto, California 94304, Phone 415-493-1501

FOR IMMEDIATE RELEASE

HP ANNOUNCES FIRST $500 FLOATING POINT

PALO ALTO, Calif., --Floating point now can be added to Hewlett-Packard 2100 microprogrammable computer systems for only $500, an 80% reduction. The low price is possible because HP floating point is implemented with a hardware microprogram that simply plugs into the user-accessible microprocessor of HP-2100 computers. The floating point instruction set is implemented in bipolar read-only memory.

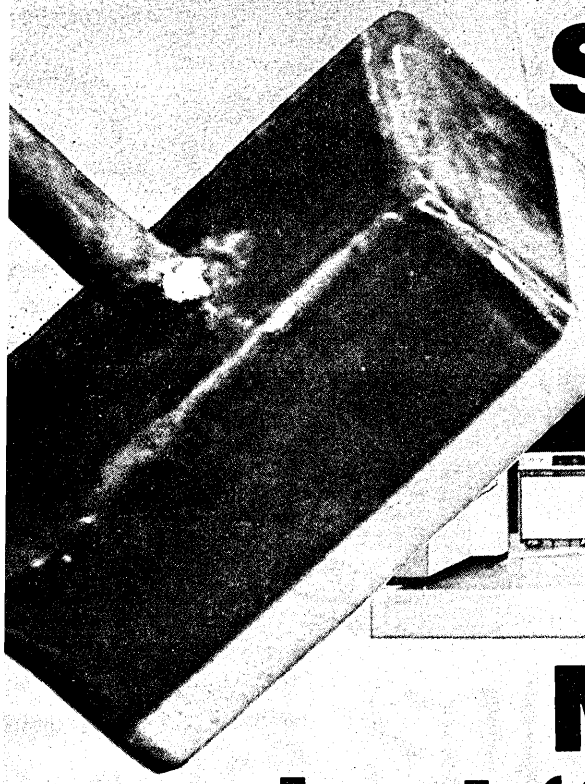
Floating point in core memory requires hundreds of words. As a firmware microprogram it conserves memory and runs five to ...nty times faster. The 2100 series floating point firmware b... ...t, multiply, and divide numbers in ... floating and

For further information on this and other innovations in microprogramming, call your nearby HP field engineer or write.

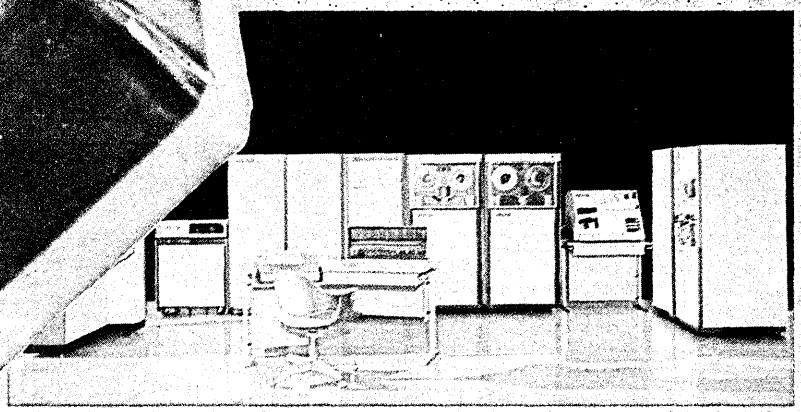
22323 Domestic USA price only.

HEWLETT hp PACKARD

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



SYSTEMS 85/86



More than just "Hot Iron."

...Cool Software.

What makes SYSTEMS 86 the hottest 32-bit real-time computer?

Memory cycle time for one thing... 600 nanoseconds. Plus, a 1.8 microsecond interrupt response time. Then, there's the standard four-port memory structure. Throughput? Each port has a transfer rate of over six megabytes per second. Repertoire? Over 150 instructions, including bit manipulation and direct addressing to over 1/2-million bytes. That's HOT. Want economy instead of speed? There's the SYSTEMS 85 with all the goodies of the 86 except that it has an 850 nanosecond memory.

But, what good is hot iron without cool software?

With SYSTEMS 85 and 86, the right software is there... software that works at high speed and gets the maximum utilization of system hardware resources.

The Real-Time Monitor software package is a good example. RTM supports *true* multiprogramming... it can handle up to 255 foreground tasks concurrently while performing batch processing in the background. Full input and output spooling. Dynamic resource allocation. Code and data sharing through the reentrant library and global COMMON... save valuable memory space. Then, there's RTM's Text Editor that lets up to 16 users at remote terminals simultaneously create and maintain text files. An excellent time and data saver in developing large, complex application programs.

Take a look at SYSTEMS 85/86 Extended FORTRAN IV. It's the one that performs semi-global optimization of generated code... maximizes savings in memory space and minimizes execution time. So efficient it's often used for real-time and time-critical programs. Rich in repertoire... takes full advantage of the instruction set and recognizes eleven data types including bit for logical items and halfword for analog data. There's also full mixed mode, ENCODE/DECODE, BUFFER IN/OUT, Random Access I/O, in-line coding and more. SYSTEMS 85/86 FORTRAN IV... a powerful language for a powerful machine.

Process Control? SYSTEMS 85/86 Process Control Executive is a software structure that's both application adaptable and peripheral independent. Now, add MACS, SYSTEMS new universal interface which links the computer to most any scientific or industrial process. The result... a process control system unmatched in versatility and virtually obsolescence-free.

This is only part of the SYSTEMS 85/86 story... two computer systems that have teamed hot iron with cool software. Price? You'll be pleasantly surprised. About a third less than any nearly-comparable 32-bit real-time system. OEM discounts? Of course.

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

SYSTEMS

ENGINEERING LABORATORIES

CIRCLE 94 ON READER CARD

the centronics phenomenon:

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

why pay 50% more?

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

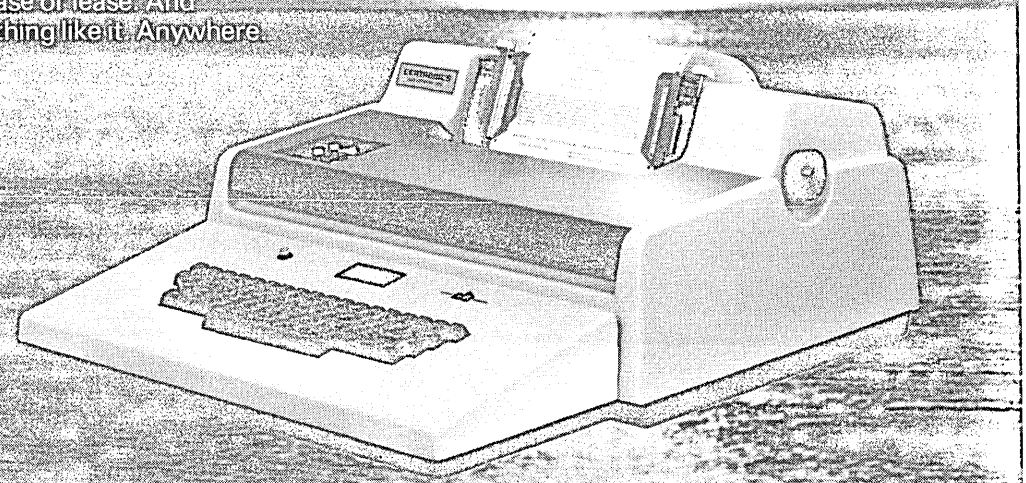
Or, why get less? Compare the 308 with a 30 char/sec teleprinter and you can get 4 times the speed for the same money with the 308. Or, compared to a 10 char/sec teleprinter, the 308 gives you 12 times the speed and cuts telephone line costs dramatically.

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

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

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

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



CENTRONICS
centronics data computer corp.
hudson, n.h. 03051
telephone (603) 883-0111
eastern region: (617) 646-7200
central region: (513) 294-0070 (ohio)
chicago office: (312) 398-4500
western region: (714) 979-8650 (calif.)

dawn of a new era

CIRCLE 89 ON READER CARD

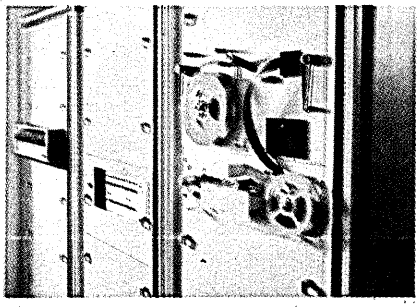
Solid waste disposal automated with Texas Instruments 960A Computer

Combustion Power Company, Inc., of Menlo Park, California is developing the CPU-400 disposal system under contract with the U.S. Environmental Protection Agency.

This system produces electric power from combustible solid waste. Also, it separates the noncombustible waste into marketable components for recycling.

A pilot plant is being operated under control of a 960A digital computer from Texas Instruments.

The computer accepts information from 334 sensors and operates the plant through signals to 176 valves and motors.

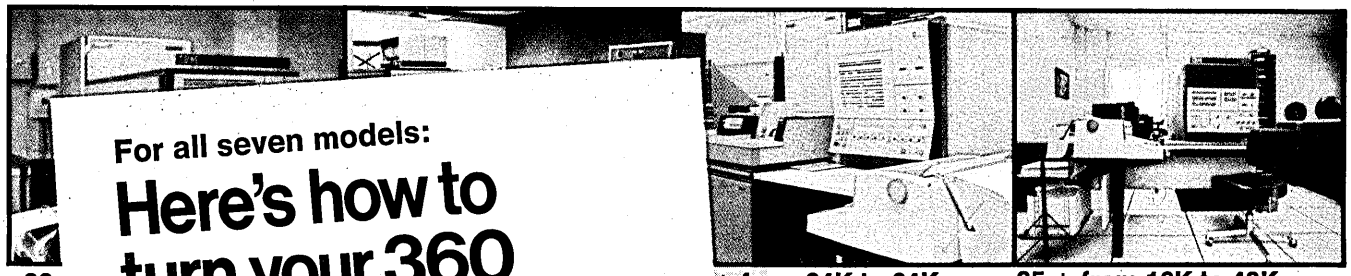


The 960A system includes a 24K-word memory, disc, paper tape reader and punch, *Silent 700** data terminal, and a video CRT.

Low-cost computer control like this is improving the economics of hundreds of industrial processes. For information about how a 960A or 980A system can improve your operations, contact Texas Instruments Incorporated, P. O. Box 1444, Houston, Texas 77001, phone (713) 777-1301, Ext. 281.

**Trademark of Texas Instruments Incorporated*

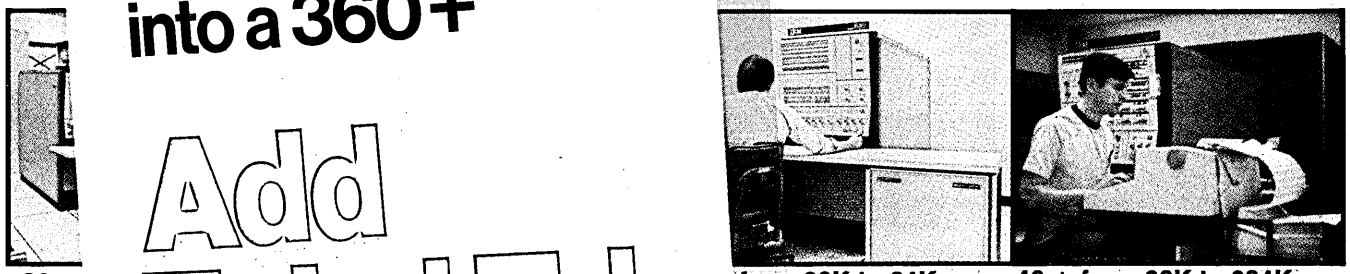
TEXAS INSTRUMENTS
INCORPORATED



22

+ from 24K to 64K

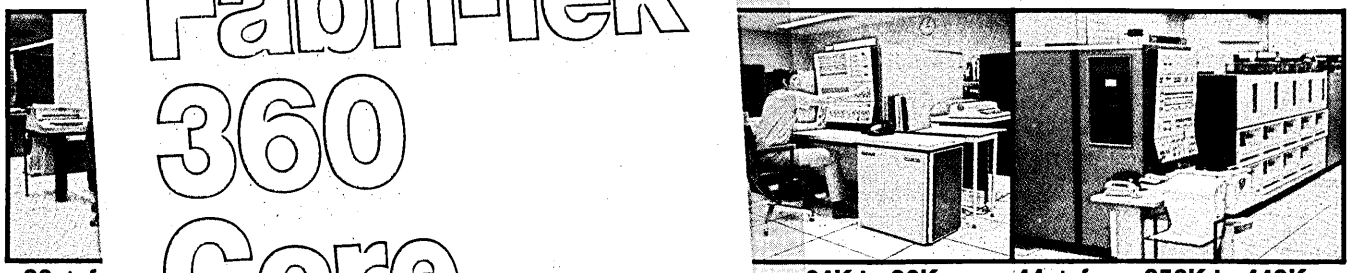
25 + from 16K to 48K



30 +

from 32K to 64K

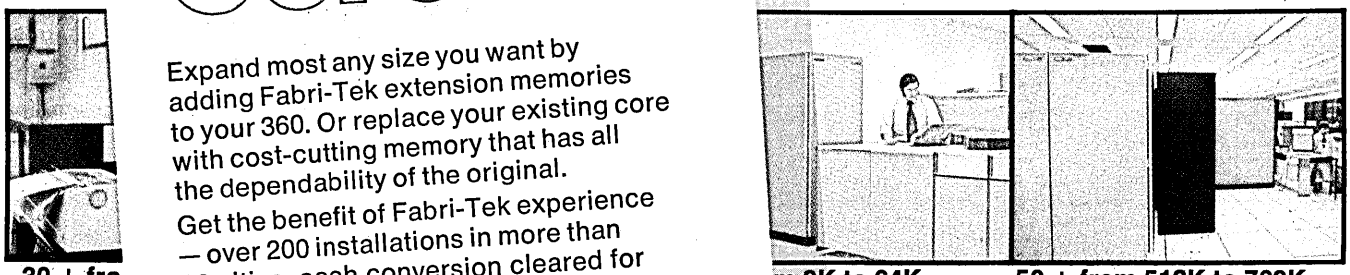
40 + from 32K to 384K



30 + fi

om 64K to 96K

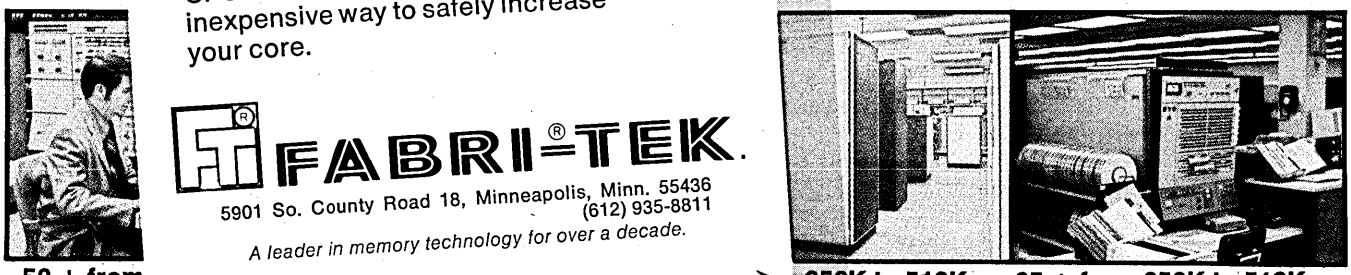
44 + from 256K to 448K



30 + fro

m 8K to 64K

50 + from 512K to 768K



50 + from

256K to 512K

65 + from 256K to 512K

For all seven models:

Here's how to turn your 360 into a 360+

Add Fabri-Tek 360 Core.

Expand most any size you want by adding Fabri-Tek extension memories to your 360. Or replace your existing core with cost-cutting memory that has all the dependability of the original.

Get the benefit of Fabri-Tek experience — over 200 installations in more than 90 cities, each conversion cleared for CPU maintenance by IBM. It's the fast, inexpensive way to safely increase your core.

FABRI-TEK.

5901 So. County Road 18, Minneapolis, Minn. 55436
(612) 935-8811

A leader in memory technology for over a decade.

← **These 360 users agree on Fabri-Tek service and savings** →

Call for full details:

EASTERN: Atlanta (404) 284-7670 ☐ Boston Area (617) 969-5077 ☐ Miami Area (305) 724-0900 ☐ New York Area (201) 694-4770 ☐ Philadelphia Area (215) 643-6950 ☐ Pittsburgh Area (412) 391-6390 ☐ Rochester (716) 586-1960 ☐ Stamford (203) 359-1315 ☐ Washington (703) 525-6435

CENTRAL: Chicago (312) 437-4116 ☐ Columbus (614) 262-7966 ☐ Dallas (214) 233-0872 ☐ Houston (713) 772-7050 ☐ Milwaukee (414) 276-3352 ☐ Oklahoma City (405) 843-6444 ☐ St. Louis (314) 721-0004 ☐ Detroit (313) 538-7480

MOUNTAIN: Denver (303) 573-5535 ☐ Phoenix (602) 266-4448 ☐ Salt Lake City (801) 359-4594

PACIFIC: Los Angeles Area (213) 420-2493 ☐ Portland (American Data Processing Supplies) (503) 222-2996 ☐ San Francisco Area (408) 739-4780 ☐ Seattle (American Data Processing Supplies) (206) 623-2413

EUROPE: NCA Nordisk Computer AB (Stockholm, Sweden) 08-52 52 90 ☐ Fleischhauer Datentraeger GmbH (Hausastrasse, West Germany) (02327) 8061 ☐ Computer Time and Hardware Brokers Ltd. (London, England) 01-748-0106 ☐ Promodata (Paris, France) 225 36-71 ☐ International Marketing and Consulting (Zimmelstrasse, Switzerland) (042) 72 25 45

Letters

Cooling the samovar

When comrade Brezhnev reads the first three lines of the Soviet Bloc RIAD article (Sept., p. 80) he is bound to immediately order his secret police to find and destroy that capitalist samovar which according to your editing is bubbling right inside the Soviet "White House." Undoubtedly, in the process they will also confiscate the few copies of DATAMATION so laboriously smuggled behind the curtains and sentence any of its readers to lifetime use of first generation computers only.

ONE RED SQUARE is the KREMLIN.

ONE KARL MARX SQUARE is the METROPOL hotel.

There, capitalists like us are permitted to operate "offices" and hang out shingles in hotel room windows saying PAN AM, AMEX or some other friendly donut sign.

Chase Manhattan's samovar is at One Karl Marx Square as I correctly reported in my draft. The only possible reason I can think of why you chose to doubt the accuracy of my report is probably DATAMATION's capitalistic urge to induce our friends at One Chase Manhattan Plaza to place their by now widely-known advertisement in your magazine in order to correct that editorial booboo.

Naughty, naughty. You should not allow the great variety of famous vodkaing places on La Cienega to interfere with the editorial process.

B. SZUPROWICZ
21st Century Research
North Bergen, New Jersey

We were advised that One Karl Marx Square was in Berlin, not Moscow, and hurriedly corrected the "error" to save ourselves from a barrage of letters exactly like this one. Had the vodkaing places actually interfered with the editorial process, we probably would have never caught the "error" in the first place. Alas.

Identity crisisist?

I must agree with Frank Wagner's opinion of the terms "computist" and "computerist" ("Who Am I?" Look Ahead, Sept.). They are neither euphonious nor succinct. I will instead submit that you have missed the crux of the problem. We should be addressing the field of "data" rather than the field of "computers" for a designation. After all, those who design the hardware to accomplish our needs already have the professional dignity of being dubbed "engineer." It is those who use that which the engineers create who remain nameless.

Neither "dataist" nor "datist" fits the bill. "Datologist" leaves a lot to be desired also. I think the answer lies in our individual fields of specialization. I personally am a member of a staff group which incorporates data standardization and data base technology. Because of the nature of my work, I call myself a "data ecologist."

Perhaps my thoughts on the subject may help some of my fellow professionals to find an identity.

LOIS ELTMAN
Union Carbide Corp.
New York, New York

Right on, Wright

The calls for a *government* data center are another indication of the increasing dominance of American politics by the collectivistic notion that "the public interest" supersedes individual rights. That notion is the justification offered for restricting the right of privacy. It is the root of dictatorship and such has been—and can be—the only result of its acceptance by a society.

Freedom and security require the recognition that individual rights may not be violated or restricted by anyone, for anyone, at any time, for any purpose whatsoever—that individual rights are *inalienable.*

The right of privacy between private individuals can be protected (when desirable and appropriate) by means of explicit contractual agreement, violations of which are subject to prosecution as fraud.

With respect to government—the greatest source of danger—the right of privacy is best protected by limiting the government to its only legitimate function, the protection of individual rights, and by forbidding to it any power to violate rights or any function that requires or results in their violation.

The recognition of the absolute supremacy of individual rights is the best —and only—means of protecting one's freedom of action and security of person and property.

JOE WRIGHT
Forest Hills, New York

Cost of silence

Your article, "155, 165 Owners Angry with IBM," (Aug., p. 76) is a good example of how IBM's "free" OS operating system software ends up kicking the user in the you-know-what. The "free" virtual memory operating system software that IBM is offering now will probably do the same thing. When is the data processing community going to realize it can't have its cake and eat it too? IBM will remain the *only* supplier of operating system software as long as it can supply that software free, and that situation, from a practical point, eliminates the possibility of any alternative operating system software.

One user quoted in the article was ready to sue; another complained of IBM's "lack of sensitivity for the purchase customer." The real problem, as I see it, is not IBM's discontinuing its OS support, but rather the users' support of IBM's continuing its policy of "free" operating system software. There are a host of independent software companies which could offer the user a choice of new and efficient compatible operating system software. The user will only have this choice, however, if such software is made available in a competitive market. As the situation now stands, the user has no alternatives because independent software companies are spending (and will continue to spend) all of their resources, developments, and planning in the "priced software" arena.

Users must realize that they can help themselves significantly by voicing their grievances against IBM's free system software. Until now, no voices have been heard, no action taken—and look at the cost of that silence.

MARTIN A. GOETZ
Applied Data Research, Inc.
Princeton, New Jersey

Required reading

"The Need for Data Code Control" by Merle G. Rocke (Sept., p. 105) is so comprehensive, yet succinct, that I want all of our systems analysts to have it for use as a guideline.

Such articles on system tools, particularly when so well presented and written, are very useful. We tend to lose sight of the large amounts that are literally dribbled away because our attention is focused primarily on the major areas of effort and expenditure such as hardware and software packages, etc. Efficient and cost effective systems require attention to *all* system components. Mr. Rocke's article should be required reading for all systems designers and analysts.

LEON KOGUT
General Services Administration
Washington, D.C.

Stamp out neglect

When DPMA was observing its 20th anniversary two years ago, it tried to persuade the U.S. Government to issue a commemorative stamp on the computer industry, since the association's anniversary coincided with the widespread introduction of commercial computer systems back in the early 1950s. On a number of occasions since then, association officials have written to the Postmaster General with this in mind.

The proposal, since then also made by several other computer-oriented professional associations, still rests with the Citizens' Stamp Advisory Committee which decides which persons or events are to be honored in

such stamps, based on national interest, historic perspective, and other criteria. We have been assured that the request will be considered at a future meeting of the committee.

It remains a mystery to us why such a computer stamp has not been issued to date, considering that much smaller countries considerably behind the U.S., the world leader in computer technology, have done so. If you agree with us that the origin, development and present far-reaching influence of the computer is deserving of philatelic recognition, drop a note to the committee, c/o Executive Functions Group, Washington, DC 20260.

DONN W. SANFORD
Data Processing Management Assn.
Park Ridge, Illinois

No monopoly on analysis

Regarding your article "Monopoly is Not a Game" (Sept., p. 73), as can be expected, someone of the media gets some figures in his hand and decides that he has editorial license to become an analyst!

I think that we can all agree that any company that regards the performance-per-dollar of its product as being of little or no consequence is obviously in trouble, regardless of the industrial arena that it competes in.

If my above statement is correct, then it must follow that a company that is "recognized" as providing the best performance-per-dollar (in your chart it's DEC and Burroughs by a mile) must be doing business very well.

A product has to be reliable and must be well-supported if it provides this ultimate in performance. How in the world, then, can IBM rank so high in these categories and perform so badly?

It's obvious that your exercise was a sincere effort to uncover something, and it did! E.g., the IBM dp managers who voted were afraid of telling it as it really is, or else had no other vendor experience from which to base a vote of "worst" in the categories of product reliability and support.

For some reason, though, the IBMers "knew" that they weren't getting the best product performance-per-dollar.

Burroughs is happy to be recognized by its customers (many former IBMers) as giving them the best possible performance for each dollar they spend. Additionally, we will continue our policy of trying to provide the best possible technical support for our hardware and software and build products of reliability and purpose.

W. E. MANSFIELD
Burroughs Corp.
Pasadena, California

DATAMATION's technology editor and the article's author, Richard A. McLaughlin, replies: Your goal is easier to agree with than is your argument. You are going to have to decide if you believe that our panelists are sensible because they recognized Burroughs and DEC as providing the best product performance-per-dollar and that IBM's product performance-per-dollar was low, or if you want to consider them dumb and afraid because they didn't rank Burroughs highest in every category.

We didn't analyze the results of the voting, we left that for you to do. Two things might help you in your analysis. First, the charts don't show that one company regards product performance-per-dollar as being of little consequence, only that its customers don't think it is doing well in that sphere. Second, we did not count the votes of users who "had no other vendor experience, etc.," only the votes of those who had dealings with more than one vendor. (license TNF218)

Asking the dp managers how they feel about changing their installed equipment for another vendor's is like asking a cavalry officer how he feels about leading a charge. And identifying dp users as the beneficiaries of freer competition is like identifying soldiers as the beneficiaries of a war.

Few dp managers are expending personal funds for their equipment, and most realize their company is being reimbursed by the consumer who, hopefully, the courts will regard as the rightful beneficiary of freer competition.

I would like to add my feeling that too many dp'ers anticipate IBM dismemberment with its potential horrors and likely impotence as the government's remedy. However, IBM need only be restrained from playing games with the standards and interface provisions which it has established in both hardware and software. This power is the source of nightmares for competitive vendors, adventuresome users, and once-burned venture capitalists. If this threat of ambush is removed—as Christensen's order provides—orderly and prudent competition will develop.

EDWARD S. HUNTER
Long Beach, California

Outlawing ambushes isn't likely to make the fight a fair one, only to change the tactics a little. You're right, we cannot expect the mercenaries to break ranks and balance the sides, either. Christensen has performed his role in the scenario magnificently, but he has not threatened the protagonists with an imminent peace.

The article, "Monopoly is Not a Game," by Richard A. McLaughlin, neglects to mention the most critical reason for breaking up IBM. In the long run, control of so much of computer R&D money concentrated in a single corporate bureaucracy must lead to stagnation. The long-term effects of such excessive concentration are readily apparent in the auto industry, where only the Japanese are able to manufacture a car capable of meeting impending U.S. emission standards. It is not inconceivable that by 1990 the world's most sophisticated computers might be manufactured in China, while IBM continues to produce a highly reliable product that is able to compete provided reasonable tariffs on imports are maintained.

PAUL BUDNIK
San Francisco, California

Data donation

A computer performance measurement project will be greatly aided if your readers donate data from their accounting logs.

Dale Brotherton (General Tire & Rubber) and I have been working on the proposition that the "job" should be the unit of measure. The "job" is that basic element going into the customer's bill, so it should be universally recognized by upper management.

We have enjoyed much success with this doctrine in a limited number of situations, but we'd like more data to work with. Thus, an offer is extended to those who might like to donate data. Results will be shared on an anonymous basis.

I would like to be able to calculate the average number of jobs processed in each shop during a 24-hour period. To do this, I need to know:

1. The number of hours the machine was available that day.
2. The number of jobs run during that time, ignoring spooling (HASP, Power, etc.).
3. Total elapsed time these jobs were active in the cpu.

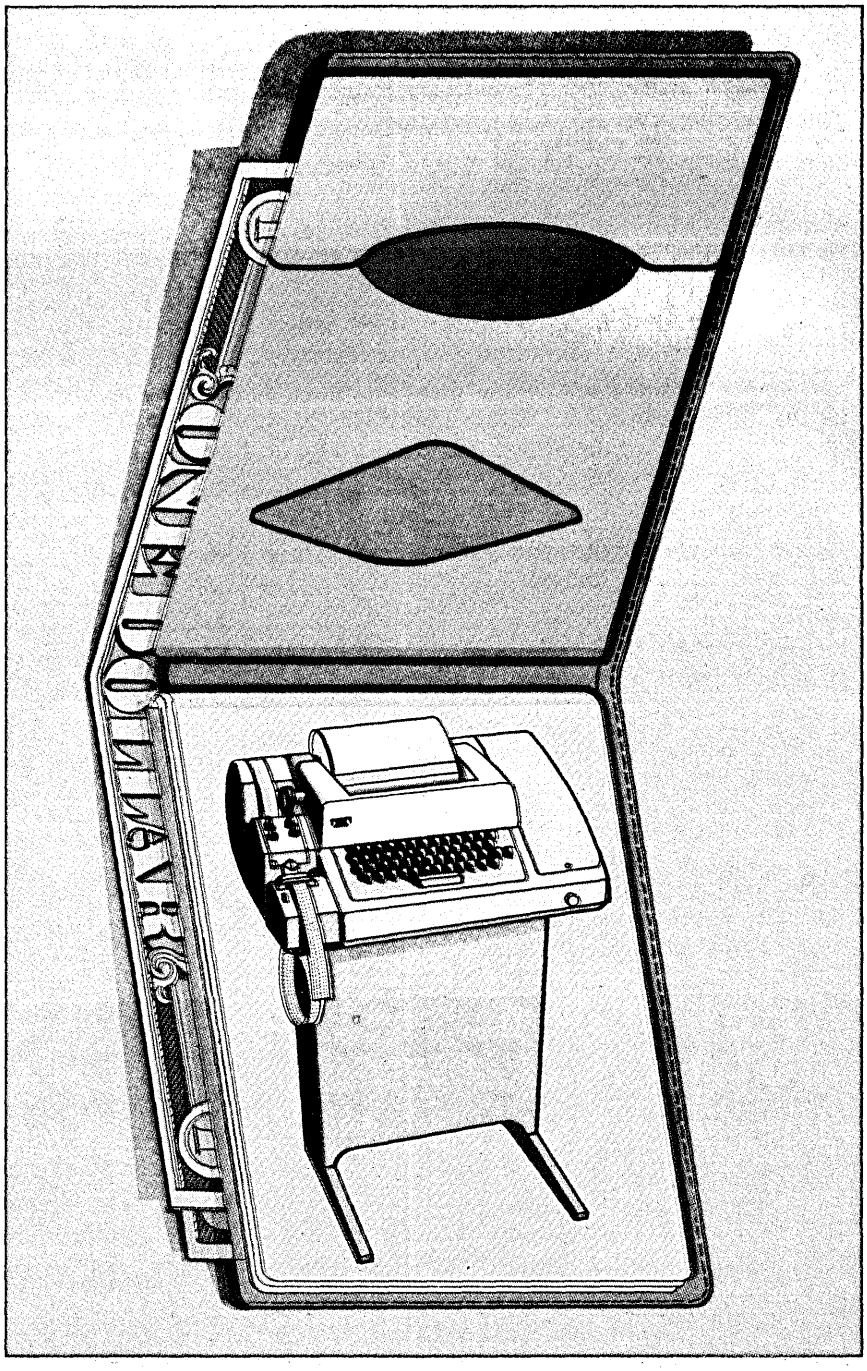
About 20-30 days worth of data is required for each installation. Optional data might be supplied by shift for periods of one month preceding and following a major change in the system.

With response I see the potential of being able to:

1. Set productivity goals by machine type.
2. Identify remainder capacity in an economic term.
3. Establish tools for daily performance review.
4. Establish shift incentives for operations.
5. Identify "sick" computer systems.
6. Identify time frame in which major increases in capacity should be planned.
7. Eventually establish analyst-programmer performance criteria and incentives.

DONALD C. HARDER
Computer EKG
Cleveland, Ohio 44141 □

This member of our family is still the thriftiest ASR terminal around.



Dollar for dollar, the Teletype® model 33 is the least expensive, most reliable data terminal in its class. Because once you see how well it performs, you won't believe its price.

That's one reason why the model 33 is the most popular terminal in the industry. But it's hardly the only reason.

The model 33 is designed and built for extremely reliable operation at 100 wpm. And since it operates on the eight-level ASCII code, it speaks the language most computers understand. Both mini-computers and maxi-computers. Which makes compatibility another reason behind its popularity.

Then there are some reasons you can't see. But they're there just the same. Like complete technical sales and service back-up to help you with installation and maintenance.

Available in three basic configurations, the model 33 is a lot of machine. At a very small price.

It takes more than manufacturing facilities to build the machines Teletype Corporation offers. It also takes commitment. From people who think service is as important as sales. In terminals for message communications - and computers.

That's why we invented a new name for who we are and what we make. The computercations people.

TELETYPE

The computercations people.

For more information about any Teletype product, write or call: TERMINAL CENTRAL, Teletype Corporation, Dept. 81P, 5555 Touhy Avenue, Skokie, Illinois 60076. Phone 312/982-2500.

Teletype is a trademark registered in the United States Patent Office.

RBT

In the good old days, it was RFD. Today, it's RBT . . . the INCOTERM® SPD® 900 Remote Batch Terminal Systems. They deliver.

And because of INCOTERM "push-button" compatibility, what you receive is a bundle of unsurpassed user options. You can mix and match . . . with batch . . . and interactive. Select 2780, 3780, and 2740, 360/20 and 2265, 1004 and Uniscope 100, 200 User Terminal and Series 710. You can interface with your CPU, with your service bureau . . . or with a combination of multiple CPU's or service bureaus.

You get card reading at 150 or 300 cpm and printing at 200 or 400 lpm. And if you want a lot of storage for programs, formats, or data, choose the INCOTERM SPD Diskette. You get up to 500,000 bytes.

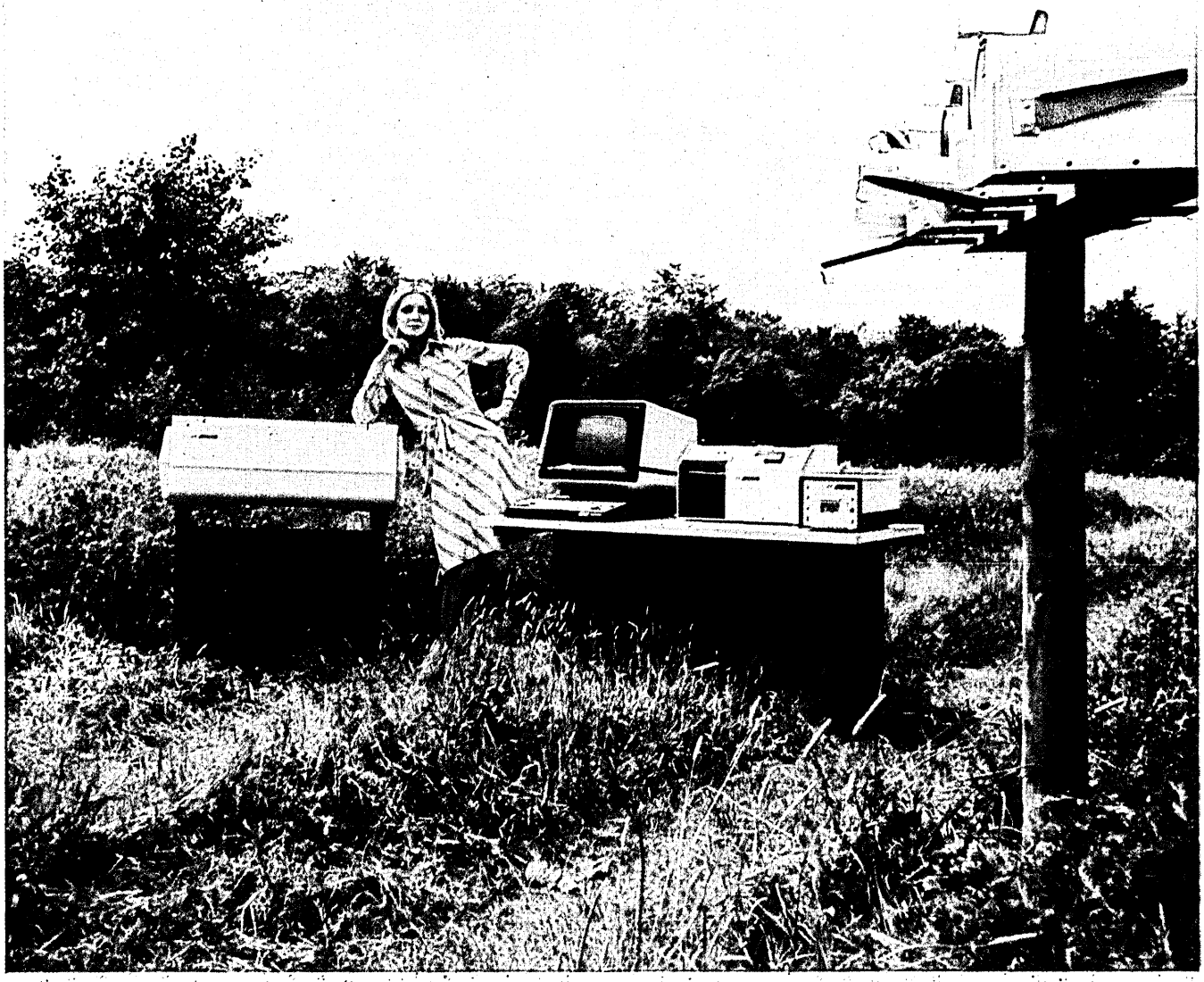
But the SPD 900 is far more than just a remote batch terminal. Use it for order entry, remote job entry, file inquiry, and a host of other applications. It all adds up to true multi-function capability.

There are many models available. One of them can deliver for you.

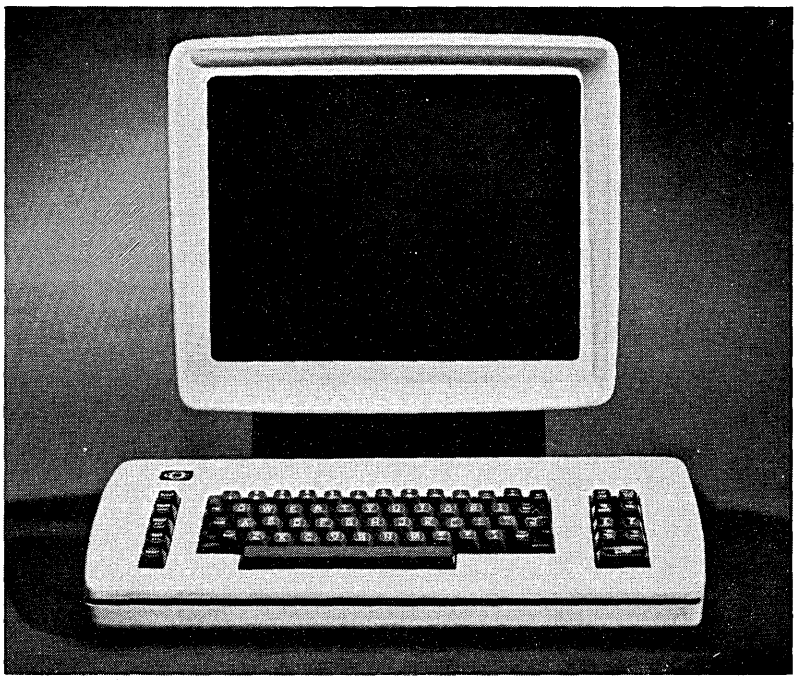
®INCOTERM® CORPORATION

6 Strathmore Road • Natick, Massachusetts 01760 • (617) 655-6100

INCOTERM Sales Offices: Boston (617) 655-6100 • New York (212) 541-5780 • Washington, D.C. (703) 524-8610 • Atlanta (404) 289-4230 • Chicago (312) 593-2230 • Dallas (214) 634-2600 • Los Angeles (213) 640-0328 • San Francisco (415) 697-3643



The IBM 3270 is a fine display system. To compete with it, Computer Optics made a superior display system that is truly interchangeable and far less expensive. We call it the CO:77



Here's the single most important fact you should know about the CO:77—it's the first Display System that is *truly* interchangeable—plug to plug, hardware and software—with IBM's 3270. With more features. At a better price. It can totally take the place of present equipment simply by plugging it in.

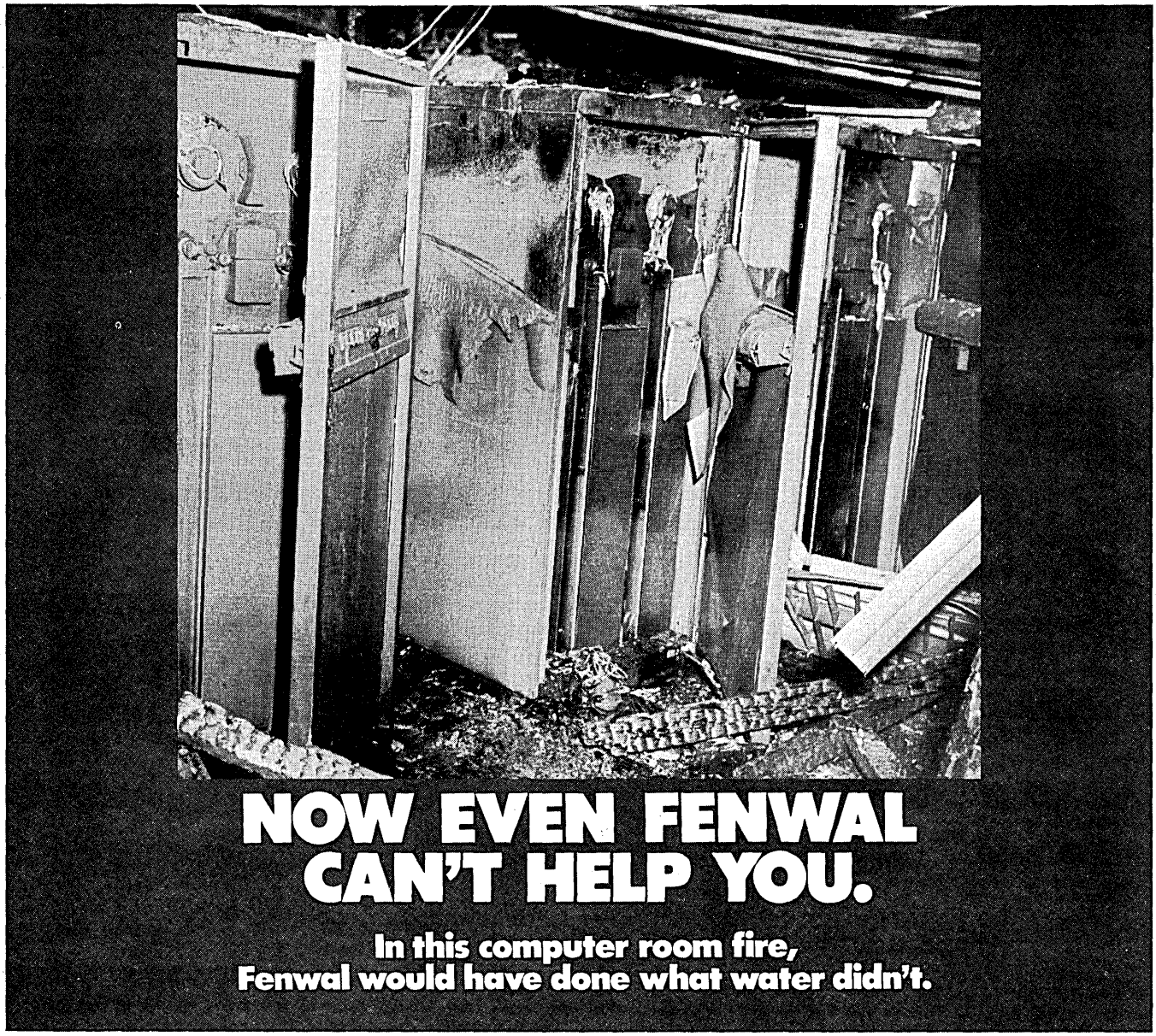
Superior Human Engineering—Each CO:77 operator is provided with a moveable keyboard and separate desk-top display that pivots on its base for convenient viewing and improved operator efficiency. Other characteristics which make usage far easier are the light weight of the terminal, important in moving it from place to place; provisions for adjusting the screen to ambient light conditions, another "human engineering" feature exclusively from Computer Optics; dual case character set with 16 x 18 matrix; ten key numeric pad; up to 9600 bps transmission rate; large cursor with reverse image; full range of display sizes: 960, 480 or 1920 characters; n-key rollover vs. IBM's two-key rollover.

Computer Optics: the company itself—Computer Optics has been selling information display systems since 1968. It is the organization that puts its *first* emphasis on expanding the state of the art in computer peripherals technology. This kind of venturesome thinking created the CO:77 Information Display System. And Computer Optics is pressing forward with work on ahead-of-the-art computer developments for the years immediately ahead.

Write to us for full information and specifications on the CO:77, *the* IBM 3270 replacement.

COMPUTER OPTICS, INC.

Berkshire Industrial Park, Dept. DM-11, Bethel, Conn. 06801 (203) 744-6720



NOW EVEN FENWAL CAN'T HELP YOU.

In this computer room fire, Fenwal would have done what water didn't.

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

Water alone can't save you from at least a temporary shutdown while the wet mess is cleaned up with overtime expense. Then there's all the business you'll lose while you're shut down. All that before you even start to pay for the heat, smoke and water damage done to your records and equipment.

Things are different when you fight fire with Fenwal. A Fenwal Automatic Fire Suppression System,* using Halon 1301, stops a fire in seconds . . . and dry. The extinguishing agent is clean, electrically non-conductive, non-corrosive and safe for people. The affected area is ready for immediate reuse.

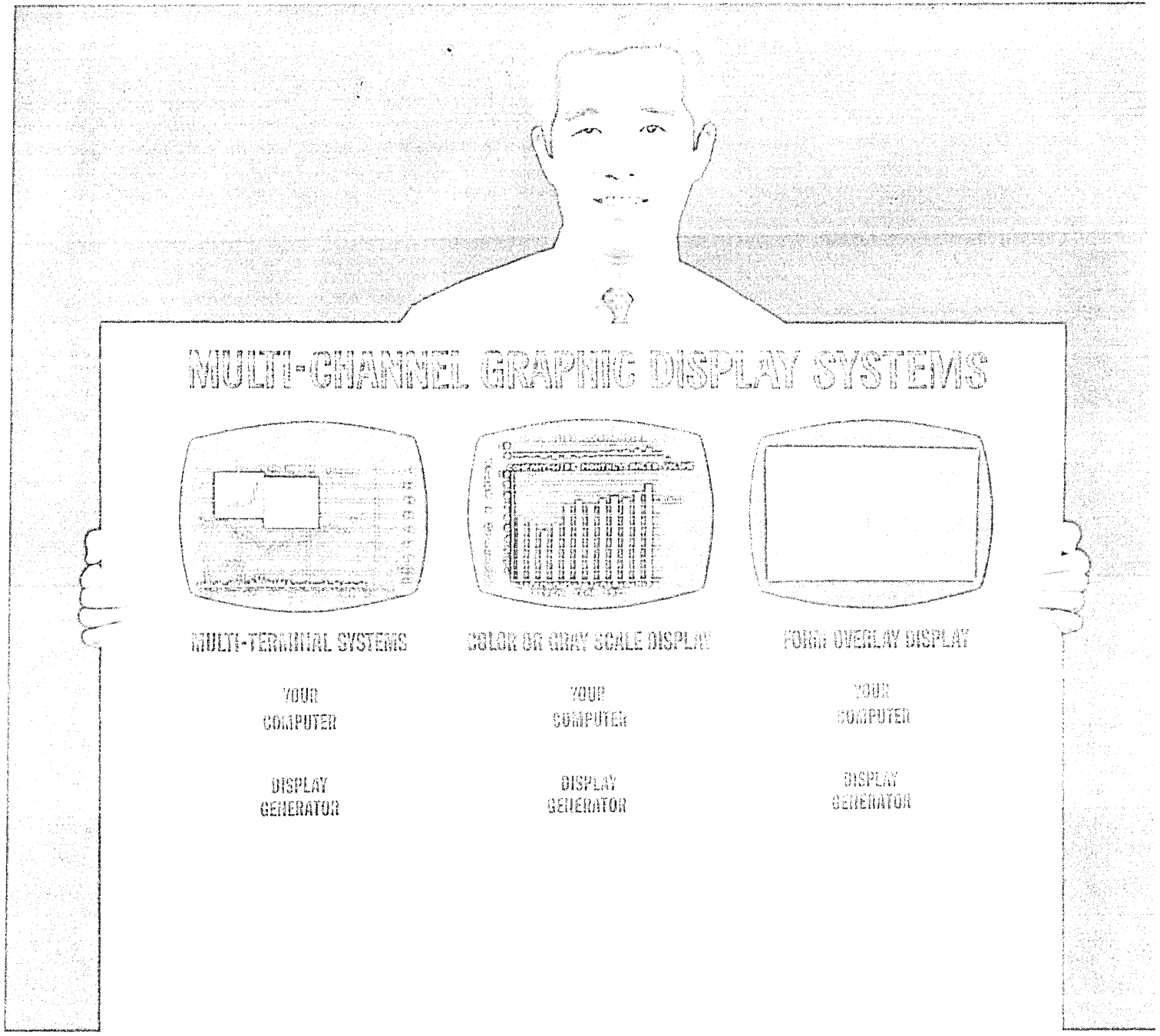
Thanks to years of designing, testing and redesigning at our own test facility, Fenwal is way ahead of everybody else in fire and explosion suppression. The application of Halon extinguishing agents is our speciality.

If your business relies on the continuous functioning of vital data processing or electronic control areas, talk to Fenwal about fool-proof fire protection. Don't leave your business to chance. Contact us, we'll be pleased to arrange a showing of our color film, "The FIREATERS," featuring our systems in action, or write on your letterhead for our free "Checklist for Computer Room Fire Protection." Fenwal Incorporated, Ashland, Mass. 01721. Phone (617) 881-2000. A Division of Walter Kidde & Co., Inc.

*FM approved — UL listed

FENWAL

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



Or choose all from column C, or . . .

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

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

For **multiterminal applications,** use each channel to drive a low cost, daylight viewable TV monitor. Cost for a 16 terminal monochrome system, complete with 14" monitors, keyboards, and typical computer interface, works out to [illegible]

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

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

These systems have all the capability you need for most applications [illegible] You can selectively erase any rectangular area of the screen; write up to 24 lines of 85 alphanumeric characters. And because the displays are disc refreshed, the CPU need generate each [illegible]

So think of the multichannel display system when you need computer graphics. Call your Data Disc representative for more information, or contact us at 986 West Maude Avenue, Sunnyvale, California 94086; 408 / 732-7330.

And for dessert, have a fortune cookie.

Regional representatives: Fullerton, California (714) 879-9411; Cleveland, Ohio, (216) 228-0621; Orlando, Florida, (305) 644-5550, Elmsford, New York, (914) 592-8658, Buffalo, New York, (716) 839-9650, Ottawa, Canada, (613) 233-4797

CIRCLE 58 ON READER CARD

Digital's PDP-11/45. Suddenly everyone in town wants timesharing.

Timesharing has taken a quantum leap. Digital's hottest selling computer ever, the PDP-11/45, has combined with one of our most sophisticated software packages ever to bring more computer power to more people at lower cost than was ever before possible.

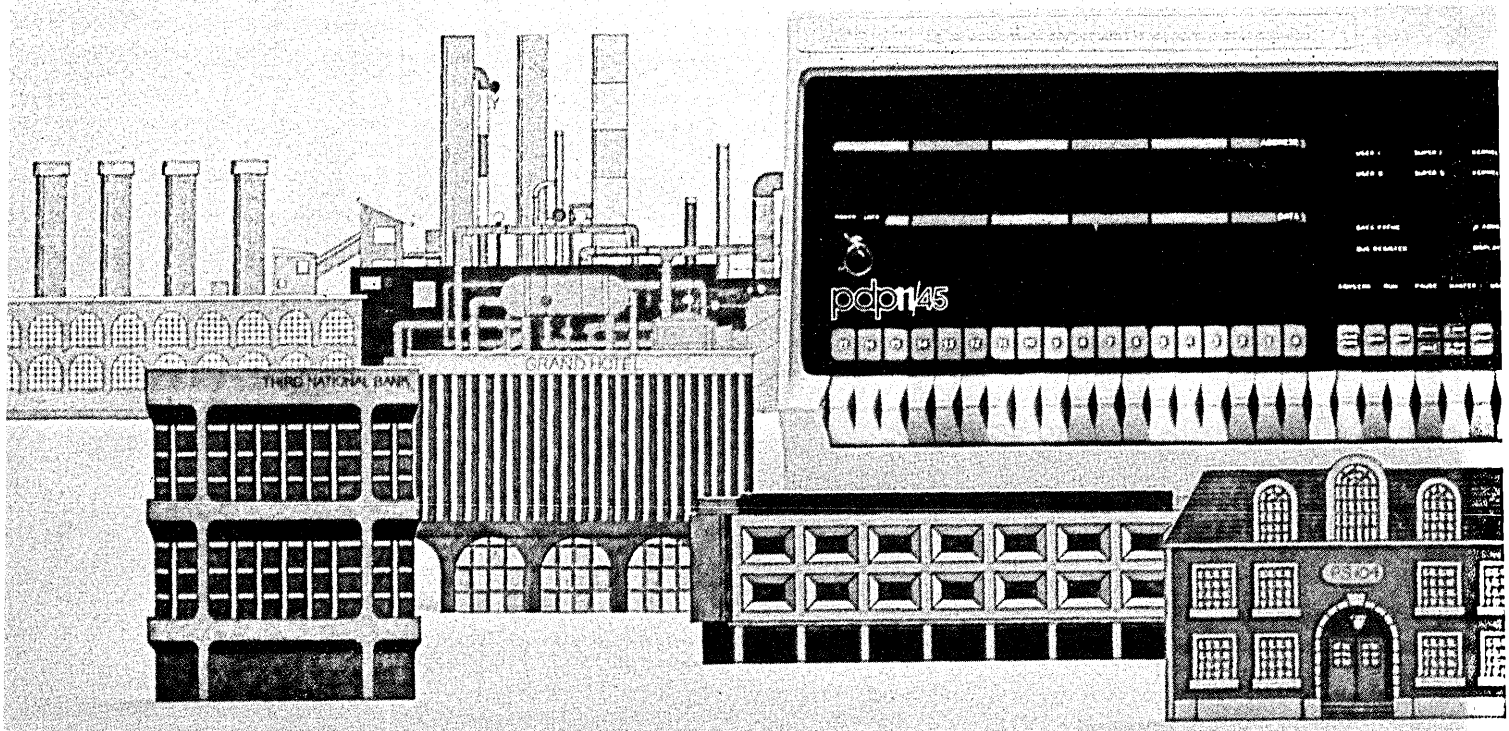
If you thought you knew what timesharing was all about, you're in for a jolt.

To begin with, the PDP-11/45 Timesharing System costs only $130,000 for a system that supports a full 32 simultaneous users (or you can start smaller for a lot less). Memory expands to 248K bytes. Bipolar memory operates at 300 nanoseconds. Core at 900. The CPU can perform 3 million operations per second. Floating point hardware gives 17-decimal-digit accuracy, in less than 12 microseconds. Jobs range from calculator size to 32K bytes.

That's just for openers.

The PDP-11/45 Timesharing System speeds program development, simplifies use, and handles every type of problem from interactive problem solving to business data processing.

PDP-11/45 timesharing has all the multi-user features you expect in a timesharing system. Features like big program capacity, powerful array handling, access to all peripherals, and fast program execution. But it goes on to give you all the features you need but won't find —all together—in any other timesharing system in this price class. For example:



- File storage to 320 million characters with index access method and record locks for protected multi-terminal updating.
- On-line preparation of mag tapes in any computer format.
- Complete commercial output formatting, including trailing minus sign, asterisk protect, and floating dollar sign.
- Disk sorting by key rather than by address.
- Programmed error recovery for dedicated applications programs.

And the list goes on. Far on.

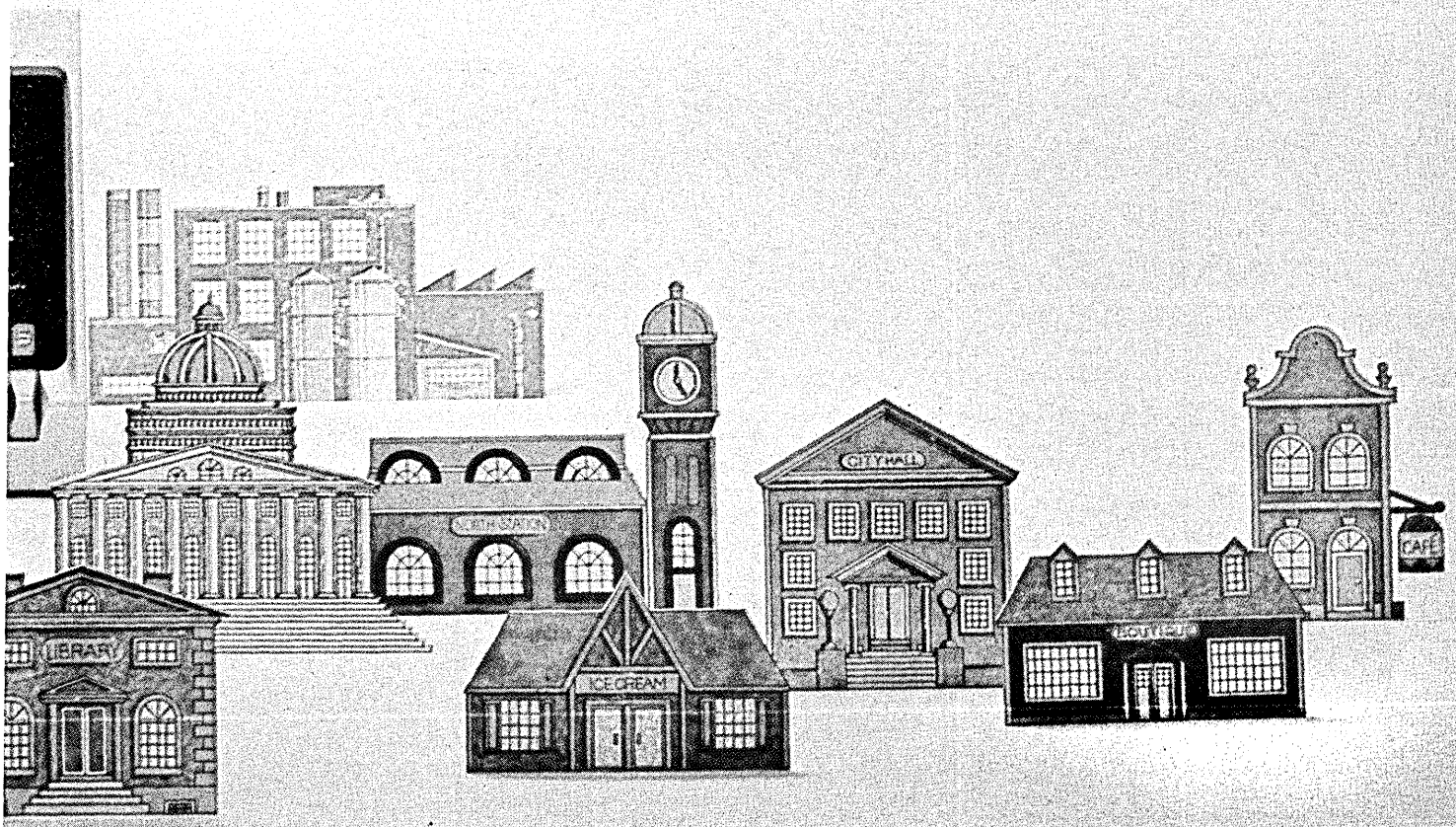
Who already owns this incredible system? Banks. Insurance companies. Manufacturers. Distributors. Shippers. Investment firms. Common carriers. Communications companies. Colleges. Universities. High school consortia. You name it.

The PDP-11/45 Timesharing System belongs wherever a dozen or more users need access to large stores of data or interactive programming.

We can't possibly tell you all about the PDP-11/45 timesharing story here; we had trouble enough cramming it into a 44-page brochure. Write for it: Digital Equipment Corporation, 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.

digital

CIRCLE 27 ON READER CARD



If you have a voice in company training, you have a responsibility to ask yourself these questions:

1) *Is the cost effectiveness of your present training efforts acceptable?*

2) *Is it possible to put your internal and customer programs in multi-media format, thus decreasing training costs and insuring standardization?*

3) *Are you now conducting training programs but lack certain methods, materials or instructor talent?*

4) *Is there a gap between company goals and technical capabilities, i.e., need for updating skills in Data Base Management, Data Communications, Business Systems Analysis and Design, Virtual Storage, Project Management, etc.?*

5) *Is your in-house training capability providing the quality and productivity levels you require?*

Here you are. Faced with training challenges that can help shape your company's future. Your co-workers' future. Your own future.

And here we are, Control Data Institute, ready to help.

We have more home office and field training specialists offering a clearer choice of contemporary in-house and off-site training tools, techniques and programs than just about any company in data processing . . . from stand-up seminars and classroom sessions to portable multi-media packages and complete customized systems tailored to your needs.

We've prepared new systems that can bring your training opportunities into sharp focus. If you're the result-oriented director of information systems, operations manager, or DP manager we think you are, you won't hesitate to send for information about them.

CONTROL DATA INSTITUTE

The Educational Service of CONTROL DATA CORPORATION

8100 — 34th Avenue, South Minneapolis, Minnesota 55440

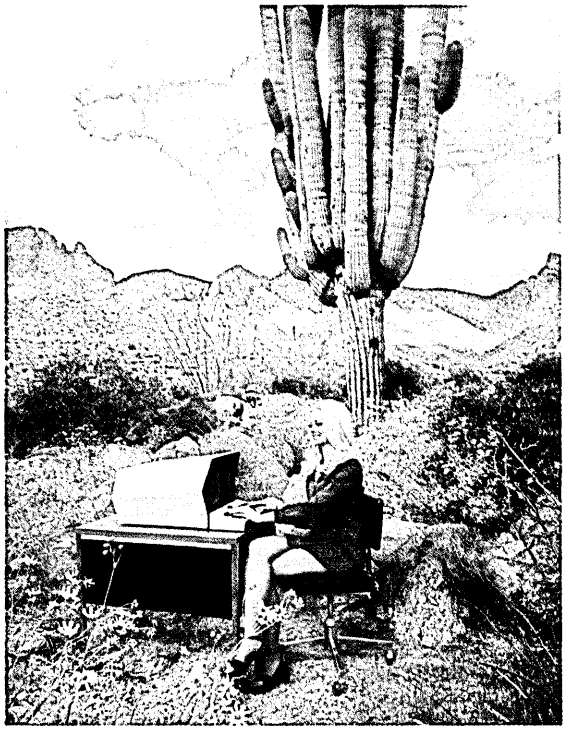
Offices in Major Cities Throughout the World.

SERIES 400

DATA-SCREEN™

TERMINALS

TEC® INCORPORATED



Stability Age Beauty

The stability of Arizona's Catalina Mountains, the age of a giant saguaro cactus, the beauty of nature are captured in this photograph by Ray Manley.

Stability, age and beauty are important, too, in the design and production of display terminals. At TEC, we've been designing and building highly reliable crt terminals called DATA-SCREEN Terminals for more than 10 years (other visual display products for more than 15 years). That's *age* in the computer peripheral equipment industry.

For all these 15 years we've been manufacturing high quality information display and control devices — providing the vital link between man and machine in this computer-oriented world. That's *stability,* especially when it has been done profitably.

We offer our carefully styled terminals in esthetically compatible colors and finishes to match any decor, any application. That's *beauty.*

SERIES 400

DATA-SCREEN™

TERMINALS

Four basic interfaces

- *High Speed Parallel*
- *Message Oriented Serial*
- *Conversational Serial*
- *TTY Replacement*

Non-glare CRT screen
40, 50, 72, 80 characters per line; 20, 24 lines
Full edit with blink, protect and field tab
Displays 64 alphanumeric characters
Sharp 5 x 7 dot matrix characters
Separate keyboard
Software actuated fixed message displays
Hard copy connector

TEC® INCORPORATED

FEATURES

Communications between man and the fabulous computers that serve him must take place with maximum speed, accuracy and reliability . . . and at sensible costs. Versatile DATA-SCREEN Terminals, with a decade of proved performance, provide that efficient, low cost link.

Thirteen models meet varied system interface requirements and provide a variety of display formats for the many applications encountered in data communications and information systems. DATA-SCREEN Terminals operate locally — at the computer at computer speeds — or remotely, via telephone lines across city or continent.

Operators using keyboard and crt screen compose and edit data before sending it to the computer in block form, reducing expensive on-line time with the computer. Similarly, data stored in the computer's memory is displayed on the crt screen for review and, if required, is updated or corrected by the operator. During text review period the computer can be engaged in other functions.

Composing and editing data before it is transmitted to the computer or modifying data brought out from the computer's memory requires an easy to understand, easy to use editing capability. DATA-SCREEN Terminals provide keyboard editing controls that give the operator unique composition freedom to insert and delete lines and characters.

Logically arranged keyboard controls for the "cursor" (flashing symbol indicating where character will be entered on screen) allow its rapid movement to any point on the screen. "Fixed" formats may be entered on the screen and protected — by the computer — from operator alteration or accidental erasure. Similarly, selected text displays read from computer memory can be protected by programming. A "Tab" function permits cursor movement directly to predetermined points on the screen and saves operator time in composing tabular material and in filling in "blanks" in preformatted material.

On command of the computer, important data can be blinked to call the operator's attention to its presence on the screen.

Optional DATA•PANEL® Display is a fixed message display panel located to the right of the crt screen. Software actuated, it provides additional display capability with up to 16 custom messages backlighted in a variety of brilliant colors. It can be used to give the operator his or her next data entry instruction, indicate computer processing modes and system alarms.

STYLING

Compatibility is a primary consideration in the design of DATA-SCREEN Terminals. And it extends beyond interfaces, languages and logic. TEC's terminals are visually compatible with their surroundings — front office or factory floor. See back cover for colors and finishes offered.

INTERFACE FLEXIBILITY

DATA-SCREEN Terminals are compatible with most computers — mini, midi or maxi. They work equally well with specialized industrial and process control systems. Interface flexibility is achieved in direct, computer linked (parallel I/O) terminals by providing controlled data rates within the terminal. As a result, the terminal operates in block mode at speeds dictated by the computer to best utilize the computer's time. Simplified software requirements for these models are the result of the terminal's "ready-resume" interface control that signals when terminal or computer is ready to receive data and then acknowledges receipt of data sent. Conventional signal levels and low impedance, long line signal drivers match requirements of most information systems.

In remotely located (serial I/O) applications, DATA-SCREEN Terminals operate at standard, industry established RS-232, TTL or current loop interface levels in character or block mode. These models offer data transmission rates from 110 to 9600 baud. Teletypewriter replacement models can be connected directly to the computer without modems or remotely via communications lines and modems.

Printed circuit boards of DATA-SCREEN Terminals are equipped with switch selectable options that permit easy, on-the-spot customization.

APPLICATION

TEC designed and built its first crt terminals in 1963. Now, with more than a decade of experience — serving a variety of OEM and end user applications — a full range of data entry/retrieval capabilities are offered:

Off-line data entry — allows the operator to compose a message on the crt screen, verify accuracy — correct or rearrange text if necessary and then go on-line to transmit the information in block mode into the computer's memory at speeds beyond human capability.

Data retrieval — allows the operator to request (via coded address) that a specific block of information held in the computer's memory be displayed on the terminal's screen. This block of data can be reviewed, updated if necessary — then returned to the computer's memory instantly.

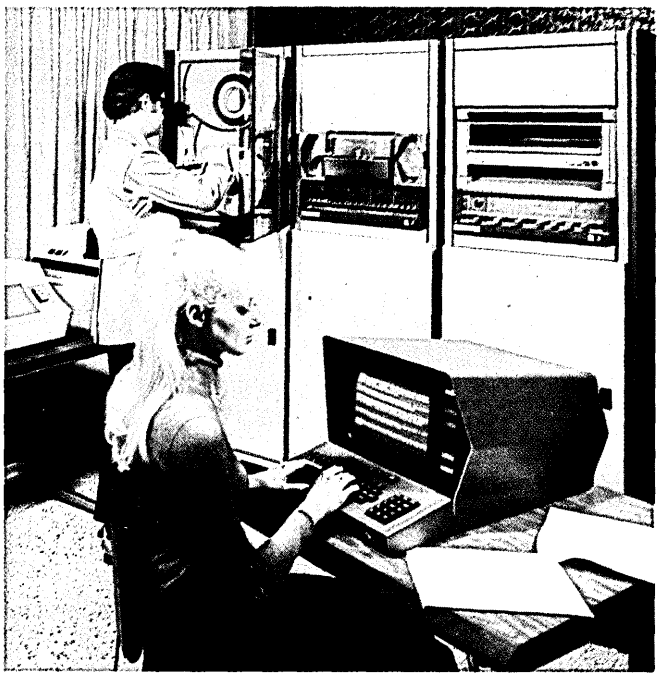
On-line conversational operation — used for time sharing, scientific, computer aided education and other applications where operator and computer communicate directly with the terminal forming the connecting link.

RELIABILITY

Every major component, subassembly and every completed DATA-SCREEN Terminal is computer tested. Completed terminals are "burned-in" for no less than 72 hours in a high temperature environment as a final test of performance. TEC has designed its terminals with unique modularity and accessability for ease of maintenance. Printed circuit boards, for example, can be replaced in less than a minute — an important consideration in keeping downtime to a minimum. Power supply, TV monitor and printed circuit card cage make up the major assemblies and are readily accessable and easily maintained.

The solid state printed circuit board logic of DATA-SCREEN Terminals is highly reliable, but should a component fail, TEC offers a printed circuit board exchange plan that puts a replacement board in the mail within 24 hours. By keeping a spare set of printed circuit boards on hand, terminal downtime can be reduced to less than one minute.

TEC® INCORPORATED



SERIES 400
DATA-SCREEN™
TERMINALS

HIGH SPEED, PARALLEL I/O BUFFERED, DATA-SCREEN TERMINALS

Full Message Editing Capability
Data Transfer Rates to 800,000 Characters Per Second
TTL Compatible Interface with Optional Line Drivers

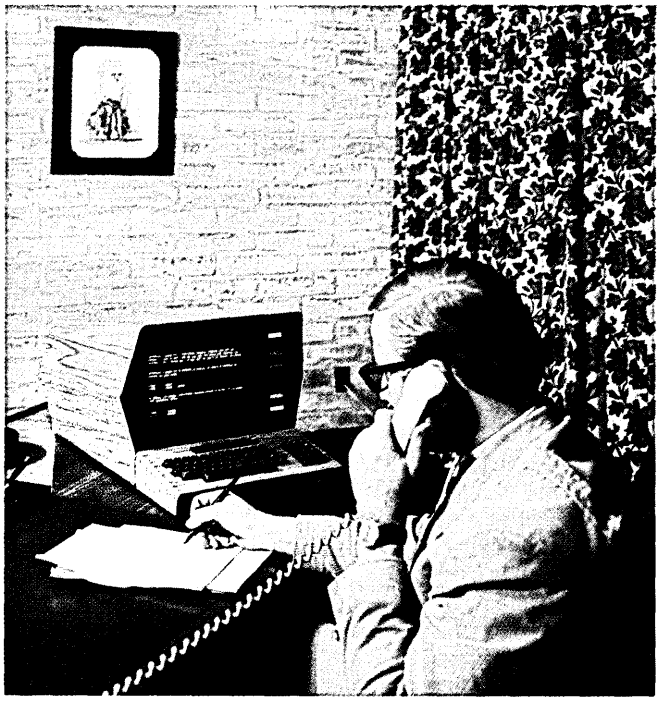
Model 410 — 1000 character display, 50 characters/line, 20 lines
Model 415 — 1920 character display, 80 characters/line, 24 lines
Model 416 — 960 character display, 40 characters/line, 24 lines

These DATA-SCREEN Terminals operate locally with computer, multiplexor or batch terminal and their high speed allows block transmission or reception of data at the maximum speed of many computers. In block mode, the message sent or received can begin or end anywhere on the screen.

Efficient use of computer time results because these models have a reply-acknowledge feature that allows the computer to control the rate of data transfer between terminal and computer. As a result, the DATA-SCREEN Terminal will operate as fast as the computer can transmit or receive data — or, if the computer is simultaneously involved with other peripherals, at slower speeds.

Terminal/computer communications is made more efficient because of the DATA-SCREEN Terminal's cursor address readout to the computer and the ability of the computer to position the terminal's cursor anywhere on the screen as it communicates with the operator.

The operator, using the terminal's full edit features, can quickly compose and correct messages prior to transmission to the computer — can easily update computer-stored data displayed on the screen.



SERIAL, POLLING, BUFFERED DATA-SCREEN TERMINALS

Address Capability — Up to 63 Terminals
Transfer Rates to 9600 Baud
RS-232 or TTL Interface

Model 420 — 1000 character display, 50 characters/line, 20 lines
Model 425 — 1920 character display, 80 characters/line, 24 lines
Model 426 — 960 character display, 40 characters/line, 24 lines

As many as 63 terminals, operating from one serial I/O channel, can send data to a computer — and the computer can address one or more of these terminals at random. In addition, the computer can poll each terminal individually to determine if the terminal has a message ready for transmission.

In single terminal, non-addressable applications, pressing the "transmit" key sends an entire pre-composed and edited message in block mode, or sends a single "message ready" code to the computer indicating that the terminal has a block of data ready for transmission whenever the computer can accept it. In block mode, messages to be transmitted or received can begin or end anywhere on the screen. Buffered operation allows the operator to edit and correct displayed messages (either operator or computer originated) off-line, then enter the data in the computer memory at maximum serial speeds from remotely located terminals. On-line time is further reduced by the terminal's cursor address readout to the computer and the computer's ability to move the terminal's cursor to any location on the screen.

see inside back cover for complete specifications.

TELETYPEWRITER COMPATIBLE, CONVERSATIONAL MODE DATA-SCREEN TERMINALS

RS-232, TTL, Current Loop Interface
Transfer Rates to 2400 Baud
Cursor Positioning by Computer

Model 430 — 1000 character display, 50 characters/line, 20 lines
Model 435 — 1920 character display, 80 characters/line, 24 lines
Model 436 — 960 character display, 40 characters/line, 24 lines

These models connect directly to the teletypewriter interface ports provided on most computers and communicate on-line in character mode. The terminal provides computer controlled cursor positioning directly to any point on the screen. For on-line editing, function command codes are transmitted from the terminal's keyboard to the computer. The terminal performs the required function when the command code is received and the computer may perform the same function in its memory.

Selectable options include automatic line feed and automatic roll-up (scroll). When the roll-up feature is used, data entered on a full screen will continue to appear on the bottom line and all copy above will move up and the top line is lost. Full (echoplex) or half duplex operation is switch selectable.

TELETYPEWRITER REPLACEMENT, CONVERSATIONAL MODE DATA-SCREEN TERMINALS

Transmits and Receives Data at Speeds to 9600 Baud
Can Transmit Data at One Speed — Receive at Another
RS-232, 20 or 60mA Current Loop or TTL Interface

Model 440 — 72 or 80 character line, 24 lines, offers 1728 or 1920 character display

Direct teletypewriter replacement is silent — up to 100 times faster than TTY's. Designed specifically for time sharing and other on-line data communications, Model 440 can transmit data at one speed and receive at another speed. As a result, the terminal can send and receive data at far higher speeds than the normal 110 to 300 baud rates of teletypewriters.

In addition to conventional bottom line data entry and line feed from the bottom, Model 440 DATA-SCREEN Terminals offer optional automatic carriage return and line feed. Automatic line feed is also provided in the local mode.

Rates of 110 to 9600 baud are switch selectable. Display of 72 or 80 character line is also switch selectable. A 9-pin connector permits use of a read-only teletypewriter or other on-line printer if/when hard copy is required.

Model 440 keyboard duplicates teletypewriter keyboard format to minimize operator training.

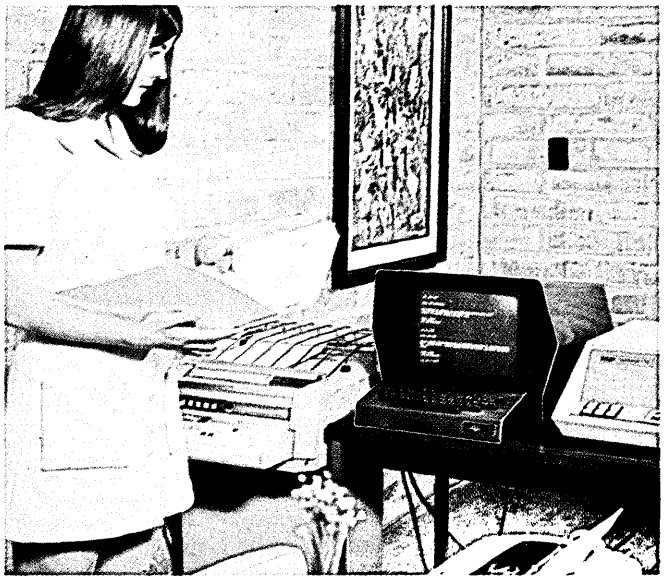
SERIAL, BUFFERED AND CONVERSATIONAL MODE DATA-SCREEN TERMINALS NEW

Automatic Interface Selection
RS-232, TTL, 20-60mA Current Loop Interfaces
Operator Controlled: Conversational or Buffered Mode

Model 450 — 1000 character display, 50 characters/line, 20 lines
Model 455 — 1920 character display, 80 characters/line, 24 lines
Model 456 — 960 character display, 40 characters/line, 24 lines

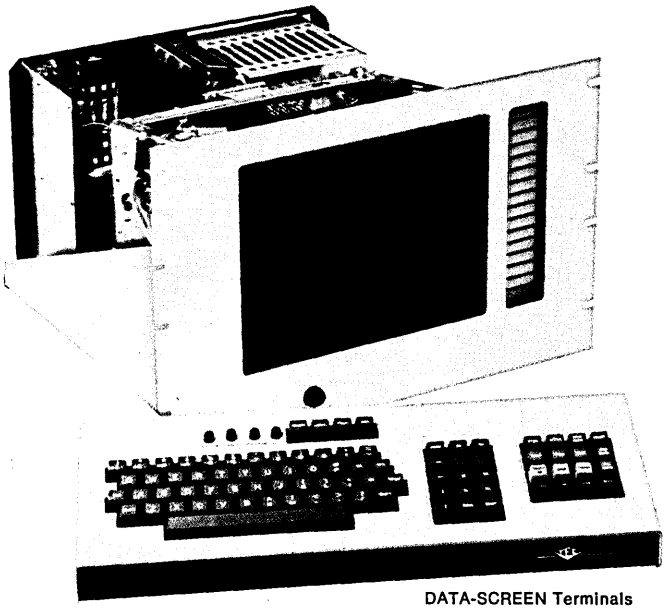
New in the DATA-SCREEN Terminal line, these versatile models give the operator the choice of communicating on-line directly with the computer, or composing and verifying data off-line, then transmitting the data to the computer in block mode at rates to 9600 baud. Keyboard switches make this selection simple. Data transmitted or received in block mode can begin or end anywhere on the screen.

Terminal/computer compatibility is improved by cursor address readout to the computer and the ability of the computer to position the terminal's cursor anywhere on the screen. Automatic line feed and automatic roll up (scroll) are selectable. Full (echoplex) or half duplex operation is controlled by a back panel switch. A single printed circuit board, which may be added at any time, provides compatible outputs for buffered printing at speeds to 120 characters (1200 baud) per second. An optional read-only memory answer-back up to 64 characters long (simulating teletypewriter feature) is available and may be added at any time.

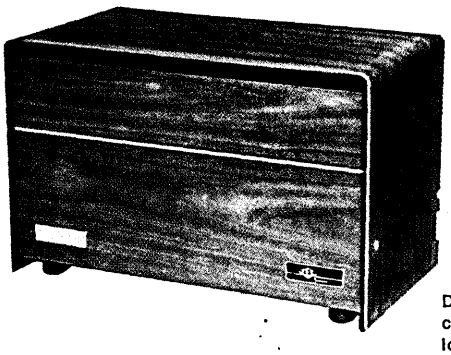


see inside back cover for complete specifications.

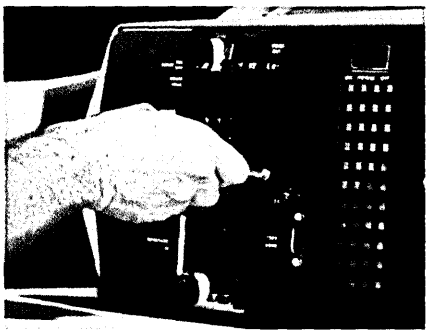
SERIES 400
DATA-SCREEN™
TERMINALS

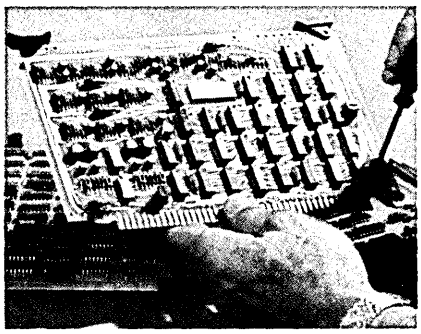


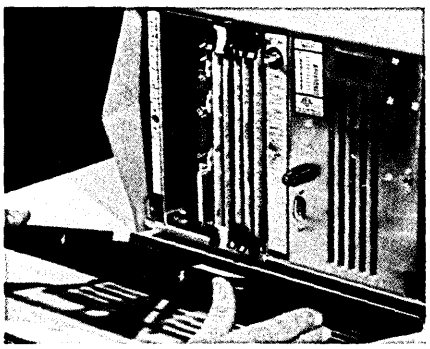
DATA-SCREEN Terminals in rack mount chassis are available with (above) and without integral crt monitor. Separate keyboards in all models can be located up to ten feet from the terminal. Keyboard above includes extra 16-key data entry matrix.

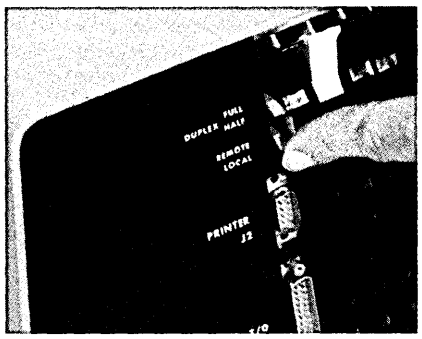


DATA-SCREEN Terminal controller for remotely located crt monitors can be placed on desk top, shelf or wall mounted. All finishes are available.



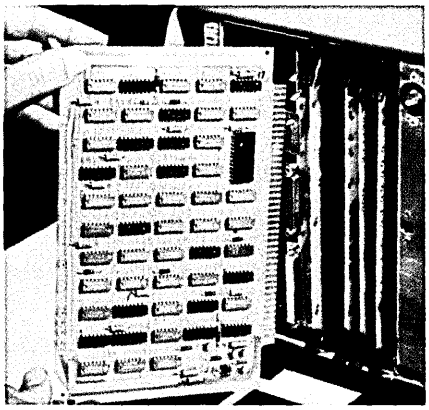


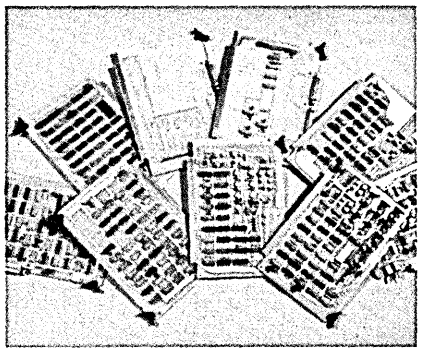




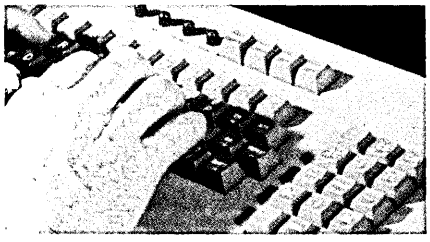
Printed circuit boards can be changed in 60 seconds or less. Three ¼-turn fasteners release rear panel. With replacement PCB's on hand, DATA-SCREEN Terminal downtime is cut to minutes.

Field selection of modes, data rates, stop bits, parity, auto roll-up and line feed, display or non-display of cursor and carriage return symbol are easily made with back panel switches and switches or jumper wires located on printed circuit boards.

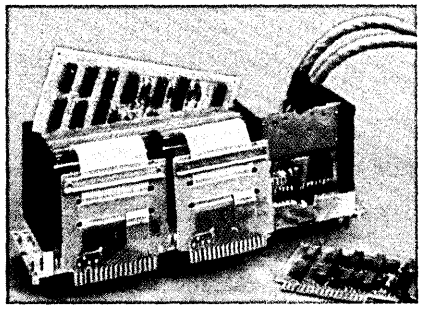




Data rates, screen capacities and other options can be field changed by simply exchanging printed circuit logic boards. Avoids DATA-SCREEN Terminal obsolescence when systems are updated. Special TEC designed interfaces, for major computers, such as Burroughs' computers with NDL line adaptor among others, are also provided by printed circuit boards located in the terminal, or as in the case of the Honeywell H316/516 Computers, interface modules located in the computer itself (lower photo).



A full complement of editing and cursor controls, plus "blink" and "protect" formatting features are standard in all except Model 440 DATA-SCREEN Terminal.



TEC® INCORPORATED

MODEL SELECTION CHART

MODELS	INTERFACE: PARALLEL	INTERFACE: SERIAL (ASYNCHRONOUS)	INTERFACE: BUFFERED (BLOCK MODE)	INTERFACE: CONVERSATIONAL (CHARACTER MODE)	INTERFACE: ADDRESSABLE	OPTIONS: CURSOR POSITIONING BY CPU	OPTIONS: CURSOR READOUT FOR CPU	OPTIONS: FULL EDITING CAPABILITY	OPTIONS: KEYBOARD	OPTIONS: FIXED MESSAGE INDICATORS	OPTIONS: HARD COPY OUTPUT
410, 415, 416	•		•			•	•	•	•	•	•
420, 425, 426		•	•		•	•	•	•	•	•	•
430, 435, 436		•		•		•		•	•	•	•
440		•		•					•		•
450, 455, 456		•	•	•		•	•	•	•	•	•

SPECIFICATIONS: *DATA-SCREEN TERMINALS BY MODEL*

	410	415	416	420	425	426	430	435	436	440	450	455	456
DISPLAY													
SCREEN CAPACITY, NUMBER OF CHARACTERS	1000	1920	960	1000	1920	960	1000	1920	960	1728/1920	1000	1920	960
CHARACTERS PER LINE, NO. LINES PER SCREEN	50/20	80/24	40/24	50/20	80/24	40/24	50/20	80/24	40/24	72 or 80/24	50/20	80/24	40/24
CHARACTER SIZE (Height x Width — inches)	.21 x .15	.20 x .08	.21 x .15	.21 x .15	.20 x .08	.21 x .15	.21 x .15	.20 x .08	.21 x .15	.14 x .08	.21 x .15	.20 x .08	.21 x .15
NUMBER OF DISPLAYABLE CHARACTERS	67	67	67	67	67	67	67	67	67	64	67	67	67
CURSOR CONTROLS AND CURSOR POSITIONING BY COMPUTER	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
CURSOR ADDRESS READABLE BY COMPUTER	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes
BOTTOM LINE ENTRY (No Cost Option)	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Standard	Optional	Optional	Optional
AUTOMATIC LINE FEED (No Cost Option)	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Standard	Optional	Optional	Optional
MESSAGE EDITING CAPABILITY	Yes	Yes	Yes	Yes	Yes	Yes	Limited	Limited	Limited	No	Yes	Yes	Yes
FIELD TAB FEATURE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
"BLINK" AND "PROTECT" FEATURE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BLACK ON WHITE DISPLAY FEATURE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
INTERFACE													
I/O ASYNCHRONOUS	—	—	—	TTL RS-232	TTL RS-232	TTL RS-232	TTL RS-232 20 ma	TTL RS-232 20 ma	TTL RS-232 20 ma	TTL RS-232 20/60 ma	TTL RS-232 20/60 ma	TTL RS-232 20/60 ma	TTL RS-232 20/60 ma
SERIAL (Baud Rates — Switch Selectable)	—	—	—	110-9600	110-9600	110-9600	110-2400	110-2400	110-2400	110-9600	110-9600	110-9600	110-9600
PARALLEL RATE (Char. per second)	0-1000, 10,000 - 400,000	0-1000, 10,000 - 800,000	0-1000, 10,000 - 400,000	—	—	—	—	—	—	—	—	—	—
TRANSMIT MODE (Switch Selectable)	—	—	—	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex	Half/Full Duplex
PARTY LINE (Multi Station)	—	—	—	Yes	Yes	Yes	No	No	No	No	No	No	No
TRANSMISSION FORMAT	7-Bit Parallel	7-Bit Parallel	7-Bit Parallel	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop	10/11 Bit Start-Stop
HARD COPY OUTPUT	Optional	Optional	Optional	Optional	Optional	Optional	Standard	Standard	Standard	Standard	Optional	Optional	Optional
MEMORY													
TYPE, CHARACTER CAPACITY	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 2048	MOS, 1024	MOS, 2048	MOS, 1024
OPTIONS													
DATA•PANEL® DISPLAY (with monitor)	Yes	Yes	Yes	Yes	Yes *	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
LONG LINE DRIVERS	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
PRINTER INTERFACE	Yes	Yes	Yes	Yes	Yes	Yes	Standard	Standard	Standard	Standard	Yes	Yes	Yes
KEYBOARD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
"WHERE IS" ANSWER BACK	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes

SPECIFICATIONS COMMON TO ALL DATA-SCREEN TERMINAL MODELS

DISPLAY: 12" Direct view non-glare CRT, 74 sq. in. viewing area.
TV type horizontal raster scan.
P4 (white) phosphor standard. P31 (green) optional.

REFRESH RATE: 50 or 60 Hz, Crystal Controlled.

CHARACTER GENERATION: 5x7 Dot Matrix.

CURSOR: Blinking underline, alternates with displayed character at 4 Hz.

INTERFACE CODE: USASCII 7-bit.

HARD COPY OUTPUT CONNECTOR: Located on rear panel.

REMOTE MONITOR OUTPUT SOCKET (BNC): Located on rear panel.

POWER REQUIREMENTS: 115 or 230 VAC; 50 or 60 Hz, 150 watts maximum.

TEMPERATURE RANGE: Operating, + 10°C to + 40°C; storage, — 40°C to + 65°C; both at 80% relative humidity (non-condensing).

STANDARD FINISH: Vinyl clad or blue Armorhide paint.

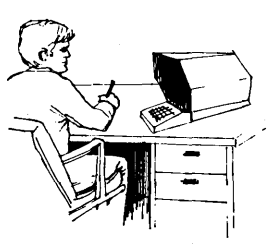
DIMENSIONS AND SHIPPING WEIGHT*

Desk top with monitor: 17⅛" W x 19¾" D x 13" H; 68 pounds
Desk top without monitor: 18" W x 10" D x 11¾" H; 48 pounds
Rack mount with monitor: 19" W x 17¼" D x 12¼" H; 65 pounds
Rack mount without monitor: 19" W x 8⅜" D x 10" H; 39 pounds

*Includes keyboard

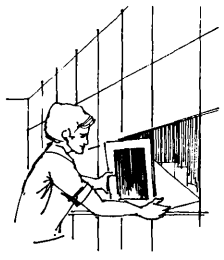
All specifications subject to change without notice.

MOUNTING OPTIONS

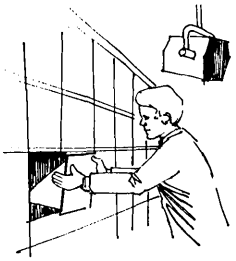


DESK TOP WITH MONITOR

DESK TOP, REMOTE MONITOR



RACK MOUNT WITH MONITOR

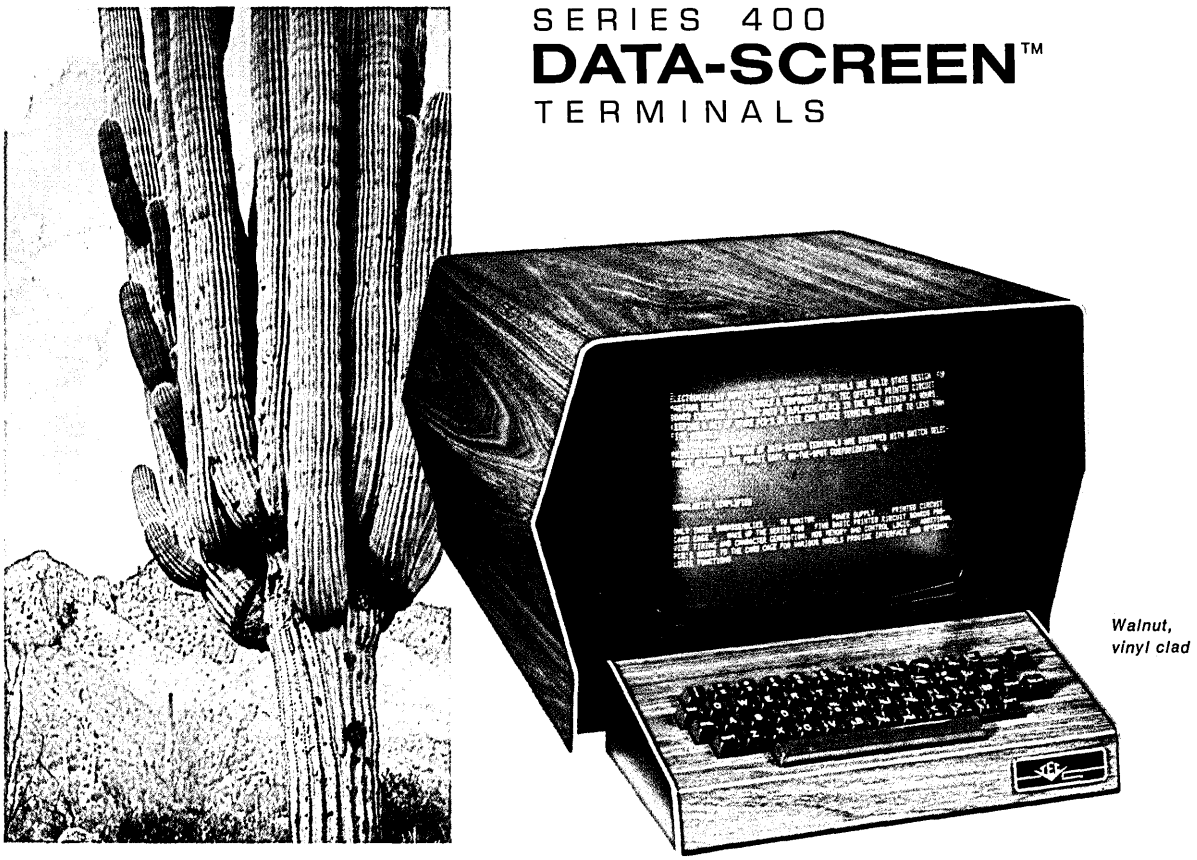


RACK MOUNT, REMOTE MONITOR

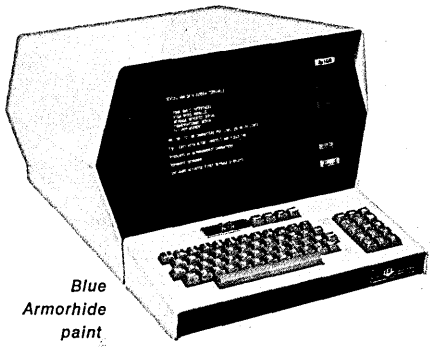
SERIES 400

DATA-SCREEN™

TERMINALS



Walnut, vinyl clad



Blue Armorhide paint

A variety of durable, easy to clean, wood grain and textured vinyl clad finishes are offered for terminal and keyboard covers. Walnut and teak wood grain finishes suit mahogany row — others complement modern office and factory decor.

Front panel choices are non-glare crt surrounded by bezel, above, or crt screen and fixed message display area mounted behind black Plexiglas filter, left.

Brown Matador vinyl clad *White Matador vinyl clad* *Blue Matador vinyl clad* *Teak vinyl clad* *Blue Marlin vinyl clad*

Use post cards enclosed to request contact by a TEC Systems Division Sales Engineer — or call the TEC DATA-SCREEN Terminal Sales Representative in your area. He's listed in the the post card insert

TEC® INCORPORATED

9800 NORTH ORACLE ROAD
TUCSON, ARIZONA USA 85704
(602) 297-1111
TWX 910-952-1377

884 5-73 Printed in U.S.A.

The Complete Message Switch.

When you select MINIPLUS you get a total message-switching package. We don't just hand you a black box and let you muddle through on your own.

We marry your circuits—any combination of simplex, half-duplex, full-duplex, telex, TWX, Dataphone—you name it. We interface with the telephone company when it's time to order lines. We negotiate, when appropriate, with foreign carriers on your behalf.

We provide whatever peripherals you need—including up to 26,000,000 bytes of auxiliary disc storage. We give you a software package tailored to your needs. We don't give you a limousine when what you need is a taxi.

As a matter of fact, our analysts will go in and study your present communications setup at no cost to you. The network configuration they recommend could save you enough in line charges to cover the cost of MINIPLUS.

The pluses in MINIPLUS don't stop there.

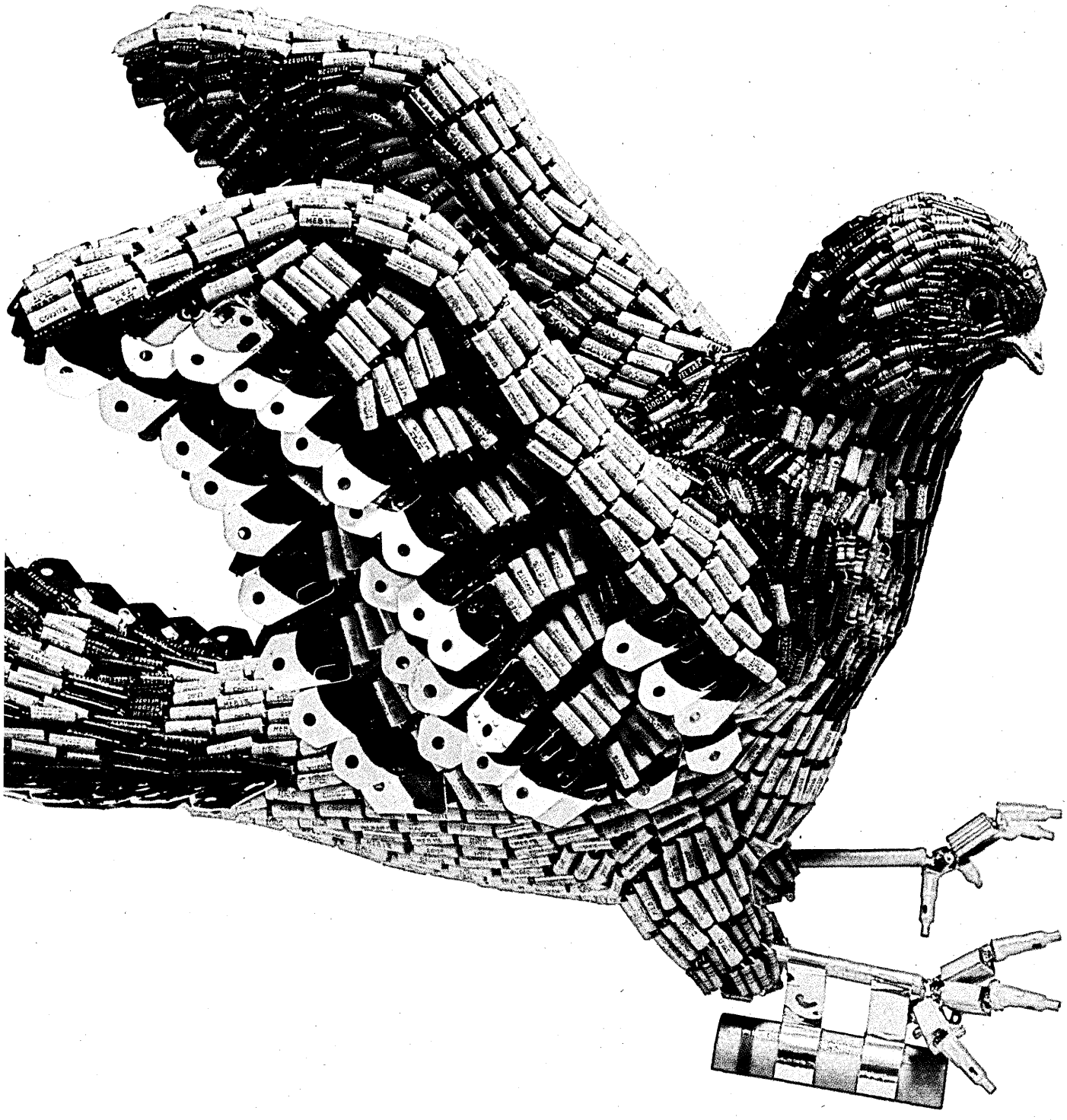
MINIPLUS can be installed on your premises or ours. If it's on ours, you save up to half of your total system overhead.

In short, MINIPLUS is not just another computer message switch. It's a complete, turn-key message-switching system. A system you can get working with one vendor—RCA Glōbcom.

For more information, contact our MINIPLUS man: Tony Annibell, RCA Global Communications, Inc., 60 Broad Street, New York, New York 10004. Phone (212) 363-2270.

RCA Global Communications

How a computer company is even helping a phone company communicate better.



Honeywell is helping all kinds of companies communicate all kinds of data, faster and more economically than ever before.

Companies like Northwestern Bell Telephone of Omaha, Nebr., which uses a Honeywell computer/communications system (two Model 1250 processors and six Model 316 minicomputers) to compute the rates for long distance calls and then communicate the results as an audio response to the local operator. The system, designed to improve customer service, serves 6,000 operators in a five-state area, and is available 24-hours-per-day, seven-days-a-week.

Companies like G.D. Searle of Skokie, Ill., the manufacturer of ethical pharmaceuticals and other health care products. They're using a Honeywell 6060 computer system with a DATANET 355 front-end processor to communicate with more than 100 terminals throughout the company. Now, more people can take advantage of the computer system – laboratory scientists, order entry clerks, managers in marketing and production and finance.

Honeywell's new 7700 microprocessor-based terminal. It offers instant visual access to computer-stored data in a variety of communications environments.

Companies like De Moulas of Tewksbury, Mass., a 16-unit supermarket chain that uses a Honeywell Model 2020 computer for inventory control, store invoicing and sales analysis. Order information is transmitted from terminals in each store over phone lines direct to the computer, saving time and clerical work, and minimizing stock shortages on the shelf.

Companies like Meyer Bros. Drug, a wholesale distributor of 17,000 drug products with warehouses in Missouri, Tennessee, Alabama, Arkansas, Louisiana, Mississippi, Kansas and Oklahoma. Honeywell Model 2020 computers are located at the regional warehouses to process orders and invoices and then communicate to a central Honeywell computer at St. Louis headquarters for company-wide inventory analysis and other management reports.

Businesses like Greyhound Parks, operating seven dog race tracks and one horse track in Arizona. Greyhound uses terminals to access Honeywell's DATANETWORK time sharing service provided by a Model 6080 system in Minneapolis, Minn. Primary application is the payroll for a seasonally changing number of employees, all of which are paid through the Phoenix headquarters office.

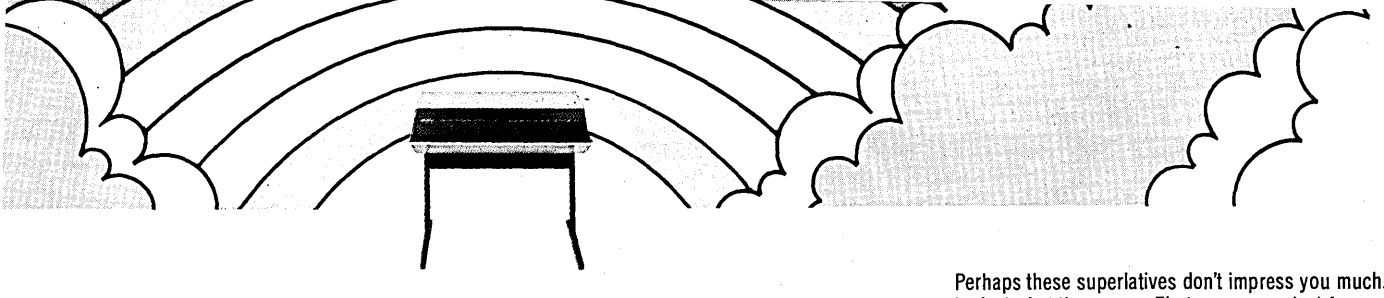
DATANETWORK also allows Greyhound to buy only that amount of computer resources required in any one week.

Honeywell's DATANET 2000 front-end processor handles communications lines without tieing up the central processor.

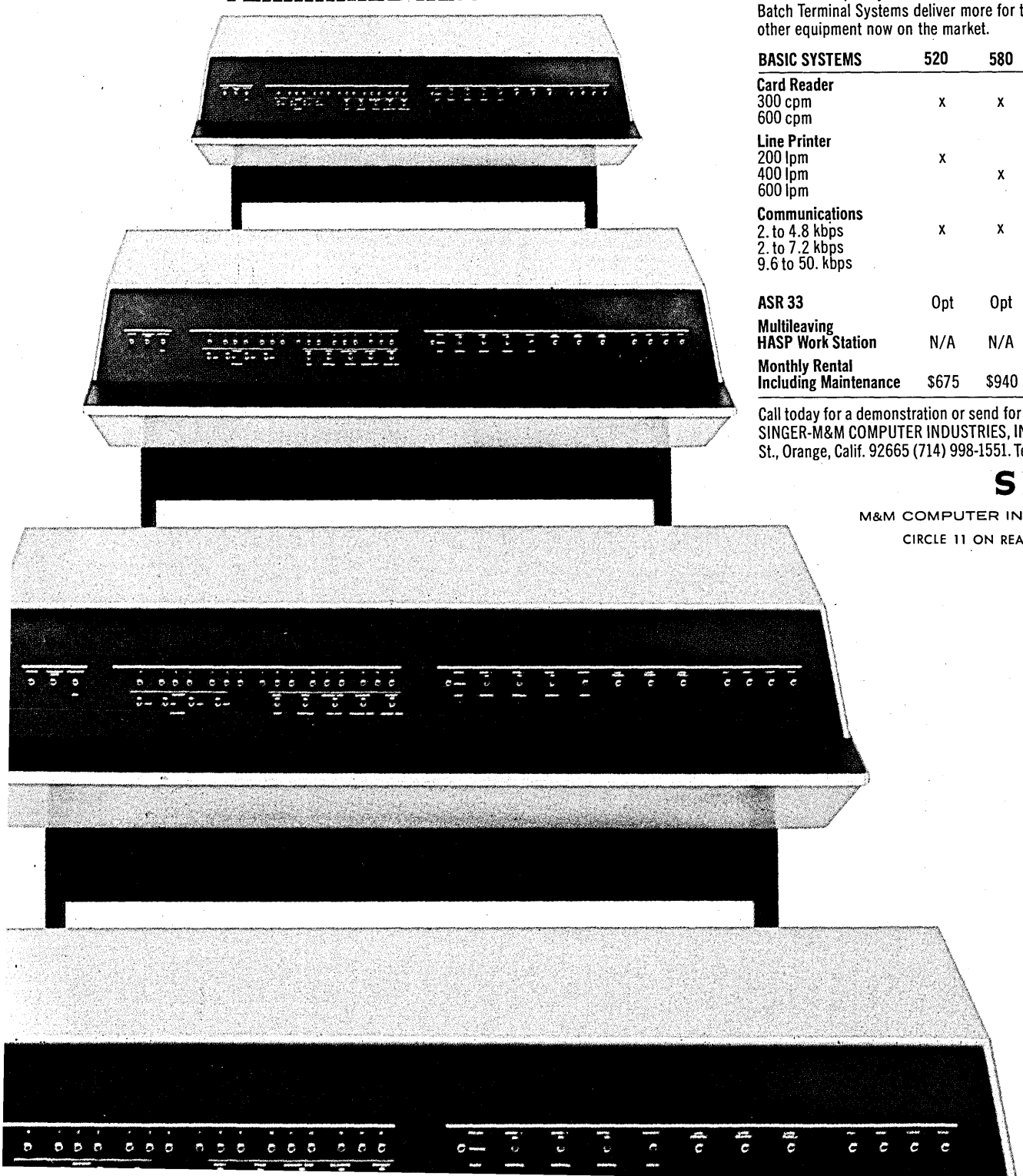
And hospitals like Bernalillo County Medical Center, the University of New Mexico's teaching hospital, at Albuquerque. They've installed CRT terminals tied to a DATANET 2000 front-end communications processor, which serves a Honeywell Model 2200 computer system. The terminals are used to speed patient admission and discharge, and to record charges for hospital services.

So you can see, just about any kind or size of company or organization can benefit from Honeywell data communications. (Your computer doesn't even have to be a Honeywell system.) Now maybe you should communicate with your local Honeywell representative. Or write: Honeywell Information Systems, (MS 061), 200 Smith Street, Waltham, Massachusetts 02154.

The Other Computer Company:
Honeywell



THE LONGEST LINE. FASTEST SPEEDS. MOST INTELLIGENT. LEAST EXPENSIVE REMOTE BATCH TERMINALS AVAILABLE.



Perhaps these superlatives don't impress you much. But, let's look at what they mean. First, you can select from several different systems to meet your precise current requirements without paying for more than you need. Yet, we can upgrade your system any time at your facility without costly down-time. If you are ready for a high speed system (up to 50.kbps) we can provide the most efficient terminal available plus a wide variety of peripherals for maximum through-put. Being intelligent, Singer-M&M terminals are compatible with all major main frames. Emulators are available for IBM System 360/370, UNIVAC 1108, Control Data Corporation 6000, Honeywell 6000/355 and others. When you consider price/performance, the chart below quickly shows that basic Singer—M&M Remote Batch Terminal Systems deliver more for the money than any other equipment now on the market.

BASIC SYSTEMS	520	580	565	560
Card Reader				
300 cpm	x	x	x	
600 cpm				x
Line Printer				
200 lpm	x			
400 lpm		x	x	
600 lpm				x
Communications				
2. to 4.8 kbps	x	x		
2. to 7.2 kbps			x	
9.6 to 50. kbps				x
ASR 33	Opt	Opt	Std	Std
Multileaving HASP Work Station	N/A	N/A	Std	Std
Monthly Rental Including Maintenance	$675	$940	$1160	$1645

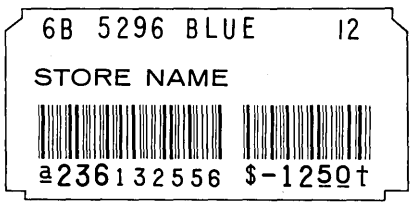
Call today for a demonstration or send for complete literature. SINGER-M&M COMPUTER INDUSTRIES, INC., 2201 N. Glassell St., Orange, Calif. 92665 (714) 998-1551. Telex 65 5464

SINGER

M&M COMPUTER INDUSTRIES, INC.

CIRCLE 11 ON READER CARD

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.

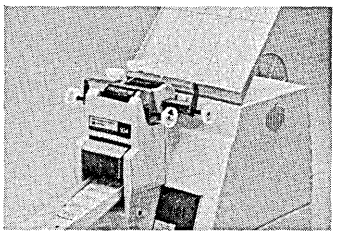
Whatever your size, Monarch has the bar code and complete systems you need for fast, accurate information control. The CODABAR™ code is flexible and reliable; compatible with your present operation. Complementing the code is a choice of systems to create and capture it economically; plus a wide range 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.

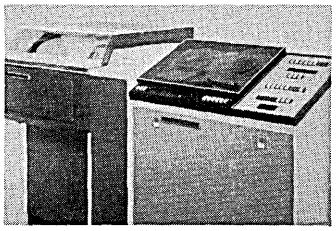
Monarch Marking Systems

PitneyBowes

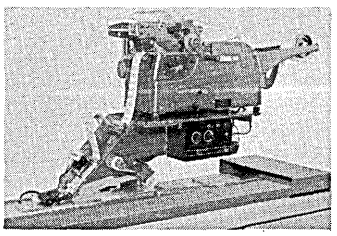
3 ways to create it.



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.

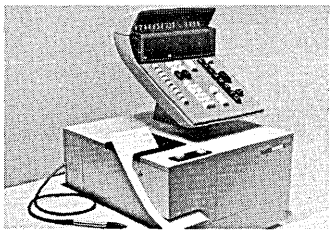


Monarch 2000 CODABAR Encoding System is a high-speed computer-controlled line printer with programmable logic and expandable memory. Ideal for high-volume distribution center printing of bar-coded tags and labels.

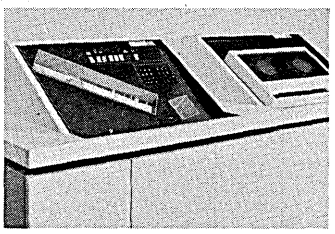


Model 2023 Rotary Imprinter is a fast, simple and reliable rotary mat printer. Enables vendors to print data on conventional merchandise tag and label supplies right on their packaging lines.

2 ways to capture it.



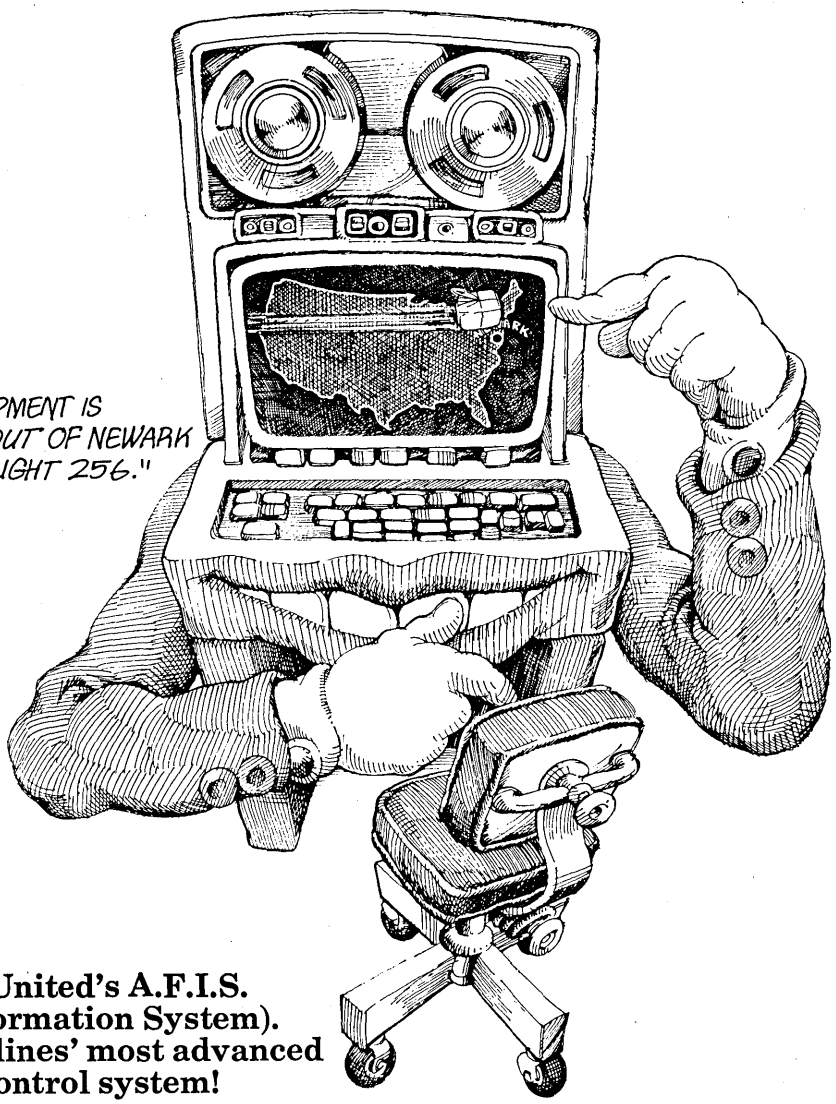
Model 2243 Bar Code Scanner is connected to the Pitney Bowes-Alpex SPICE® terminal to read the CODABAR code at point of sale. Data is checked seven times in the logic to assure accuracy before being released to the interface and transmitted to the terminal.



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.

Get Monarch into your system... to get the most out of it.

Now-in 4 seconds-United can track down your shipment!



"YOUR SHIPMENT IS ONE HALF HOUR OUT OF NEWARK ON UNITED FLIGHT 256."

Announcing United's A.F.I.S. (Air Freight Information System). The airlines' most advanced computerized control system!

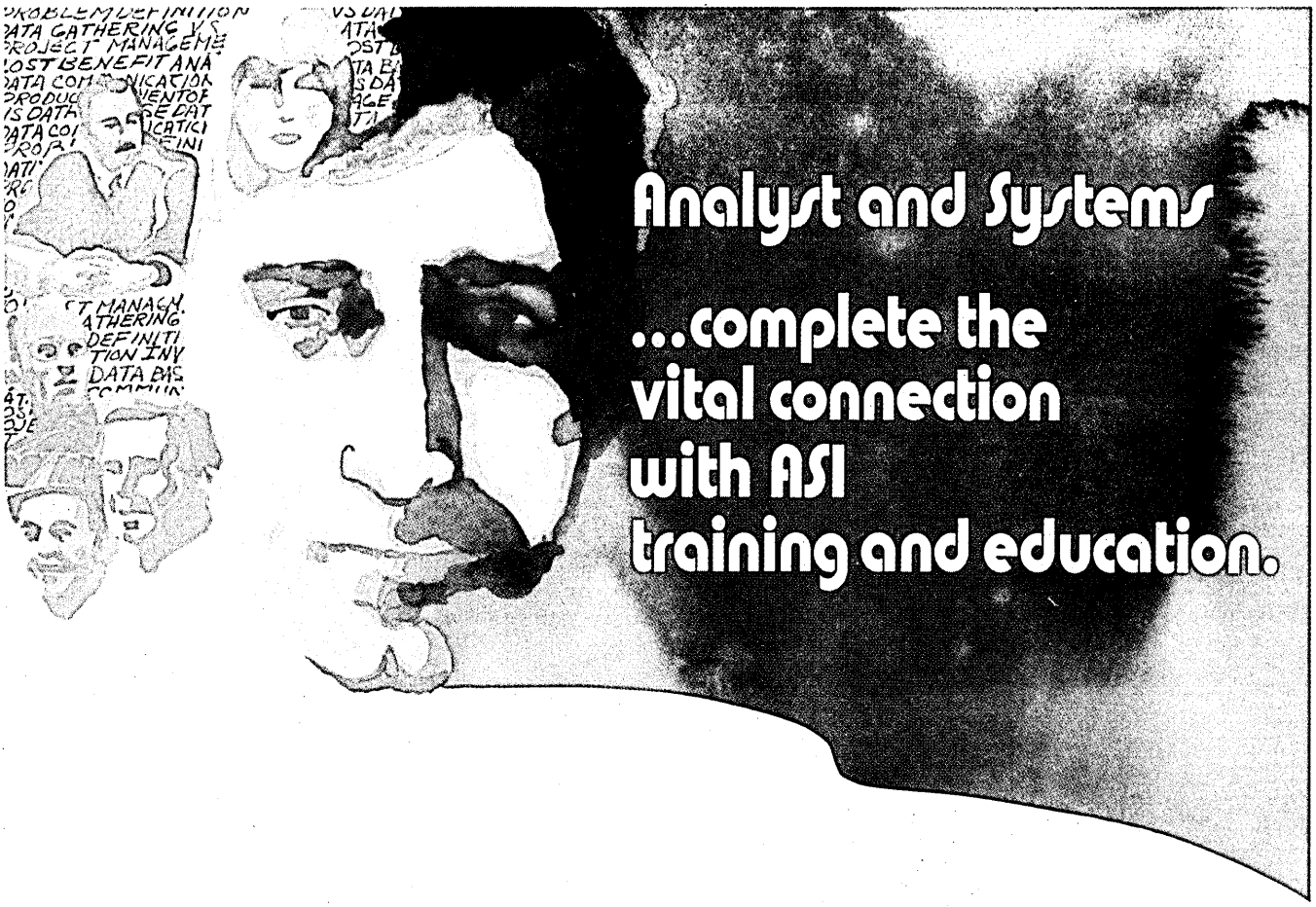
Now, in the wink of an eye, we can give you accurate details on your shipment. Where it is. How it is. Who has it.

Whether that shipment is 10,000 pounds in one of our Jet Freighters, or 100 pounds in the hold or belly of a United Passenger Jet—if we've got it, we know where it is. And so do you.

A.F.I.S. is already a proven success. Every day throughout 113 United cities, it gives thousands of shippers and consignees complete information (both air and ground) about their shipments. Try it. All it takes is a phone call—and 4 seconds of your time.

One call to your A.F.I.S. girl does it all.
Simply phone your local United Jet Freight office. All you need is the air bill number. Or we can locate your shipment with your United account number. Or the shipper's order number. Or just the shipper's name.

United Air Lines
Jet Freight *No. 1 in the U.S. sky*



Of all the data processing areas of specialization, the systems analyst is the most unusual. The analyst is forced to be both a generalist *and* a specialist. He must be prepared to deal with not only other DP people, but also be competent to deal in the area of user needs as well. On the one hand, the need to keep current with the state of the art in data processing... and on the other, the need to know marketing, production, personnel, purchasing, financial and manufacturing systems.

That's why Advanced Systems Incorporated offers a total curriculum of video assisted instructional systems designed specifically for the analyst. Our analyst career path includes such courses as Problem Definition, Data Gathering, Project Management, Cost Benefit Analysis *plus* Data Communications, Data Base, V S, Production Inventory Control and many others all directed at what the analyst needs to know.

ASI is the world's largest producer and supplier of in-house video assisted instruction, with a client list that reads like an international "Who's Who" of financial and industrial institutions, government and education. Our educational and training systems are designed around the concept of "behavioral objectives". We believe the end result of education and training must be quantifiable ... measurable change.

Our thrust: action-orientated as well as concept orientated training. Our intent: to teach the "why is" and carry through to the conclusion... the "how to".

For more information on how ASI can help your people, fill out and mail the coupon.

Developing today's Man for tomorrow's challenge

ADVANCED SYSTEMS INCORPORATED

Corporate Office, 1601 Tonne Road
Elk Grove Village, Illinois 60007
Phone 312/593-1790

Offices in Atlanta, Boston, Chicago, Cleveland, Dallas, Detroit, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Washington, D.C.

International affiliates in South Africa, Australia, Canada, England, West Germany, Iran, Mexico and Sweden.

ADVANCED SYSTEMS INCORPORATED
Dept. 22
1601 Tonne Road/ Elk Grove Village/ Illinois 60007
Please send me more information on your Systems Analyst Curriculum.

NAME_____

TITLE_____ PHONE_____

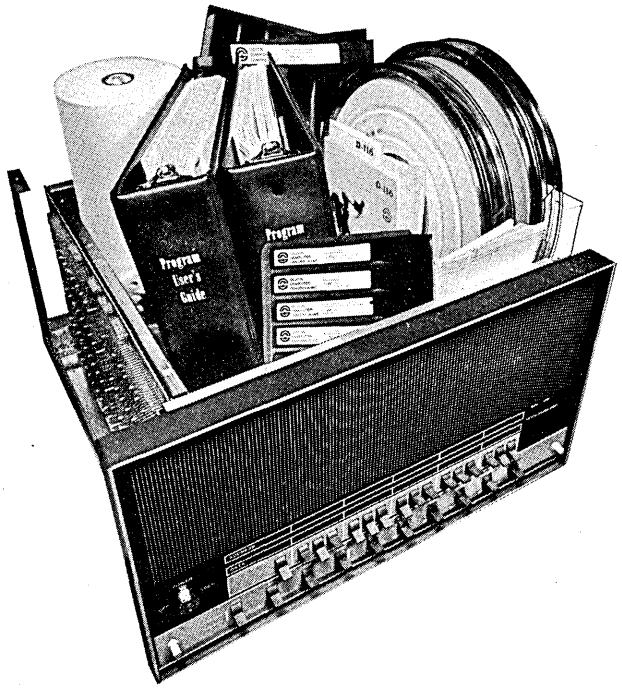
COMPANY_____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

Which company gives you the software and systems support to see the job through?

We do.



Better minicomputer design is only part of our story. We install your computer and provide assistance as necessary to insure your complete satisfaction.

Now, let's explode some myths.

First, we *do* provide software—our own operating systems, utilities, math routines and maintenance/test programs. Second, we give them to you with no strings attached and no licensing agreement required.

For your convenience, we maintain a program library of the documentation, listings and tapes for all our programs. And we are as near as your phone with our "dial-a-pro" service, to bring our programming professionals to your aid quickly.

So, whether you're a first-time user or an experienced OEM, it's nice to know that the hardware and software package you bought will be supported by people who continue to care about doing business with you after the installation.

Try us.

Digital Computer Controls, Inc.
12 Industrial Road
Fairfield, New Jersey 07006
(201) 227-4861

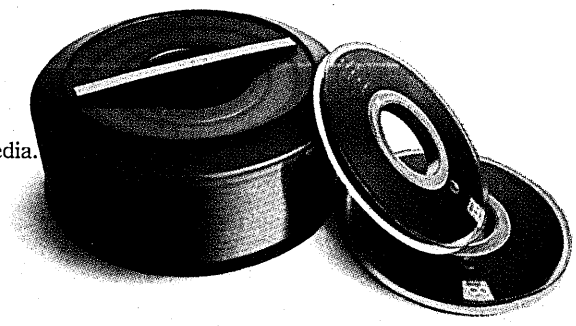
The do it people.

DIGITAL COMPUTER CONTROLS INC

CIRCLE 16 ON READER CARD

When you need 3M's help, we'll call out the whole clan.

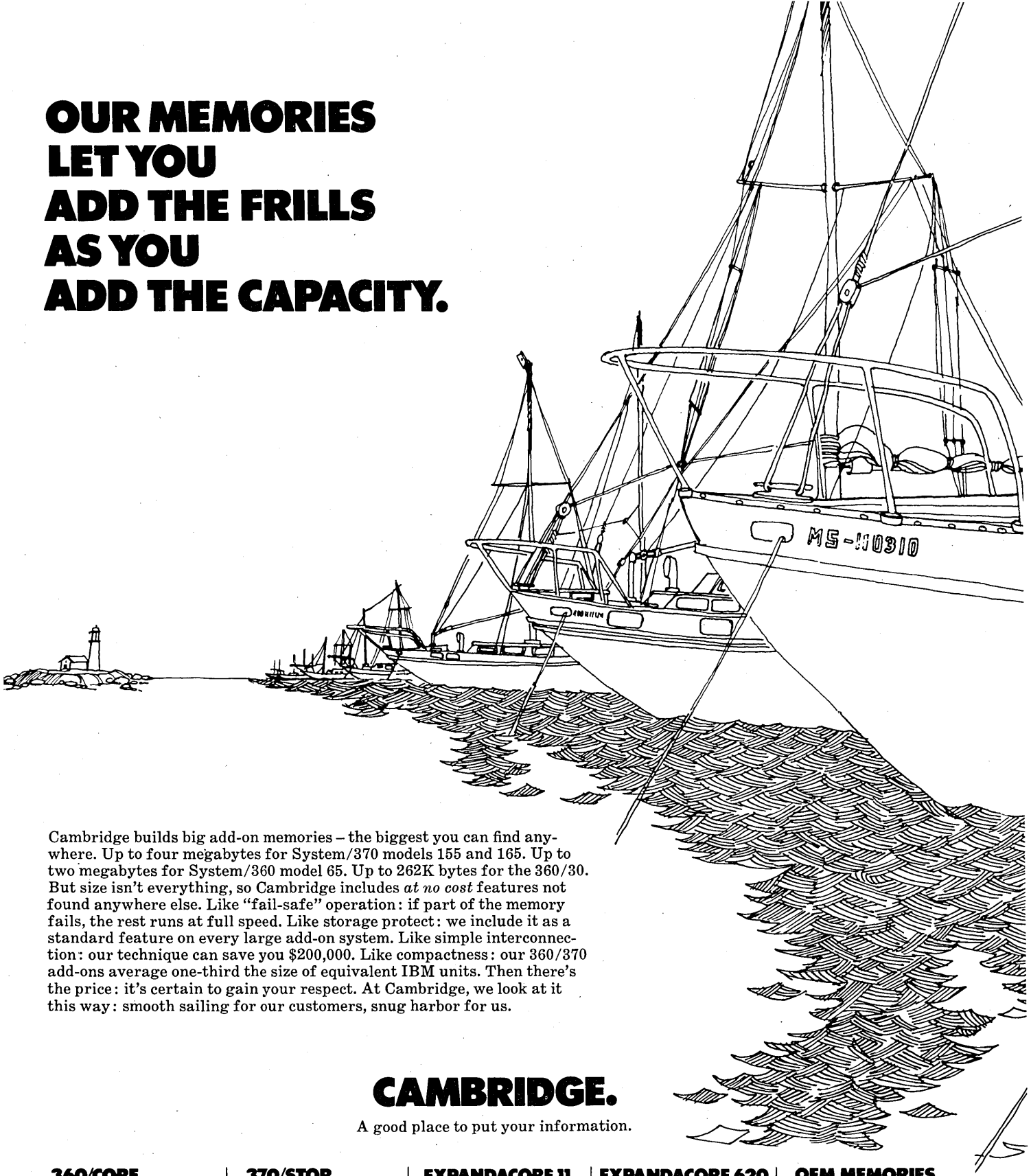
When you use "Scotch" computer tapes and disk packs, you get the combined skill and dedication of more than 1000 special people. The 3M Clan. People who have led the industry with innovations in computer media technology, starting with the development of the first computer tape in 1953. A clan which stands behind its products with one of the largest and most extensive groups of technical sales representatives in computer media. People who thrive on assisting. People who will go to any length to solve a customer's problem. The Data Recording Products Division of 3M. A proud clan.



"Scotch" is a registered trademark of 3M Company.

3M COMPANY

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.

CAMBRIDGE.

A good place to put your information.

360/CORE

Add-on and extended memory systems for Models 22, 30, 40 50 and 65 processors in the System/360 line.

370/STOR

Up to four megabytes of main memory for the Models 155 and 165 in the IBM System/370 line.

EXPANDACORE 11

Full expansion for all PDP-11 processors, with 30% speed increase in some models. Two-way data save, interleaving and other features.

EXPANDACORE 620

Up to 32K storage for all 620/i, L, L-100 minis. Self-contained and self-powered 5¼" plug-in system.

OEM MEMORIES

Core and semiconductor memories for mainframes, controllers, peripherals and terminal products.

CAMBRIDGE MEMORIES, INC., 696 Virginia Road, Concord, Mass. 01742 (617) 369-8850

Datapoint delivers at Scientific American

SCIENTIFIC AMERICAN is one of the most prestigious and successful of U.S. publications. With a fully paid circulation of 500,000, it reaches an elite strata of scientific and humanistic readership throughout the world. In common with other large circulation magazines, a major administrative function within SCIENTIFIC AMERICAN concerns subscription fulfillment and specifically the order entry "cage" in which subscription renewals (and accompanying payments), gifts, new and agent orders, address changes, deletions and other alterations are accounted for and prepared for entry into the master circulation list.

After years of processing transactions manually—that is, all functions from the opening of the daily mail to the entry of its data into the central computer—SCIENTIFIC AMERICAN now utilizes Datapoint 2200 Business Computer Systems for these activities. The results?—"A real breakthrough," says Felix Kalin, data systems manager for the publication. "With the 2200's we can give same-day service to virtually all incoming mail, even in peak seasons, with substantial improvement in employee productivity and a lower direct cost to the magazine."

The Datapoint 2200, which combines a fully programmable computer with a video display, keyboard and internal tape cassettes, integrates into one handling function tasks that formerly required as many as four different work stations. "The 2200 automated cage gives the operator total control over the accurate disposition of mail and the data it contains from start to finish, instead of just unchecked 'pieces' of the job. The result has been a more productive employee, and a happier, more responsible one," notes Kalin.

All incoming mail to SCIENTIFIC AMERICAN is routed through the subscription fulfillment "cage," where the Datapoints are programmed to provide "guided entry" and immediate validation for each data element. The cursor oriented video display as coordinated with an audible click or beep gives a teaching machine response to each keystroke, guiding options, exceptions and corrections. Dynamic relabeling of ten function keys prompts one-stroke, precise capture of most fields. "Each guided entry program is optimized to support the specifics of the clerical job design—not the other way around," said Kalin. This approach is applicable to many other magazines. And in fact, we are making the program available to other publications in cooperation with the Datapoint Corporation."

The Datapoint 2200 delivers at SCIENTIFIC AMERICAN and at many other organizations around the world for a variety of data entry, data communications and data processing applications. Prices on this unique system begin at $6040. For further information contact the Datapoint sales office nearest you or write or call Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284, (512) 696-4520.

Datapoint

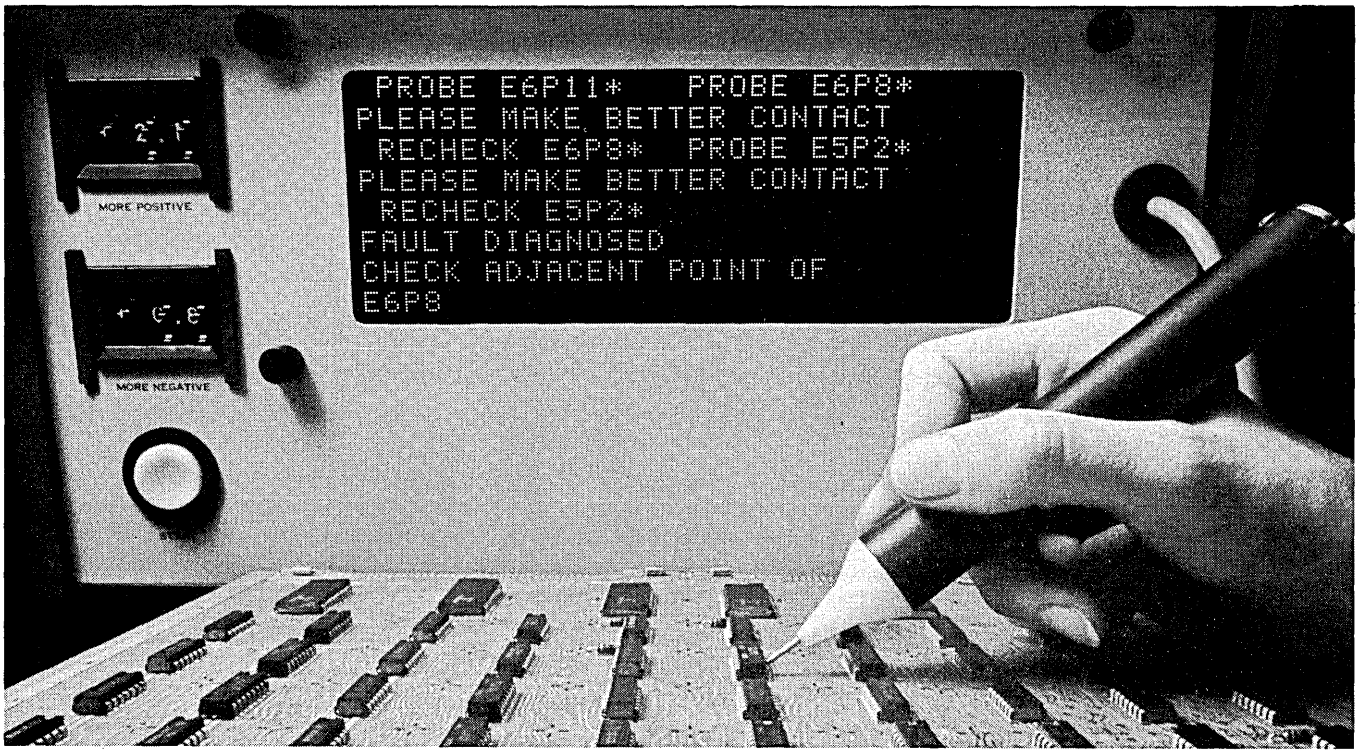
"With the Datapoint 2200's we now handle in subscription fulfillment an average of over 2500 mail items a day with less than half the personnel previously required and with an almost four-fold increase in the productivity of employees in order entry. The programmability of the 2200 has enabled us to custom-tailor 'Guided Entry' routines for each of the diverse mail groups we receive. As importantly, the 2200 reestablishes the clerk's sense of identity with and responsibility for her work by enabling total one-step control."

Felix Kalin
Data Systems Manager
SCIENTIFIC AMERICAN

Home Office: 9725 Datapoint Drive/San Antonio, Texas 78284/(512) 696-4520 • **Sales Offices:** Albuquerque, N.M./(505) 225-0120 • Atlanta/(404) 458-6423 • Boston/(617) 237-2090 • Chicago/(312) 671-5310 • Cleveland/(216) 283-9323 • Dallas/(214) 630-1342 • Darien, Conn./(203) 655-4800 • Denver/(303) 771-0140 • Detroit/(313) 557-6092 • Greensboro, N.C./(919) 299-8401 • Liberty, Mo./(816) 781-0400 • Los Angeles/(213) 645-5400 • Melbourne, Fla./(305) 727-3205 • Minneapolis/(612) 854-4054 • New York/(212) 759-4656 • Orlando, Fla./(305) 671-4500 • Philadelphia/(215) 643-5767 • Phoenix/(602) 265-3909 • Portland/(503) 244-0101 • Salt Lake City/(801) 272-3681 • San Francisco/(408) 732-9953 • Washington, D.C./(301) 937-2215
• **International Representatives:** TRW Communications/Toronto, Ontario, Canada/(416) 481-7288 • TRW Communications/Lyss/Berne, Switzerland/Telex: 845-34446 • TRW Electronics-International/Los Angeles, California/Telex: 674593

CIRCLE 10 ON READER CARD

Anyone can find fault with the Teradyne L100.



If you're testing a fair number of digital circuit boards without benefit of automatic fault isolation, you're probably spending much more money on troubleshooting than you have to. Consider:

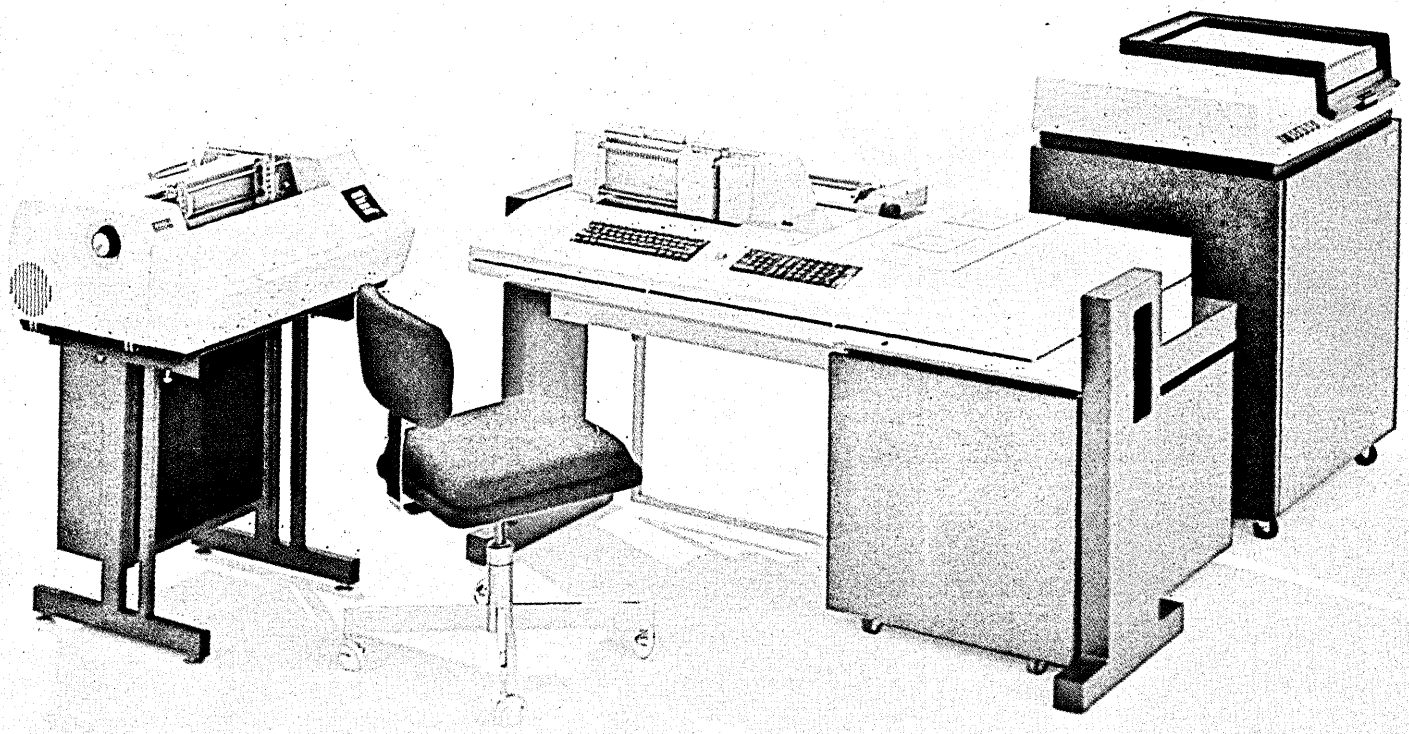
Board *testing* usually ends and board *troubleshooting* begins once you know that an output pin is in the wrong logic state. Automatic fault isolation, available with Teradyne's L100, picks up the trail at that point, automatically telling the operator where to probe, step by step, until the source of trouble is reached. Instructions are in plain English, in terms of specific pins of specific ICs. The whole procedure might take less than a minute, even with a complex board. Best of all, it requires no special technical skills.

Maybe you think all this diagnostic power adds up to one big programming headache. Not at all. *The same probe you troubleshoot with, you program with* — simply by letting the system learn the logic on a known good board.

To learn how you can find fault with the L100 Automatic Digital Circuit Test System, write: Teradyne, 183 Essex Street, Boston, Massachusetts 02111. In Europe: Teradyne Europe S.A., 11 bis, rue Roquépine, 75 Paris 8e.

TERADYNE

CHICAGO (312) 298-8610 / DALLAS (214) 231-5384 / NEW ENGLAND (617) 458-1256 / NEW YORK (516) 364-9797 / SUNNYVALE (408) 732-8770
LONDON (093-28) 61111 / PARIS 265 72 62 / ROME 59 47 62 / MUNICH (0811) 33 50 61 / TOKYO (03) 406-4021



When you need to know...Nixdorf.

The more you know the more you grow. That's why Nixdorf makes business computers.

Nixdorf sells computers in 20 major U.S. cities. From $7,990 up. They do all your accounting, payroll, sales analyses, inventory . . . everything.

When you need to know more, you plug in more modules: cassettes, tape decks, discs, printers. And plug-in replacement parts are the reason Nixdorf's field engineers can give you such fast service.

We also program your Nixdorf computer to fit in perfectly with your present procedures. And you pay for the machine only after it's set up to do the exact job you need.

If you want to know more . . . you need to know Nixdorf. Send for our free brochure now.

NIXDORF COMPUTER INC. O'Hare Plaza, 5725 E. River Rd., Suite 365, Chicago, Illinois 60631 ▪ (312) 693-6600

I want to know more about Nixdorf . . . now. 34-D

NAME_____

TITLE_____

COMPANY_____

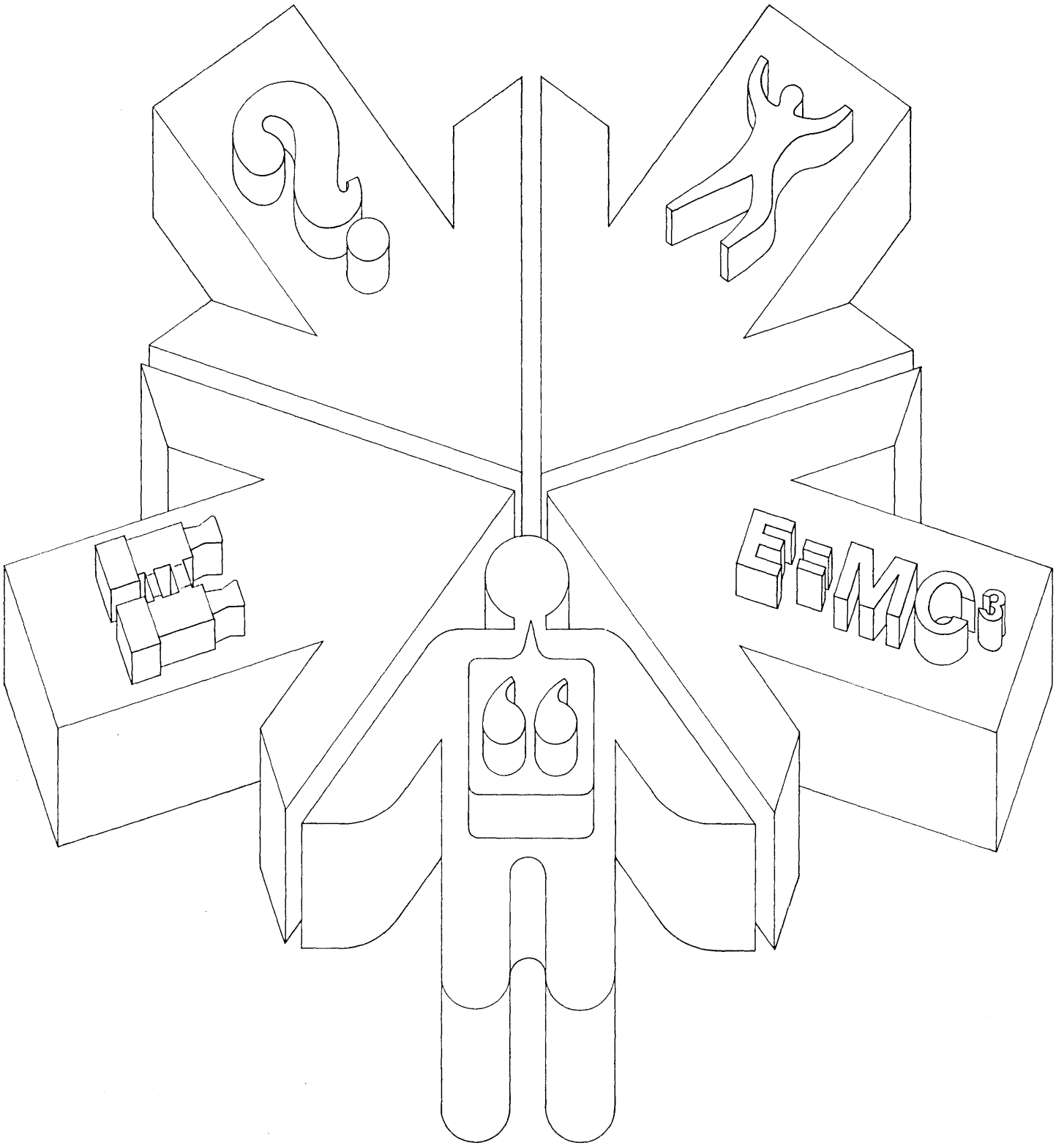
ADDRESS_____

CITY_____ **STATE**_____ **ZIP**_____

NIXDORF COMPUTER

More than 30,000 computers installed around the world.

CIRCLE 17 ON READER CARD



Dedicated to the Memory of Gordon V. Wise

Illustrations by: MediaGroup / James Leonard Christopher Potocki

An attempt to find basic truths about the industry must begin with an about-face of the opinions expressed by Boehm in his May article: "Software and Its Impact: A Quantitative Assessment"

Some months ago, DATAMATION published an article by Dr. Barry W. Boehm entitled, "Software and Its Impact: A Quantitative Assessment."[1] Unfortunately, the majority of the problems which were discussed in that article represent *symptoms,* not problems (a polite way of expressing intense disagreement with many of Dr. Boehm's views)! This article, therefore, is an attempt to find basic problems and perhaps rediscover a few simple truths about computers, people, and the nature of our industry.

The strange thing about truth is that it usually entails both a collection of facts, and a strategy which fits them together with a very definite perspective. For example, it's relatively easy to determine a rather accurate breakdown of statistics relating to automobile accidents. By examining these figures, we might then conclude that a substantial impact can be made by forcing the automotive industry to build safer automobiles. This particular solution (based on "facts") has a great deal of emotional appeal because: it eases the conscience of the majority; it permits the development of solutions so simple that anyone can understand them and, therefore, feel that something is being done about the problem (e.g., stronger bumpers); it creates a convenient fall guy who nobody ever liked or trusted anyway (the automotive industry).

Consider, however, a host of other factors which collectively have a far larger impact on automobile accidents:

1. The almost complete lack of proficiency required to obtain and keep a driver's license.
2. The irresponsibility which people show toward the maintenance of their automobiles.
3. The lack of serious concern for keeping emotional defectives (such as alcoholics) off the highways.
4. The almost complete propensity of local police departments to confuse traffic safety with traffic tickets.

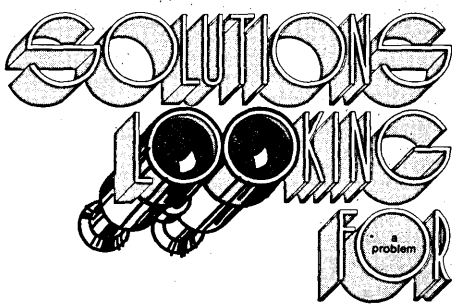
Now, any and all of these factors are far more germane to the issue of automotive safety than stronger bumpers. Unfortunately, however, each represents a politically difficult and psychologically traumatic posture relative to proposed solutions because:

1. They distribute guilt to the majority.
2. They place the responsibility for problem solution on people who might be inconvenienced as a result of a reasonable solution.
3. They describe problems whose solutions require human behavior modification—and few people want to change their behavior just for the sake of someone else.

It will be our thesis that the "facts" concerning programming which seem to receive systematic identification as being *problems* are in reality *symptoms* of very fundamental problems (when viewed from a different perspective) which cannot be relegated to "programming" and summarily forgotten. These fundamental problems fall into four classifications:

1. Inventing problems for computers to solve based on the existence of a computer rather than the existence of a problem.
2. Trying to build infinite solutions to indefinite problems in a fixed hardware framework.
3. Failing to adequately come to grips with our technology
4. Permitting incompetent people to practice software.

Thomas Szasz,[2] a noted psychologist, tells about the "second sin." It is, he contends, the sin of *speaking clearly.* Man's desire to communicate and speak clearly prompted construction of the Tower of Babel. But the tower was promptly destroyed, leaving man both master and victim of the tyranny of language. As we discuss each problem we will try to point out how this tyranny affects our thinking about computers, systems, and software. But identifying fundamental problems and basic truths about our industry is not to say that there aren't problems with programming as we know it; no more than the identification of a drunken driver problem means that automobiles are safe. There is, however, a deeper and more important vantage point from which our industry must be viewed if we are to continue technological advancement unencumbered by the inability to deal appropriately with human beings.



People use computers to solve problems. At least sometimes. But we commit a serious *post hoc, ergo propter hoc* fallacy (the fallacy of assuming something has caused an event merely because it preceded it) when we reason from this that their *purpose* is to solve problems. The purpose of building computers is to make a profit for their builders! Now that may embarrass some of our more erudite intellectuals whose environment is firmly anchored in tenure, government funding, and miscellaneous freebies, but the sad truth is that we live in a crass commercial world. And he who doesn't profitably sell his product doesn't stay in business very long. This profit motive, coupled with the search for a problem, provides us with an opening scenario.

Contrast, if you will, the conceptual difference between a computer and an automobile. (This comparison gets more meaningful when you realize that many computers today cost less than some of our more interesting automobiles.) The automobile, when you buy it, is a solution to a problem. It's there, ready to go. It's a finished product, ready to be put to work satisfying the

1. Barry W. Boehm, "Software and Its Impact: A Quantitative Assessment," *Datamation,* May 1973, pp. 48-59.

2. Thomas Szasz, *The Second Sin,* Anchor Press, 1973.

needs of human beings in a complete and direct manner. No so, however, with the computer. As delivered, a computer and its normal environmental software is a stupid hulk of machinery capable of doing nothing and requiring a vast expenditure of time and effort before it even begins to solve a problem. The computer claims to be "general purpose." So does the automobile. But there is an important philosophic difference in the use of the term "general purpose" in these two contexts. A vanilla-flavored automobile, without formal modification, is capable of being immediately and directly used for an unbelievably wide variety of tasks. When computer people talk "general purpose" however, this translates into the notion that, ". . . if one puts enough time, effort, and energy into problem definition, analysis, and programming, one can make a computer do many wonderful things . . . " The two notions are not identical and the distinction between them is important. The automobile manufacturer doesn't have to invent problems for his product to solve. The problems already exist and the product solves many of them. Not so with the computer manufacturer. To sell computers, he must somehow create the feeling that they can do useful work and solve problems. This, it turns out, gets a little sticky.

Our computer manufacturer is caught between the proverbial rock and a hard place. Many problems that a computer is capable of solving (and which the manufacturer himself could solve if he so desired) relate directly to the profitability of his potential customer. Since the manufacturer does not wish to be responsible for the profitability of his customer, he must discover ways to solve problems without actually solving (being responsible for) them.

In the late '50s and early '60s, computer manufacturers were pretty dumb; their sales people were even dumber. They got so caught up in the thrill of their technology that they actually believed their own sales pitch about the wonderfulness and cost savings associated with computers. They wrote letters and signed contracts committing themselves to a myriad of problem-solving jobs. They then went to court and lost several lawsuits when users discovered that the computer's best didn't match its promise. But computers are expensive and their manufacturers can afford the best lawyers in town. So the best lawyers in town went to work and created today's contract terminology which:

1. Excludes any and all oral and written representations made by the manufacturer which do not specifically appear in the contract.
2. Limits express warranties and denies completely any implied warranty for merchantability or fitness for a particular purpose.[3]

The hardware manufacturer thus got out from between the rock and the hard place and is now perfectly free to talk about the wonderful problems computers can solve (such as accounts receivable, but not necessarily *your* accounts receivable, and only if you're clever enough and spend time and money enough to make it work) without actually being contractually, morally, or financially committed to any solution.

Now, someone's bound to reply that this statement is slightly inaccurate because many manufacturers supply applications software with their computers. This may be true, but there is a substantial difference between supplying an applications program and contractually committing that an applications program will solve a user's problem. Consider a reasonable analogy in a doctor/patient relationship. I go to the doctor and tell him I'm feeling ill. He examines me and prescribes some medicine. I ask if the medicine will cure my illness and the doctor tells me that whether the medicine will cure me or not is my problem, not his. In fact, the medicine might kill me, he explains; and, if it doesn't kill me, it's sure to cause a skin rash and I might actually lose most of my hair. I ask why then is he prescribing that medicine in the first place? His reply is simple. He claims that he hasn't got the time and I haven't got the money to afford a proper diagnosis; further, he owns stock in the pharmaceutical company that makes the drug and he is also a 50% owner of the pharmacy which will fill my prescription.

When we catch doctors doing something like that, we do bad things to them. But computer manufacturers get away with similar activities every day. To escape unscathed from this form of malpractice, the computer manufacturers need a scapegoat. This scapegoat is the user himself. And users don't build hardware, they build software. When a user's program fails to run fast enough or can't fit into the computer, it is never because he was sold the wrong computer, but always because the user's programmers weren't clever enough to bring it off. Under the veil of modularity, a hardware manufacturer sells a fixed solution to an undefined problem. Whether or not any given problem can be solved with the fixed solution is a matter for the user to decide.

Dr. Boehm shows us curves which relate the cost for problem solution to how close we come to using 100% of the resources of a system. The fatal flaw in this logic is that it politely assumes the existence of a pre-defined solution to a problem and then varies our ability to approximate it. In point of fact, the only aspect of the solution that's fixed is the hardware on which the problem is to be solved.

It comes as no surprise to any designer that, beyond a certain point, it takes an extraordinary amount of effort to achieve a rather small amount of gain. This is true whether you're designing automobiles and coming to grips with the 1975 emission standards, or whether you're building programs and trying to shave off the last few microseconds at execution time. The appropriate measure for the difficulty of such tasks is highly internalized and relative to the task itself and our understanding of it. A classic example of effort vs. accomplishment in software activity can be observed by reviewing the historical sequence of material available from the ACM in the form of algorithms which relate to the sorting process.[4]

From time to time people within our industry have suggested that perhaps hardware shouldn't be a fixed solution looking for a problem, but instead should be designed with more attention to solutions and software. Unfortunately, when you study most of these positions further (including Dr. Boehm's) they rapidly drift away from their initial fluid-like philosophical position to one in which the hardware has once again become fixed, but this time more in concert with an author's conceptual leanings of the moment. It's just another form of verbal tyranny lurking under the clothing of change.

As practiced, we consistently (and badly) misuse the term "systems design" and in fact often use it with an almost overt attempt to deceive.[5] The majority of activities performed under the title of systems design are more clearly and appropriately called either "problem definition" or "software design." (Of course, there are still those who believe that any entity involving more than one program is so unbelievably complicated that it must be a "system" rather than "more than one program.")

The fundamental notion of systems design is one in which all possible solutions are given equal voice and inte-

3. IBM, *Agreement for Purchase of IBM Machines* Z120-7086-11 (U/MO25), p. 3.

4. "Collected Algorithms From CACM" from the Algorithms Dept. of *Communications of the ACM*, since the inception of the department in 1960. Algorithm numbers 23, 63, 64, 65, 76, 113, 143, 144, 151, 175, 201, 207, 232, 245, 271, 347, 402, 410, 26, 27, 38, 43, 46, 66, 67, and 426.

grated into a cohesive end product necessary to solve some predefined problem. But that isn't what happens. What really takes place is a sequence of events organized roughly in the following manner:

1. An undefined problem whose solution is of interest to someone is given a sufficiently generic and grand title so as to merit a desire upon the part of another individual to commit dollar resources to its solution.
2. The majority of the hardware upon which the problem will be solved is now defined.
3. Given the hardware and the desire to solve the problem, we now attempt problem definition. Of course at this point, implicit in problem definition is the underlying assumption that the solution lies in software, since this is the only available unconstrained parameter.
4. Occasionally, we reach an impasse, a juncture at which someone believes that software won't solve the problem. The two most common methods for overcoming this impasse are to either imply that the software designer doesn't know what he's doing or modify the problem definition to eliminate the cause of the impasse.

This unfortunate and peculiar process of design is so common and so ingrained in most people that they don't even recognize it's happening. We speak of designing new "systems" when the only thing new about them is their software. Under such circumstances, it's surprising that automated activities ever get accomplished in the first place. When was the last time, for example, you ever got involved in an automated function in which the hardware was procured and specified *after* the problem had been defined and the software constructed?

Consider problem definition. This amounts to the simple act of clearly explaining what it is you want some function to accomplish. But human beings have a difficult time describing such things, even when the subject of the description is *themselves*. Why, then, should we expect them to do better when speaking about something with which they are less familiar?

The nature of most new dp tasks is such that their entire project structure must be thought of as developmental. As such, the yardsticks and measurements of success must be recast for that framework. This doesn't mean that improvements aren't possible in the area of better developmental methods—they are. But the improvements come about largely by reorganizing the process, not by improving a bad process.

The direct and immediate consequences of "a fixed hardware solution looking for a problem to solve" approach to automation is that every other element of the problem-solving process looks bad in contrast to the hardware. We even develop an entire sub-industry whose existence is predicated upon measuring how efficiently we are using the fixed solution![6]

The latest and most dramatic example of this form of perverted thinking involves IBM's virtual storage announcement.[7] Armed with virtual memory (we were told) we were sure to be the best gunfighter in town. Two chromed pistols would snap smartly in smooth leather holsters, and you could shoot 17 million sheriffs just like that! And since P. T. Barnum was right, a few million bytes of IBM's latest snake oil was sold to the industry. And when people began to discover that virtual memory could cause more problems than it solved,[8] the giant from Armonk was ready for them. What it seems to be saying is that virtual memory isn't the problem—it's the user programs that don't know how to use it efficiently. *We thought you understood that.*[9]

Most common solutions to problems begin with problems, they don't begin with solutions!

CONCERNING EXISTENCE

When a computer hardware manufacturer decides to build a new computer, an elaborate R&D effort is launched whose purpose is to determine the details and feasibility of all aspects of the computer prior to its manufacture. The architects and designers of these computers usually spend years of agonizing reappraisal, cost reevaluation, goal compromise, and just plain redo as an integral part of this process. As a natural by-product, many circuits and strategies find their way to the wastebasket before the first flip-flop hits the production floor.

This is not the case when it comes to software, as many people have repeatedly pointed out. Software development doesn't go through a research phase, or a modeling phase, or a cost analysis phase, or a preproduction prototype phase, or any of those good things that serve to substantiate existence. People seem to tacitly assume that in the absence of concrete proof that a function cannot be accomplished, all they have to do is briefly describe it and a full-blown "manufacturing" project can be launched. Existence theorems, however, aren't single objective strategies, either for hardware or for software. The mere fact that a process is *in principle* capable of being programmed, provides no evidence whatsoever concerning: the length of time it takes to design and construct it; the cost to construct it; the efficiency with which it will work; the equipment configuration it requires; or its ability to be built in a sufficiently modular fashion so that any and all aspects of it can be changed on 30 seconds' notice.

Of course, if people understood clearly that they were proceeding with software constructed without a proven existence theorem, they should then be content with whatever the end product turned out to be. Unfortunately, they aren't. But it's interesting to note that although the general attitude toward software development is substantially more cavalier than the attitude toward hardware development, few software projects have ever been involved in the quantity of cost overruns, delays, and troubles that the hardware people have been privileged to experience. Burroughs' misadventures with its 8500 computer system[10] and Control Data's development of the STAR computer[11] are only two of the examples we can cite. (Then there's always Viatron . . .[12]) Those of us who have had the privilege of working within the innards of a hardware manufacturer's organization know full well that hardware people are anything but paragons of timely, cost-effective project completion.

Nonetheless, software touches more of us directly during its construction process, thus its problems are far more

5. Dr. Boehm cites his own writings in an effort to substantiate several points made in the article. One such citation is chapter eight of *Planning Community Information Utilities*, Harold Sackman and Barry W. Boehm (Eds.), AFIPS Press, 1972, pp. 197-218. A careful reading of the list of system design functions which Dr. Boehm presents on pp. 198-199 of this book reveals that most of the items that Dr. Boehm feels are elements of system design have nothing to do with system design; they have to do with problem definition and software design. Of course, one might argue that by adroitly shifting the frame of reference to a sufficiently high meta-level of discourse, any area one desires can be part of a system design relative to its higher level problem definition. In this particular case, however, such a semantic shift isn't possible since the avowed intent of the chapter is to discuss the problem of building something—even if we're not sure what it's going to do.

6. Kenneth W. Kolence, "A Software View of Measurement Tools," *Datamation*, January 1, 1971, pp. 32-38, and C. Dudley Warner, "Monitoring: A Key to Cost Efficiency," *Datamation*, January 1, 1971, pp. 40-42, 49.
7. IBM advertisement, *Datamation*, September 1972, pp. 20-21.
8. Donald C Harder, "IBM's gentle nudge," Letter to the Editor, *Datamation*, February 1973, p. 24, and "Virtual Memory Drawbacks Substantial?" *Computerworld*, July 4, 1973, p. 15.
9. Richard V. Bergstresser, "Virtual Storage Operation," *Datamation*, February 1973, p. 57.

10 Robert B. Forest, "Burroughs Says 8500 Problems Solved, Eyes Role in the Supercomputer Market," *Datamation*, August 1968, pp. 85-86.
11. "Still Looking for the First Star," *Datamation*, October 1972, p. 8.
12. W. David Gardner, "The Rise and Fall of Viatron," *Datamation*, May 15, 1971, pp. 38-40, and July 1, 1971, pp 44-47.

visible than those associated with hardware development. We are somehow duty-bound to explain why software always appears to "look bad" while hardware, although equally disastrous, doesn't seem to. Happily, there are several excellent reasons for this, two of which it is appropriate to mention at this point.

The first reason lies within the design process itself. Problems in this area will be corrected only when we begin to use the same techniques for software design and construction as we do for hardware. Until software existence theorems go beyond the point where we claim that because we can describe a problem we can also solve it, we will continue to find ourselves in a situation which would parallel the hardware situation if we went directly from a statement of the problem to the manufacturing floor. There are certainly many factors involved in the entire design, modeling, and prototype process required for reasonable software construction. But it is decidedly wrong to determine (as Dr. Boehm does) where improvements in the software process can be made by breaking down and analyzing projects whose very strategy guarantees their poor performance! Anyone who sets out to build an IBM OS/360, whose goal is to be all things to all people on a fixed machine, is bound to have trouble. And SAGE, another of Dr. Boehm's cited projects, is a solution whose problem is to protect us from all enemies, real or imagined. Try programming that using quantitative assessment. (See box below.)

A second and more troublesome disappointment with software has little to do with the fact that a particular project took 12 months to complete, but rather with the fact that it took 12 to complete when we were led to believe it would only take 10. We then are forced into feeling either that software people consistently lie, that they are consistently incompetent, or that they consistently overestimate their own capabilities. In fact, none of these is true. If you ask a hardware engineer to build the world's fastest computer and fit it into one cubic foot of space and he tells you it can't be done, ask him why. His answer will never be that he is incompetent, unskilled, or unable to solve your problem. The hardware engineer will always cheerfully point away from himself by telling you that the job can't be done with the circuits he's capable of buying, or the circuit boards available to him, or will mumble something about the technology "not being there yet." In some cases of course, this is true. In other cases, it isn't. Regardless, the engineer can always eliminate his feelings of cognitive dissonance[13] by making factors outside himself responsible when something can't be accomplished.

The software designer is faced with a different sort of problem. If he is asked to build the world's fastest program and fit it into 2K of storage, then somehow if he tells you "no" he is not saying something about the technology or the computer. He is instead always making a claim about himself! That claim, of course, is negative. Just picture a software man telling you that he couldn't do the program because the "technology isn't there yet." You'd probably make a note to pass him up on his next performance appraisal and look around for someone else who would tell you, "Sure, boss, I can do it."

It is imperative that we recognize the significant psychological difference between a negative answer in hardware and one in software. The software man must psychologically contend with so much cognitive dissonance when he says no, that he would rather say yes, hoping that the fullness of time will more equitably distribute the guilt. This isn't, by the way, a question of honesty, but one of simply understanding that it takes a strong person to live in a world in which he is constantly putting his job on the line. After all, an answer of no will surely generate the rejoinder of a demand for substantiation. And the software man's main substantiation for a denial of existence is a personal inability on his part to accomplish the work.

The strange thing about software existence theorems is that, unlike mathematical theorems, we almost never demand their proof. We would achieve far better quantitative assessment of software projects if, every time a proj-

13. " . . . cognitive dissonance is a state of tension that occurs whenever an individual simultaneously holds two cognitions (ideas, attitudes, beliefs, opinions) that are psychologically inconsistent. Elliot Aronson, *The Social Animal*, The Viking Press, 1972, pp. 92-93.

In order to provide credibility and specificity for his article (see footnote 1), Dr. Boehm, on p. 48, makes the following statement: "For some individual projects, here are some overall software costs:

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

To support these costs, Dr. Boehm cites references, but these references don't check out. As one very simple example, Dr. Boehm cites a reference for his claim that IBM OS/360 cost $200,000,000. This citation is: T. Alexander, "Computers Can't Solve Everything," *Fortune*, May 1969. Through the courtesy of *Fortune*, we were able to get a copy of this article together with a prior *Fortune* article referenced by that article. In reverse sequence, then, this is how the chain of citations checks out:

1. T. A. Wise, "The Rocky Road to the Marketplace," *Fortune*, October 1966, p. 212:

   "To date, the 360 program seems, with one large reservation, to be a considerable success. The reservation concerns programming, where a lot of problems are yet to be licked. The company is currently investing very heavily in money and manpower to get them licked: some 2,000 programmers and 'support personnel' are on the job, and the cost of this effort may run over $200 million."

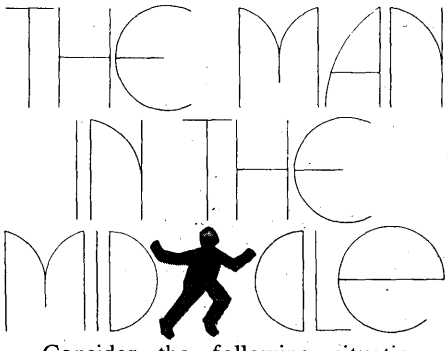
2. T. Alexander, "Computers Can't Solve Everything," *Fortune*, October 1969, p. 168:

   "The sheer technical difficulty and high cost of software have placed real limitations on the advanced uses of computers. Even the computer manufacturers themselves failed to anticipate this problem. IBM ran into more than a year of delay and around $200 million of unforeseen expense in writing essential new software for its System/360 (see 'The Rocky Road to the Marketplace,' *Fortune*, October 1966)."

How in the world Dr. Boehm concludes, from these two citations, that the cost of IBM OS/360 is $200 million completely escapes me. Further, in support of Dr. Boehm's $250 million cost for SAGE, he cites his own work (*Planning Community Information Utilities*, Harold Sackman and Barry W. Boehm (eds.), AFIPS Press, 1972). However, nowhere in this chapter does that specific figure ever appear. In citing the cost for the manned space program, Dr. Boehm once again cites Dr. Boehm who further cites Dr. Boehm in the article: Barry W. Boehm, "Some Information Processing Implications of Air Force Space Missions: 1970-1980," *Astronautics & Aeronautics*, 1971. (Note: It's nitpicky, but even Dr. Boehm's citation wasn't accurate and did not specify the month of the publication. Fortunately, the people at the American Institute of Aeronautics and Astronautics Technical Information Service in New York were kind enough to get us a reprint.) In any event, the $1 billion figure quoted as almost fact in the DATAMATION article turns out to be an estimate based on someone else's estimate using other estimates. Perhaps these are small points, but the word "quantitative" denotes both accuracy and numerical value, neither of which appear to be substantiated, judging by Dr. Boehm's references. □

ect was proposed, we demanded sufficient proof of its existence as well as its ability to be accomplished within its cost, space, and temporal constraints. After all, if you plan to assess quantitative performance on a software project, you should be able to show that your yardstick is accurate. A software project without proven existence theorems has no yardstick. It is unworthy of any form of quantitative assessment (even if someone thought it could be done in some finite period of time).

It is interesting to point out that once some reasonable form of existence has been verified, software people perform with a dedication, concern, and swiftness unparalleled in almost any other industry. For example, in the area of software modification and maintenance, it is normally easy to predict and control the time it takes to accomplish any given modification or repair any malfunction. The majority of these activities take place with little or no assistance other than the skills of the assigned individual. There are also many properly planned, well-defined, and reasonably managed software projects (even large ones) which met their time, cost, and performance objectives. But nobody bothers talking about those because, like vehicle safety, it's more interesting to talk about accidents than about safe passages. So the next time you're tempted to pull out a yardstick to measure software performance, be sure you have a measuring tool and not a mirror. (There is an important exception to the rule of quantitative assessment. This exception crops up when you can invent words to describe politically mature problems whose very nature is qualitative. In that case, available resources for solution become infinite and assessment isn't needed, only expenditure of taxpayer dollars. Some good examples of such words are: real or imagined enemies, ecology, drug dependency, equal opportunity, community information utility, information security, etc.)



Consider the following situation. We've decided we want to do some computations. We therefore go out and purchase a handy-dandy Gomar mini-calculator for $69.95. This calculator features add, subtract, multiply, divide, 8-digit precision, and the very finest of LED displays. We then hire a bright young mathematician named Charlie Brown and teach him how to work the Gomar. We then tell Charlie to go down to the engineering dept. because they've been hollering a lot lately about needing some calculations, and since the engineering dept. is falling behind schedule, perhaps Charlie can help them out. Charlie approaches the engineering dept. without really knowing what it does, and lo and behold, three project managers descend on him. Manager A gives him a problem requiring advanced differential equations; manager B needs an analysis of minimum re-order quantities for several thousand parts; manager C needs some boundary value analysis to help solve heat problems on the new model X34B platinum engine. Diligent Charlie Brown writes copious specifications for each problem and the managers assure him that they'll be around if he needs more help. All three urge him to hurry since their projects are already behind.

Gomar calculator in hand, diligent Charlie Brown begins to analyze each of the problems and, in several cases, to figure out ways to make the 8-digit Gomar do 14-digit floating point arithmetic. Diligent Charlie Brown is making progress. His desk is piled high with papers and his fingers fly nimbly over the Gomar.

Before long, the three engineering managers are back. Manager A has decided that he really doesn't have a differential equation problem, but one involving linear programming. Manager B suddenly found out he had to change all the part numbers and half of the vendors so that Charlie Brown's calculations must be re-done. Manager C has conceded that maybe platinum was too expensive for the engine, has changed the design to pig iron, but still has a heat problem.

Humbled, but unbowed, diligent Brown clears his desk of forty pounds of now unneeded calculations, makes more notes, whips the Gomar into position, and attacks his changing problems with (what else?) diligence. Before long, Charlie Brown is once again making the Gomar work just under the speed of light.

Suddenly, he feels a tap on his shoulder. Turning around, he finds himself staring at Lucy and Linus from the payroll dept. "We've come to take your calculator, Charlie Brown." Lucy explains. "The payroll department is late in getting out paychecks and you know what has top priority around this company, Charlie Brown—the payroll." "Haven't they got their own Gomar up in payroll?" asks diligent Charlie Brown. "Yes," replies Lucy, "but Shroeder lost the time sheets and now we need two Gomars to get the payroll out. So, be a good man, Charlie Brown, and give us the calculator."

Later that afternoon, the three engineering managers are called on the carpet because their projects are behind schedule. They explain their problems as follows:

Manager A: "It's not our fault, boss. It's a software problem. Dumb Charlie Brown in programming can't tell a differential equation from a linear programming problem and I have to spend most of my time watching over what he does."

Manager B: "Our project's really in good shape but your programming department used all the wrong vendors and part numbers for their calculations; now we don't know what we have in inventory. Maybe we ought to get our own computer."

Manager C: "We've got a heat transfer problem. We asked for programming support but that dumb Charlie Brown had a bug in his program. He told us to use platinum in the engine, when all along we knew it should have been pig iron."

Still later that afternoon, a small note goes out to all the company's employees attached to their (late) paychecks. It reads, "Your payroll department is sorry that the checks are late this week. Unfortunately, someone in programming took our calculator without authorization. Not only that, but he programmed it using the constant switch which made all our payroll calculations come out wrong. We don't want to blame anyone in particular, but the payroll department isn't talking to Charlie Brown anymore."

This simple portrait (with apologies to Charles Schulz) is repeated every day in thousands of organizations around the country. Computers, in spite of their power, are still looked upon by many people with a great deal of resentment. They represent a transfer of control and cognizance from the human being to the machine. Few people automate any function, regardless of cost consequences, in order to improve the "human use of human beings." Laurence H. Tribe has told us in some detail about the fourth great discontinuity: man's coming to grips with his technology and learning to control it rather than be controlled by it. But at present we are still feeling controlled by our technology and we resent it.

Open resentment of technology is a fundamentally intolerable attitude in our present society. We therefore transfer this resentment to the man in the middle—he who stands between us and the computer—the programmer.

Software: Man in the Middle

We give him problems to solve whose solutions are worthless; targets to hit which move at the speed of light; and responsibility for everything, but authority for nothing.

Once in a while, probably because programmers aren't that stupid, we get caught at our own game. We are told that we have failed to properly communicate jobs to be accomplished. But we were ready for that because we're not stupid either. We tell diligent Charlie Brown that it isn't our failure to communicate, it's his failure to comprehend. Rather than making us wiser, discovery has only made us wary. We need a way to eliminate the troublesome man in the middle. And so, aided and abetted by the many people eager and willing to profit from any form of human activity, we invent an entire technical concept to exploit our miserable failure to communicate technology. We call it time-sharing. We build a confidential relationship between an uncommunicative and distrustful engineer or executive, and a computer, in which their mistakes are translated into monthly billings and show up as dollars disguised under the title of useful work. Now that's a very heavy charge to launch at time-sharing, since the existence of one or two useful projects might invalidate it. So we'll acknowledge its few useful contributions and let you figure out what to do with the other 95% of its waste. Software isn't patent medicine, it's more like full-fledged open heart surgery, and it stands squarely between us and the fourth discontinuity. Controlling our technology means using it wisely, not avoiding it or setting up a straw man-in the-middle on whom we can heap our anxieties. But if software is like open heart surgery, then it must be administered by qualified professionals. And that brings us to our final subject.

A QUESTION of COMPETENSE

Question: "What's a dp manager?" Answer: "The guy who always has his resume up-to-date." While there may be humor in that definition, there is also a distinct note of tragedy.

Several years ago, I made the (unfortunately not famous) observation that, if 50% of the people involved in systems and software in the U.S. suddenly lost their jobs, not a single project would be delayed. I believe that statement still holds true. The computer industry has mushroomed like an atomic cloud, carrying with it a vast quantity of incompetent people whose job titles span an undefined gamut of vagueness. People call themselves programmers or systems analysts or consultants based on little more than the fact that they slept one night with a programming textbook under their pillow. Every technology has its camp followers; in our case the proliferation has become cancerous.

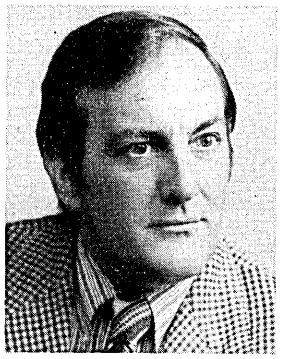
But unlike a cancerous growth that blissfully distributes its lack of control or direction, human beings require some supervision and leadership. Thus, in the fullness of time, a large number of fundamentally incompetent individuals, untrammeled by their lack of capability, have remained in our industry and have been promoted into some rather remarkable job descriptions.

Since software is relatively new, many people have pointed out that it possesses the virtues of an almost complete lack of discrimination. More correctly, not only do we provide equal opportunity regardless of race, creed, color, or sex; we also provide it regardless of ability. Perhaps it's time for a change.

Now there are a lot of ways to do this. The ACM, for example, would probably lean toward intellectual elitism. Those who believe in the CDP exam are on the other end of the spectrum. And those who run programming schools which, for an appropriate pittance, claim to transform the typical high school drop-out into a "programmer" are so far down that anything looks up. But there are several practical steps that one might take to advance the cause of software professionalism. The first step is to immediately fire the 35% or more of those people presently in the industry who would be more qualified in almost any other job situation. We must then define a range of specific professional titles such as programmer, systems programmer, systems analyst, systems architect, etc. To each of these we must apply a precise and rigid set of criteria, standardized throughout the country, which entitle a person to claim that title. Included in these criteria would be qualifying exams similar to a lawyer's bar exam. Software people no longer deal only with pieces of machinery; they deal with information security and privacy, the lives of other human beings, the fate of corporations, the defense of our country, and the relationship of man and his machinery. We can no longer permit unqualified people to practice software, any more than we would permit a hospital orderly to perform heart surgery.

If we are going to be a profession we must act like one. As individuals, we must be responsible for our actions and be prepared to suffer the consequences of malpractice. Unfortunately, this also entangles us in such things as licenses, controlled use, and many other bureaucratic amenities that seem designed to hinder progress rather than promote it. On the other hand, we have an obligation to those who need our services, and part of that obligation is called trust. But you can't trust a profession with no standards whose calling cards can be printed in the back room. Automation is big medicine, serious medicine, to be dispensed only by qualified professionals. And we better start finding out who they are.

So here we are, with many symptoms but only four real problems. We may now wonder where their solutions will come from. All four problems have the identical characteristics of problems we systematically leave unsolved with respect to automotive safety. Will it be any different with software? Perhaps. But only when we become much more hard-nosed about our profession, less fearful of accepting responsibility for our actions, and less anxious to find a convenient fall-guy. Because the real fall-guy is all of us. □



Two of the many sides of Gerald H. Larsen.

Mr. Larsen is the president of Unicorn Systems Co., Los Angeles, which specializes in computer systems design, programming, dp audits, and consulting. He has a BS in mathematics from CCNY.

It's a strange thing.

Modular Computer Systems has been delivering its ModComp systems since 1970, with over 700 systems now operating in a wide variety of applications. A large number of them in the communications field.

Yet the fact is a lot of people still don't seem to think of us in connection with their communications needs. Which is why we'd like to blow our horn a bit, if you don't mind.

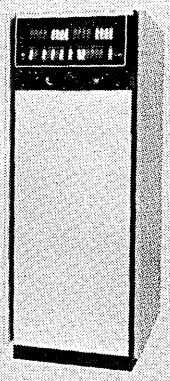
Our MODCOMP II Communications Processor, for example, offers a specialized set of communications-oriented macro instructions. A byte can be moved in core, edited, code translated, and CRC accumulated in only 3.7 microseconds.

Interfacing with this processor, you have our Universal Communications Subsystem, which offers a flexibility unmatched by any other subsystem available. Among its many capabilities, it allows both character and direct memory transfer for full and half duplex synchronous and asynchronous lines, at aggregate data rates up to 2,000,000 baud.

MAXCOM is our Communications Executive. A multi-task exec designed by ModComp, from the ground up, specifically to achieve maximum efficiency in management of system resources in communications applications.

There's more, of course. ModComp offers a complete selection of supporting elements, including a broad range of communications line handlers (TTY compatible, binary synchronous, IBM 2780, CDC UT200, etc.). Plus hardware interfaces to the most widely used host processors.

The point we're making is that when you have a communications need, come to ModComp. We believe we can meet and beat the best the other guys have to offer.



The MODCOMP II Communications Processor, with up to 128K bytes of 800 nanosecond memory, 16 general purpose registers and communications macro instructions.

If you don't connect ModComp with communications, maybe it's time we blew our horn.

modular computer systems

650 West McNab Road / Ft. Lauderdale, Florida 33309
Telephone: (305) 974-1380. TWX 510-955-9820

CIRCLE 63 ON READER CARD

The most powerful argument for buying a Nova 840 is what you don't pay for.

Nobody's ever going to beat our prices for the Nova 840 software.

It's free.

Which is particularly shocking when you consider that it's some of the most powerful software you can get with any computer at anywhere near the price.

You get an incredibly versatile Real Time Disc Operating System that does double duty as a powerful program development tool and as a run time support system that can handle two modes of operation at the same time.

You get Fortran 5. So fast, you can use it for fussy real-time or computation applications. So comprehensive, the diagnostics tell you exactly what's wrong and where. In English.

Then there's Batch that lets you pick your peripherals, load your job and go do something else.

And Extended Algol. Extended so far it can develop the kind of complex programs you used to need big expensive computers to do.

And Extended Timesharing Basic. It'll take on up to 32 users at the same time and distribute all the system resources to all those users.

And our Remote Synchronous Terminal Control Program that lets the Nova 840 become a programmable remote job entry terminal.

Finally, there's our utility programs: Macro-assembler, Editor, Symbolic Debugger that let you work in assembly language.

All in all, a most remarkable library of software.

But before you get the bright idea of circling the bingo card and asking for it all, please be advised: you get the software free when you get the required hardware from us. And with that software, you're going to be able to use a lot of hardware.

You see, we write software to sell hardware.

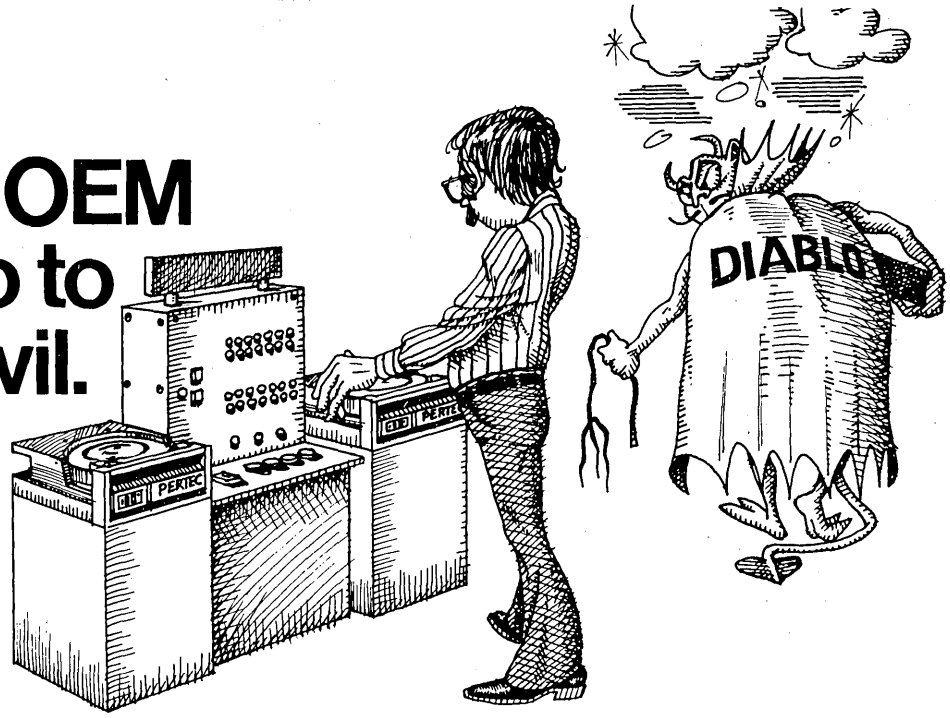
The Nova 840

Data General

Southboro, Massachusetts 01772 (617) 485-9100

CIRCLE 20 ON READER CARD

Another OEM doesn't go to the devil.



He went to Pertec for his disk drives. And he's buying drives that exceed Diablo capabilities while interfacing just as they do. A good business decision. And very good drives for his systems.

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

And they offer many standard features that you cannot even get as options on a Diablo Series 30 or 40 drive. Like independent write-protect for each platter, track offset and a built-in power supply.

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

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

All at surprisingly low prices.

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

The best values in computer peripherals come from

PERTEC

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

CIRCLE 83 ON READER CARD

The dumb, the intelligent, the standalones, and the clusters

Alphanumeric Display Terminal Survey

by Richard A. McLaughlin, Technology Editor

The first impulse upon reading a survey article is to skip the introductory text and turn back to the charts. If you do this, you will find much easily interpretable data. But you may question why some information is absent. You may think similar-appearing products are equivalent when in fact they have been designed for different applications. And you risk being convinced that a high degree of standardization exists in the display terminal business when things are not quite that settled.

There are 79 models or series of interactive alphanumeric display terminals from 54 manufacturers in the tabulations. To find that many products we contacted, or attempted to contact, over 100 firms thought to be in this business. Still, more terminals are announced daily, and there are even three that appear in the "Hardware" dept. this month that were announced too late to be included in the charts.

Some of the terminals we have included can stand alone; others are built to be used in clusters. Some are intelligent and others are not. To be included, they had only to meet the following criteria:

1. Have a display large enough to show at least 72 characters (a full teleprinter line), though not necessarily all 72 on one line;
2. Be interactive (a keyboard is a must, therefore there are no receive-only displays or monitors);
3. Be actively marketed in the U.S.;
4. Be "general purpose," or at least reasonably well suited to a large number of applications;
5. Be available to any customer (rather than being marketed by a vendor only for attachment to his brand of mainframe);
6. Function primarily as a terminal rather than as a small computer or special purpose system with a display.

Not all of the products met all of the criteria equally well, and in some cases we bent the rules a little. Graphics terminals were purposely excluded. We did not purposely exclude storage tube terminals, but none were submitted. We did not intend to limit this survey to crt terminals, but only one or two other kinds of displays were submitted.

We can try to describe the terminals we found as belonging to four basic groups: tv controllers, dumb terminals, intelligent terminals, and clusters.

Tv controllers

Some devices included are controllers which interface a user's own television set with a keyboard and a communications line. These products have several good points and a few bad ones. They are relatively inexpensive and portable. It is easy to find a backup display when that portion goes on the fritz, and their screen sizes can be large enough to be viewed from a distance. They also offer full color and a Saturday night movie.

Their disadvantages stem from the fact that tv's may be restricted in the size and the number of characters they can display without fuzziness or jitter.

Tv controllers belong in the survey because they can be serious contenders for your attention. They can usually be identified in the tables by the notation "user's choice" where screen size should be.

Dumb vs. intelligent terminals

The most difficult distinction to make is in separating dumb and intelligent terminals, and that distinction may not be necessary. There is no point beyond which terminals are considered bright, and many features associated with intelligence—like operating in a polled environment or establishing protected fields on the screen—can be hardwired or implemented in read-only memory. We submit that only terminals with user-programmable processors qualify as "intelligent," but terminals without this facility can be very powerful and very flexible.

We used a convention in organizing the charts that reflects our concept of intelligence. Those features that mark a terminal as more intelligent fall toward the bottom of the columns, just before prices. The simpler terminals have shorter columns of data. References to programming languages in the lines marked "comments" are also good indicators of processing power.

Clusters

When a single application becomes large enough to require a half-dozen terminals, today's economics dictate that a cluster of several terminals sharing a single controller (or processor) is more cost-effective than an equal number of standalones. This is the motivation behind such products as the IBM 2260 and 3270.

There are two types of clusters with two types of terminals that can be included in them. Clusters may be located at the computer site, attached directly to a channel, or they may be at remote sites and talk to the cpu through a communications box such as the IBM 2701. For IBM-compatible systems, local clusters talk in EBCDIC and remote ones generally talk in ASCII. The only other major difference is that

local configurations are priced slightly higher due to the add-on expense of a channel adaptor.

The crt terminals used in either remote or local configurations may be standalone boxes which happen to be connected to a shared controller or may be very simple boxes that cannot function without that controller. For instance, all crt's need some refresh storage to support their displays. Because normal crt tubes do not hold an image long, the data must be continually retransmitted to the screen (refreshed). Very simple boxes may lack even the storage to do this; the controller may supply it.

There is great variety in the kinds of terminals and kinds of controllers available for multiple-terminal installations. A user has a tough job in determining the most cost-effective configuration. When he chooses between two teleprinter replacements, only the two boxes need be compared. But in deciding how to handle the larger jobs, he must examine the costs of his whole network—communications lines, modems, preprocessors, and terminals—before he can settle on the lowest-price-per-terminal solution.

Future product types

Two cost factors are driving the evolution of display terminals: the nearly-static relatively high cost of communications lines, and the falling cost of microprocessors. Because communications lines are expensive, it is more practical to use terminals in clusters than to run individual phone lines to each. Vendors are projecting that more terminals will be sold for clustering during the next five years than will be sold for standalones. So we can expect an increased number of manufacturers to offer products for clustering.

The falling cost of microprocessors will enable vendors to distribute intelligence throughout a terminal system, putting processing capability in cheap front-ends, in multiplexors, in terminals, and in modems. This will lead to increased capabilities in general purpose display terminals like those in this survey, and to increased flexibility in terminals dedicated to point-of-sale, reservation, and other transaction-oriented applications.

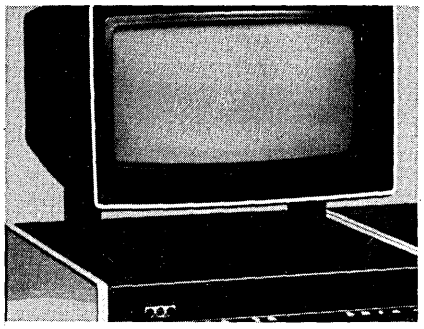
Cheap, small processors will lead to cheap, small controllers for using touchtone phones as terminal keyboards, and for attaching home television sets to two-way cable tv lines (a far-out sounding application that is already being tried experimentally).

The increased flexibility of each terminal will make future distinctions among our arbitrary classes of terminals even fuzzier than they are now. Already these distinctions are sometimes impossible to perceive. That's why you will find the products on the following pages grouped alphabetically by vendor name. What you want to call each of them is up to you.

Understanding the charts

There are many more terminals represented here than there are columns of data on the charts. When two terminals in a series could be represented by a single column of data, we opted for the compression. Therefore the charts can be viewed as representing product line capabilities.

Because the products are sometimes grouped, and because we have often indicated upper limits for specifications rather than listing every option, the entries for two vendors can bear a superficial similarity. What you see is not necessarily what you *can* get, if you'll ask for it.



The Teletype Model 40: A new standard for standalones.

As always, the vendors are the ultimate authorities for supplemental information or explanations. These charts were compiled from information they supplied. For more data from a vendor, either circle the appropriate number on the reader service card bound into this issue, or write to the name and address listed in the vendor profiles at the end of this article.

Not all the information on the charts is self-explanatory. There isn't even agreement on the terms used. What we intended is described below.

Model description

Model: Model numbers have been grouped when the differences between products are slight, or when models in a series differed only in options.

First installed: We asked for the date of first customer acceptance, not the date announced, the date shipped, or the date delivered.

Number installed: This number is often considered proprietary, and sometimes the product is so new that none have been installed. We try to indicate which is the case. When terminals are normally sold in clusters, the number of displays is given, not the number of installations.

Compatibility

Teletype 33: This compatibility generally means that the unit has an RS232B or C interface, transmits ASCII codes asynchronously (character by character) in 11-bit form up to 110 baud rates and in 10-bit form for faster transmissions, and uses full-duplex lines with echo-plex error checking.

IBM 2260: There are two ways to be compatible with the 2260. A unit may either be compatible with IBM's 2265 display and 2845 single-station controller, or with IBM's 2260 display and 2848 cluster controller. In either case it must transmit ASCII asynchronously. From remote sites, units communicate through an IBM 2701 or equivalent communications box, and for local clusters may attach to a multiplexor or selector channel through an adapter. For more detailed description, see the 2260 entry in the charts.

IBM 3270: As with the 2260 series, the 3270 comes in a standalone display, the 3275, or in clusters using the 3277 display with either the 3271 or 3272 cluster controller. Communication is half-duplex and synchronous (IBM's "binary synchronous") with either ASCII or EBCDIC codes. For more description, see the 3270 entry in the charts.

Display specifications

Screen size: Those units that employ television tubes rather than higher-bandwidth crt's will usually show "user's choice" for screen size. For those products, the display itself may not be included in the price listed. Refer to the lines "Low price includes."

Maximum characters displayed: Using this number and the screen size, it is possible to estimate how big the characters will be. The vendor usually offers units with the same size screen and a lower limit for the characters displayed; some displays that show fewer characters use larger characters. A few vendors prefer not to sell the maximum-character display.

Displayable character set: After the number of different characters that can be displayed, there is a notation for how the character is generated. Most often a matrix of 35 dots in a 5 x 7 format is used, but there are some stroke character generators which use line segments to make letters. Sometimes a larger dot matrix is used for greater legibility, especially when lower case letters are to be displayed.

Display functions

Variable intensity (a different brightness level for part of the display), *blinking,* and *reversed characters* (usually dark on a light rather

than light on a dark background) are most useful when the display terminal has the ability to store preformatted forms and the user wishes to differentiate between stored and keyed data. When two such features are offered for the same screen, the vendor may refer to "four-level video" because four combinations can be displayed (e.g., light characters only, dark characters only, light with blinking, and dark with blinking).

Split screen: This refers to the ability to display two half-pages of information at a time; for example, using the top half of the screen to show transmissions from the computer and the bottom half for composing messages to the computer.

Communications

Maximum asynchronous and *maximum synchronous transmission rates* are shown, but each product is probably obtainable in lower-speed versions; many are switchable over several ranges.

Line selection: This refers to whether the terminal operator has the ability to select the line speed he will use for transmission to or from the unit. In many cases there is no choice for the operator to make; the unit may be hardwired to use only one communications speed.

Maximum parallel rate: This figure was requested from the manufacturers since many terminals can be used as computer consoles, attaching directly to an I/O or direct memory access channel. We suspect that vendors showing relatively slow parallel rates are actually referring to a parallel interface to the terminal's peripherals.

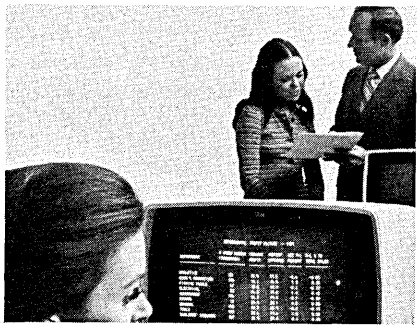
Block transfers: This is an indication of how the terminal is buffered, as well as an indication of how it communicates. A device with a maximum display of 1920 characters that can send or receive message blocks of 1920 characters probably has no more to work with than its refresh buffer, while other devices may have the ability to receive and store two or more "pages" of information. Those with large enough buffers may also allow their operators to "scroll" line by line, or "page" through all of the information stored.

There are two cases where block transmissions are not listed. The block sizes for terminals with built-in processors are determined by the amount of read/write memory available, and this figure appears on another line. Similarly, block sizes are not listed for clusters as the controller, not the terminal, again determines message size.

Error checks: At least five types of error checking are commonly used in crt's. One is echo-plex, a method of playing back what was sent to the cpu or terminal to compare with what was received. This type of checking is customary on full-duplex lines and should be expected where Teletype-compatibility is claimed.

The other commonly used checks are parity checks, including character parity (where an extra bit is added to make sure each character has either an even or odd number of one bits), LRC, VRC, and CRC. LRC (longitudinal redundancy check) and CRC (cyclic redundancy check) are both methods of adding extra bits to strings of characters and can be thought of as block parity. We let "block parity" stand in a couple of cases when we didn't know what was being used or when we suspected the vendor had come up with a unique system.

VRC (vertical redundancy check), used with parallel transmissions, means roughly the same thing as character parity and has been lumped with it under "parity" on the charts.



The IBM 3270: A new standard for clusters.

Additional interfaces

All of the devices shown here have either an RS232B or RS232C interface; what they need to communicate over phone lines. The "B" and "C" interfaces are primarily the same, but the "C" is used for higher-speed transmission. The "C" version is equivalent to the European CCITT v24.

Current loop: This is the kind of interface a Teletype has for attachment to instruments or peripherals or whatever it uses locally. Many manufacturers that indicate Teletype compatibility do not list this interface. We presume this means their products are expected to be used on phone lines and the instrument attachment is left to the teleprinters.

Parallel: We asked for parallel interfaces expecting to be told of high-speed connections to a computer's I/O or DMA channels. Some of the responses may indicate parallel interfaces to peripherals like line printers. See the "Max parallel rate" line.

Other: Two specialized interfaces cropped up. One, TTL (for transistor-transistor logic), is made for attaching a terminal to a processor without going through a channel. It may be either serial or parallel; the TTL only signifies certain voltage levels. The other, MIL 188, is a military interface.

Built-in modem: This feature makes the terminal a self-contained work station, but not much more flexible than when an external modem must be installed. When a built-in acoustic coupler was specifically flagged, it's in the footnotes. A built-in coupler allows hook-up to almost any phone line, and therefore offers greater mobility.

Basic text handling

Horizontal tab (the equivalent of a typewriter's TAB key), *Insert/delete character,* and *Insert/delete line* add up to a basic text editing function. Certain "erase" functions are often offered as complements to these, but erasing can be accomplished through deletions or by replacing with blanks.

Field protect: This enables the user to establish segments of his display as "permanent" as in displaying preformatted forms with fill-in blanks for data. These fixed fields are protected from being erased or written over by the operator. Facilities are often provided for storing old forms and designing new ones.

Transmit data only: Once a screenful of protected and variable fields has been constructed, most terminals allow for transmitting only the variable data to the cpu. In rare cases, systems allow for sending only the variable text that has been altered by the operator since last transmitted to the terminal.

Transmit full screen: Terminals without the protect function can send only full screens of information, as they have no way to discriminate between fields. Some terminals with the protect function can also send the entire contents of the screen at the operator's discretion.

Off-line operation

Data entry: This can often be done off-line by the simplest of terminals. When the terminal has a magnetic tape or flexible disc peripheral, off-line data entry is much like off-line paper tape preparation on a Teletype ASR 33.

Data editing: Doing this off-line requires a slightly smarter terminal. The basic text editing functions (tab, insert/delete character and line) must be implemented in hardwired form or through a built-in processor. Generally a larger internal memory is included to support editing, as well as a disc or tape.

Field definition: When this can be performed off-line, the terminal has considerable intelligence. This feature implies first that the field-protect definitions are user-programmable, and also that the terminal has both the intelligence to understand some com-

mand language plus the storage to retain the field definitions entered through that language.

Plotting

Shading/cross-hatching and *Forms rule* (line drawing) together enable the user to create lined forms and even bar charts on the screen. This is done by storing special characters.

Other: Some vendors indicate the ability to use the entire screen as a huge dot matrix. This makes it possible to construct complicated graphics, but is not much different from shading and cross-hatching as it is normally implemented through the storage of a solid dot matrix block as a special character.

Special functions

Automatic answering: This feature, which makes unattended operation possible, requires that the terminal be able to interpret and respond to certain control codes. This takes a certain amount of intelligence plus a specific type of answer-back modem.

Polling: Operation in a multi-drop, or polled, network requires that a terminal be addressable by a cpu. It must have an identifier that is stored in some register, and the ability to open up to input with its address code. It must also have a flag to turn on when a message is readied for the cpu. The amount of logic required to implement these functions is evident in the price of the feature, which can run up to $1,000.

Cursor moved by cpu: Most cursors can be positioned on the screen by the cpu, although frequently only line by line up and down the screen. Some can be positioned character by character along a line.

Cursor read by cpu: This feature, sometimes called a "report cursor," is far tougher to implement than the ability to position the cursor by cpu command. This option is found in most intelligent units, but some terminals that can let the cpu know the location of the cursor do not have other features associated with intelligence. We have used cursor address reading as the demarcation point, the separation between the last of the hard-wired functions and the first of the intelligent ones.

Intelligent functions

User-programmable fields: This is the ability to define protected fields on the screen. A truly intelligent box should be able to do this off-line.

Advanced text editing: This is the ability to maintain paragraph integrity when using the basic text editing commands. For instance, a terminal that does not have the ability to remake a paragraph may run into trouble in a situation where it is necessary to add words to the middle of one paragraph without affecting the others. A terminal that can remake paragraphs knows where each paragraph ends and treats following paragraphs as protected blocks.

Validity checking: This may not sound much like an intelligent function when we remember that an 029 keypunch can check for alpha in numeric fields and vice versa, but it takes an intelligent terminal to be able to do this in user-defined fields.

Range checking: Checking to see if a number is out of bounds and the validity checking are the only data editing functions we asked about. Note how many terminals have neither.

Internal memory

Random access: This kind of read/write memory is essential for functions like range checking and should appear in any intelligent terminal. We have used two conventions in listing it. We have not listed random access memory for a terminal if the memory exists in an outside controller or if the memory seemed to be only that amount necessary for refreshing the screen. Only the amount accessible by the user is shown.

Read-only: Hardwired terminals that come from the factory with stored formats for protected fields generally implement the forms storage through ROM. Similarly, the amount of ROM can be indicative of the number of other fixed functions.

Programmable read-only memory: Although user-programmable protected field definitions can be implemented with only read/write memory, PROM is a more efficient medium for this if only because it does not have to be reloaded each time the machine is powered up.

Standalone sales

Primary customers: A vendor's primary customers may be either end-users or original equipment manufacturers. Vendors who sell mainly to end-users are always interested in selling big quantities, at a discount, to oem's; the reverse is not true. In those few cases where a vendor deals primarily with oem's but is willing to sell to end-users, we have indicated both as the "primary" customers and published the end-user prices.

Purchase price: Preference has been given to end-user prices when available. End-user purchase prices listed, or price ranges listed, are always for fully-operational terminals. Oem prices may represent units without interfaces or cabinetry, but always correspond to 100-unit sales. Some oem price ranges are listed high price first, which we take to show a falling price for quantities over 100.

Known options in the vendor's offering are marked with an asterisk. The manufacturers were not always careful to indicate which features were optional. Except in those cases where we have indicated "no options" (indicating that everything shown is a standard feature), it is a good rule to assume that not much is included in the low end price.

One-year lease: CAUTION. We have asked for and included monthly lease prices (figured on a one-year lease basis) that do *not* include maintenance. The figures shown correspond to the purchase prices shown.

Minimum maintenance: These maintenance figures must be added to both the purchased systems and the leased systems. Generally the maintenance charge quoted is for "being available for remedial maintenance on prime shift," and the charge then includes the cost of parts and labor to make a repair. Assume higher maintenance charges if you operate more than one shift, if you absolutely must have a man there within a couple of hours of the failure, or if you have located your terminal in the Northwest Territories where it takes a Mountie's help to get a repairman in.

Low price includes: This category has been added because unexplained prices are meaningless. The space available is not sufficient, however, to list much detail, and we referred to "all the standard features" or gave the most important ones. End-users can always assume a fully-operational terminal, including interface.

Cluster sales

IBM-compatible clusters have been priced on an eight-terminal basis. For 2260-compatible clusters the eight terminals have 960-character displays; for 3270-like clusters, the display size is 1920 characters. All sales are assumed to be to end-users.

Choosing an eight-terminal configuration was an arbitrary decision, but there seems to be no way to price clusters that would be fair to everyone. Firms that offer an eight-terminal controller have an advantage in pricing an eight-display system. A firm with only a 16-terminal controller probably will have its most attractive pricing in larger systems. Furthermore, these vendors may offer a wide range of controllers. We have indicated the number of terminals supported by the largest controller, but the pricing has been figured, when possible, with an eight-terminal controller.

Vendor Index starts on page 91

Manufacturer	Ann Arbor Terminals Inc.	Applied Digital Data Systems	Automatic Electronics Inc.	Beehive Medical Electronics Inc.	Beehive Medical Electronics Inc.
Model	KSR 200 Series	Consul 880	85 Series	Mini Bee	Super Bee
1st installed	1973	1970		1973	1973
No. installed	not released	1,000	new product	not released	not released
Compatibility					
Teletype 33	✓	✓		✓	✓
IBM 2260			✓		
IBM 3270			✓		
Display Specifications					
Screen size	user's choice	8 x 10 inches	user's choice	6 ¾ x 9 inches	6½ x 7½ inches
Max chars displayed	80 x 24 char	80 x 24 chars	80 x 24 chars	80 x 25 chars	80 x 25 chars
Displayable char set	64 (5 x 7 matrix)	64 (5 x 7 matrix)	128 (5x7 matrix)	64 (5 x 7 matrix)	244 (5x7 matrix)
Display Functions					
Variable intensity	✓	✓	✓		
Blinking		✓	✓		✓
Reversed characters		✓			✓
Split screen		✓	✓		✓
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	9600 bps	9600 bps	38,400 bps	9600 bps	9600 bps
Max synch rate			9600 bps		9600 bps
Line selection	switch-select*	switch-select	switch-select		switch-select
Max parallel rate		1,500 cps	100,000 cps		
Block transfers	1280 chars	1920 chars	1920 chars		2047 chars
Error checks	parity*	parity	parity & custom	parity	parity
Additional Interfaces					
Current loop	✓*	✓	✓	✓	✓
Parallel		✓	✓		
Other	TTL				
Built-in modem		✓			
Basic Text Handling					
Horizontal tab	✓	✓	✓		✓
Insert/delete char		✓	✓		✓
Insert/delete line			✓		✓
Field protect	✓	✓	✓		✓
Transmit data only	✓	✓	✓		✓
Transmit full screen	✓	✓	✓		✓
Off-Line Operation					
Data entry	✓	✓	✓	✓	✓
Data editing	✓	✓	✓		✓
Field definition			✓		
Plotting					
Shading/cross-hatching					
Forms rule					
Other		1150-dot matrix*			
Special Functions					
Auto answering			✓		
Polling (multi-drop)	✓*	✓	✓		✓*
Cursor moved by cpu	✓	✓	✓		✓
Cursor read by cpu			✓		✓
Intelligent Functions					
User-programmable fields	✓		✓		
Advanced text editing			✓		
Validity checking			✓		
Range checking			✓		
Internal Memory					
Random access (read/write)			to 4KB		
Read-only			to 64KB		to 2.4KB
Programmable read-only			to 64KB		to 2.4KB
Comments	page/roll modes & dual baud rate available	portable and rack mountable models available	uses 92 micro-instructions; 7 x 9 chars avail		has paging, scrolling; 7 x 9 chars available
Standalone Sales					
Primary customers	OEMs	end-users	OEMs	OEMs	OEMs
Purchase price	$1,021-$1,313	$2,650-$3,500	to $4,000	$1,710-$1,795	$2,595-$3,345
1-year lease	not offered	not offered	not offered	not offered	not offered
Min maintenance	not offered	$30/month	not offered	not offered	not offered
Low price includes	9-inch monitor & cables	editing functions			
Cluster Sales					
Type of cluster					
Max cluster size					
Refresh memory					
Purchase price					
1-year lease					
Min maintenance					
Low price includes					

***asterisks refer to optional features**

Manufacturer	Bendix Interact. Terminals Corp.	Bendix Interact. Terminals Corp.	Bunker Ramo	Bunker Ramo	Bunker Ramo
Model	3001	Logiport 2	2212	2204/2206	2210
1st installed	1972	1972	not released	1968	not released
No. installed	not released	not released	not released	not released	not released
Compatibility					
Teletype 33	✓	✓			
IBM 2260				✓	
IBM 3270					
Display Specifications					
Screen size	6 x 10 inches	4½ x 6½ inches	6-inch diagonal	12-inch diagonal*	3-inch diagonal
Max chars displayed	80 x 16 chars	80 x 16 chars	37 x 12 chars	80 x 12 chars	20 x 10 chars
Displayable char set	96* (5x7 matrix)	96* (5x7 matrix)	56 (5x7 matrix)	96 (5x7 matrix)	48 (5x7 matrix)
Display Functions					
Variable intensity			✓	✓	✓
Blinking	✓	✓	✓	✓	✓
Reversed characters					
Split screen			✓	✓	✓
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	9600 bps	9600 bps	2400 bps	2400 bps	2400 bps
Max synch rate			4800 bps	4800 bps	4800 bps
Line selection	switch-select	switch-select			
Max parallel rate	9600 bps	9600 bps			
Block transfers	1280 chars*	1280 chars*	1000 chars	1000 chars	1000 chars
Error checks	parity	parity	parity	parity	parity
Additional Interfaces					
Current loop	✓	✓	✓	✓	✓
Parallel	✓	✓			
Other					
Built-in modem	✓*	✓*	✓	✓	✓
Basic Text Handling					
Horizontal tab	✓	✓	✓	✓	✓
Insert/delete char			✓	✓	✓
Insert/delete line			✓	✓	✓
Field protect	✓*	✓*	✓	✓	✓
Transmit data only	✓*	✓*	✓	✓	✓
Transmit full screen	✓*	✓*	✓	✓	✓
Off-Line Operation					
Data entry	✓	✓			
Data editing	✓	✓			
Field definition	✓	✓			
Plotting					
Shading/cross-hatching					
Forms rule					
Other					
Special Functions					
Auto answering					
Polling (multi-drop)			✓	✓	✓
Cursor moved by cpu	✓	✓			
Cursor read by cpu					
Intelligent Functions					
User-programmable fields	✓	✓	✓	✓	✓
Advanced text editing					
Validity checking					
Range checking					
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments	uses very large characters	portable (25 lbs)	alphanumeric keyboard for non-typists	2260-like keyboard	alphanumeric keyboard for non-typists
Standalone Sales					
Primary customers	end-users	end-users	end-users	end-users	end-users
Purchase price	$2,100	$2,250	$4,800	$4,900	$3,900
1-year lease	not offered[1]	not offered[1]	$124/month	$124/month	$99/month
Min maintenance	$50/repair	$50/repair	$38/month	$38/month	$35/month
Low price includes	tty-compatible	tty-compatible	crt & controller	crt & controller	controller & terminal
Cluster Sales					
Type of cluster			remote or local	remote or local	remote or local
Max cluster size			36 terminals	36 terminals	36 terminals
Refresh memory				in the controller	
Purchase price			$54,000	$18,000-$18,500	$34,000
1-year lease			$1,425/month	$534-$543/month	$950/month
Min maintenance				$140/month	
Low price includes			36 displays	8 remote or local 960-char displays	36 displays

[1]full payout only

[1]full payout only

*asterisks refer to optional features

Manufacturer	Burroughs Corp.	Burroughs Corp.	Car-Mel Electronics Inc.	Computek Inc.	Computer Communications
Model	TD700	TD800	I-211 Informer	200	CC-335 Totelcom
1st installed	1972	1973	1972	1972	1972
No. installed	over 2,000	over 200	108	500	25
Compatibility					
Teletype 33			✓	✓	✓
IBM 2260	✓	✓			
IBM 3270				✓	
Display Specifications					
Screen size	9 x 3½ inches	9½ x 7½ inches	4½ x 3 inches	10 x 8 inches	3½ x 8½ inches
Max chars displayed	32 x 8 chars	80 x 24 chars	32 x 16 chars	80 x 25 chars	80 x 12 chars
Displayable char set	64 (5x7 matrix)	90 (5x7 matrix)	64 (5x7 matrix)	128 (20x14 matrix)	64 (5x7 matrix)
Display Functions					
Variable intensity			✓	✓	
Blinking				✓	
Reversed characters				✓	
Split screen			✓	✓	
Communications					
Modes	half-duplex	half-duplex	full/half-duplex	full/half-parity	full/half-duplex
Max asynch rate	1800 bps	1800 bps	9600 bps	19,200 bps	1200 bps
Max synch rate	4800 bps	4800 bps	9600 bps	19,200 bps	
Line selection	switch-select	switch-select	switch-select	switch-select	switch-select
Max parallel rate				300,000 cps	
Block transfers			512 chars		960 chars
Error checks	parity & LRC	parity & LRC	parity*	parity, CRC, LRC	parity
Additional Interfaces					
Current loop			✓*	✓	
Parallel				✓	
Other			custom*	MIL 188	
Built-in modem			✓*		✓*1
Basic Text Handling					
Horizontal tab	✓	✓	✓*	✓	✓
Insert/delete char	✓	✓		✓	✓
Insert/delete line				✓	✓
Field protect	✓	✓	✓*	✓	✓
Transmit data only	✓	✓	✓*	✓	✓
Transmit full screen	✓	✓	✓*	✓	✓
Off-Line Operation					
Data entry			✓	✓	✓
Data editing			✓*	✓	✓
Field definition			✓*	✓	✓
Plotting					
Shading/cross-hatching					
Forms rule					
Other					
Special Functions					
Auto answering				✓	
Polling (multi-drop)	✓	✓	✓*	✓	
Cursor moved by cpu			✓	✓	✓
Cursor read by cpu				✓	
Intelligent Functions					
User-programmable fields	✓	✓		✓	✓
Advanced text editing				✓	
Validity checking				✓	
Range checking				✓	
Internal Memory					
Random access (read/write)				2KB to 18KB	
Read-only				1KB to 8KB	
Programmable read-only				1KB to 8KB	
Comments	a light matrix screen, not a crt		has scrolling; rack mount available	emulates other terminals	supplied with carrying case
Standalone Sales					
Primary customers	end-users	end-users	OEMs	end-users	end-users
Purchase price	$3,850	$4,750-$5,490	$1,000-$1,200	$4,000-$6,000	$3,500-$4,250
1-year lease	$96/month	$113-$138/month	not offered	$300-$500/month	$70-$80/month
Min maintenance	$11/month	$21/month	$50/repair	$40/month	$20/month
Low price includes	standard features	960-char display	standard features	everything but peripherals	crt, keyboard & controller
Cluster Sales					
Type of cluster				local	
Max cluster size					
Refresh memory				in the terminal	
Purchase price				$65,000-$150,000	
1-year lease				not offered	
Min maintenance				$650/month	
Low price includes				8 local displays & front end	

[1]acoustic coupler built-in

***asterisks refer to optional features**

Manufacturer	Computer Communications	Computer Optics	Computer Optics	Conrac Corp.	Conrac Corp.
Model	CC-30/CC-40	77	75	480 TTY Plus	401
1st installed	1967		1970	1968	not released
No. installed	over 1,600	new product	not released	"sev. thousand"	not released
Compatibility					
Teletype 33				✓	✓
IBM 2260			✓		
IBM 3270		✓			
Display Specifications					
Screen size	user's choice	7½ x 9½ inches	7 x 9 inches	3½ x 7 inches	7 x 9 inches
Max chars displayed	80 x 24 chars	80 x 24 chars	100 x 30 chars	80 x 12 chars	80 x 25 chars
Displayable char set	96* (5x7 matrix)	96* (7x9 matrix[1])	90 (16x18 matrix)	64 (5x7 matrix)	128 (5x7 matrix)
Display Functions					
Variable intensity		✓		✓	✓
Blinking	✓*	✓	✓	✓	✓
Reversed characters		✓	✓		
Split screen	✓	✓	✓	✓	✓
Communications					
Modes	full/half-duplex	half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	9600 bps		9600 bps	9600 bps	9600 bps
Max synch rate	50,000 bps	9600 bps		9600 bps	9600 bps
Line selection				switch-select	switch-select
Max parallel rate	100,000 cps	650,000 cps	250,000 cps	500,000 cps	500,000 cps
Block transfers	1920 chars	1920 chars	3000 chars	960 chars	2000 chars
Error checks	parity	CRC	parity & LRC	parity & LRC	parity & LRC
Additional Interfaces					
Current loop				✓	✓
Parallel	✓	✓		✓	✓
Other				TTL & Burroughs	TTL & Burroughs
Built-in modem					
Basic Text Handling					
Horizontal tab	✓	✓	✓	✓	✓
Insert/delete char	✓*	✓	✓	✓	✓
Insert/delete line	✓*	✓	✓	✓	✓
Field protect	✓*	✓	✓	✓	✓
Transmit data only	✓*	✓	✓	✓	✓
Transmit full screen	✓	✓	✓	✓	✓
Off-Line Operation					
Data entry	✓			✓	✓
Data editing	✓			✓	✓
Field definition	✓*			✓	✓
Plotting					
Shading/cross-hatching					
Forms rule			✓		
Other	9216-dot matrix				
Special Functions					
Auto answering					
Polling (multi-drop)	✓	✓	✓	✓	✓
Cursor moved by cpu	✓	✓	✓	✓	✓
Cursor read by cpu	✓	✓		✓	✓
Intelligent Functions					
User-programmable fields	✓	✓	✓	✓	✓
Advanced text editing					
Validity checking					
Range checking					
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments	color, light pen, spec char sets available	the IBM 3271/3272 can be used with a converter		9-inch high profile	no options
Standalone Sales					
Primary customers	end-users	end-users	end-users	OEMs	OEMs
Purchase price	$3,500-$9,000	$3,500-$3,833	$6,425-$7,550	$900-$1,200	$2,200-$3,000
1-year lease	$80-$260/month	$112-$123/month	$165-$198/month	not offered	not offered
Min maintenance	$80/month	$28/month	$37/month	not offered	not offered
Low price includes	crt, keyboard, controller	400-char display		standard features	everything listed
Cluster Sales					
Type of cluster		remote or local	remote or local		
Max cluster size		32 terminals	32 terminals		
Refresh memory			in the controller		
Purchase price		$22,267-$42,087	$27,250-$28,050		
1-year lease		$725-$1,404	$743-$883/month		
Min maintenance		$140/month	$152/month		
Low price includes		8 remote or local 1920-char displays	8 remote or local 960-char displays		

[1]16 x 18 optional

*asterisks refer to optional features

Manufacturer	Control Data	Courier Terminal Systems	Data 100 Corp.	Data Communications	Datamedia Corp.
Model	713-10	Executerm	73	DCC Controller	DMC 2100
1st installed	1971	1971	1971	not released	1972
No. installed	not released	4,500	800	not released	300
Compatibility					
Teletype 33	✓		✓	✓	
IBM 2260		✓			
IBM 3270		✓			
Display Specifications					
Screen size	8 x 10 inches	12-inch diagonal	9 x 6 inches	user's choice	supplied by user
Max chars displayed	80 x 16 chars	80 x 24 chars	80 x 24 chars	40 x 15 chars	80 x 24 chars
Displayable char set	96 (5x9 matrix)	64 (7x8 matrix)	64 (5x7 matrix)	64 (5x7 matrix)	64 (5x7 matrix)
Display Functions					
Variable intensity		✓		✓	
Blinking		✓		✓	
Reversed characters	✓	✓		✓	
Split screen		✓			
Communications					
Modes	full/half-duplex	half-duplex	full/half-duplex	full/half-duplex	full-duplex
Max asynch rate	300 bps	4800 bps	1200 bps	300 bps	1800 bps
Max synch rate					
Line selection	switch-select	switch-select	switch-select	switch-select	
Max parallel rate					
Block transfers	1280 chars		1920 chars		1920 chars
Error checks	parity	parity & LRC	parity		parity
Additional Interfaces					
Current loop				✓	
Parallel					
Other		360/370 channel			
Built-in modem				✓	✓
Basic Text Handling					
Horizontal tab	✓	✓	✓		
Insert/delete char		✓		✓	
Insert/delete line		✓		✓	
Field protect	✓	✓			
Transmit data only		✓			
Transmit full screen			✓		
Off-Line Operation					
Data entry			✓	✓	✓
Data editing		✓		✓	
Field definition		✓			
Plotting					
Shading/cross-hatching					
Forms rule					
Other					
Special Functions					
Auto answering		✓			
Polling (multi-drop)		✓			
Cursor moved by cpu		✓	✓		✓
Cursor read by cpu		✓			✓
Intelligent Functions					
User-programmable fields		✓		✓	
Advanced text editing					
Validity checking		✓			
Range checking					
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments		3270-compat. is new feature for clusters only		has 2-page buffer & built-in acoustic coupler	integrated 12-inch monitor available
Standalone Sales					
Primary customers	end-users	end-users	end-users	OEMs	OEMs
Purchase price	$1,995-$2,315	$3,400-$6,000	$3,485-$3,780	$1,400 range	$1,628-$1,676
1-year lease	$60/month	$126-$145/month	$105-$115[1]	not offered	not offered
Min maintenance	$15/month	$25/month	$22/month	not offered	not offered
Low price includes	640-char display	480-char display	12-line display		80 x 18 display, modem, no crt
Cluster Sales					
Type of cluster		remote or local			
Max cluster size		16[1]-32[2] terms.			
Refresh memory		in the terminal			
Purchase price		$37,600[1]-$45,000[2]			
1-year lease		$1,171[1]-$1,200[2]			
Min maintenance		$229/month			
Low price includes		8 remote displays			

[1]2260-compatible
[2]3270-compatible
[1]includes maint.

***asterisks refer to optional features**

Manufacturer	Datamedia Corp.	Datamedia Corp.	Datapoint Corp.	Datapoint Corp.	Data Trends Inc.
Model	Elite 1500/2000	Elite 2500	3300	2200	GTU
1st installed	1970	1973	1969	1971	1971
No. installed	400	new product	not released	2,000	160
Compatibility					
Teletype 33	✓	✓	✓	✓	
IBM 2260					
IBM 3270					
Display Specifications					
Screen size	6 x 9 inches	6 x 9 inches	10 x 7½ inches	7 x 3½ inches	6½ x 5 inches
Max chars displayed	80 x 24 chars	80 x 24 chars	72 x 25 chars	80 x 12 chars	25 x 12 chars
Displayable char set	64 (5x7 matrix)	128 (5x7 matrix)	64 (5x7 matrix)	94 (5x7 matrix)	64 (5x7 matrix)
Display Functions					
Variable intensity		✓		✓	✓
Blinking		✓	✓		
Reversed characters					
Split screen					✓
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	half-duplex
Max asynch rate	4800 bps	9600 bps	2400 bps	9600 bps	4800 bps
Max synch rate		9600 bps		2400 bps	
Line selection	switch-select		switch-select		
Max parallel rate					
Block transfers		1920 chars			100 chars
Error checks		parity		parity, CRC, LRC	parity, CRC, LRC
Additional Interfaces					
Current loop	✓			✓	
Parallel				✓	
Other					
Built-in modem	✓*				
Basic Text Handling					
Horizontal tab		✓		✓	
Insert/delete char		✓*1		✓	✓
Insert/delete line		✓*1		✓	✓
Field protect		✓		✓	✓
Transmit data only		✓	✓	✓	✓
Transmit full screen		✓		✓	✓
Off-Line Operation					
Data entry	✓*			✓	✓
Data editing	✓*			✓	✓
Field definition				✓	✓
Plotting					
Shading/cross-hatching					
Forms rule					
Other					
Special Functions					
Auto answering	✓*			✓	✓
Polling (multi-drop)					
Cursor moved by cpu		✓	✓	✓	
Cursor read by cpu		✓			
Intelligent Functions					
User-programmable fields		✓		✓	✓
Advanced text editing				✓	
Validity checking				✓	✓
Range checking				✓	
Internal Memory					
Random access (read/write)				2KB to 16KB	
Read-only					
Programmable read-only					
Comments	drives 16 monitors; available as RO or cont.	drives 16 monitors		has assembler, bus, language BASIC, RPG II[1]	can have calculator functions, is 2780 compat.
Standalone Sales					
Primary customers	OEMs	OEMs	end-users	end-users	end-users & OEMs
Purchase price	$1,100-$1,516	to $1,664	to $3,240	$6,040-$13,297	$5,900 (one unit)
1-year lease	$65-$75/month	$85/month	$50-$95/month	$167-$360/month	not offered
Min maintenance	$20/month	not offered	$15 month	$30/month	not offered
Low price includes	80 x 6 or 64 x 8 char display			2K and two built-in cassettes	
Cluster Sales					
Type of cluster					
Max cluster size					
Refresh memory					
Purchase price					
1-year lease					
Min maintenance					
Low price includes					

[1]to be available

[1]to be available

*asterisks refer to optional features

Manufacturer	Delta Data Systems Corp.	Digi-Log Systems	Four-Phase Systems Inc.	Four-Phase Systems Inc.	GTE Information Systems
Model	5000 (Telterm)	33/109/209	IV/40	IV/70	IS/7700
1st installed	1970	1971	1973	1971	not released
No. installed	1,600	750	100	5,000	not released
Compatibility					
Teletype 33	✓	✓			
IBM 2260	✓		✓	✓	✓
IBM 3270	✓		✓	✓	
Display Specifications					
Screen size	9 x 6 inches	11-inch diagonal	7¼ x 10¼ inches	7¼ x 10¼ inches	12-inch diagonal
Max chars displayed	80 x 27 chars	80 x 16 chars	80 x 24 chars	80 x 24 chars	80 x 24 chars
Displayable char set	96* (7x9 matrix)	64 (5x7 matrix)	125 (7x9 matrix)	125 (7x9 matrix)	67 (5x7 matrix)
Display Functions					
Variable intensity		✓	✓	✓	
Blinking	✓	✓	✓	✓	✓
Reversed characters	✓	✓			✓
Split screen	✓		✓	✓	✓
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	half-duplex
Max asynch rate	9600 bps	9600 bps	4800 bps	4800 bps	9600 bps
Max synch rate			4800 bps	4800 bps	9600 bps
Line selection	switch-select	switch-select			switch-select
Max parallel rate	500,000 cps			50,000 cps	55,000 cps
Block transfers	3072 chars	1280 chars			
Error checks	parity		parity, CRC, LRC	parity, CRC, LRC	parity
Additional Interfaces					
Current loop	✓	✓			
Parallel	✓	✓			✓
Other		TTL		360/370 channel	
Built-in modem		✓			
Basic Text Handling					
Horizontal tab	✓		✓	✓	
Insert/delete char	✓		✓	✓	✓
Insert/delete line	✓		✓	✓	✓
Field protect	✓		✓	✓	✓
Transmit data only	✓		✓	✓	✓
Transmit full screen	✓		✓	✓	
Off-Line Operation					
Data entry	✓		✓	✓	
Data editing	✓		✓	✓	
Field definition	✓		✓	✓	
Plotting					
Shading/cross-hatching					
Forms rule	✓		✓	✓	
Other					
Special Functions					
Auto answering	✓	✓	✓	✓	
Polling (multi-drop)	✓		✓	✓	✓
Cursor moved by cpu	✓	✓	✓	✓	✓[1]
Cursor read by cpu	✓		✓	✓	
Intelligent Functions					
User-programmable fields	✓		✓	✓	
Advanced text editing			✓	✓	
Validity checking			✓	✓	
Range checking			✓	✓	
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments	compatible with 3270 standalone & 2260 cluster		has assembler, COBOL & DOS	has assembler, COBOL & DOS	
Standalone Sales					
Primary customers	end-users	end-users			end-users
Purchase price	$3,000-$7,000	$1,195-$1,395			$4,680-$4,980
1-year lease	$120-$240/month	not offered			$85-$120/month
Min maintenance	$25/month	$15/month			$40/month
Low price includes	standard features	keyboard & interface			
Cluster Sales					
Type of cluster	remote or local		remote	remote or local	remote or local
Max cluster size	95 terminals		16 terminals	32 terminals	24 terminals
Refresh memory	in the terminal		in the controller	in the controller	in the controller
Purchase price	$28,000		$30,125[1]-$39,840[2]	$40,250[1]-$54,440[2]	$30,016
1-year lease	$1,160/month		$522[1]-$686[2]/month	$790[1]-$1,033[2]/month	$1,091/month
Min maintenance	$267/month		$156[1]-$179[2]/month	$188[1]-$227[2]/month	$98/month
Low price includes	8 remote or local 960-char displays		8 remote displays 85-key keyboards	8 remote displays 85-key keyboards	8 remote or local 960-char displays
			[1]2260-compatible, 960-char displays	[1]2260-compatible, 960-char displays	[1]by line only
			[2]3270-compatible, 1920-char displays	[2]3270-compatible, 1920-char displays	

***asterisks refer to optional features**

Manufacturer	GTE Information Systems	Hazeltine	Hazeltine	IBM	IBM
Model	IS/780	1000	2000	2260	3270
1st installed	not released	not released	not released	not released	1972
No. installed	not released	not released	over 7,000	not released	not released
Compatibility					
Teletype 33		✓	✓		
IBM 2260				✓	
IBM 3270	✓				✓
Display Specifications					
Screen size	12-inch diagonal	6 x 9½ inches	6 x 9 inches	4 x 9 inches	8 x 10½ inches
Max chars displayed	80 x 24 chars	80 x 12 chars	80 x 25 chars	80 x 12 chars	80 x 24 chars
Displayable char set	128 (5x7 matrix)	96* (5x7 matrix)	96 (5x7 matrix)	64 (stroke)	64 (7x9 matrix)
Display Functions					
Variable intensity	✓		✓		✓
Blinking	✓		✓*		
Reversed characters					
Split screen			✓		✓
Communications					
Modes	half-duplex	full/half-duplex	full/half-duplex	half-duplex	half-duplex
Max asynch rate	9600 bps	9600 bps	9600 bps	2400 bps	
Max synch rate	9600 bps		9600 bps		7200 bps
Line selection	switch-select	switch-select	switch-select		
Max parallel rate	650,000 cps		8,000 cps	2,560 cps	
Block transfers			1999 chars	960 chars	1920 chars
Error checks	parity	parity	parity	parity & LRC	parity, CRC, LRC
Additional Interfaces					
Current loop		✓*	✓*		
Parallel	✓		✓*		
Other					360/370 channel
Built-in modem					✓
Basic Text Handling					
Horizontal tab	✓		✓	✓	✓
Insert/delete char	✓		✓		✓
Insert/delete line	✓		✓		
Field protect	✓		✓		✓
Transmit data only			✓		✓
Transmit full screen				✓	✓
Off-Line Operation					
Data entry	✓*[1]		✓		
Data editing	✓*[1]		✓		
Field definition			✓		
Plotting					
Shading/cross-hatching					
Forms rule					
Other					
Special Functions					
Auto answering	✓*[1]	✓*			✓
Polling (multi-drop)	✓		✓*	✓	✓
Cursor moved by cpu	✓		✓	✓[1]	✓
Cursor read by cpu	✓				✓
Intelligent Functions					
User-programmable fields			✓		✓
Advanced text editing					
Validity checking					✓
Range checking					
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments					
Standalone Sales					
Primary customers	end-users	end-users	end-users	end-users	end-users
Purchase price	$5,100-$6,500	$1,750	$2,995	$14,625	$4,000-$7,600
1-year lease	$90-$115/month	$49/month[1]	$88/month[1]	$369/month	
Min maintenance	$25/month	$10/month	$20/month	$73/month	
Low price includes			standard features	2265/2845	3275 mod 1 with 66-key keyboard
Cluster Sales					
Type of cluster	remote or local			remote or local	remote or local
Max cluster size	32 terminals			24 terminals	32 terminals
Refresh memory	in the terminal			in the terminal	in the terminal
Purchase price	$37,900			$47,430	$48,275[1]-$49,275[2]
1-year lease	$903/month			$1,265/month	$1,235[1]-$1,260[2]
Min maintenance				$122/month	$176[1]-$187[2]/month
Low price includes	8 remote or local 1920-char displays			8 960-char displays with keyb.	8 1920-char displays with keyb.
	[1]future options	[1]includes maint.	[1]includes maint.	[1]by line	[1]remote cluster [2]local cluster

*asterisks refer to optional features

Manufacturer	Incoterm Corp.	Infoton Inc.	Infoton Inc.	Infoton Inc.	I. P. Sharp Associates Inc.
Model	SPD 10/20	Vistar/Vistar GT	Vista Series	Vista Plus	100/200
1st installed	1970	1972	1970	not released	1973
No. installed	over 6,000	not released	not released	not released	50
Compatibility					
Teletype 33	✓	✓	✓		
IBM 2260					
IBM 3270	✓				
Display Specifications					
Screen size	9 x 7½ inches	9 x 7 inches	9 x 7 inches	9 x 7 inches	user's choice
Max chars displayed	64 x 30 chars	80 x 24 chars	80 x 20 chars	80 x 20 chars	1024 characters*
Displayable char set	96* (10x7 matrix)	64 (5x7 matrix)	96* (5x7 matrix)	96 (5x7 matrix)	89 (5x7 matrix)
Display Functions					
Variable intensity					✓
Blinking	✓		✓		
Reversed characters	✓				
Split screen	✓				
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full-duplex
Max asynch rate	9600 bps	9600 bps	4800 bps	4800 bps	134.5 bps
Max synch rate	4800 bps			4800 bps	
Line selection		switch-select	switch-select	switch-select	
Max parallel rate			15,000 cps	10,000 cps	
Block transfers		1920 chars*	1600 chars*	1600 chars	
Error checks	parity, CRC, LRC	parity	parity	parity & LRC	
Additional Interfaces					
Current loop	✓	✓	✓	✓	
Parallel	✓		✓	✓	
Other					
Built-in modem					✓
Basic Text Handling					
Horizontal tab	✓			✓	
Insert/delete char	✓			✓	
Insert/delete line	✓			✓	
Field protect	✓			✓	
Transmit data only	✓			✓	
Transmit full screen	✓				
Off-Line Operation					
Data entry	✓	✓	✓*	✓	
Data editing	✓	✓	✓*	✓	
Field definition	✓				
Plotting					
Shading/cross-hatching					
Forms rule					
Other	point plotting				APL-Plus facility
Special Functions					
Auto answering	✓	✓*	✓*		
Polling (multi-drop)	✓			✓	
Cursor moved by cpu	✓	✓	✓	✓	✓
Cursor read by cpu	✓				
Intelligent Functions					
User-programmable fields	✓			✓	
Advanced text editing	✓				
Validity checking	✓				
Range checking	✓				
Internal Memory					
Random access (read/write)	1KB to 4KB				
Read-only					
Programmable read-only					
Comments	has real-time clock, 8 I/O channels	Vistar is OEM version, Vistar/GT is end-user			APL-043 correspondence codes
Standalone Sales					
Primary customers	end-users	see "Comments"	OEMs	OEMs	end-users
Purchase price	$5,800	$1,600	$1,395-$1,885	$2,375-$2,620	$1,700-$2,100
1-year lease	$165/month	not offered	not offered	not offered	not offered
Min maintenance	$30/month	$50/repair	$50/repair	$50/repair	third-party
Low price includes	half-duplex interface				controller only
Cluster Sales					
Type of cluster					
Max cluster size					
Refresh memory					
Purchase price					
1-year lease					
Min maintenance					
Low price includes					

***asterisks refer to optional features**

Manufacturer	ITT Data Equip. and Systems Div.	ITT Data Equip. and Systems Div.	Jacquard Systems	Lear Siegler	Lear Siegler
Model	3100 Alphascope	3501 Asciscope	100	ADM-1	7700A
1st installed	1969	1972		1973	1971
No. installed	800	500	new product	new product	600
Compatibility					
Teletype 33		✓	✓	✓	✓
IBM 2260	✓		✓		
IBM 3270			✓		
Display Specifications					
Screen size	6 x 8½ inches	8 x 5 inches	12-inch diagonal*	6¾ x 8½ inches	6¾ x 8½ inches
Max chars displayed	80 x 24 chars	80 x 12 chars	80 x 24 chars	80 x 24 chars	80 x 25 chars
Displayable char set	64 (5x7 matrix)	65 (5x7 matrix)	96* (7x9 matrix)	64 (5x7 matrix)	64 (5x7 matrix)
Display Functions					
Variable intensity			✓	✓	
Blinking			✓		✓
Reversed characters					
Split screen	✓		✓		✓
Communications					
Modes	half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	2400 bps	1200 bps	4800 bps	9600 bps	9600 bps
Max synch rate	9600 bps	2400 bps	50,000 bps	9600 bps	9600 bps
Line selection		switch-select			switch-select
Max parallel rate			250,000 cps		15,750 cps
Block transfers	1920 chars	960 chars		1920 chars	2000 chars
Error checks	parity & LRC	parity	CRC & LRC	parity, CRC, LRC	parity, CRC, LRC
Additional Interfaces					
Current loop			✓	✓	✓
Parallel			✓		✓
Other	360/370 channel				
Built-in modem		✓			
Basic Text Handling					
Horizontal tab	✓		✓	✓	✓
Insert/delete char	✓		✓	✓	✓
Insert/delete line			✓	✓	✓
Field protect	✓		✓	✓	✓
Transmit data only	✓		✓	✓	✓
Transmit full screen	✓	✓	✓	✓	✓
Off-Line Operation					
Data entry			✓	✓	✓
Data editing			✓	✓	✓
Field definition			✓	✓	
Plotting					
Shading/cross-hatching			✓		
Forms rule					
Other				special chars	special chars
Special Functions					
Auto answering			✓		
Polling (multi-drop)	✓		✓	✓*	✓
Cursor moved by cpu	✓	✓	✓	✓	✓
Cursor read by cpu			✓	✓	✓
Intelligent Functions					
User-programmable fields			✓	✓	✓
Advanced text editing					
Validity checking			✓		
Range checking			✓		
Internal Memory					
Random access (read/write)			2KB to 12KB	to 15KB	
Read-only			2KB to 32KB		to 6KB
Programmable read-only			2KB to 32KB		
Comments		switch-selectable 72-char line	has assembler & integrated floppy discs and tapes		has rolling & scrolling
Standalone Sales					
Primary customers	end-users	end-users	end-users	end-users	end-users
Purchase price	$6,150	$2,195	$3,400-$8,000	$1,600-$1,715	$2,895
1-year lease	$135/month	$50/month	$100-$200/month	not offered	$150/month
Min maintenance	$40/month	$15/month	$15/month	$20/month	$20/month
Low price includes		modem, coupler & print inter.	2K user memory & 1.5-usec cpu	limited editing	all above except polling
Cluster Sales					
Type of cluster	remote or local		remote or local		
Max cluster size	32 terminals		32 terminals		
Refresh memory			in the controller		
Purchase price	$39,750-$45,350		$20,900[1]-$35,900[2]		
1-year lease	$1,050-$1,200/month		$500[1]-$1,000[2]/month		
Min maintenance	$135/month		$150[1]-$200[2]/month		
Low price includes	8 remote or local 960-char displays		8 displays		
			[1]2260- or 3270-compatible remote cluster		
			[2]3270-compatible local cluster		

***asterisks refer to optional features**

Manufacturer	Megadata Computer & Communications	Olivetti Corp. of America	Olivetti Corp. of America	Omron R & D Inc.	Ontel Corp.
Model	SiR-1000	DE 523	TCV 270	8025A	4000 Series
1st installed	1972	1973	Jan. 74 expected	Nov. 73 expected	1971
No. installed	not released	not released	new product	new product	130
Compatibility					
Teletype 33	✓				
IBM 2260					
IBM 3270	✓		✓		
Display Specifications					
Screen size	8 x 10 inches	5½ x 4¾ inches	12-inch diagonal	8 x 10 inches	7 x 10 inches
Max chars displayed	80 x 27 chars	31 x 7 chars	80 x 24 chars	80 x 24 chars	80 x 20 chars
Displayable char set	128 (7x8 matrix[1])	96 characters*	96 (5x7 matrix)	224* (7x7 matrix[1])	112* (5x7 matrix
Display Functions					
Variable intensity	✓	✓	✓	✓	✓
Blinking	✓	✓		✓	✓
Reversed characters	✓			✓	✓
Split screen	✓		✓	✓	✓
Communications					
Modes	full/half-duplex	half-duplex	half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	9600 bps	110 bps	1200 bps	2400 bps	9600 bps
Max synch rate		2400 bps	4800 bps	9600 bps	9600 bps
Line selection	switch-select	switch-select		switch-select	
Max parallel rate				1,200,000 cps	1,500 cps
Block transfers		216 chars	1920 chars	2000 chars	8000 chars
Error checks	parity, CRC, LRC	parity & LRC	parity, CRC, LRC	parity & LRC	parity, CRC, LRC
Additional Interfaces					
Current loop	✓			✓	✓
Parallel	✓			✓	✓
Other					see "Comments"
Built-in modem	✓				✓
Basic Text Handling					
Horizontal tab	✓	✓	✓	✓	✓
Insert/delete char	✓		✓	✓	✓
Insert/delete line	✓		✓	✓	✓
Field protect	✓		✓	✓	✓
Transmit data only	✓		✓	✓	✓
Transmit full screen	✓	✓	✓		✓
Off-Line Operation					
Data entry		✓		✓	✓
Data editing		✓		✓	✓
Field definition				✓	✓
Plotting					
Shading/cross-hatching				✓	✓
Forms rule					✓
Other					12,800-dot matrix
Special Functions					
Auto answering	✓	✓		✓	✓
Polling (multi-drop)	✓	✓	✓	✓	✓
Cursor moved by cpu	✓		✓	✓	✓
Cursor read by cpu	✓		✓	✓	✓
Intelligent Functions					
User-programmable fields	✓	✓	✓	✓	✓
Advanced text editing	✓			✓*	✓
Validity checking	✓	✓	✓	✓*	
Range checking	✓	✓	✓	✓*	
Internal Memory					
Random access (read/write)	10KB[2]	1KB to 8KB	2KB to 8KB	2KB to 12KB	4KB
Read-only		4KB to 8KB	to 8KB	1KB to 4KB	
Programmable read-only	10KB[2]			1KB to 4KB	
Comments	over 100 micro-instructions, same as PDP-8E	HASP-compatible, primarily for data entry	has its own programming language	off-line calculator operation, has roll/scroll	Burroughs, 188C, & selectable APL/ASCII interfaces
Standalone Sales					
Primary customers	end-users	end-users	end-users	end-users	end-users
Purchase price	$2,950-$3,300	$6,800-$20,000	$4,000-$6,000	$2,350-$7,500	$2,945-$3,395
1-year lease	not offered	$188/month	not offered	not now offered	not offered
Min maintenance	$25-$28/month	$29/month	$20/month	$645 plus $20/mo.	$25/month
Low price includes	4K memory	4K ROM, 1K RAM, one cassette	480-char display	standard features	
Cluster Sales					
Type of cluster					
Max cluster size					
Refresh memory					
Purchase price					
1-year lease					
Min maintenance					
Low price includes					
	17 x 9, 10 x 10 and 10 x 12 also			17 x 9 lower case	[1]black on white with 7 x 10 lower case
	[2]max RAM and PROM mix is 10KB				

***asterisks refer to optional features**

Manufacturer	Quotron Systems	Raytheon Data Systems	Research Inc.	Sanders Data Systems Inc.	Sci. Measurement Systems
Model	800	PTS-100 Series	Teleray 3300/II	804/810	1440
1st installed	1971	1972	1972	1972	1967
No. installed	3,500	over 1,000	over 300	800	over 2,500
Compatibility					
Teletype 33			✓		✓
IBM 2260		✓		✓	
IBM 3270	✓	✓		✓	
Display Specifications					
Screen size	6 x 8 inches	10 x 7 inches	6½ x 8½ inches	12 x 9 inches	9-inch diagonal
Max chars displayed	80 x 20 chars	80 x 24 chars	80 x 24 chars	80 x 24 chars	80 x 18 chars
Displayable char set	96 (12x20 matrix)	96 (5x7 matrix)	96* (5x7 matrix)	88 (5x7 matrix)	128 (5x7 matrix)
Display Functions					
Variable intensity		✓	✓	✓	
Blinking	✓	✓		✓	✓
Reversed characters					
Split screen	✓	✓		✓	
Communications					
Modes	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	2400 bps	9600 bps	9600 bps*	1800 bps	1200 bps
Max synch rate	9600 bps	9600 bps		9600 bps	150Kbps
Line selection	switch-select		switch-select		switch-select
Max parallel rate					
Block transfers	1600 chars			1920 chars	1440 chars
Error checks	parity, CRC, LRC	parity, CRC, LRC	parity	parity, CRC, LRC	parity
Additional Interfaces					
Current loop	✓	✓	✓		✓
Parallel					✓
Other			TTL	TTL	
Built-in modem				✓	✓
Basic Text Handling					
Horizontal tab	✓	✓		✓	✓
Insert/delete char	✓	✓		✓	✓
Insert/delete line	✓	✓		✓	✓
Field protect	✓	✓		✓	✓
Transmit data only	✓	✓	✓	✓	✓
Transmit full screen	✓	✓		✓	✓
Off-Line Operation					
Data entry	✓	✓	✓	✓	✓
Data editing	✓	✓		✓	✓
Field definition	✓	✓		✓	
Plotting					
Shading/cross-hatching					
Forms rule	✓				
Other					
Special Functions					
Auto answering	✓	✓		✓	✓
Polling (multi-drop)	✓	✓		✓	✓
Cursor moved by cpu	✓	✓		✓	✓
Cursor read by cpu	✓	✓		✓	✓
Intelligent Functions					
User-programmable fields	✓	✓		✓	
Advanced text editing				✓	
Validity checking	✓			✓	
Range checking	✓			✓	
Internal Memory					
Random access (read/write)				2KB to 8KB	
Read-only				2KB to 4KB	
Programmable read-only					
Comments	off-line data inquiry	has its own programming language	selectable double-size chars	assembler, RJE pkg, data entry pkg & util. incl.	
Standalone Sales					
Primary customers		end-users	end-users	end-users	OEMs
Purchase price		$4,575-$6,500	$1,200-$1,400	$6,055-$9,855	$1,395-$1,995
1-year lease			$75/month[1]	$200-$290/month	$79-$120/month
Min maintenance		not given	$20/month	$29/month	$20/month
Low price includes		display & 8K processor		80 x 12 display, 2K RAM	basic tty replacement
Cluster Sales					
Type of cluster	remote	remote or local			
Max cluster size	24 terminals	32 terminals			
Refresh memory	in the controller	in the controller			
Purchase price	$33,000-$53,000	$25,250[1]-$26,500[2]			
1-year lease	$1,000-$1,800/mo	$824[1]-$859[2]/month			
Min maintenance	$350/month	$125[1]-$131[2]/month			
Low price includes	8 remote 1920-char displays	8 remote displays			

[1]2260-compatible, 960-char displays

[2]3270-compatible, 1920-char displays

[1]includes maint.

*asterisks refer to optional features

Manufacturer	Sidereal Corp.	Sycor Inc.	SYS Computer	TEC Inc.	TEC Inc.
Model	1AC/2AN/88CS	250	420/820/1320	Mini-Tec	440 Data-Screen
1st installed	1973	1973	1971	not released	not released
No. installed	not released	10	1,500	not released	not released
Compatibility					
Teletype 33	✓		✓	✓	✓
IBM 2260			✓		
IBM 3270		✓			
Display Specifications					
Screen size	10½ x 7½ inches	9½ x 6½ inches	14-inch diagonal*	6 x 9 inches	6 x 9 inches
Max chars displayed	80 x 18 chars	80 x 24 chars	132 x 30 chars	80 x 12 chars	80 x 24 chars
Displayable char set	126 (7x11 matrix)	96* (7x9 matrix)	256* (5x7 matrix)	63 (5x7 matrix)	64 (5x7 matrix)
Display Functions					
Variable intensity	✓*	✓	✓	✓	
Blinking	✓*	✓	✓	✓	
Reversed characters	✓		✓		
Split screen	✓		✓		
Communications					
Modes	full/half*-duplex	full/half-duplex	full/half-duplex	full/half-duplex	full/half-duplex
Max asynch rate	13,460 bps	1200 bps		9600 bps	9600 bps
Max synch rate	9600 bps	7200 bps	9600 bps		
Line selection	switch-select			switch-select	
Max parallel rate	447,000 cps		15,500 cps		
Block transfers		1920 chars	3840 chars	1024 chars	1920 chars
Error checks	parity, CRC*, LRC*	parity, CRC, LRC	parity & LRC	parity	parity
Additional Interfaces					
Current loop			✓	✓	✓
Parallel	✓		✓		
Other				TTL	TTL
Built-in modem	✓				
Basic Text Handling					
Horizontal tab		✓	✓	✓	
Insert/delete char	✓	✓	✓		
Insert/delete line	✓		✓		
Field protect	✓*	✓	✓	✓	
Transmit data only	✓*	✓	✓		
Transmit full screen	✓*	✓	✓		
Off-Line Operation					
Data entry	✓	✓	✓	✓	
Data editing	✓	✓	✓	✓	
Field definition		✓			
Plotting					
Shading/cross-hatching			✓		
Forms rule					
Other					
Special Functions					
Auto answering	✓*		✓		
Polling (multi-drop)	✓	✓	✓		
Cursor moved by cpu		✓	✓	✓	
Cursor read by cpu			✓		
Intelligent Functions					
User-programmable fields		✓		✓	
Advanced text editing			✓		
Validity checking		✓	✓		
Range checking		✓	✓		
Internal Memory					
Random access (read/write)	1KB to 32KB	3KB to 7KB			
Read-only		4.5KB to 8KB	1KB to 8KB		
Programmable read-only		special order	1KB to 8KB		
Comments	series uses CMOS, has integ. tape & Model 40 equiv.	can send modified data only	many text editing functions & scroll/roll		switch-selectable 72 x 8 display
Standalone Sales					
Primary customers	end-users	end-users	OEMs	OEMs	OEMs
Purchase price	$1,490-$3,200	$4,310-$4,840	$4,450-$8,050[1]	$1,300-$1,085	$1,763-$1,404
1-year lease	$40-$115/month	$98-$110/month	not offered	$92-$78/month	$128-$100/month
Min maintenance	$12/month	$24/month	$35/month	not offered	not offered
Low price includes	interfaces & 1K	480-char display with 1K RAM	960-char display	standard features	standard features
Cluster Sales					
Type of cluster		remote	remote or local		
Max cluster size		32 terminals	256 terminals		
Refresh memory		in the terminal			
Purchase price		$37,550	$16,720		
1-year lease		$864/month	not offered		
Min maintenance		$216/month	$160/month		
Low price includes		8 remote 1920-char displays	8 remote 960-char displays		

[1]single-unit sale

*asterisks refer to optional features

Manufacturer	TEC Inc.	Tektronix Inc.	Teletype Corp.	Terminal Communications	Terminal Communications
Model	400 Series	4023	40	62	275
1st installed	not released	not released	1973	1971	1973
No. installed	not released	not released	new product	500	new product
Compatibility					
Teletype 33	✓	✓			
IBM 2260					✓
IBM 3270					✓
Display Specifications					
Screen size	6 x 9 inches	9 x 5½ inches	5¼ x 11¼ inches		
Max chars displayed	80 x 24 chars	80 x 24 chars	80 x 24 chars	80 x 12 chars	80 x 24 chars
Displayable char set	67 (5x7 matrix)	96 (5x7 matrix)	128 (7x9 matrix)	(5x7 matrix)	64 (7x9 matrix)
Display Functions					
Variable intensity		✓	✓		✓
Blinking	✓	✓	✓		
Reversed characters		✓			
Split screen					
Communications					
Modes	full/half-duplex	full/half*-duplex	half-duplex	half-duplex	half-duplex
Max asynch rate	9600 bps	9600 bps	1200 bps	9600 bps	
Max synch rate		9600 bps			4800 bps
Line selection	switch-select	switch-select			switch-select
Max parallel rate	800,000 cps				
Block transfers	1920 chars	1920 chars	5760 chars	4096 chars	1920 chars
Error checks	parity* & LRC*		parity	LRC	LRC
Additional Interfaces					
Current loop	✓	✓			
Parallel	✓				
Other	TTL & Burroughs				
Built-in modem				✓	
Basic Text Handling					
Horizontal tab	✓	✓	✓	✓	✓
Insert/delete char	✓	✓	✓		✓
Insert/delete line	✓	✓	✓		✓
Field protect	✓	✓	✓		✓
Transmit data only		✓	✓	✓	✓
Transmit full screen		✓	✓		
Off-Line Operation					
Data entry	✓	✓	✓	✓	✓
Data editing	✓	✓	✓	✓	✓
Field definition			✓		
Plotting					
Shading/cross-hatching					
Forms rule		✓			
Other					
Special Functions					
Auto answering	✓*		✓	✓	
Polling (multi-drop)	✓*			✓	✓
Cursor moved by cpu	✓	✓	✓	✓	✓
Cursor read by cpu	✓	✓			
Intelligent Functions					
User-programmable fields	✓		✓		✓
Advanced text editing					
Validity checking					✓
Range checking					
Internal Memory					
Random access (read/write)					
Read-only					
Programmable read-only					
Comments	15 models available		has scrolling, avail. as RO	IBM 2740 line control	standalone is 3275-compat; clusters 2260 or 3270
Standalone Sales					
Primary customers	OEMs	end-users	end-users & OEMs	end-users	end-users
Purchase price	$2,860-$1,900	$2,995	$2,995-$4,210[1]	$2,900-$3,250	$4,625-$6,425
1-year lease	$206-$135/month	$98/month[1]	not offered	$102-$109/month	$107-$132/month
Min maintenance	not offered	$20/month		$22/month	$18/month
Low price includes	standard features		1920-char buffer	500-char display	1920-char display
Cluster Sales					
Type of cluster					remote or local
Max cluster size					
Refresh memory					in the controller[1]
Purchase price					$29,000-$35,000
1-year lease					$708-$804/month
Min maintenance					$107/month
Low price includes					8 remote 1920-char displays
		[1] includes maint.	[1]end-user prices		[1]for 2260-compat; in the terminal for 3270-compat.

***asterisks refer to optional features**

Manufacturer	Texas Scientific	Texas Scientific	Trivex Inc.	Trivex Inc.	Univac
Model	Entelekon 80	Entelekon 100	40/80	Plus 70	Uniscope 100
1st installed	1970	1973	1971	Oct. 73 expected	1970
No. installed	not released	new product	3,000	new product	14,000
Compatibility					
Teletype 33					
IBM 2260	✓	✓	✓		✓
IBM 3270		✓		✓	
Display Specifications					
Screen size	8 x 10 inches	8 x 10 inches	7 x 9 inches	8 x 10½ inches	5 x 10 inches
Max chars displayed	80 x 24 chars	80 x 24 chars	80 x 12 chars	80 x 24 chars	80 x 16 chars
Displayable char set	64 (5x7 matrix)	128 (5x7 matrix)	57 (5x7 matrix)	96* (7x9 matrix)	96* (stroke)
Display Functions					
Variable intensity	✓	✓	✓	✓	
Blinking	✓	✓		✓	✓
Reversed characters	✓	✓	✓		
Split screen	✓	✓			✓
Communications					
Modes	half-duplex	half-duplex	half-duplex	full/half-duplex	half-duplex
Max asynch rate	9600 bps	9600 bps	9600 bps	1800 bps	2400 bps
Max synch rate	9600 bps	9600 bps	9600 bps	9600 bps	9600 bps
Line selection				switch-select	
Max parallel rate	500,000 cps	650,000 cps	125,000 cps	650,000 cps	
Block transfers	1920 chars	1920 chars	960 chars		1024 chars
Error checks	parity & LRC	parity & CRC	parity & LRC	parity & CRC	parity & block
Additional Interfaces					
Current loop					
Parallel	✓	✓			
Other			360/370 channel	360/370 channel	MIL 188B
Built-in modem				✓	
Basic Text Handling					
Horizontal tab	✓	✓	✓	✓	✓
Insert/delete char	✓	✓	✓	✓	✓
Insert/delete line	✓	✓			✓
Field protect	✓	✓	✓	✓	✓
Transmit data only	✓	✓	✓	✓	✓
Transmit full screen	✓	✓	✓	✓	✓
Off-Line Operation					
Data entry				✓	✓
Data editing	✓	✓		✓	✓
Field definition	✓	✓		✓	
Plotting					
Shading/cross-hatching		✓			
Forms rule		✓			
Other		special symbols			
Special Functions					
Auto answering				✓	✓
Polling (multi-drop)	✓	✓	✓	✓	✓
Cursor moved by cpu	✓	✓	✓	✓	✓
Cursor read by cpu	✓	✓	✓	✓	✓
Intelligent Functions					
User-programmable fields	✓	✓		✓	
Advanced text editing			✓		
Validity checking		✓		✓	
Range checking					
Internal Memory					
Random access (read/write)					
Read-only			6KB		
Programmable read-only					
Comments		switch-select 2260- or 3270-compatibility			has scrolling, can be clustered with Univac soft.
Standalone Sales					
Primary customers	end-users	end-users	end-users	end-users	end-users
Purchase price	$4,195-$4,595	$4,450-$6,500	$4,300	$5,652	$4,020-$5,950
1-year lease	$150-$160/month	$100-$125/month	$148/month	$147/month	$92-$149/month
Min maintenance	$25/month	$12/month	$25/month	$41/month	$32/month
Low price includes			960-char remote display	1920-char remote display	
Cluster Sales					
Type of cluster		remote or local	remote or local	remote or local	
Max cluster size		32 terminals	32 terminals	32 terminals	
Refresh memory			in the controller	in the controller	
Purchase price		$34,940[1]-$35,140[2]	$28,300	$34,716	
1-year lease		$9981-$985[2]/month	$977/month	$1,026/month	
Min maintenance		$147[1]-$136[2]/month	$142/month	$128/month	
Low price includes		8 1920-char displays & graphics	8 960-char local displays	8 1920-char local displays	

[1]local cluster

[2]remote cluster

*asterisks refer to optional features

Manufacturer	Westinghouse Canada Ltd.	Wiltek	Wyle Computer Products Inc.	Xerox Corp.
Model	1600	500	Series 8000	BC 100/200
1st installed	1972	1970	1972	1970
No. installed	not released	350	not released	400
Compatibility				
Teletype 33	✓			
IBM 2260			✓	
IBM 3270		✓		
Display Specifications				
Screen size	8 x 8 inches	12-inch diagonal	9 x 6½ inches	user's choice
Max chars displayed	80 x 24 chars	74 x 27 chars	80 x 24 chars	80 x 20 chars
Displayable char set	96* (5x7 matrix)	(5x7 matrix)	96* (5x7 matrix)	155 (5x7 matrix)
Display Functions				
Variable intensity		✓		
Blinking	✓			✓
Reversed characters				✓
Split screen	✓			
Communications				
Modes	full/half-duplex	half-duplex	half-duplex	full/half-duplex
Max asynch rate	9600 bps	2400 bps	1200 bps	2400 bps
Max synch rate	9600 bps	2400 bps	4800 bps	9600 bps
Line selection	switch-select	switch-select		switch-select
Max parallel rate			3,720 cps	3,000 cps
Block transfers	1598 chars	1998 chars	1920 chars	1600 chars
Error checks	parity & LRC*	CRC	parity & LRC	parity, CRC, LRC
Additional Interfaces				
Current loop	✓*			
Parallel				
Other			360/370 channel	
Built-in modem		✓	✓*	
Basic Text Handling				
Horizontal tab	✓	✓	✓*	✓
Insert/delete char	✓	✓	✓	✓
Insert/delete line	✓	✓		✓
Field protect	✓	✓		✓
Transmit data only	✓	✓	✓	✓
Transmit full screen		✓	✓	
Off-Line Operation				
Data entry	✓	✓		✓
Data editing	✓	✓		✓
Field definition				
Plotting				
Shading/cross-hatching				
Forms rule		✓		
Other				point plot
Special Functions				
Auto answering	✓*	✓		
Polling (multi-drop)	✓*		✓	✓
Cursor moved by cpu	✓		✓	✓*
Cursor read by cpu		✓		✓*
Intelligent Functions				
User-programmable fields			✓	✓
Advanced text editing				
Validity checking		✓		✓
Range checking				
Internal Memory				
Random access (read/write)				
Read-only				0.9KB to 1.3KB
Programmable read-only				
Comments		has two 50,000 char buffers		drives 10 monitors
Standalone Sales				
Primary customers	OEMs	end-users	end-users	end-users
Purchase price	$2,180-$2,550	$5,000-$12,000	$4,850	$6,800-$11,465
1-year lease	$98-$115/month	$342/month[1]	$106/month	not offered[1]
Min maintenance	$20/month	$30-$70/month	$42/month	not offered[1]
Low price includes	9600 bps synch/ asynch, editing	crt, keyboard, & buffers	all features but lower case	14-inch monitor
Cluster Sales				
Type of cluster			remote or local	
Max cluster size			16 terminals	
Refresh memory			in the controller	
Purchase price			$28,900	
1-year lease			$894/month	
Min maintenance			$126/month	
Low price includes			8 960-char displays	
		[2]2 yr lease; 1 yr not offered		[1]except with Xerox cpu's

*asterisks refer to optional features

Vendor Index

at right . . .

ANN ARBOR TERMINALS, INC.
6107 Jackson Road, Ann Arbor, MI 48103
Established 1970; 45 employees
Gross sales $1.5M
Offices in 22 states plus Canada, England, Germany and Japan.
Bert T. Johnston, vp mktg (313) 769-0926
FOR DATA CIRCLE 160 ON READER CARD

APPLIED DIGITAL DATA SYSTEMS, INC.
100 Marcus Blvd., Hauppauge, NY 11787
Established 1968; 56 employees
Gross sales $1.7M
Offices in eight states plus Canada, Denmark, Finland, France, Italy, Japan, Norway, Sweden, West Germany and U.K.
Richard Kaufman, dir mktg (516) 231-5400
FOR DATA CIRCLE 161 ON READER CARD

AUTOMATIC ELECTRONIC SYSTEMS, INC.
5455 Paré St., Montreal 309, Quebec
Established 1964; 98 employees
Gross sales not released
Offices in Colorado, New Hampshire, New Jersey, North Carolina, Vermont plus Venezuela and Japan.
Gerald Blanchard, mktg rep (514) 735-6581
FOR DATA CIRCLE 162 ON READER CARD

BEEHIVE MEDICAL ELECTRONICS, INC.
870 W 2600 South, Salt Lake City, UT 84119
Established 1968; # employees not given
Gross sales $2.2M
Offices in 48 states plus Canada and England.
John Bodell, sales mgr (801) 487-0741 x61
FOR DATA CIRCLE 163 ON READER CARD

BENDIX INTERACTIVE TERMINALS CORP.
32969 Hamilton Ct., Farmington, MI 48024
Subsidiary of Bendix Corp.
Established 1971; 100 employees
Gross sales not released.
Offices in 48 states.
M. Katzman, reg mgr (313) 477-3700
FOR DATA CIRCLE 164 ON READER CARD

BUNKER RAMO CORP.
35 Nutmeg Dr., Trumbull, CT 06609
Established 1928; 1,500 employees
Gross sales over $50M
Offices in U.S., Europe and Far East.
Jim Brown, mktg dept (203) 377-4141
FOR DATA CIRCLE 165 ON READER CARD

BURROUGHS CORP.
Burroughs Place, Detroit, MI 48232
Employees and sales information not given.
Offices in 50 states plus world-wide.
Sales information: (313) 972-7000
FOR DATA CIRCLE 166 ON READER CARD

CAR-MEL ELECTRONICS, INC.
5794 Venice Blvd., Los Angeles, CA 90019
Established 1969; eight employees
Gross sales not released.
Offices in 13 states plus England, France, Germany, Japan and Switzerland.
Byron Cole, vp (213) 934-1866
FOR DATA CIRCLE 167 ON READER CARD

COMPUTEK, INC.
143 Albany St., Cambridge, MA 02139
Established 1968; 100 employees
Gross sales $4M
Offices in 11 states plus Benelux, Canada, England, France, Germany, Italy and South Africa.
Michael R. Gold, sales mgr (617) 864-5140
FOR DATA CIRCLE 168 ON READER CARD

COMPUTER COMMUNICATIONS, INC.
5933 W Slauson Ave., Culver City, CA 90230
Established 1966; 100 employees
Gross sales $5M
Offices in California, Florida, Illinois, Maryland, Massachusetts, New York, Tennessee, Texas, Virgina, plus Canada.
Ervin K. Dorff, vp (213) 390-7777
FOR DATA CIRCLE 169 ON READER CARD

COMPUTER OPTICS, INC.
Berkshire Indus. Park, Bethel, CT 06801
Established 1968; 80 employees
Gross sales $660K
Offices in U.S. plus England, France, Germany, Italy and Japan.
David I. Gould vp mktg (203) 744-6720
FOR DATA CIRCLE 170 ON READER CARD

CONRAC CORP.
600 N Rimsdale Ave., Covina, CA 91722
Established 1947; # employees not given
Gross sales over $58M
Offices in California and Germany.
Elton N. Sherman, sales mgr. (213) 966-3511
FOR DATA CIRCLE 171 ON READER CARD

CONTROL DATA CORP.
8100 34th Ave. So., Minneapolis, MN 55440
Established 1957; 28,500 employees
Gross sales $663M
Offices in U.S. plus Australia, Europe and Far East.
D. E. Lundstrom, mgr term mktg (612) 853-4803
FOR DATA CIRCLE 172 ON READER CARD

COURIER TERMINAL SYSTEMS, INC.
2202 E University Dr., Phoenix, AZ 82034
Subsidiary of Boothe Computer Corp.
Established 1969; 275 employees
Gross sales $7M
Offices in 38 states.
R. E. Nosky, sr vp, mktg (602) 244-1392
FOR DATA CIRCLE 173 ON READER CARD

DATA 100 CORP.
7725 Washington Ave. So., Minneapolis, MN
Established 1969; 1,300 employees
Gross sales $32M
Offices in 21 states plus Australia, Canada, England, France, Germany, The Netherlands and Scotland.
R. L. Smith, prod line mgr (612) 941-6500
FOR DATA CIRCLE 174 ON READER CARD

DATA COMMUNICATIONS CORP.
650 Algonquin Rd., Des Plaines, IL 60016
Employee and sales information not given.
Offices in Illinois only.
James Griffin, pres (312) 593-8640
FOR DATA CIRCLE 175 ON READER CARD

DATAMEDIA CORP.
7300 N Crescent, Pennsauken, NJ 08110
Established 1969; 23 employees
Gross sales $762K
Offices in California, New Jersey, Washington, DC, plus England.
K. E. Asquith, pres (609) 665-2382
FOR DATA CIRCLE 176 ON READER CARD

DATAPOINT CORP.
9725 Datapoint Dr., San Antonio, TX 78284
Established 1968; 600 employees
Gross sales not released.
Offices in 21 states plus Australia, Belgium, Canada, Denmark, England, Finland, France, Germany, Holland, Israel, Japan, Mexico, Norway, South Africa, Sweden and Switzerland.
Carole J. Brooks, mktg serv (512) 696-4520
FOR DATA CIRCLE 177 ON READER CARD

DATA TRENDS, INC.
50 Intervale Rd., Parsippany, NJ 07054
Established 1962; 21 employees
Gross sales $1.9M
Offices in 21 states.
For sales information contact:
Weston Marketing Corp.
A. D. Gallo, vp (301) 948-8300
FOR DATA CIRCLE 178 ON READER CARD

DELTA DATA SYSTEMS CORP.
Woodhaven Ind. Pk., Cornwell Heights, PA
Established 1968; 125 employees
Gross sales $2.5M
Offices in all states plus Belgium, England, Finland, France, Germany, Holland, Norway and Sweden.
Paul Freeman, dir of sales (215) 639-9400
FOR DATA CIRCLE 179 ON READER CARD

DIGI-LOG SYSTEMS, INC.
666 Davisville Rd., Willow Grove, PA 19090
Established 1970; 72 employees
Gross sales over $1M through 3rd quarter
Offices in 44 states plus Canada, France, Monaco and West Germany.
B. M. Williams, vp mktg (215) 659-5400
FOR DATA CIRCLE 180 ON READER CARD

FOUR-PHASE SYSTEMS, INC.
10420 N Tantau Ave., Cupertino, CA 95014
Established 1969; # employees not released
Gross sales not released.
Offices in 13 states plus Brazil, Canada and Japan.
Wm. J. Steinmetz, mgr commo (408) 255-0900
FOR DATA CIRCLE 181 ON READER CARD

GTE INFORMATION SYSTEMS, INC.
One Stamford Forum, Stamford, CT 06904
Subsidiary of General Telephone & Elec.
Established 1970; 3,300 employees
Gross sales $70M
Offices in 18 states plus Argentina, Austria, Belgium, Brazil, Canada, England, Finland, France, Israel, Italy, Mexico, Netherlands, Spain, Sweden, Switzerland, West Germany and Yugoslavia.
Robt. Sanchez, mktg admin (203) 357-2627
FOR DATA CIRCLE 182 ON READER CARD

HAZELTINE CORP.
Greenlawn, NY 11740
Established 1924; 2,700 employees
Gross sales $65M
Offices in 48 states plus Australia, Austria, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, England, France, East and West Germany, Holland, Hungary, Israel, Luxembourg, New Guinea, New Zealand, Norway, Papua, Poland, Portugal, Romania, Spain, Sweden, Switzerland, USSR and Yugoslavia.
Edith Westermann, mgr pr (516) 261-7000
FOR DATA CIRCLE 183 ON READER CARD

INCOTERM CORP.
6 Strathmore Rd., Natick, MA 01760
Established 1969; 400 employees
Gross sales not released.
Offices in 27 cities plus Canada, England and France.
M. R. Smith, mgr adv & pr (617) 655-6100
FOR DATA CIRCLE 184 ON READER CARD

INFOTON, INC.
Second Avenue, Burlington, MA 01803
Subsidiary of Optical Scanning Corp.
Established 1969; 120 employees
Gross sales not released.
Offices in all 50 states plus Benelux, Canada, Costa Rica, France, Germany, Hong Kong,

Israel, Italy, Japan, Philippines, Scandinavia, South Africa, Spain, Switzerland and U.K.
Ted Robinson, sales mgr (617) 272-6660
FOR DATA CIRCLE 185 ON READER CARD

I. P. SHARP ASSOCIATES, INC.
104 Bridge Plaza, Ogdensburg, NY 13669
Subsidiary of I. P. Sharp Associates Ltd.
Established 1964; over 120 employees
Gross sales not released.
Offices in California, Massachusetts, New York, plus Canada, Holland, West Germany and U.K.
W. O. Chamberlain, mktg mgr (613) 257-3610
FOR DATA CIRCLE 186 ON READER CARD

IBM
1133 Westchester, White Plains, NY 10604
Established 1911; over 260,000 employees
Gross sales $9.5 Billion
Offices nationwide and worldwide.
Sales information: (914) 696-1900
FOR DATA CIRCLE 187 ON READER CARD

ITT DATA EQUIPMENT AND SYSTEMS DIV.
E Union Ave., E Rutherford, NJ 07073
Subsidiary of Int'l. Telephone & Telegraph
Established 1969; over 150 employees
Gross sales not released.
Offices in California, Connecticut, Georgia, Illinois, New Jersey, New York, Pennsylvania, Texas and Washington, D.C.
Robt. Miller, mgr adv & pr (201) 935-3900
FOR DATA CIRCLE 188 ON READER CARD

JACQUARD SYSTEMS
1505 11 St., Santa Monica, CA 90404
Established 1969; 50 employees
Gross sales $1.5M
Offices in California and North Carolina.
F. W. Peters, sales mgr (213) 393-3711
FOR DATA CIRCLE 189 ON READER CARD

LEAR SIEGLER, INC.
714 N Brookhurst St., Anaheim, CA 92803
Established 1954; 800 employees
Gross sales $600M
Offices in 48 states plus Canada and Germany.
Wm. A. Terry, sales mgr (714) 774-1010
FOR DATA CIRCLE 190 ON READER CARD

MEGADATA COMPUTER & COMMUNICATIONS CORP.
10 Evergreen Pl., Deer Park, NY 11729
Established 1967; 35 employees
Gross sales over $1M
Offices in U.S., Canada and England.
J. A. Hill, dir mktg (516) 667-2900
FOR DATA CIRCLE 191 ON READER CARD

OLIVETTI CORPORATION OF AMERICA
500 Park Ave., New York, NY 10022
Subsidiary of Olivetti Intl. SA
Established 1960; 5,400 employees
Gross sales $175M
Offices in all states plus worldwide.
Roger Hancock, prod. mgr (212) 371-5500
FOR DATA CIRCLE 192 ON READER CARD

OMRON R & D, INC.
432 Toyama Dr., Sunnyvale, CA 94086
Subsidiary of Omron Tateisi Electronics
Established 1970; 180 employees
Gross sales $250M for parent company.
Offices nationwide.
W. A. Pugh, dir term mktg (408) 734-8400
FOR DATA CIRCLE 193 ON READER CARD

ONTEL CORP.
3 Fairchild Court, Plainview, NY 11803
Employee information not given.
Gross sales $400K.
Offices in 48 states.
Freeman Dyke, exec vp (516) 822-7800
FOR DATA CIRCLE 194 ON READER CARD

QUOTRON SYSTEMS, INC.
5454 Beethoven St., Los Angeles, CA 90066
Established 1957; 475 employees
Gross sales $10M
Offices in 23 states.
D. L. Stevens, dir mktg (213) 398-2761
FOR DATA CIRCLE 195 ON READER CARD

RAYTHEON DATA SYSTEMS
1415 Providence Turn., Norwood, MA 02062
Over 800 employees
Gross sales not released.
Offices in 18 states plus Canada and Holland.
H. P. Bannon, mgr mktg (617) 762-6700
FOR DATA CIRCLE 196 ON READER CARD

RESEARCH, INC.
Box 24064, Minneapolis, MN 55424
Established 1951; 160 employees
Gross sales $4.5M
Offices in 18 states plus Argentina, Australia, Brazil, China, Denmark, England, Finland, France, Germany, India, Israel, Italy, Japan, Netherlands, South Africa, Spain/Portugal and Sweden/Norway.
R. M. Deegan, sales mgr (612) 941-3300
FOR DATA CIRCLE 197 ON READER CARD

SANDERS DATA SYSTEMS, INC.
Daniel Webster Hwy. So., Nashua, NH 03060
Subsidiary of Sanders Associates, Inc.
Established 1965; 1,320 employees
Gross sales $20M
Offices in 28 states plus England.
B. G. Starkey, dir mktg (603) 885-3726
FOR DATA CIRCLE 198 ON READER CARD

SCIENTIFIC MEASUREMENT SYSTEMS
26 Olney Ave., Cherry Hill, NJ 08003
Established 1967; 75 employees
Gross sales not released.
Offices in all states.
R. P. Weinmann, sales mgr (609) 424-5220
FOR DATA CIRCLE 199 ON READER CARD

SIDEREAL CORP.
Box 1042, Portland, OR 97202
Sales and employee information not given.
Offices in 14 western states plus England and Common Market countries.
R. Taylor, sales mgr (503) 223-0545
FOR DATA CIRCLE 200 ON READER CARD

SYCOR, INC.
100 Phoenix Dr., Ann Arbor, MI 48104
Established 1967; 575 employees
Gross sales $15.6M
Offices in 16 U.S. cities plus Italy and Japan.
Pat McMahon, prod mgr (313) 971-0900
FOR DATA CIRCLE 201 ON READER CARD

SYS COMPUTER CORP.
17-25 DiCarolis Ct., Hackensack, NJ 07601
Established 1967; 107 employees
Gross sales $1.5M
Offices in Hackensack only.
P. F. Polizzano, vp mktg (201) 488-0300
FOR DATA CIRCLE 202 ON READER CARD

TEC, INC.
9800 N Oracle Rd., Tucson, AZ 85704
Established 1958; over 300 employees
Gross sales $7.5M
Offices in all states plus Australia, Canada, Eastern and Western Europe, and Israel.
John Jamieson, sales mgr (602) 297-1111
FOR DATA CIRCLE 203 ON READER CARD

TEKTRONIX, INC.
Box 500, Beaverton, OR 97005
Gross sales under $20M
Established 1946; 10,450 employees
Bob Keyes, sales mgr (503) 644-0161 x8392
FOR DATA CIRCLE 204 ON READER CARD

TELETYPE CORP.
5555 Touhy Ave., Skokie, IL 60076
Subsidiary of Western Electric Co.
Established 1907; 6,000 employees
Gross sales not released.
Offices in California, Illinois and New Jersey.
A. G. LeRoy, gen sales mgr (312) 982-2700
FOR DATA CIRCLE 205 ON READER CARD

TERMINAL COMMUNICATIONS, INC.
3301 Terminal Dr., Raleigh, NC 27611
Established 1969; 670 employees
Gross sales $8.7M
Offices in all states plus Canada.
W. Rein Jr., vp mktg (919) 834-5251
FOR DATA CIRCLE 206 ON READER CARD

TEXAS SCIENTIFIC CORP.
8000 Harwin Dr., Houston TX 77036
Established 1967
Employee and sales information not given.
Offices in 48 states and Canada.
T. H. Bowden, vp (713) 785-7731
FOR DATA CIRCLE 207 ON READER CARD

TRIVEX, INC.
3180 Redhill Ave., Costa Mesa, CA 92626
Established 1968; 140 employees
Gross sales $6M
Offices in California, Illinois and New Jersey.
E. F. Thompson, mktg coord (714) 546-7781
FOR DATA CIRCLE 208 ON READER CARD

UNIVAC
322 N 22nd West, Salt Lake City, UT 84116
Subsidiary of Sperry Rand Corp.
Employee and sales information not given.
Offices in all 50 states plus Africa, Asia, Australia, Europe and Japan.
Sales information: (801) 328-8066
FOR DATA CIRCLE 209 ON READER CARD

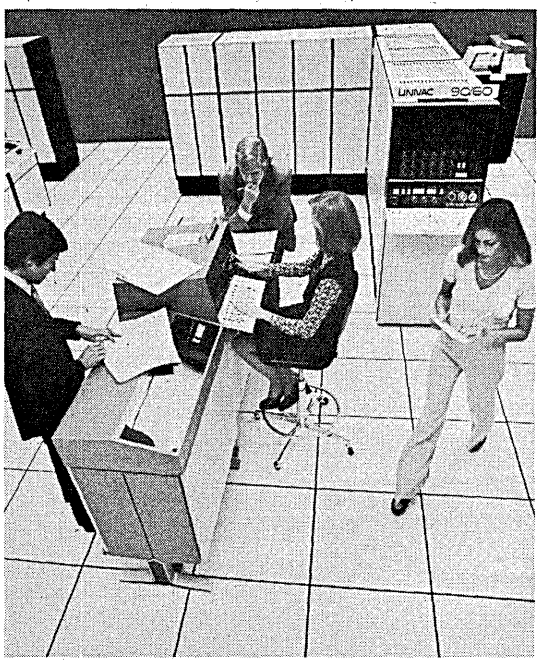
WESTINGHOUSE CANADA LIMITED
Box 510, Hamilton, Ontario L8N 3K2
Subsidiary of Westinghouse Electric Corp.
Employee and sales information not given.
D. S. Farquharson (416) 528-8811
FOR DATA CIRCLE 210 ON READER CARD

WILTEK, INC.
Glover Ave., Norwalk, CT 06852
Established 1947; 350 employees
Gross sales $7M
Offices nationwide.
E. Robt. Collela, mktg mgr (203) 853-7400
FOR DATA CIRCLE 211 ON READER CARD

WYLE COMPUTER PRODUCTS, INC.
128 Maryland St., El Segundo, CA 90245
Subsidiary of Wyle Laboratories
Established 1949; 2,500 employees
Gross sales $93M
Genesis One markets Wyle terminals through 17 branch offices.
Robt. K. Shaal, vp mktg (213) 322-1763
FOR DATA CIRCLE 212 ON READER CARD

XEROX CORP.
701 S Aviation, El Segundo, CA 90245
Established 1906; 75,000 employees
Gross sales $2.42 Billion
Offices in 48 states and worldwide.
Tom Livoti, prod mgr (213) 679-4511 x1362
FOR DATA CIRCLE 213 ON READER CARD □

From Blue Bell, a computer that talks management's language. The new UNIVAC 90/60.



Value, growth, protection of investment are key words in any business manager's vocabulary.

The new UNIVAC® 90/60 medium scale computer system was particularly designed with these words in mind.

Let's take value. The 90/60 has a high performance to cost ratio. It is over 50 percent more powerful than the computer you may be thinking of using, at a comparable price. Power enough to process many new applications.

What about growth? If you're an IBM 360, a UNIVAC 9400 or Series 70 user, for example, the 90/60 itself offers phenomenal growth. What's more, it can easily and economically be upgraded on your site to a UNIVAC 90/70 in less than one day.

How is your investment protected? Not only is your upward move economical, but your software gets converted without charge. In fact there are no hidden charges for "extras." The new UNIVAC 90/60 is bundled. So our price includes installation assistance, education, systems engineering support and software.

Another good management word is compatibility. So the 90/60 is compatible with the IBM 360, the UNIVAC 9400 and the Series 70.

If you're in the market for a medium scale computer system that speaks your language, look into the new UNIVAC 90/60. Talk to your SPERRY UNIVAC representative. Or write SPERRY UNIVAC World Headquarters, P.O. Box 500, Blue Bell, Pa. 19422. You can have one beginning January, 1974.

You'll like what it has to say.

SPERRY UNIVAC

Only when our customers succeed do we succeed.

SPERRY UNIVAC IS A DIVISION OF SPERRY RAND CORPORATION

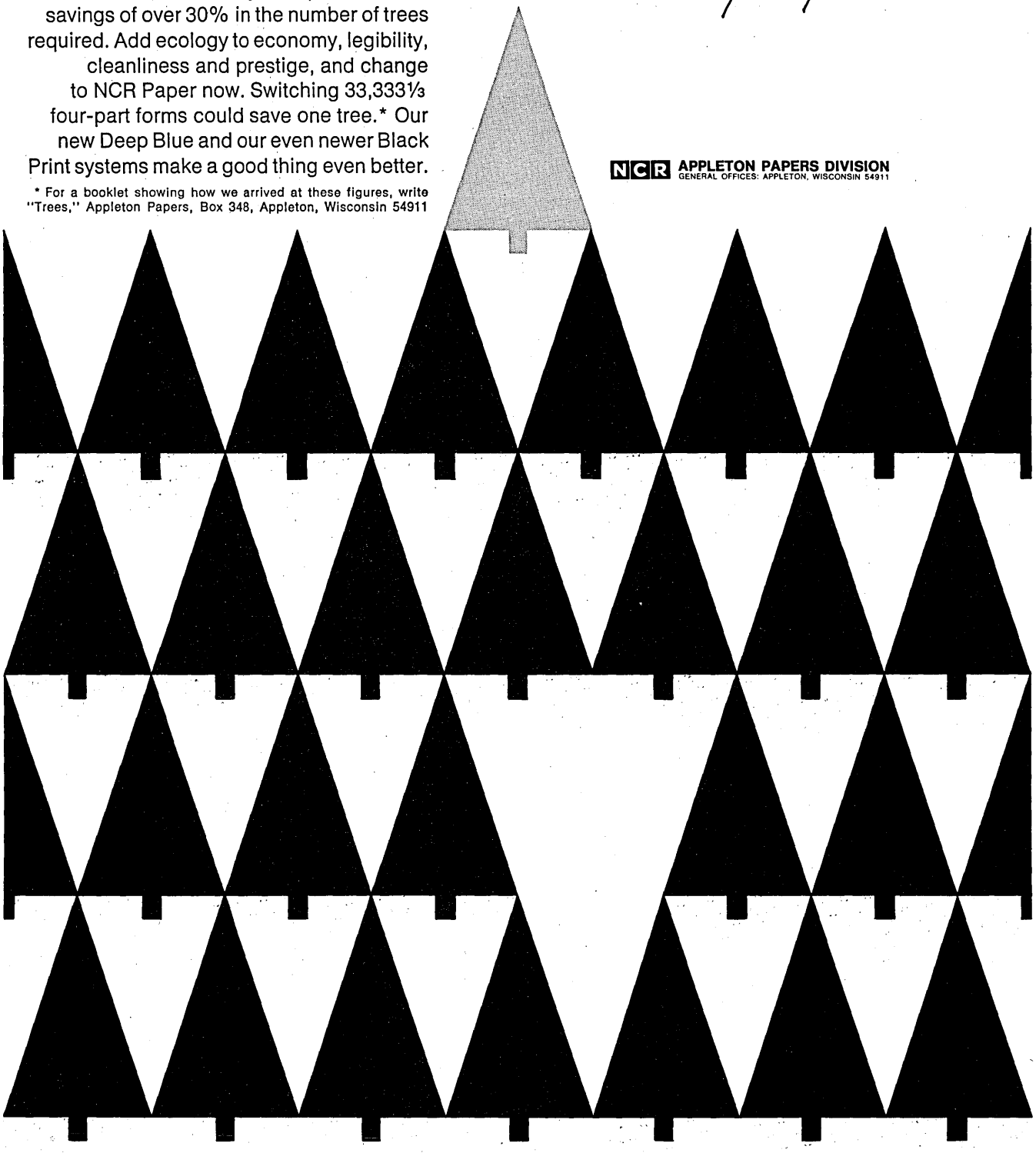
Switch a million 4-part forms to NCR Paper and save 30 trees.

Although the paper industry does have an excellent re-forestation program, reducing the demand for paper would lessen our need to cut trees. One way to lessen demand is to switch your business forms from carbon and bond to NCR Paper. Not only will you get a better form, you'll save three pieces of paper out of seven in every four-part form—a savings of over 30% in the number of trees required. Add ecology to economy, legibility, cleanliness and prestige, and change to NCR Paper now. Switching 33,333⅓ four-part forms could save one tree.* Our new Deep Blue and our even newer Black Print systems make a good thing even better.

* For a booklet showing how we arrived at these figures, write "Trees," Appleton Papers, Box 348, Appleton, Wisconsin 54911

NCR *Paper*®

NCR APPLETON PAPERS DIVISION
GENERAL OFFICES: APPLETON, WISCONSIN 54911



You're up to your eyeballs in software for hardware that's obsolete.

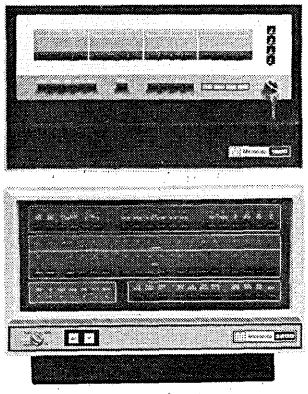
A sad situation. You've built your product around a computer that's no longer supported. So you have a huge investment in software and nothing much to run it on.

Take heart. We'd like to talk to you about a very attractive solution to your problem.

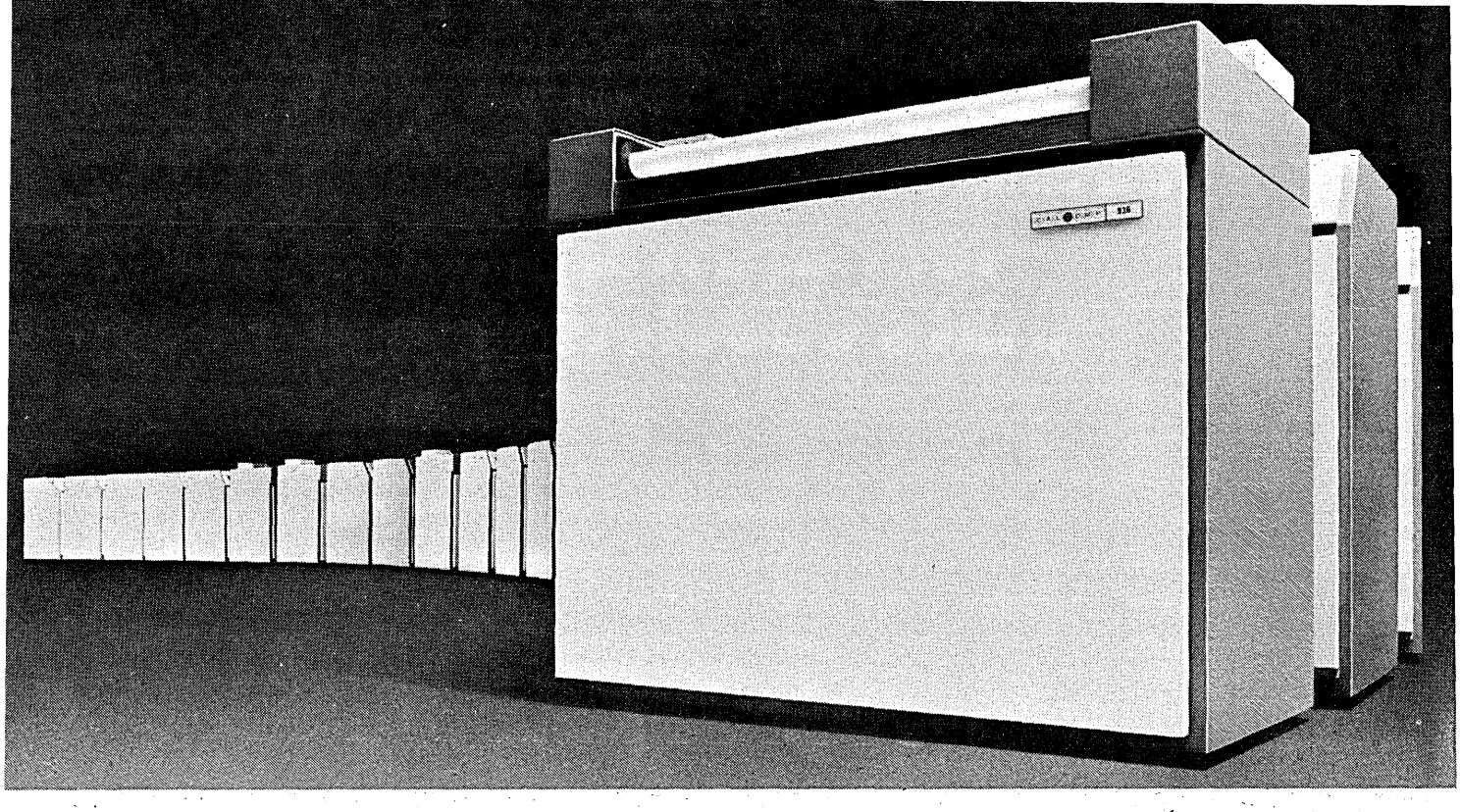
Because Microdata minicomputers are microprogrammable, combining the hardware and software (we call it firmware), we can emulate any computer ever made. So your software will be 100% compatible. Your speed will probably increase substantially. Your cost will almost surely decrease dramatically. And you'll have an advanced, fully serviced, well-supported computer tailored to your specific needs.

You're not facing a problem. You're facing an opportunity.

If you're interested in emulation or a total OEM system, write or call Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. Telephone 714/540-6730.



Microdata. Bring us your problems.



When you're the leader, how do you follow the leader?

We introduced digital plotting.

For the last ten years, our drum plotters have set the standards of their industry.

Our 565, and the models we've built around it, have made us the largest manufacturer of drum plotters in the world.

But we've known for a long time that someone would come along with something new one day. What we've been working on, is making certain that the new leader would still be us.

Starting now, you'll measure drum plotters by our two new models.

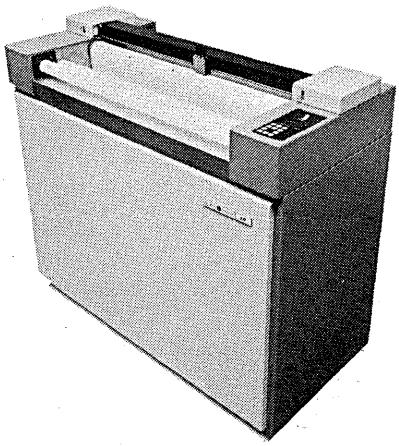
First, the 936. It's faster and it has greater plotting quality than the unit it replaces.

And, it costs less.

Next, our top of the line 1036. It's almost twice as fast as the 936. And again, its plotting quality is higher and its price is lower than the unit it replaces.

We've increased performance and decreased the price of the drum plotter. And that's going to be a hard act to follow.

Call or write California Computer Products, Inc., DM-11-73, 2411 West La Palma Avenue, Anaheim, California 92801. (714) 821-2011.



CALCOMP

Thorough job analysis
is the most important factor
in establishing a certification program

Certification: A Suggested Approach to Acceptance

by Robert N. Reinstedt and Raymond M. Berger

Judging from the recent flurry of activity to create the Institute for Certification of Computer Professionals, certification appears to be one of the most pressing problems facing the industry today. However, there is virtually no evidence at this time to indicate the industry's readiness to come up with a certification test that is sufficiently valid for operational purposes. "Valid for operational purposes" means the test must be job-related, otherwise its usefulness as a standard of proficiency to managers, to the public, and to the individual programmer is very limited.

This article explains in more detail the current capabilities and limitations of certification testing, and outlines a plan by which one might achieve an operationally useful certification capability in roughly two years. Any attempt to build a certification structure before such a foundation has been laid will, in our opinion, be doomed to failure.

The 1970 round table meeting on Professionalism in the Computer Field, sponsored by AFIPS and chaired by the Honorable Willard Wirtz, recommended that for certification, "A comprehensive program should be initiated based on a meaningful set of job descriptions. Tests should be developed to measure various competence levels."

If the computer societies are to carry out that recommendation, it is not enough to merely initiate a program of certification, or to adopt an existing one. It will have to be comprehensive in the sense that both those within *and* without the industry know precisely what job or family of jobs the certification certifies. It must be valid in the sense that one who holds the certificate has been evaluated (either by education, test, experience, knowledge, or a combination thereof) and found to possess the qualifications to satisfactorily perform those tasks which compose the certification requirements. Put simply, certification boils down to: exactly what is the certificate-holder expected to do, and can he or she do it?

There are some additional components which demand consideration. One is the temporal aspect. Will certification endure the test of time, or will there have to be periodic updating? Are ethics and standards a necessary part of continued "membership?" For example, if a certificate-holder uses his knowledge to embezzle or to rig an election, is there to be a process by which he is no longer certified and if so, who does the policing and how?

There are numerous other considerations. For purposes of brevity, however, it seems more productive for this article to limit its scope, and address the two primary problems mentioned earlier: determining what to certify, and how to certify in a way which assures a satisfactory degree of validity.

Two populations

Certification actually must serve two populations; those who have been granted a certificate, and those who seek the services of a certified programmer. For the former, the certificate attests to the attainment of a particular level of expertise. For the latter, certification establishes some minimal and premeasured degree of confidence in the programmer's knowledge and ability to perform. An analogous situation is the certification of doctors and lawyers. Their licenses say to those outside of their field that they have passed through a prescribed course of training and have been judged capable of executing their respective tasks with competence. Doctors and lawyers are subject as well to losing their credentials.

As in the medical profession, there are diverse jobs in "programming." Perhaps some of them will ultimately be included in other disciplines (e.g., a medical diagnostic programmer under the aegis of the AMA), but even if this should be the case, it would seem appropriate for the programming field to continue certifying members of its own discipline.

This type of sponsorship will not be possible, however, if there is a single measuring stick used to divide the world simply into "certified programmers" and "all others." The problem is not even as straightforward as determining degrees of programming competency (e.g., junior programmer, programmer, senior programmer, etc., if this kind of a breakdown should be decided). There may have to be columns as well as rows so that a further delineation can be made as to applications of skills (such as medicine, accounting, science, etc.).

No matter what is decided as to gradations or applications, the essence of the problem is to find out: "Can a given individual be expected to do a predetermined task, with a necessary degree of competence?" The hooker here is in defining that predetermined task. Programmers often say that their job would be made much easier if the customer could articulate clearly what he wanted. Test constructors face the same problem, and the computing world is no more guilty (or innocent) than most other fields in being unable to define in sufficient terms what it is that should be tested.

Ideally, the interview, the selection test, salary reviews, employee evaluation, decisions on continued employment, and certification would all be based on identical criteria. Admittedly, they are different approaches using different methods, but they all ought to be devices designed to extract data to be measured against the description of necessary performance elements for a given job. This may appear to be blatantly obvious, and in conversations with various managers there seems to be universal agreement. But how many managers go into, say, an interview situation with any kind of crystallized thoughts about what they specifically expect in job performance? This is not to say that in all cases nothing is learned or accomplished, even if it is as simple as getting an indication of compatibility, but if more thought were given to the job requirements, the interview could become significantly more valuable.

Selection tests are similarly misused since they are assumed to correlate with a given job for a given individual in a given company, but are actually based on group findings, and usually not within the company. (E. L. Thorndike once pointed out that "Some of the tests which parade be-

hind the banner of educational science measure the fact in question about as well as the noise of the thunder measures the voltage of the lightning.")

But selection devices are not the villain any more than past attempts at certification instruments are. What has been lacking and must be corrected if certification is ever to be possible, is to establish requirements. If done right, this is a fairly long, exacting and laborious task, but it is possible, and is essential if the program is to succeed.

Other difficult selection, training and evaluation problems have been solved. An example can be found as far back as World War II when the (then) U.S. Army Air Corps at the outbreak of war was training approximately 300 pilots per year. By the war's end over 180,000 pilots had been selected, trained and had received their wings. The problem was certainly difficult—that of selecting very large numbers from a previously peacetime population to perform a function which demanded a combination of intellectual, physical, and psychological requirements.

A concerted, systematic effort was conducted, based on first establishing the detailed job functions of pilots. Once done, the rest was almost routine. Even at that point, scientific methods ("testing" the tests, "evaluating" the evaluation) are required. But the main design work is done when the "job" is defined.

Certifying programmers must be approached in the same way. There should be a research design which meets the needs of the problem, and that design already exists in part as a result of the recent work that one of the co-authors (Dr. Ray Berger) has been doing for AFIPS. The approach, and a proposed road map to certification, will be discussed shortly, but a couple of general points still remain to be mentioned before getting to the specifics.

First of all, it would seem to be sheer folly to expect some committee comprised of dp personnel to devise a certification program for meeting requirements both in and out of the computing field, including legal considerations.

Second, although one would reasonably enough be interested in a cost-effective solution, arriving at a certification program is probably best done with less emphasis on the *developmental* costs. Already, various societies are talking in terms of when the program becomes self-supporting. This could be counter-productive. No one suggests that thought should not be given to the long- or even short-run economics of the problem, but the program shouldn't be lost for "want of a nail."

Finally, there is a very real possibility that the only way to accomplish the task is through universal industry acceptance at all levels, which can only result through the effort of the entire computing industry. In this sense, the decision to have all groups represented regarding further certification is an excellent one.

Since the dp field is seeking to professionalize itself, it must develop standards that will identify those individuals who have reached a certain level of competence. How these standards are developed, and who sets them is of prime importance. It was indicated earlier that standards, whether technical, professional, or academic, should come from people who are active in the field. It would be a mistake to accept the argument that since management must be served they therefore must set the standards. It is perhaps more erroneous to let either the federal or state government be the agency to set standards.

Managers may be able to evaluate the end-products, but are not necessarily schooled in the most effective means of arriving at them. The federal government, for the same reasons that they have abstained from setting standards in the medical, legal, accounting, and other professions, should not have to set the professional standards for programmers and, in turn, the programming profession should not want the government to do so. The computer professional should derive his identity and certification from a society composed of his peers.

The computer profession, among whose basic functions is analysis, has done very little systematic analysis of its own job. Such an analysis would start with a job analysis and end with an effective set of standards.

The job analysis

Describing the job in terms that can be translated into professional standards is the touchstone of a properly executed job analysis. The job descriptors must be detailed, relevant, generalizable beyond a specific organizational setting, and at the same time capable of being reduced to skill requirements. The accumulation of job descriptions put out by many organizations, including governmental agencies are, at best, a useful literature bank.

A universe of task statements should be collected as the basic raw data from which to extract the job descriptions. Statements, which should include all activities and responsibilities, can originate in several ways: from observation, from interpreting the user's job requirements, and from employee and manager reports. The recommended procedure is a combination of all of these, with emphasis on the employee self-report. The format of the statements would be, preferably, a simple declarative sentence, starting with a verb, to denote some activity of the programmer. Examples can be used but must be carefully checked for their applicability to the entire programming field. Some examples of such statements would be:

"Design the program to meet specified formats and/or decide among alternative formats for input and output information."

"Write general instructions for using and operating a program, and instruct users and operators in running the program."

"Code and debug program changes and corrections." For systems programmers this becomes: "Code and debug modifications and corrections to systems software."

A statement that is more appropriate for scientific and engineering programmers than business programmers would be: "Code and debug in higher level language such as FORTRAN or PL/1."

In the AFIPS job analysis project, it became painfully evident that an example of an activity drawn from scientific programming did not clarify the general sense of the statement for a business programmer. Indeed, the differences in activities according to programming focus made it expedient to create subdivisions of statements for the several programming focuses: (e.g., business, scientific, engineering, systems). However, one should be wary of maintaining the subdivisions as separate job worlds since to do so would impede the possibility of later establishing a job communality for all subdivisions. A job communality in addition to the various subdivisions would allow one to be certified as a computer programmer with a specialty in, say, business dp.

When the universe of tasks has been assembled, the process of evaluation, modification, and further evaluation begins. The first evaluations are usually informal. The number of ways a task statement can be interpreted is amazing. As a result, it often must be modified several times before it acquires a sufficiently common meaning. This is a costly, time-consuming procedure, but prematurely locking-in on a particular set of statements can reduce the reliability of the final evaluation, ultimately resulting in an even more costly venture.

The informal evaluations should be done by highly-rated individuals, actively engaged in the job being analyzed. The well-intentioned (but non-

programming) manager with a wealth of experience, not all of which is current, may only introduce ambiguity and delay into the evaluation.

The final evaluation of the job elements, preferably on some quantified scale, should be performed by groups that are representative to some degree of the "professional" population. Individuals in this population should be experienced and highly recommended by their managers and peers for their dp proficiency. When the final goal of the job analysis is the determination of professional standards, then the group making the evaluation of task and skill requirements must itself be professional. A job analysis based on the evaluation of a thoroughly representative sample of the industry as a whole is too difficult to achieve at the present time. For one thing, there is no accurate census of the programmer population on which to determine a representative sample. The best procedure is to carefully define the criteria for a professional group of programmers whose judgments will be acceptable by other computer people, and then to sample for these individuals, as accurately as possible, within important strata of the general programmer population. The sampling procedure should aim for organizational and geographic representativeness rather than rely on availability of individuals on professional society lists and/or in attendance at computer group meetings. Organizations sampled can more readily identify the individuals who are actively engaged in programming work and who are regarded as highly proficient.

The second part of the job description is the building of a skills-and-techniques bridge between the job tasks and the people who perform them. What specific skills do they require? How are the skills identified, and their importance determined? These questions are answered by following the same procedure used for defining the set of tasks: assemble a universe of skill statements from a variety of sources and evaluate the extent of their involvement in the programmer's repertoire.

When the job has been described in terms of the task requirements and the subject-matter skill requirements, one can then move with scientific (and legal) force to the personal requirements. The individual can only perform competently when he or she has the training, experience, and abilities that have been shown to be directly related to the task and skill requirements.

One way to determine just how much training and experience are required is to survey the kinds and amounts of education and training computer people have. Another way is to ask training directors what the training requirements are for the described tasks and skills.

Surveys have revealed a great variety of training and education patterns for programmers and systems analysts. Self-study and on-the-job training are the most frequent ways in which knowledge and skills are acquired. Training programs themselves vary widely in objectives and methods, and there are even wide differences among training programs that share the same goals. Fair standards for training and educational requirements will obviously be difficult to determine, but the arbitrariness may be reduced by careful reference to information yielded by biographical survey and task/skill descriptors.

The experience variable is a little less problematic; although the relationship between experience and proficiency may be non-linear, it is, nonetheless, definitely positive. Job analysis data correlated against experience would presumably uncover the minimal experience required for different levels of programming jobs. These requirements can be translated into standards for minimum experience for professional standing. For example, it might be ascertained that a minimum of one year of full-time programming is one requisite to become a candidate for certification, and that three years of experience may be the minimum to qualify for advanced standing. In any event, the minimum experience requirements, like the job descriptors, should be based on a job analysis rather than on some committee's arbitrary decision.

It is essential that the determination of all personal requirements, training, experience, and abilities be started with a data base of important tasks and skills. A survey of the background characteristics of individuals in the field, the judgments of panels of experts, and the psychological insights of a professional experienced in job analysis can indicate the parameters of the personal correlates of on-the-job proficiency; recommendations for professional standards follow naturally.

Determining professional standards

When a job analysis is complete, then the establishment of the standards for professional membership becomes appropriate. The education, training, and experience requirements should emerge in large measure from the job analysis. A final requisite, perhaps the ultimate objective of conducting a scientific job analysis, has now to be satisfied: the construction of a qualifying examination.

Such an examination (there would more than likely be several in order to cover different levels and focuses) *must* be based almost entirely on the job analysis. Any exam chosen for interim use until a job analysis is completed may do more harm to a certification program than no exam at all. A test developed by a special interest group may tend to reflect only concerns of that group irrespective of whether that is the motive of the group. A case in point: an exam presently in use was originally constructed to certify competence in several areas for which study was required. The exam, because of its high correlation with recency of education, has had an *inverse* relationship with amount of experience and thus gives an advantage to those who have just completed their training or schooling.

Reports on the exam results indicate that on the average, those with greater experience are disadvantaged in their scores. Moreover, the exam covers areas not directly related to the technology of programming. Such an exam, however suitable for its original purpose, would not seem to be an appropriate instrument for certification even as an interim measure. Any future achievement or professional qualification exams, to be useful, must be constructed according to acceptable psychometric standards.

In summary, the case has been made here for a scientific approach to a certification program, acceptable within the profession as well as outside of it. The design is accomplished by using careful job analysis for defined subdivisions of the programming field. Starting with the job description, the job is structured in terms of important tasks and skills, and these elements will indicate the personal requirements.

This information then provides the means for establishing professional standards and qualifying examinations. Fortunately, the first (and perhaps most difficult) stage, that of job description, is nearing completion, specifically in the job analysis project sponsored by AFIPS. The subsequent stages remain to be carried out, but if done as described, the end result will be a better and more lasting foundation for professional standards and the establishment of a certification program acceptable both to those in the field and to those the field serves.

The time and effort necessary to develop a comprehensive valid certification test can be spelled out in detail if the suggested approach is accepted and supported. With the completion of the job analysis stage, the time for the test construction stage (assuming reasonable funding) would be roughly nine months to one year. The professional staff requirements are not large; the judicious and efficient use of consultants for the different parts of the test, especially when they are guided by a

Certification

meaningful job analysis, can keep the test construction costs within reason. The time and effort required to construct a valid test are often underestimated because the necessary steps to achieve that validity are not taken into account. In addition to the test item construction (hopefully based on a valid job analysis) there are steps such as test item tryouts, item analysis, revisions, preliminary total form tryout, and final form norming. Two to three times the number of items needed may be constructed since the test item survival rate is usually one-third to one-half. Those who talk of a committee being able to dash off a "good" test, given a few days of concentration, are talking about a collection of questions that has a low probability of validity for the purpose intended. At best these collections of questions have entertainment value and perhaps some instructional worth; at worst they could be a basis for invalid guidance, selection or certification. □

Mr. Reinstedt is the associate dept. head of the information sciences and mathematics dept. of the Rand Corp., where he has previously conducted several studies in personnel selection and evaluation.

Dr. Berger is the director of Psychometrics, Inc., and is an associate professor at USC. He has developed the Berger Test of Programming Proficiency and the Berger Aptitude for Programming Test, and is a special consultant to the AFIPS professional certification committee. He has a PhD from USC.

Refuting Reinstedt's and Berger's argument, the author traces the history of certification testing and asserts that existing tests are both valid and valuable

Certification— Evolution, Not Revolution

by John A. Guerrieri, Jr.

The historical roots of certification go back to Hippocrates, and maybe even further. However, the thrust of certification in the business community was not generally felt until after the industrial revolution, when it became necessary for many owners to delegate various functions to specialists. As the levels of delegation increased and the owners became further removed from day-to-day operational control, it became more difficult to personally guarantee the competence of the specialists. If enough errors in judgment are formed on insufficient or unsubstantiated information, the decision-maker will look for something to better the odds. Certification is one method of increasing the chances of making a sound judgment on an individual's competence.

When a certification program is created, it is generally a voluntary effort by the group involved; either in response to an existing need to enhance its image and provide some ranking of its members, or to preclude the development of such needs. As with most voluntary programs, acceptance of voluntary certification generally proceeds with mixed reactions and at a snail's pace. That is the expected reaction when any individual is given the *option* of submitting himself to evaluation against his peers.

A certification program can be viewed, then, as progressing upward in steps rather than in a continuous growth pattern. The first significant step occurs when industry recognizes the meaning and value of the certificate. That first step is the most difficult and often takes many years. Before then, certificate holders are viewed with all sorts of suspicion, generally expressed as, "He's got to have some ulterior motive." That seems many times to get translated to, "It's a shield to hide his lack of ability." Some certificate holders fit that image. The vast majority, however, strive for the certificate because they believe in the need to be evaluated against their peers on an objective basis. That provides the individual with a measure of his own position as well as identifying him as someone with the initiative and confidence to open his knowledge to inspection.

As certification proceeds beyond the first step to wider voluntary recognition, the certificate develops more immediate benefit as an added tool in the "credentials bag" of the professional. It begins to carry weight in the form of preferred status and extra monetary rewards. The rationale for obtaining a certificate then changes from an individual commitment to peer pressure—"If you don't have one, you aren't one of the elite." The perception of certification's role also changes as society begins to accept the certificate as a measure of ability. The monumental step for certification comes when it becomes an integral part of government licensing. The certificate then becomes a necessity for performing certain jobs and is generally viewed by society as guaranteeing competent performance.

When a certification program reaches that point, it can be more of a handicap than a help to the profession involved. That will be regarded by many as a radical statement, but in light of such things as medical malpractice, disbarment or recent cases involving certified public accountants, and the reaction they generate among the general public, it is relatively obvious that widespread misunderstanding of certification exists.

No one involved in any legitimate and respectable certification program would be presumptuous enough to predict the quality of performance or ethical behavior of a certificate holder. If they could there would be no need for the certificate revocation procedures that exist. A certification program, regardless of how rigorous or inclusive, is only able to predict *potential* quality of performance or ethical behavior.

Successful completion of a certification program and acceptance of the obligation to uphold the attendant code of ethics can provide no more than identification of the individual as having the knowledge and understanding of the tools and techniques necessary to perform in a competent manner; and having the inclination toward ethical behavior. In fact, beyond the point at which certification is awarded, the individual is in complete control of his behavior and is totally free to conduct himself in an incompetent and/or unethical manner. There is not (and, frankly, never will be) a certification

program that guarantees that a certificate holder will always perform competently, honestly, and in the best interests of his client (or employer). That is beyond the scope of certification and was never intended to be its purpose.

The purpose of certification, in general, is to identify those individuals who at a given point in time can demonstrate, through an objective instrument, the level of knowledge considered the minimum necessary to function in a particular job. Certification can make no judgment on whether that knowledge will ever be applied in a competent manner.

Despite its limitations, certification should not be treated lightly because it does have great value in the practical world. If the certification program has been well conceived, developed, and implemented, it does provide an objective measure of knowledge which would otherwise be difficult to obtain.

The Certificate in Data Processing (CDP) examination and the Registered Business Programmer (RBP) examination developed by the Data Processing Management Assn. (DPMA) have had their share of criticism as being ill-conceived, ill-designed, or ineffective. Much of that criticism is based on incomplete or inaccurate information. On the eve of the new Institute for Certification of Computer Professionals, it is most appropriate to review both programs.

Historical benchmarks in exam development

In January 1960, a certificate advisory committee was formed by the National Machine Accounts Assn. (forerunner of the DPMA). Their charter: to guide the association in the development of an international certification program. Later that year, based on the committee's recommendations, the association decided that: every candidate, regardless of work experience, would have to take the exam; the CDP would be available to all qualified persons, not just association members; at least three years of "field" experience in data processing would be required of candidates; and, based on the serious lack of dp courses available at the time, academic requirements were to be dropped for the first three years of testing.

In the summer of 1961, the San Diego State College Foundation, a nonprofit research and testing organization, was contracted to prepare the first test. For several months, batches of items were developed and tested on various control groups. The best were selected and a 150-item multiple-choice test, covering a wide range of subjects, was prepared, and given on June 20, 1962. This, with two subsequent tests of practicing dp personnel, formed the basis for the first CDP examination.

At 44 sites in the U.S. and Canada, 1,049 candidates took the first edp exam in December, 1962. The next year, 2,396 candidates took the exam and 1,594 certificates were awarded.

Also in 1962, the association (now the DPMA) created the certificate advisory council to handle planning, policy-making and direction of the certificate program. The college course requirements, in force for the 1966 exam, greatly reduced the number of qualified candidates. Only 1,005 persons took the test and 408 passed. When the specific course requirements were dropped in 1968 and were replaced by two years of college, including or supplemented by two years of dp courses, nearly 3,000 took the exam.

In 1970 the exam was expanded to 300 questions divided equally into five sections: dp equipment; computer programming and software; principles of management; quantitative methods; and systems analysis and design. Candidates were graded on each section and could retake failed sections within three years. Of the 2,314 candidates sitting for the 1970 exam, 718 passed all five sections; 411 passed all but one section. In 1971, one-third of the total 2,728 candidates retook a part or all of the exam. The 1972 and 1973 examinations were marked by the same high attendance and significant number of returnees.

From its inception in 1960, DPMA's certification council has evaluated and modified the CDP's exam and its requirements based on testing experience and the changing nature of the computer industry. Over the past 10 years, 27,464 individuals have taken the exam and 13,992 of them are now CDP holders.

There is evidence that the CDP certification is growing in national recognition. For example, a recent Weyerhaeuser Co. recruiting ad for senior dp auditors stated that a "CPA, CDP, or MBA is helpful." An ad from a prestigious management consulting firm in Washington, D.C., and the job specifications for the Data Processing Manager of Phoenix, Ariz., both called for college degrees and a CDP. Successful CDP candidates at Franklin Life Insurance in Springfield, Ill., received a gold CDP key and a $100 bonus from company president George E. Hatfield. State Farm Insurance, the Prudential Insurance Co. of America, and the U.S. Army Corps of Engineers have extended official recognition to the CDP program and their employees who have passed the exam.

CDP holders are subject to a code of conduct and ethics evolved by the council, and violations can lead to the loss of certification.

The RBP examination is the result of a recognized need to identify that corps of practicing business programmers who have reached a level of technical knowledge which qualifies them to effectively and efficiently translate human needs into computer instructions.

The development of the examination itself began by using the 186 programmer task statements developed by Rigney and Berger. A group of supervisors and managers of commercial programmers in a number of industries including banking, utilities, retail and manufacturing, along with two members of the certification council recognized as particularly knowledgeable in the programming area, judged the business programming applicability of each of the 186 tasks.

The 186 task statements were reduced to 115 by this evaluation. Then, 25 programmers from well-respected business firms were selected to cooperate in classifying the 115 task statements into the following four levels of use: not used; 0-20% usage; 21-50% usage; over 50% usage.

Tasks included in the third and fourth levels (21-50% usage and 51% or more usage) were ranked by the percentage of programmers checking such tasks. Tasks on this ranked list for which at least 50% of the respondents agreed were selected as the basis for constructing examination questions. The certification council then provided an outline of topics and sub-topics to be covered and the types of items to be included, such as work problems, name recognition, and complex structure. In addition, members of the certification council furnished questions. They either wrote these questions themselves or requested knowledgeable persons involved in business programming to write them. Over 300 questions were developed for the original question pool.

After three trial administrations to business programmers who represented various levels of training and experience, and a statistical analysis of the results each time, the questions were revised and refined.

Every year the exam is evaluated statistically in terms of question difficulty, question discrimination, and test reliability. A demographic description of the population tested included age, schooling, experience, and current occupation—also included in the evaluation process.

Quality control and upgrading of the exam is the job of the Programming Expertise Advisory Committee,

created in 1970. Every examination is evaluated by the committee with the assistance of research and testing organizations. In addition, the committee develops questions, analyzes exam results from statistical reports, and determines cut-off scores.

Difficulty, discrimination, reliability

The proportion of individuals passing each question is calculated for each question on the examinations. That proportion, expressed as a decimal fraction, is the difficulty index. Thus, for example, if 50% of the individuals pass a question, the difficulty index would be .50. The guidelines recommended by our testing consultant specify an acceptable range for difficulty of between .20 and .90. That means that questions answered correctly by less than 20% of the population are too difficult and questions answered correctly by more than 90% of the population are too easy.

One of the objectives of a good question is its ability to discriminate between the high scorers and the low scorers. That means basically that the question should be constructed so that the knowledgeable individuals get it right while the others get it wrong. The discrimination index represents, in the form of a decimal fraction, the relationship of the question to the total score. The higher the fraction, the greater power the question has to discriminate between high and low scorers. The minimum acceptable discrimination index as a general rule is .20.

While the difficulty and discrimination indexes provide accurate statistical information on the performance of a question, they are still an "after the fact" appraisal. The suitability of a question is not known until after it has been used at least once in a test situation. Therefore, because the council does not consider it appropriate to base certification on an unknown quantity, as a general rule not less than 75% of each of the sections consists of questions that have acceptable difficulty and discrimination indexes. The other 25% are new or revised questions which have not been statistically validated but are considered suitable for inclusion based on evaluation by the council members.

It is necessary to verify that each section of the examination has the ability to rank candidates on the basis of total score in some defined order. The concept here is that if a section is measuring what it has been constructed to measure, then each question should have some relationship to the other questions to the extent that each item represents a measurement of the subject matter of the section. The method of verifying the consistency of the questions is to calculate a reliability index using standard statistical techniques (Kuder-Richardson Formula 20). A high index of reliability by that technique is generally defined as .80 or above, and indicates that most of the questions contributed to the ranking of subjects. The RBP examination is superior in this regard, with reliabilities in the .90s.

The actual scoring of the sheets takes a maximum of one day. However, it does take a week and a half to get the testing materials back from the examination centers by air freight, a week and a half to two weeks to verify that all answer sheets and other materials have been returned, and to correct the roughly 10% of answer sheets that have been miscoded. All of that precedes the day of scoring.

Following the day of scoring, another six weeks is required to prepare the extensive statistics necessary for the Certification Council, or Programming Expertise Advisory Committee, to analyze the performance of each question. This individual question analysis is done to identify questions which did not perform up to the statistical standards established for a valid question. Questions which did not per-

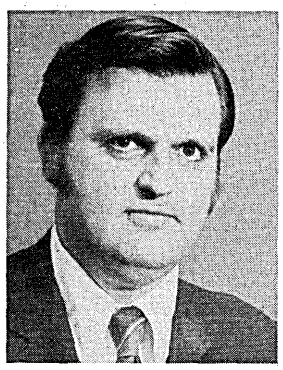
Certification... Evolution

form satisfactorily, regardless of reason, are discarded to avoid any possibility of negative bias in an individual's score. Once the examinations have been reduced to a set of completely valid questions, the passing score is established. Then another week to 10 days is required to adjust each individual's score and record to eliminate the discarded questions. Then and only then will the candidates be advised of the results. It is obvious that there is a great deal of work involved in getting the answer sheets scored and the passes/fails determined, to insure accurate and defensible results.

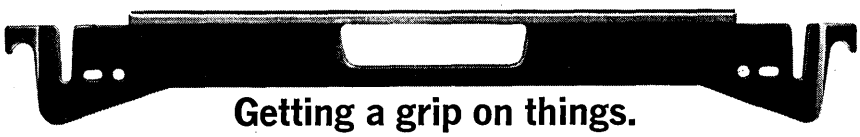
Over the past decade, we have become very familiar with the difficulties involved in developing and administering certification tests and the need to devise new questions to meet the changing requirements of the computer field. The Certification Council is continually evaluating both the CDP and RBP programs.

Recertification, a currently popular topic, has been under study for some time. We are also examining other forms of testing such as the use of oral and essay questions. The concept of other "specialty programming examinations" has been considered and accepted; in fact, the RBP examination is the first in a series of specialty examinations envisioned by the council.

We expect that the creation of the Institute for Certification of Computer Professionals will enhance the fine work of the Certification Council and insure that the CDP and RBP examinations, and any others developed in the future, will continue the pattern of success demonstrated to date. □



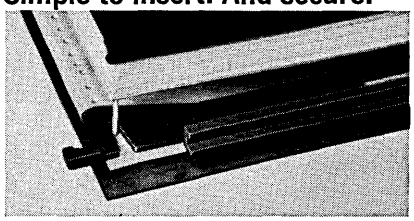
Mr. Guerrieri is director, research and professional services, of DPMA, and is responsible for all facets of educating members of the association and others in the latest tools and techniques of information processing and computer technology within a business framework. He was previously assistant education director of DPMA, has an MBA from Loyola Univ. of Chicago, and was awarded the CDP by DPMA in 1968.



Getting a grip on things.

There's a difference between our EDP binder hangers and some others. Ours are designed for people as well as printouts. While some hangers don't have a handle, ours do. So you can get a grip on things, handle the bulkiest binders with ease. This is why we call our hangers "handles". They give you a hand-grip to hold onto.

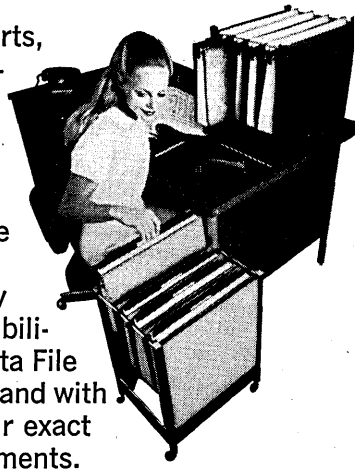
Simple to insert. And secure!



Another advantage of our handles is that they're easier to insert into binders. You don't have to remove posts, take off any sheets or thread. Just loosen the posts, slide our handle in, and tighten up. It won't slip off or slide.

Fits all binders, all data racks.
Our handles come in two universal sizes: 14⅞" handles for unburst binders; 11" handles for burst binders. Both sizes fit all major suspension racks and brands of binders.

Better handles help make Data File Module™ better all around.
Although you can use our handles advantageously in any EDP reference rack, they are a feature component of our new Data File Module. They reflect its overall superiority.



With fewer parts, Data File Module assembles simply and securely. Conversion channels make side retrieval possible. Its many stacking possibilities enable Data File Module to expand with you, meet your exact space requirements.
For more information on Data File Module or its unique handle, call your office products supplier. Or write us. Boorum & Pease, 84 Hudson Avenue, Brooklyn, N.Y. 11201. McMillan Book Co., Inc., 128 Spencer St., Syracuse, N.Y. 13201. Trussell Manufacturing Co., Inc., P.O. Box 911, Syracuse, N.Y. 13201.

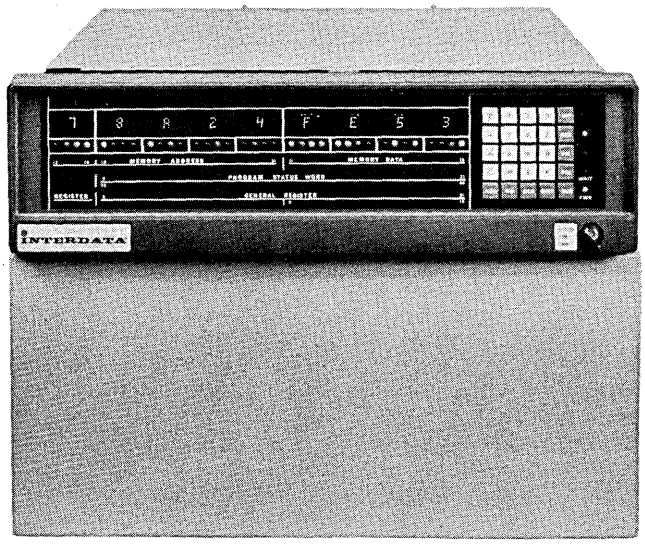
Boorum & Pease
McMillan-Trussell

CIRCLE 14 ON READER CARD

Now you can handle the facts with ease.

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

WITH UP TO A MILLION BYTES OF DIRECTLY ADDRESSABLE MEMORY.



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

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

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

Minicomputer myths you can live without:

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

2. Minicomputers have an absolute 64K addressing limit.

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

All wrong.

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

Big it is. But hairy it isn't.

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

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

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

The new Interdata 7/32.

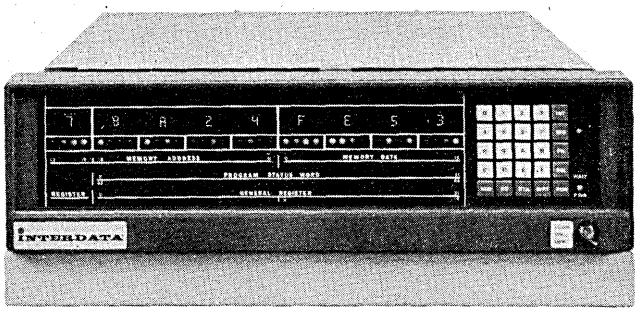
We put our muscle where their myth is.

INTERDATA®

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

INTERDATA ANNOUNCES THE INDUSTRY'S FIRST $3200 MINICOMPUTER TO CHALLENGE THE NOVA.

PDP-11 PERFORMANCE AT A NOVA 2 PRICE.



Minicomputer myths you can live without:

1. There is no such thing as a high-performance, low-cost minicomputer.

2. You have to choose between two extremes – pay a ton for a machine like the PDP-11 and save on software costs, or buy a cheapie like the Nova 2 and pay the price later.

All wrong.

Because now there's the Interdata 7/16 – an extremely flexible 16-bit OEM minicomputer that combines the best of both worlds.

It's easier to program than the PDP-11 because it has 16 hardware registers, up to 64K bytes of directly addressable main memory, 255 I/O interrupts with automatic vectoring to service routines and a comprehensive set of more than 100 instructions. That's a lot of muscle.

It's completely modular in design – plug-in options can be installed in the field to meet your specific application requirements.

Options like multiply/divide, programmers' console with hexidecimal display, power fail/auto restart, memory protect and a high-speed Arithmetic Logic Unit that includes floating point hardware. In fact, you can expand the low-cost 7/16 all the way up to the 32-bit Interdata 7/32.

Yet it costs as little as $3200. Just like the machines that give you the barest minimum. And quantity discounts can reduce that low price by as much as 40%.

Performance	7/16	Nova 2/4	PDP-11/05
Data word length (bits)	4, 8, 16	16	1, 8, 16
Instruction word length (bits)	16, 32	16	16, 32, 48
General-purpose registers	16	4	8
Hardware index registers	15	2	8
Maximum memory available (K-bytes)	64	64	64
Directly addressable memory (K-bytes)	64	2	64
Automatic interrupt vectoring	Standard	Not available	Standard
Parity	Optional	Not available	Special order
Cycle time (usec.)	1.0 or 0.75	1.0 or 0.8	0.9
Available I/O slots	4	2	2

Price	7/16	Nova 2/4	PDP-11/05
8 KB processor 16 KB processor 32 KB processor	$3,200 3,700 5,300	$3,200 3,700 5,300	$4,795 6,495 10,895
Multiply/Divide option	$950	$1,600	$1,800
Floating Point option	$4,900	$4,000 plus $1,000 for 2/10 configuration	Not available

Source: Data General Price List, Copyright 1973, and addendum dated 5/15/73. Nova 2/4 bulletin 012-000060, 1973. DEC OEM & Product Services Catalog, 1972. Auerbach Minicomputer Characteristic Digest, June, 1973. "How to use Nova Computers", 1973.

So you no longer have to make the painful choice between good performance and good price. Or between hardware economy and software efficiency. Now you have a minicomputer that gives you both.

The Interdata 7/16.

We put our muscle where their myth is.

INTERDATA®

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

Precautions must often take precedence over performance of a computer system

Security vs. Performance

by Dennis R. Chastain

In the intelligence community of the federal government, security of classified information is a legal requirement. Therefore, the necessity for security often overrides the concern for optimum performance of a computer system. However, it is important that the relationships between security and performance be recognized. In this paper three major areas concerning these relationships are discussed.

The first concern is with some of the types of hardware and software that are required to maintain security internally in an adp system, and the effect of this hardware and software on the performance of the system.

The second concern is with some of the complex problems of evaluating the impact of security software on the performance of computer systems.

Finally, a number of other technical and human problems often associated with evaluating performance in a secure environment are discussed.

Security hardware and software

Security hardware is generally employed when computer systems must transmit and receive sensitive data over telecommunications lines. This type of hardware is employed to protect data during transmission, and consists of cryptographic devices at each end of the communication line. Basically, a device at the originating end of the line scrambles data into some seemingly meaningless bit pattern. The device at the receiving end of the line unscrambles the bits into the original form. This security hardware usually operates at speeds at least as fast as the transmission speed of the communication line, and therefore causes no degradation in the performance of the computer system.

Unlike security hardware, security software does cause some degradation in the peformance of computer systems. The degree of degradation depends on the level of security which is employed (as well as the efficiency of the code). There are at least three levels of security which can be implemented internally in a computer system: file access security, input and output processing security, and data transmission security. These are discussed below with some comments on other internal security precautions which may be considered.

File access security basically is a check at "file open time" to determine if the user attempting to open the file for processing has permission and clearance to access the file. Usually the list of users, their access rights, and their clearance level are stored in a direct-access storage file. When opening a file, the user's record is pulled from the list and examined to determine if he has the required permission. A comparison is also made of his security clearance and the highest level of security data in the file.

This level of security imposes insignificant overhead on the system. The time spent opening files is usually minor relative to the time spent processing the data in the files.

The processor time required to make the security level and permission determination is insignificant. The number of additional input or output instructions required to make these determinations varies depending on the number of users with access to the system, the number of protected files on the system, and the blocking efficiency of the files which contain the access lists. In one such system the additional I/O's required are usually less than 10.

Input and output processing security is the lowest level of software security. It involves security checks on every input or output instruction received by the system. There can be several security checks made at this level. The most elementary check is to insure that the user attempting to access the data is the one who was processed through file-access security at file open time. A check is also made to insure that the user has the authority to do what he wishes with the file. For example, a check may be made to insure that a user who has "read only" authority is not attempting to alter information in the file. Additional security checks could be made at this level.

In the system within the intelligence community (Defense Intelligence Agency) with which the author is familiar, the overhead introduced at this level can be as low as one-tenth msec per input or output instruction.

The security hardware discussed previously only "protects" data while it is being transmitted. It does not determine whether or not the data should be transmitted. This determination is normally made by an additional software security check. The purpose of this check is twofold. First, it insures that the security level of data to be sent is not higher than that authorized to go to the destination terminal. Second, it insures that the security level of the data is not higher than that authorized to be received by the person who is using that terminal. Security of this nature is usually implemented in the telecommunication software, whereas the levels previously discussed are usually implemented in the input and output control system of the supervisory software.

In the system familiar to the author, the overhead introduced by this level of security is less than one msec/transmission.

Within the author's experience in measuring performance of secure systems, a properly designed system does not add overhead greater than 5-10% of any resource for these three levels of software security. On one such system the overhead is less than 1%.

There are at least two other types of overhead that are associated with most secure systems.

First, there is overhead caused by requiring security identification information to be printed at the top and bottom of each output page on either printers or terminals.

Second, there may be some special hardware or software associated with computer systems which is designed to occasionally test or attempt to subvert the security of the system. This function tests the integrity of the security system by occasionally attempting to perform the operations that the security system is designed to prevent. In

one system it was found that this function, due to the frequency of its use, was taking 7% of the total processor time. (This problem has since been corrected.)

Depending on the degree of security required by an installation, additional supervisory software may be implemented to provide more comprehensive internal security in computer systems. Some functions this additional software could perform are:

1. Specially validating programs requesting to enter supervisory mode.
2. Monitoring and validating certain types of requests within supervisory mode—such as requests to access different locations in internal memory.
3. Preventing access to the control information of files (as opposed to access of the data in the files).
4. Periodically testing the system to insure that the mechanisms established to control applications programs have not been illegitimately altered.
5. Destroying sensitive data when it is no longer needed by writing over the files with meaningless data.

The additional overhead caused by any of these functions depends on how it is designed and implemented in the operating system, and the efficiency of the programming required to perform the function. The function of writing over files to destroy the data could introduce significant I/O overhead, since many applications and utility programs use a significant number of temporary files.

Performance evaluation of secure systems

Security routines are usually part of the supervisory software. The security software provided by the computer vendors may not be sufficient to satisfy the unique security requirements of individual installations. When this situation arises, modifications—which may not be minor—must be made to the supervisory software.

The job of measuring the effect of security software on the overall system can be difficult. The problem is essentially the same as that of monitoring any non-standard supervisory software. Three techniques are especially applicable to measuring the effect of security software on the overall performance of the computer system: advanced hardware monitors, detailed simulation models, and software instrumentation.

A hardware monitor which can monitor activity at selected memory locations can be used to ascertain overhead due to security. Several existing monitors have this capability, but they are somewhat expensive.

Detailed simulation models may also be used to determine the effect of security software. Since security software usually consists of modifications to standard supervisory software, traditional computer simulation packages (such as SCERT and CASE) cannot be used. Models of the detail required have to be constructed in lower level simulation languages such as SIMSCRIPT, SAM and ECSS.

The construction of detailed simulation models in lower-level simulation languages requires considerable expertise, time, and computer resources. Modeling of supervisory software is difficult. It requires the same level of understanding as that needed for the original writing of the software. Considerable computer resources are also required to debug, test, and run the models. It would not be inconceivable for a detailed model to have an actual run-time to simulated-time ratio of 10:1.

Software instrumentation is basically a monitor which is in continuous operation, for it is built in as an integral part of the supervisory software. Software instrumentation consists of specially-located instructions that count and time the execution of the security software. The counting and timing data is used to evaluate the effect that the security software has on the overall computer system.

Since software instrumentation is embedded in the operating system, programming for it is very difficult. This programming must be repeatedly performed for each new release of the operating system. Because this coding cannot easily be removed, it continually imposes a degree of overhead on the computer system.

Technical and human considerations

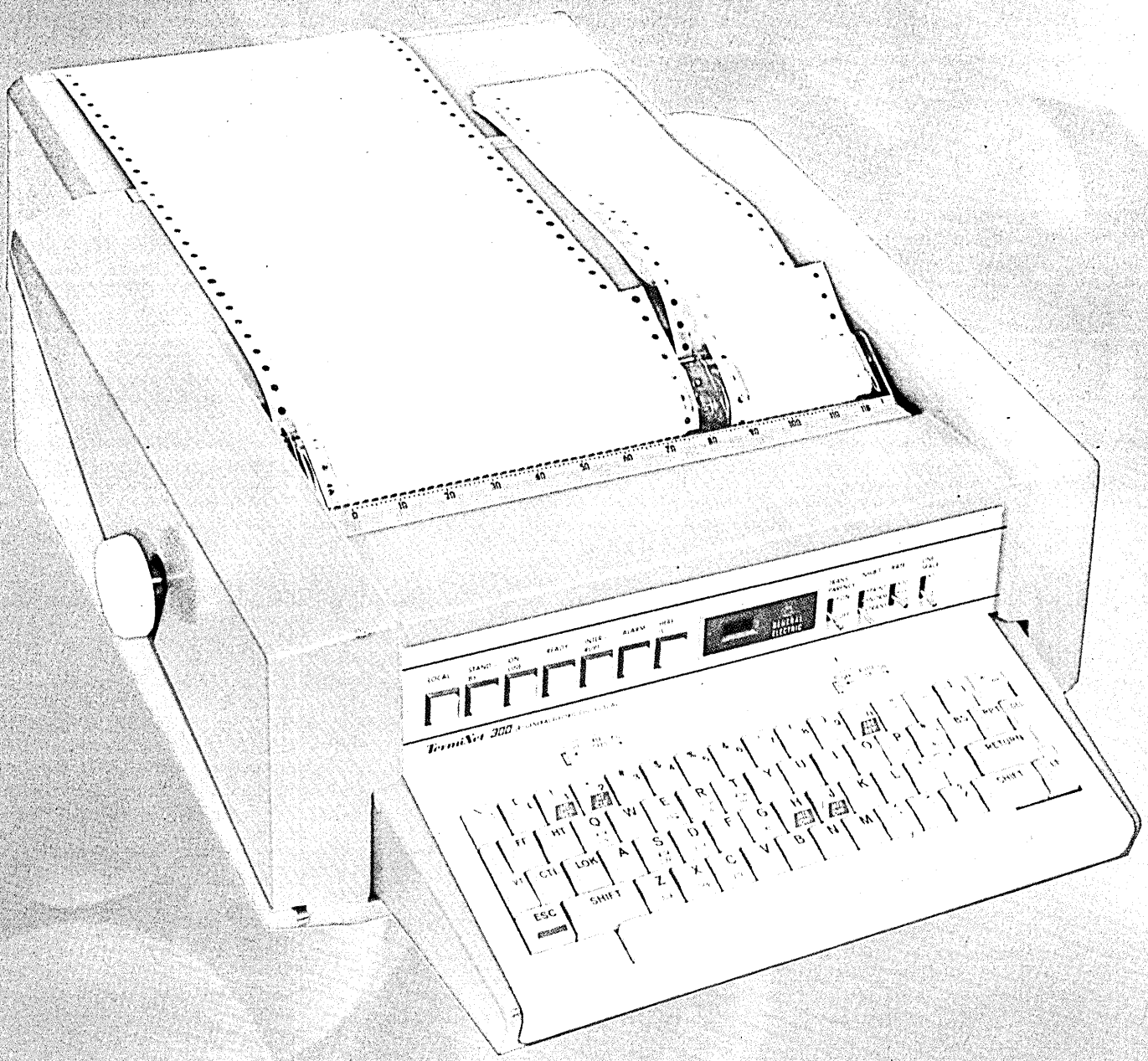
When making performance measurements in a secure environment, additional technical and human factors should be considered. A popular consideration is, "Can a performance monitor either accidentally or intentionally obtain sensitive information from a secure computer system?"

It is unreasonable to suspect that hardware monitors composed of only mechanical and electronic counters could inadvertently obtain sensitive information from computer equipment. Hardware monitors which can monitor data (bit patterns for example) in ad-

(Continued on page 116)

"7×8=52, 9−3=5 . . . things like that."

General Electric's answer to dual-output



The new split-platen TermiNet* 300 SP printer

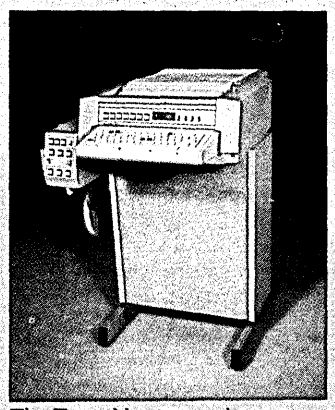
- **2 platens operate independently**
- **2 separate forms**
- **Unlimited application flexibility**
- **Reduces costs of printers**
- **30 characters per second**

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

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

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

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



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

GENERAL ELECTRIC

CIRCLE 29 ON READER CARD

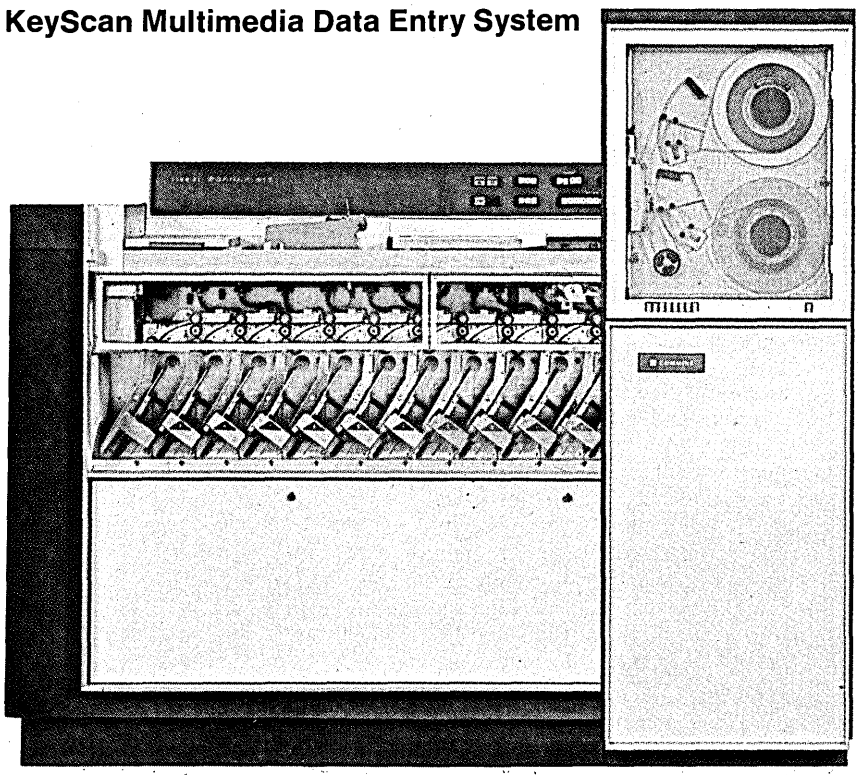
*Trademark of General Electric Company.

Look at scanning. Key/disk. Look at performance.
And costs. Look at multimedia.

When you look at the best... you'll see the Cummins KeyScan™ Data Entry System.

4400

KeyScan Multimedia Data Entry System



Look at scanning. With KeyScan, a single key stroke of each unrecognized character provides re-entry of rejects without rehandling while still scanning the same block of documents. Data from all documents is edited and balanced by batch, in a single pass through the System.

Look at key entry. Cummins key/disk terminals provide more power per dollar than any other key entry system.

Look at both. KeyScan is a shared processor, key/disk scanning system that affords unparalleled flexibility. It's the first multimedia data entry system, the only high performance system *and* it's moderately priced.

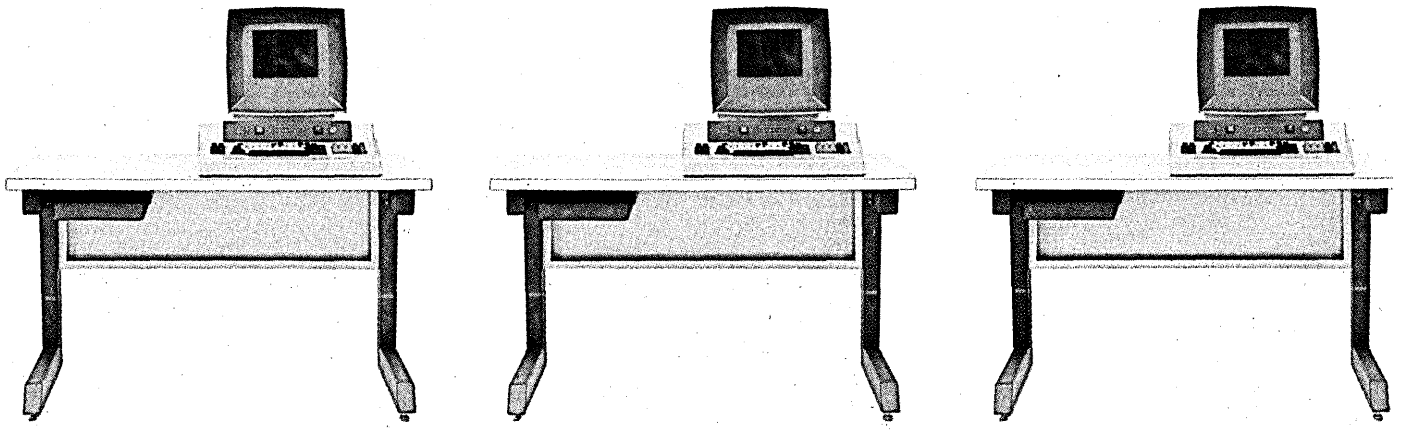
Whether you need an OCR scanning system, a stand alone key/disk system, or an off-line print station . . . KeyScan enables you to select what you need at a price you can afford.

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

All this from a company with systems, programming, and forms design support, and over 45 branch sales and service offices located across the country. So write today for our new 4400 KeyScan System brochure. Write: Cummins, 836 Waukegan Rd., Glenview, IL 60025. Or better yet, call us at 312/724-8000 and make an appointment to visit our demonstration facilities.

And remember, when you think data entry, look at Cummins KeyScan Multimedia Data Entry System. Then look at other systems and you decide which is best.

CUMMINS
CUMMINS-ALLISON CORP



dition to just counter data could possibly record sensitive data. It is doubtful that monitors could accidentally be attached to the computer in such a manner that meaningful alphanumeric data would be recorded. In addition, the data-reduction software that is used to process the monitor data into reports would probably be unable to process data that has been erroneously recorded.

It is conceivable that software monitors could record sensitive data. Primarily, this is because most software monitors operate in privileged mode and have authority to access data anywhere in the computer system. However, the author does not believe it is likely that meaningful data would be recorded inadvertently; even if data were recorded it would not be likely that the data-reduction software supplied with the monitor could process the erroneous data.

Using monitors to intentionally obtain sensitive information from computer systems is quite another matter. It has often been noted that the applications of hardware monitors are limited only by the creativity of the individuals using them. Today there are in existence some very advanced hardware monitors. Some of these not only have internal storage but are actually minicomputer based. Such hardware monitors could record some of the alphanumeric data that is being processed by computer systems. Data-reduction software could be developed to process the recorded alphanumeric data.

Another security consideration involving hardware monitors (or any hardware device) is the possibility of a foreign device being placed in the monitor to transmit either the conversations of the people in the computer area or electronic signals from the computer. Some monitors are physically complex internally and it would be difficult for someone unfamiliar with this internal structure to detect such a covert device.

Since software monitors operate in supervisory mode and have the complete system at their disposal (unless prevented by special security software), it is entirely possible that they could obtain sensitive information from the system. Again it would not be difficult to implement reduction software to process the recorded data.

The number of people who have access to a secure computer facility is usually limited. These individuals usually undergo a background investigation before they are given clearance to access the computer facility.

Many performance measurement tools and techniques in use today are acquired from outside vendors. If problems arise (don't forget Murphy's law) vendor personnel may have to be called in to find and solve the problems. If their backgrounds have not been investigated, special controls must be followed before they are allowed entry into the computer facility. At the least, they will have to be escorted by authorized personnel. Depending on the sensitivity of the data, all normal processing may have to be suspended until the uncleared personnel have corrected the problems and left the premises. This may sound like a minor inconvenience, but installations which are new to performance evaluation may depend heavily on outside support.

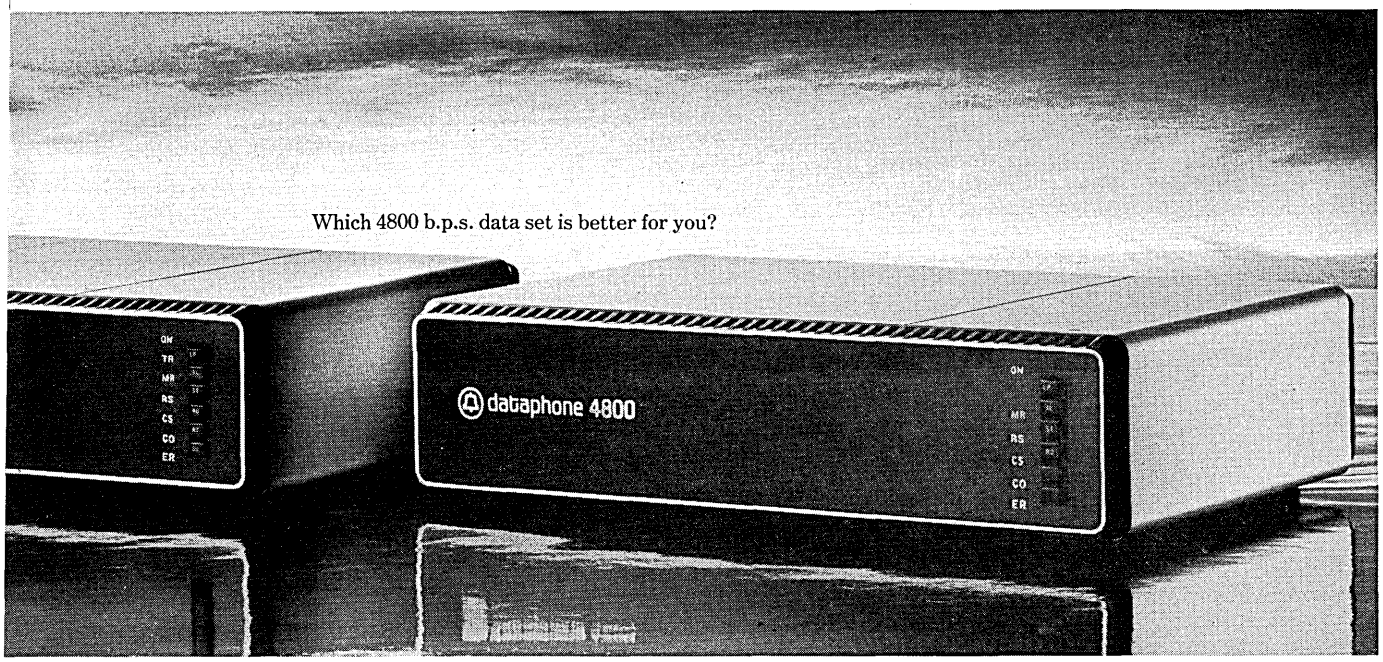
In conclusion

The necessity for security is often of greater concern than the performance of the computer system. However, it is important that the relationships between security and performance be identified. The most important noted were that security (cryptographic) hardware has no effect on performance, and security software should not degrade performance by more than 5-10%. The determination of the actual effect of security software may be a complex and costly job.

It is not likely that performance monitors would unintentionally compromise sensitive information from secure computer systems; however, it is possible for performance monitors to intentionally obtain sensitive information, and, if utilizing performance monitors, one should consider the precautions and associated inconveniences of occasionally having outside personnel in the immediate vicinity of the secure computer. □

Mr. Chastain is a computer systems performance analyst for the U.S. General Accounting Office. He was previously manager of the computer systems software evaluation section of the Defense Intelligence Agency. He has an MS in computer systems and management information systems from American Univ.

switched telephone network lines, depend on Bell System Dataphone® 4800 service.



The Bell System's Dataphone 4800 service is designed to transmit data at 4800 b.p.s.—economically. It is now available for data customers who use the switched telephone network, as well as for those with private-line facilities.

Dataphone 4800 service features automatic adaptive equalization. Turnaround times of 50 milliseconds for private lines and 50 or 150 milliseconds for the switched network, as you choose. And low monthly charges.

Provisions for local and remote loop-back testing are built right into the 4800 data sets. Signal lights indicate the status of the sets at all times.

And solid-state technology from Bell Laboratories fits all these features into a compact housing 16 by 11 by 4½ inches.

In addition to our local maintenance forces, the Bell System's Data Technical Support Team stands behind all our Dataphone service. The Team's collective expertise analyzes and corrects malfunctions quickly, and so minimizes your cost of downtime.

At AT&T and your Bell Company, we know good data service at moderate cost is vital to your business. Whether you use the switched network or private lines.

We hear you.

Genesis

Release 2.5

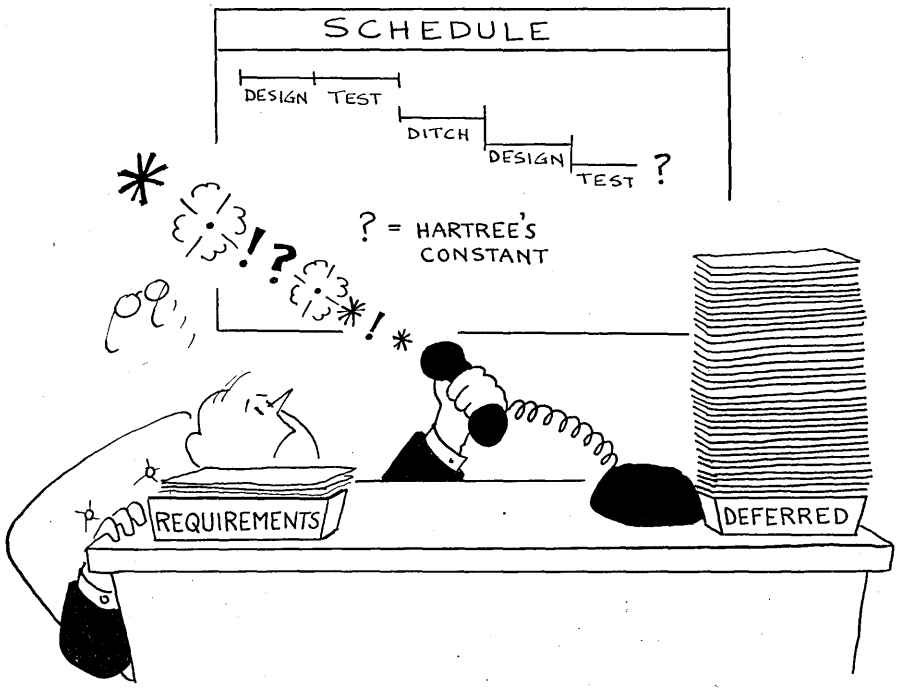
by Michael L. Coleman
with illustrations by Stew Burgess

IN THE BEGINNING the Project Manager created the Programming Staff. The Programming Staff was without form and structure. And the Project Manager said, "Let there be Organization;" and there was Organization. And the Project Manager saw that Organization was good; and the Project Manager separated the workers from the supervisors, and he called the supervisors—"Management," and he called the workers—"Exempt."

And the Project Manager said, "Let there be a mission in the midst of the Organization, and let it separate the workers, one from another." And the Project Manager created the mission and he called it—"The System." And the Project Manager separated those who were to benefit from The System from those who were to build it. And he called the former—"Users," and he called the latter—"Programmers."

And the Project Manager said, "Let all the Programmers in the Organization be gathered together into one place, and let a Chief Programmer be brought up to lead them." And it was so. And the Project Manager saw that he was competent.

And the Project Manager said unto the Chief Programmer, "Create for me a schedule, so that I may look upon the schedule and know the Due Date."



And the Chief Programmer went among his staff and consulted with them. And the staff was divided into two parts, one part was called—"Ana-

lysts," and the other part was called—"Application Programmers." And the Analysts went back to their desks and estimated, as was their custom. And it came to pass that each Analyst brought his estimate to the Chief Programmer, whereupon he collected them, summarized them, and drew a PERT Chart.

And the Chief Programmer went unto the Project Manager and presented to him the estimate saying, "It shall take ten months." And the Project Manager was not pleased and said, "I have brought you up from the depths of the staff; you have not grasped the 'Big Picture.'" And the Project Manager hired consultants, and authorized overtime, and he said to the Chief Programmer, "Behold, see all that I have done! The Due Date will be in five months." The Chief Programmer was much impressed and went from before the Project Manager and proceeded to implement The System.

And the Chief Programmer sent his Analysts to the Users and said, "Let Specifications be written." And there were meetings, and lunches, and telephone calls. And the Specifications were written. And there was a Payday and the Happy Hour, one month.

And the Chief Programmer examined the Specifications and saw that they were too ambitious. And he separated the mandatory features from the optional features; and he called the mandatory features—"Requirements," and he called the optional features—"Deferred," and the Users called him names. And the Chief Programmer gave the Specifications to the Analysts and said, "Let the Requirements be analyzed and let the Files be designed." And it was so. And the Chief Programmer said, "Let the Software Houses put forth their Salesmen, and let us have a Data Management System." And it was so. The Software Houses brought forth all manner of Salesmen who presented their packages, and claimed wondrous things for them, each according to his own file structure. And it came to pass that a Data Management System was selected; and the Chief Programmer saw that it was good. And there was a Payday and the Happy Hour, a second month.

And the Chief Programmer said, "Let the System be divided into parts, and let each part be called a 'Module.' And let programming teams be formed and let each be assigned to write a Module." And it was so. And the Chief Programmer created the programming teams with two levels, a greater and a lesser; and he called the greater the "Senior Programmers," and he called the lesser the "Junior Programmers." And he gave the greater dominion over the lesser. And the Chief Programmer saw it was good. And the Junior Programmers saw it differently. And there was a Payday and the Happy Hour, a third month.

And the Chief Programmer said, "Let the programming be started and let much overtime be consumed, for there is but two months left." And the Programmers, both the Senior and the Junior, were much afraid, and they strove to please the Chief Programmer. And they flowcharted, and they coded, each in his own fashion. And the Chief Programmer looked upon the work and liked it not. And the Chief Programmer said, "Let there be a Standard;" and there was a Standard. And the Programmers looked upon the Standard and liked it not. And there

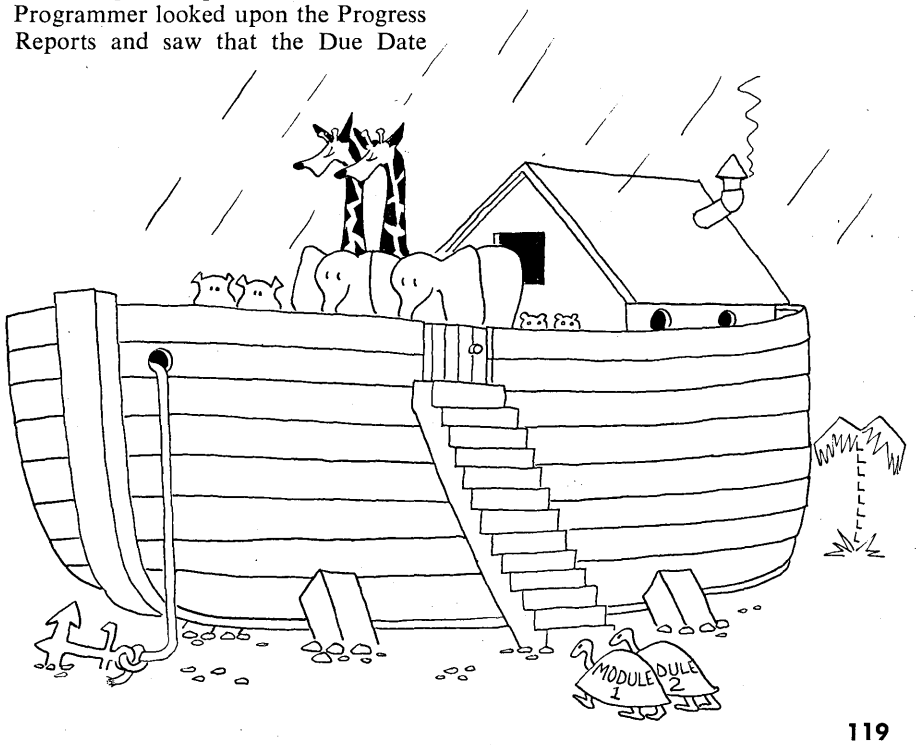
was a Payday and the Happy Hour, a fourth month.

And the Chief Programmer said, "Let there be Progress Reports, so we can monitor and control;" and there were Progress Reports. And the Chief Programmer looked upon the Progress Reports and saw that the Due Date was not to be met. And the Chief Programmer arose, pressed his suit, shaved his beard, and went unto the Project Manager, and groveled. And the Chief Programmer pointed his fingers, and caused Blame to issue forth upon all manner of creatures who sold Hardware and Software. And the Chief Programmer asked for an Extension.

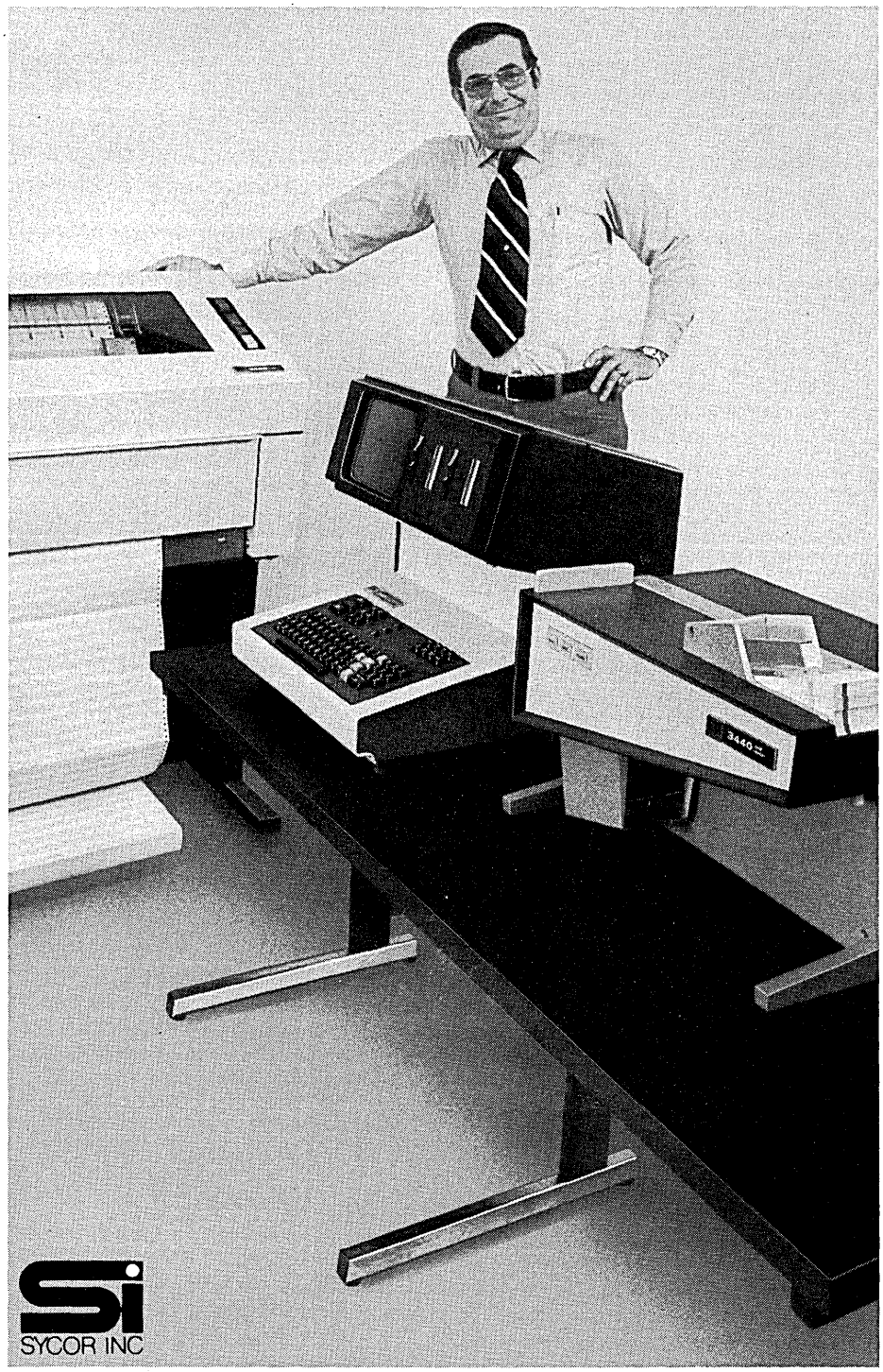
And the Project Manager was exceedingly angry, and cast doubts upon the Chief Programmer's ancestry; and uttered a multitude of threats. But it came to pass that an Extension was granted; and the Chief Programmer took the Extension back to the programming teams, and there was much rejoicing. And the programming of the modules was completed. And there was a Payday and the Happy Hour, a fifth month.

And the Chief Programmer said, "Let the Modules be integrated, one with another, so that System Testing may begin." And it was so. Two by two the Modules were integrated, one with another. And great difficulties were experienced, and many hours of overtime were used, and many cups of coffee were consumed. And it came to pass that System Testing was completed. And there was a Payday and the Happy Hour, a sixth month.

Then the Chief Programmer did go to the Project Manager and said unto him, "Behold, I bring you good tidings of a great joy which will come to all the Users; for on this day The System is completed." And suddenly there was with them a multitude of Users praising the Chief Programmer and saying, "Glory be to The System in the highest, but can you make this one small change"? ⚀



INTRODUCING THE INTELLIGENT WAY TO DO LARGE SCALE REMOTE JOB ENTRY.



It's our intelligent Sycor 340.

You see, we've given it the same large scale remote job entry capability as IBM's 2780. Including a high-speed card reader, 300 lpm printer, 2780 compatible bi-sync . . . the whole package.

But that's where the similarity between the two ends. Our Sycor 340 not only costs less, but runs circles around the old 2780 when it comes to intelligence and versatility.

Standard on the Sycor 340 is its capability for error-free data entry. It's also programmable—so you can edit, validate and perform range checks and other operations only an intelligent terminal can. Since it already features a CRT and keyboard console, you don't have to pay for them as extras.

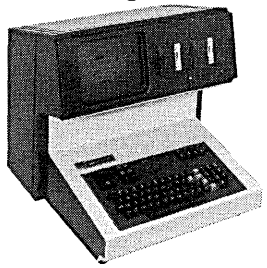
And how's this for versatility: you can use the 340 to talk to your time-sharing computer using our asynchronous communications package.

Or if you need bulk storage, you can get an optional IBM-compatible magnetic tape drive.

What's more, for those locations where you don't need a 300 lpm printer, we have 50 lpm and 80 cps models for you to choose from.

To find out more about this versatility, economy and 2780 compatibility in large scale remote job entry, call your Sycor representative today.

It's the intelligent thing to do.

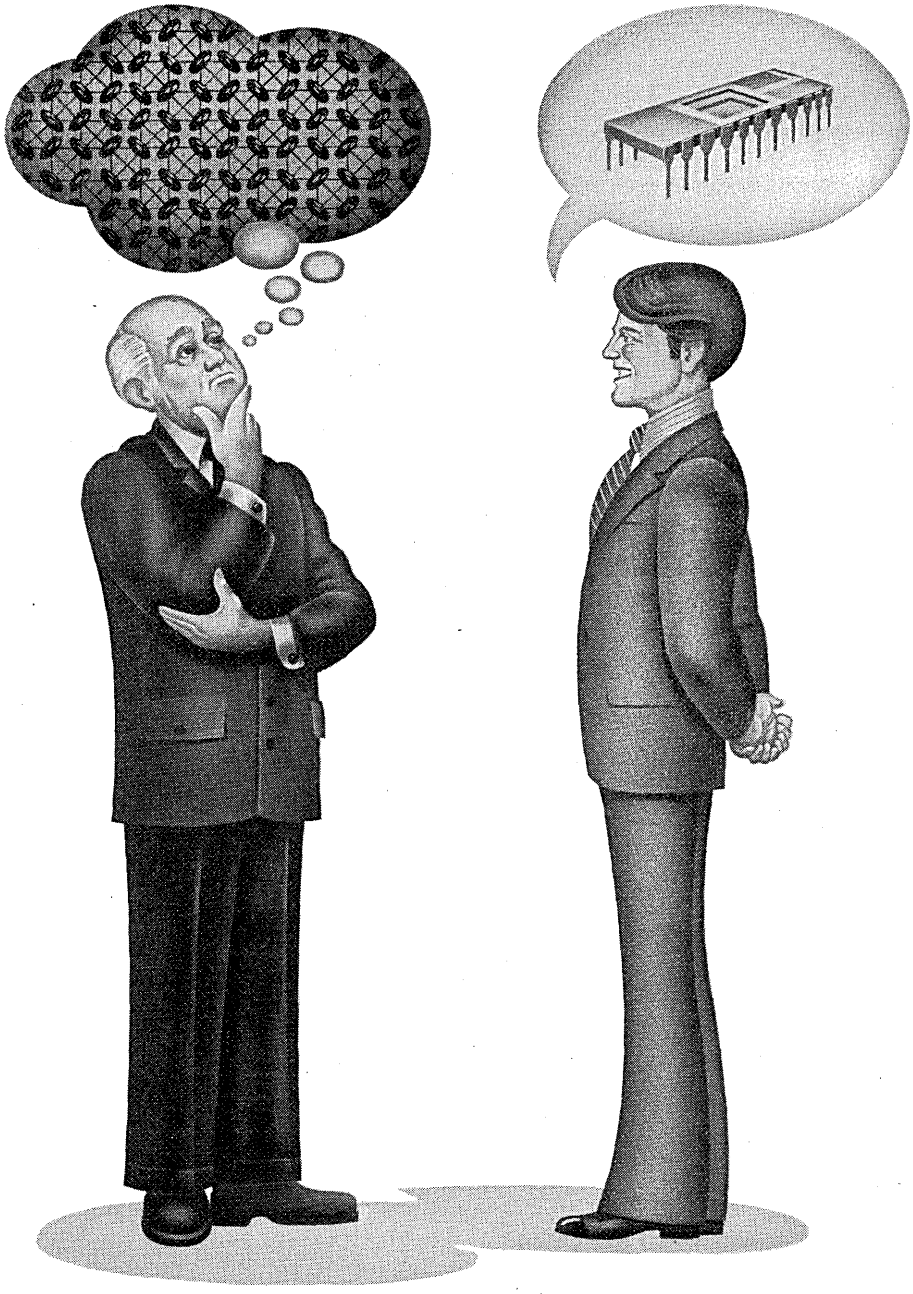


SYCOR

Corporate Offices: Ann Arbor, Michigan 48104 (313) 971-0900. **District Sales Offices:** Atlanta (404) 457-1166 • Boston (617) 890-7290 • Chicago (312) 986-1833 • Cleveland (216) 831-8625 • Dallas (214) 521-6710 • Detroit (313) 355-5770 • Hartford (203) 529-1100 • Houston (713) 688-5224 • Indianapolis (317) 784-6779 • Los Angeles (213) 640-0120 • New York (212) 371-9050 • Philadelphia (609) 665-1170 • Pittsburgh (412) 922-3350 • San Francisco (415) 349-6626 • St. Louis (314) 878-0090 • Washington (703) 525-7300. **Canada:** Sycor International Ltd., Toronto (416) 429-0883. **Service Centers in 80 cities.**

Sycor has opportunities for experienced data processing equipment salesmen and systems engineers in major cities.

LET US REFRESH YOUR MEMORY.



If you're being slowed down by core memory, we'd like to refresh you with a few facts about add-on Monolithic Main Memory from ITEL:

With it, you can upgrade memory at less cost than core, and it's far more reliable.

But, best of all, with Monolithic Memory you can exceed the IBM design limits. From the 360/22 up through all models of System/370. Add Monolithic Memory to a 370/155 for example, and you can expand the memory from two megabytes to four megabytes—a 100% increase!

And Monolithic Memory utilizes semiconductor chips that eliminate most wired interconnections, so there are far fewer potential sources of failure.

The Monolithic Memory is just one example of our data processing story. Whenever you want advanced computer equipment on the best terms, call the Data Products Group at ITEL—the financial alternative to IBM.

ITEL CORPORATION One Embarcadero Center, San Francisco, Calif. 94111 (415) 989-4220

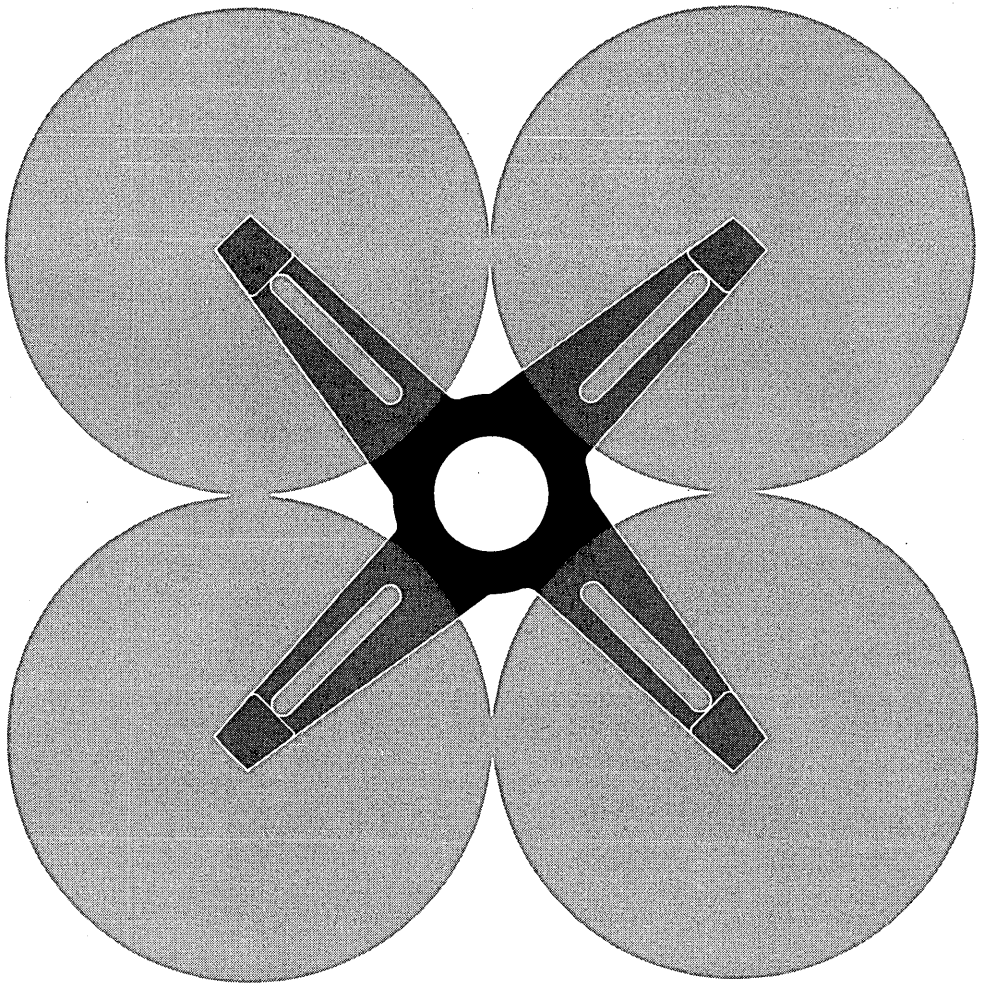
I'm interested. Please send me more detailed information.

Name _____ Title _____

Company _____ Phone _____

Address _____

City _____ State _____ Zip _____ D-11



super disk

makes other data storage subsystems byte the dust!

With up to twice the capacity of the 3330-11 and more than 35% savings per subsystem, this revolutionary STC Series 8000 disk storage subsystem marks a new era in data storage . . .

• system capacity of up to an incredible 6.4 billion bytes • intermix with 3330 type units • software compatible with systems 370 used with 3330-1 or 3330-11 units • average access time: 27ms.

Find out more about the new look in on-line storage equipment from Storage Technology Corporation. **Super disk. A super innovation.**

STC®

STORAGE TECHNOLOGY CORPORATION

2270 South 88th Street/Louisville, Colorado 80027/(303) 666-6581

The theme was
"Computers in the Service of Man"

ACM '73

by Angeline Pantages,
Associate Editor

You could drift out of the session on IBM virtual system benchmark tests, stop to watch the film on medical graphics work being done at the Univ. of Utah, and go on to hear university dp managers discuss the ills of statewide networks.

You could hear IBM's Dr. Lewis Branscomb urge international cooperation in applying technology to the world's problems, and Honeywell's Charles Bachman give his elucidating Turing lecture on data base technology and politics. You could hear about

motivational considerations in dp organizations and then listen to a vendor (there were 18) try to motivate you to buy his wares in an hour-long session. And you could see the Univ. of Chicago's Fred Harris get thrown into the pool, clothes and all.

The ACM 1973 conference in Atlanta in August recalled earlier days in the computer industry, when meetings were small, and full of familiar faces. The one new wrinkle was that sessions which could be labelled "business data processing" had titles that were not only pronounceable but applicable.

The ACM audience of 1,100 was not vastly different from years past; heavily loaded with university computing professionals and the research-oriented. But academia contains users too, and the program gave them an ample serving which could have been of interest to a broader spectrum of the edp community. (The Atlanta organizing committee tried to attract more attendance from commercial firms in the area by offering ticket packets to allow attendance at part of the three-day meeting. Thirty-three companies were represented.)

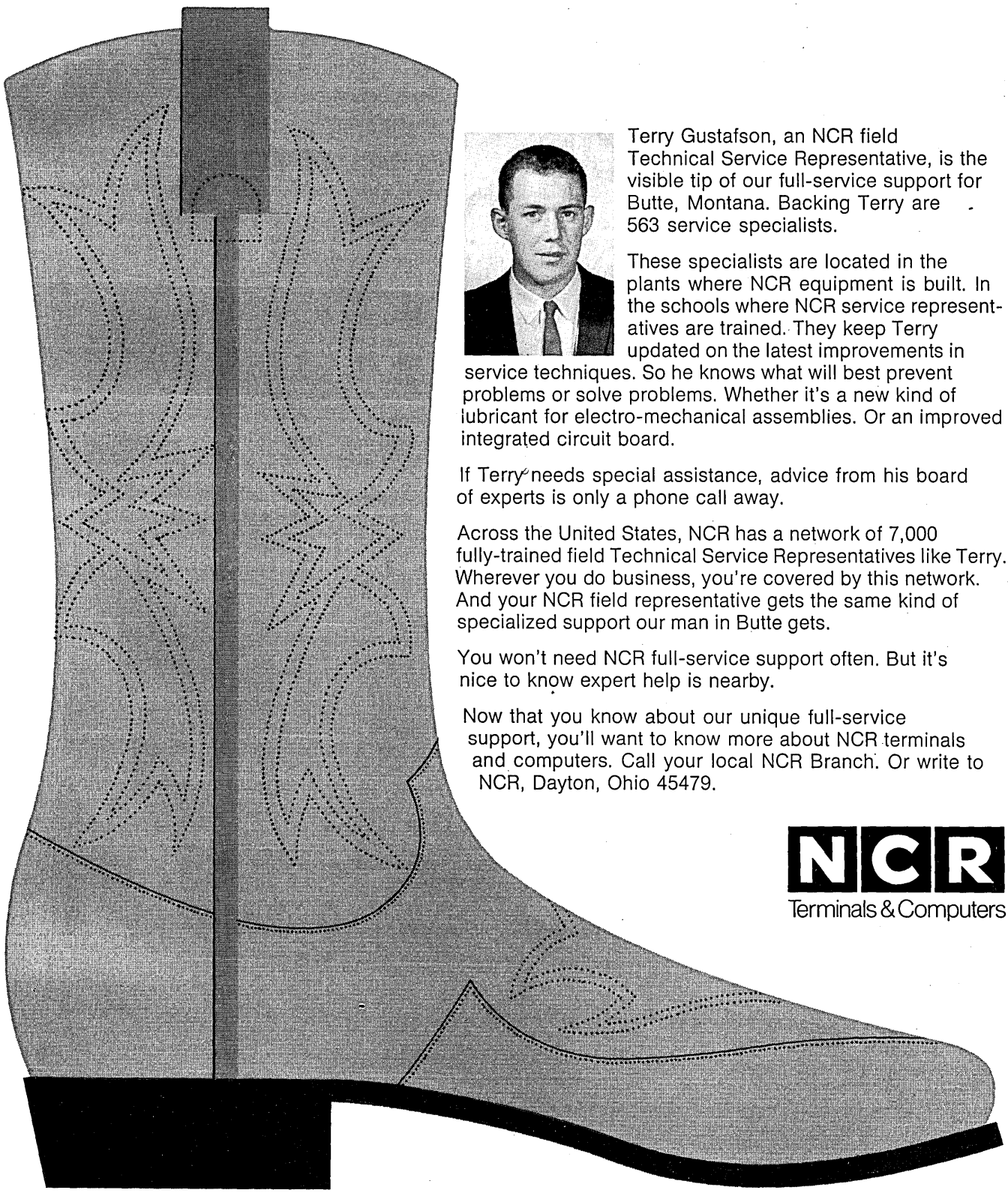
The service of man

The theme of the conference was "Computers in the Service of Man," and Dr. Branscomb, chief scientist at IBM, tailored his keynote to that. After eloquently enumerating the evident reasons for international technological cooperation, he pointed out significant current efforts. One is the newly established International Institute for Applied Systems Analysis, established under largely non-government scientific academies from 12 countries in the East and West. Headquartered near Vienna, its purpose is to "initiate and support individual and collaborative research on problems relating to modern society which arise from scientific and technological developments." Among the problems: environmental planning and control, depletion of physical resources, urban problems, medical diagnostics and treatment.

But, Branscomb warned, "even the Institute's strongest supporters would hesitate to predict certain success for this international effort. Most of us can name the number of truly successful internationally-sponsored research laboratories on the thumbs of one hand—the Center for European Nuclear Research in Geneva."

He also pointed out that the lessening of tensions between East and West affords new opportunities for cooperation. After a trip to the USSR, Branscomb returned with "two strong impressions—that the USSR takes very seriously the need for more sophisti-

It takes 564 people to fill Terry Gustafson's boots in Butte, Montana.



Terry Gustafson, an NCR field Technical Service Representative, is the visible tip of our full-service support for Butte, Montana. Backing Terry are 563 service specialists.

These specialists are located in the plants where NCR equipment is built. In the schools where NCR service representatives are trained. They keep Terry updated on the latest improvements in service techniques. So he knows what will best prevent problems or solve problems. Whether it's a new kind of lubricant for electro-mechanical assemblies. Or an improved integrated circuit board.

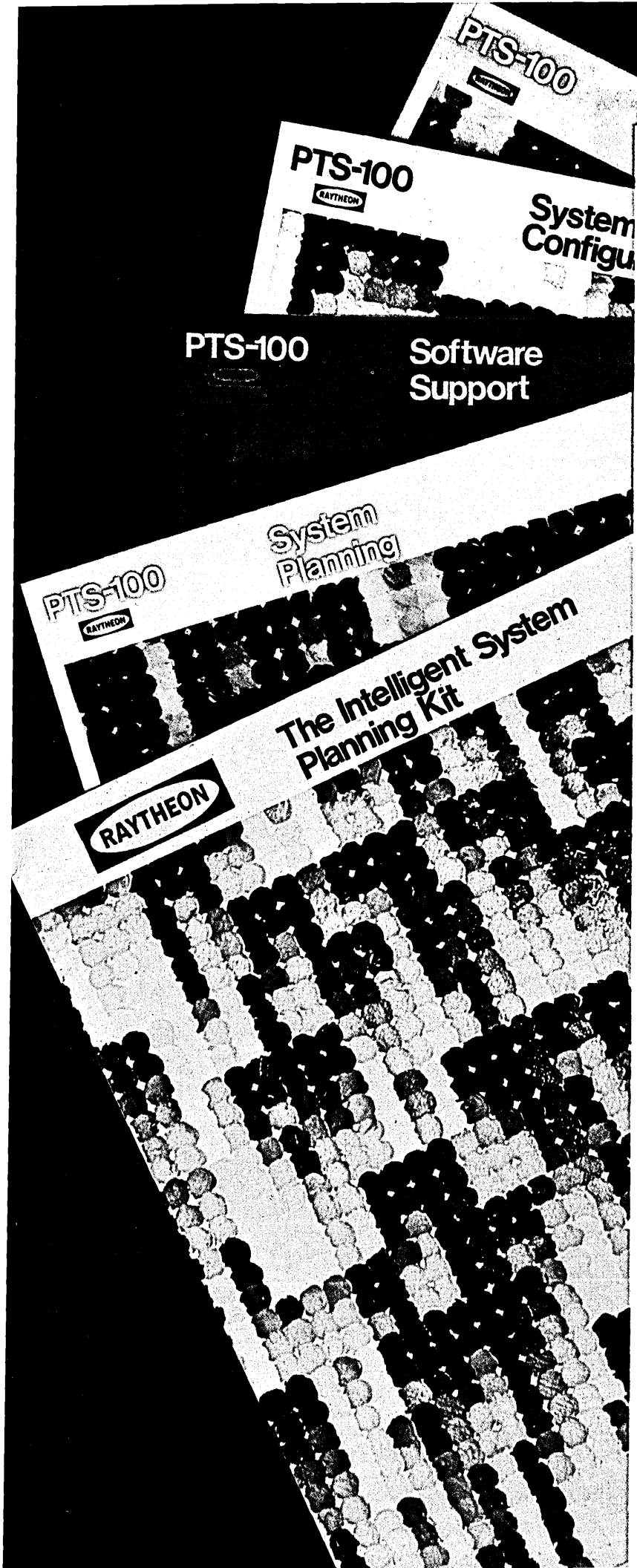
If Terry needs special assistance, advice from his board of experts is only a phone call away.

Across the United States, NCR has a network of 7,000 fully-trained field Technical Service Representatives like Terry. Wherever you do business, you're covered by this network. And your NCR field representative gets the same kind of specialized support our man in Butte gets.

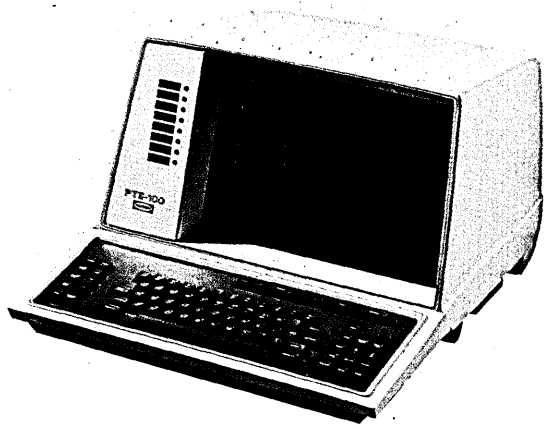
You won't need NCR full-service support often. But it's nice to know expert help is nearby.

Now that you know about our unique full-service support, you'll want to know more about NCR terminals and computers. Call your local NCR Branch. Or write to NCR, Dayton, Ohio 45479.

NCR
Terminals & Computers



Free kit shows you intelligent alternatives to a 3270



You're *not* locked into a 3270. You *do* have an intelligent, money-saving alternative: our PTS-100 Programmable Terminal System. Our free Planning Kit tells you all about it, including:

Software IBM 2260/3270 emulator packages.
Planning Compatibility with 360/370.
Configurations Small, medium, large systems.
Applications PTS-100 as used in industries from airlines to stock exchanges.

One more thing: price. Although our PTS-100 *more* than emulates the 3270, it costs as little as a TTY (in cluster configurations). Before you invest lots of dollars in a 3270, spend a few seconds with our free Planning Kit. Staple coupon to your letterhead, drop in mailbox, it's yours. Raytheon microwave radio, minicomputer, and programmable terminal systems. They make it easier for your data to work harder.

Raytheon Data Systems, 1415 Boston-Providence Turnpike, Norwood, Mass. 02062. (617) 762-6700. Att: Hugh Bannon. In Europe: Raytheon Data Sales, Spaklerweg 53, Amsterdam, Netherlands. Tel: 020-93-0787. In England: A.C. Cossor Ltd., The Pinnacles, Elizabeth Way, Harlow, Essex. Harlow 26862.

Please send me free Kit about intelligent alternative to 3270.
I'm thinking of ☐ installing ☐ expanding ☐ replacing ☐ just thinking.

Name_____ Title_____

Company_____

Street_____

City_____ State_____

Zip_____ Phone_____

RAYTHEON

RAYTHEON DATA SYSTEMS

An equal-opportunity employer. Challenging positions open.

CIRCLE 71 ON READER CARD

cated and aggressive technology for developing resources and managing its large-scale effects, and second, that their commitment to computers as an indispensable tool . . . commands the highest priority. The Russians are aggressively promoting East-West cooperation in these directions. . . . Still I think it would be wise to temper our optimism with caution." Branscomb called for "careful nurturing of the cooperation, "based on enlightened mutual self-interest," as he feels "the Soviet leadership has no intention of abandoning its basic political structure and objectives."

He pointed to the new joint U.S.-Soviet Commission on Science and Technology, which, in the edp field, has started a joint study dealing with computer applications in management. He also underscored his agreement with the Russian emphasis on computer-supported simulation. "Through modeling and simulation, cooperating researchers can communicate their value-dependent assumptions as well as their input data to one another without the use of culture-dependent language."

Turing lecture

ACM's Turing award was given to Honeywell's Charles Bachman for his work in creating the first data base management system, Integrated Data Store, which has been the springboard for major data base developments to date. His lecture, "The Programmer as Navigator," was a highly sophisticated tutorial based on the concept that "today a new basis for understanding is available in the area of information systems. It is achieved by a shift from the computer-centered to the data base-centered point of view. This new understanding will lead to new solutions to our data base problems and speed our conquest of the n-dimensional data structures which best model the complexities of the real world."

It should be read more than once and will be published in the November *Communications of the ACM*. It will suffice here to note some of his conclusions: "It is important that the mechanics of data structures be developed as an engineering discipline based upon sound design principles. It is important that it can be taught and is taught.

"The equipment costs of data base systems to be installed in the 1980's has been estimated at 100 billion dollars. . . . It has been further estimated that the absence of effective standardization could add 20% of that to the bill. Therefore, it is prudent to dispense with the conservatism, the emotionalism, and the theological arguments which are currently slowing progress. The universities have largely ignored the mechanics of data structures in favor of problems which more nearly fit a graduate student's thesis requirement. Big data base systems are expensive projects which university budgets simply cannot afford. Therefore, it will require joint university/industry and university/government projects to provide the funding and staying power necessary to progress."

After flailing journals for the long delay between the "detection of significant results and their earliest possible publication," Bachman zeroed in on what he feels is the greatest single barrier to progress: "the lack of general data base information within a very large portion of the computer users resulting from the domination of the market by a single supplier. If this group were to bring to bear its experience, requirements and problem-solving capabilities in a completely open exchange of information, the rate of change would certainly increase." He applauded the recent Working Conference on Data Base Systems, sponsored by IBM user group SHARE, which brought together users of all kinds of equipment and data base systems.

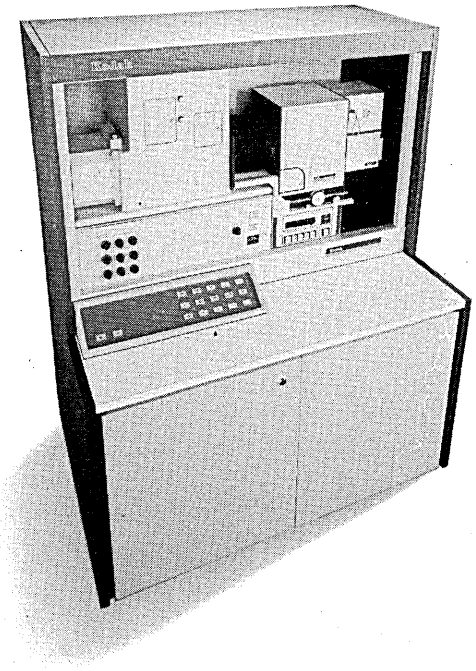
In another session, a presentation on Western Electric's benchmark tests on OS/VS1 indicated that IBM is accomplishing its goals for the majority of the user community: providing significant performance improvements while forcing the user to buy increasing quantities of its ever-cheaper hardware. John Hills described comparisons between a 370/145 using VS1 and the same system using OS/MFT without HASP. VS1 executed the mix of 23 programs in 80 minutes, vs. 129 minutes for OS/MFT. VS1 was also, however, a big winner in overhead, tallying "cpu active" time at 82.2% vs. 37.6% under MFT. The increase in throughput and lower turnaround time impressed Western Electric enough to decide to implement the virtual system, but it was also clear that the overhead problem would demand more VS fine tuning and more memory, neither of trivial cost. VS2.1 tests, he indicated, were also showing enormous cpu utilization.

Computing networks

Statewide networks for university computing came under fire during a session on the topic. Extrapolating for the general user community, it was the old debate on centralized vs. decentralized computing, on large systems vs. multiple minicomputers and various network configurations. General conclusions were that large centralized

(Continued on page 131)

COM can boost your throughput.



That's what Kodak computer output microfilm is all about.

The idea of bypassing impact printers to go directly to microfilm via COM is bound to appeal. It's an electronic path versus a mechanical one. That means speed with reliability.

Kodak KOM microfilmers do this job at 20 or more times the speed of impact printers. So you have more time to get more jobs done on the mainframe.

Besides speed, consider what else comes with a KOM microfilmer. First, Kodak specialists will help you design, develop, and implement your COM system. Second, Kodak software helps you get each job done faster and in the format you need. Third, Kodak equipment service that will help keep your COM unit up and running.

Take the important first step.

Write us for our new booklet, "The New Generation of Computer Output". Eastman Kodak Company, Business Systems Markets Division, Dept. DP626, Rochester, New York 14650.

Kodak: for better use of information.

Care for

another byte?

When it comes to lion-hearted computers, you need to keep them well fed with animal size portions of data. Yet your computer doesn't thrive on input by the pound. It needs a savory diet of lean, meaty data. High quality data with none of the fat.

Inforex Data Entry Systems give you both quantity *and* quality.

For example, concurrent data entry and verification improves throughput. Full record display simplifies error detection and correction. System-generated messages assist operators. Processor logic and checks make sure only the choicest data gets to your computer.

Plus a full range of data entry functions: Virtual Program Control, Keystroke Counting, Automatic Batch Transfer, Keystation Command Mode...and more. In addition, only Inforex Systems let you do file searching and update in place on both disc and tape.

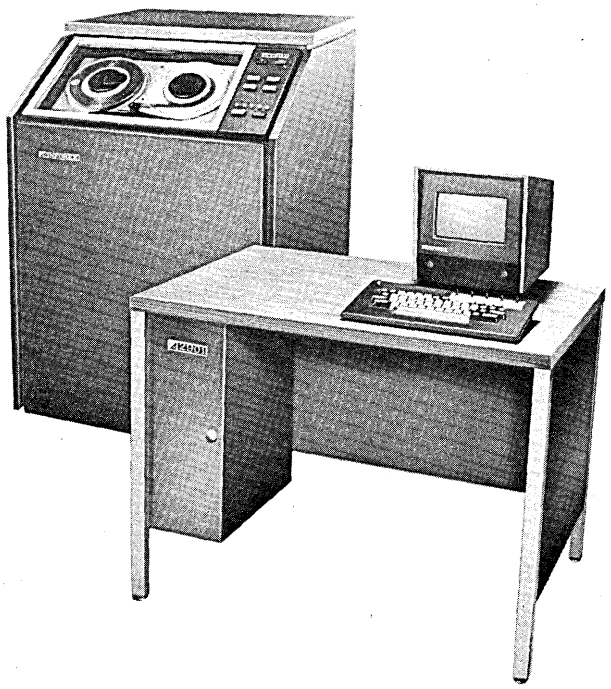
You can get more than just data entry, too. Line and Serial Printing, fully formatted, On- and Off-Line Communications for local or remote locations, and advanced 1600 BPI Phase Encoded tape output for high performance tape transports.

No wonder Inforex has more key-to-disc systems installed than anyone else in the world.

No bones about it.

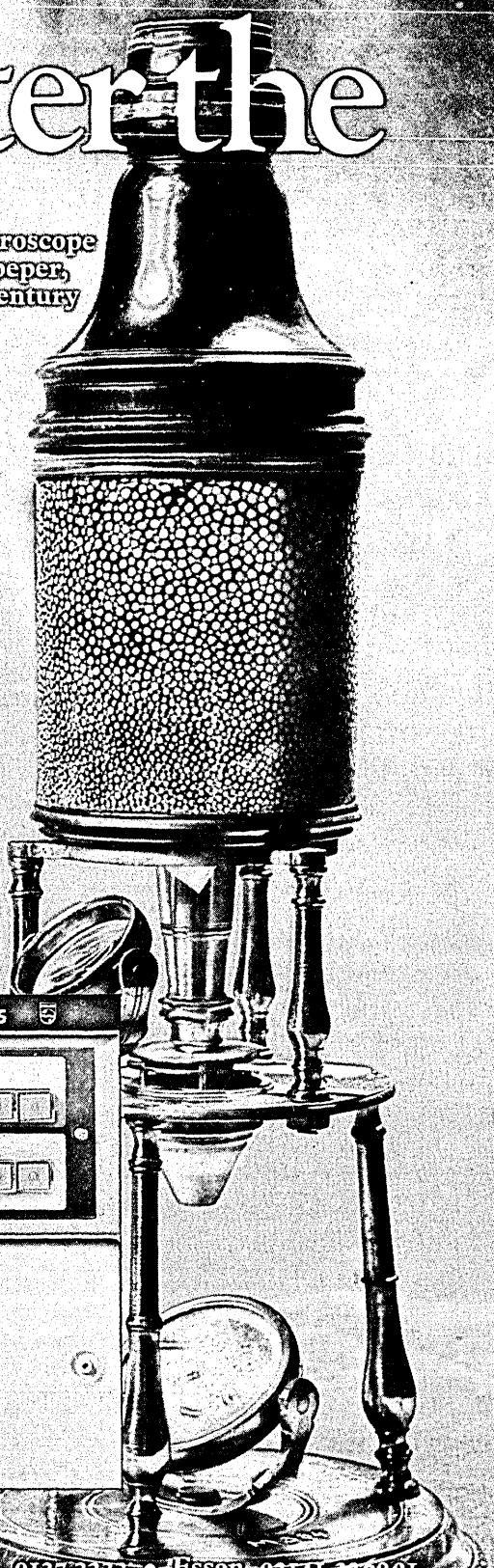
Choose system 1301, 1302, 1303 or In-Line Data Entry for the price/performance/backup mix that best meets your needs.

Inforex. The high performance feed company for your computers. Offices in major cities throughout the United States, Canada and Europe. Distributors world wide. Talk to us. Inforex, Inc., 21 North Avenue, Burlington, Mass. 01803.



INFOREX

Looking after the details



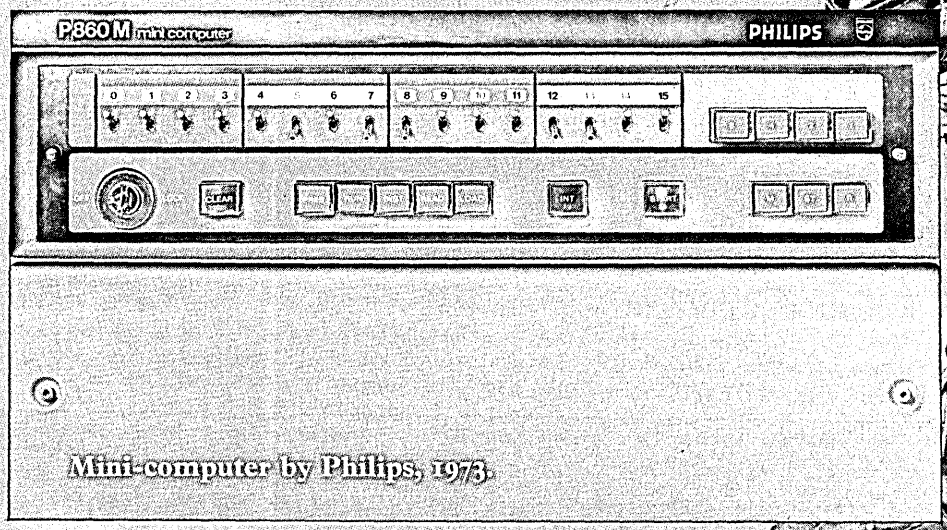
Tripod microscope by Ed. Culpeper, mid 18th. century

Philips mini-computers are built to a standard. Using components we know are good (we make them ourselves). To the requirements of our most exacting OEM customer (ourselves).
With software that's been proved (in our systems).

On top of that there's the backing of a worldwide organisation that's there wherever your systems go.
On price, too, we've something to interest you. There's a lot to be said for a mini-computer company that isn't just a mini-computer company. Full details are at the end of your phone.

Philips P800 M series plus points

Memory capacity from 0.5k to 32k 16 bit words
Cycle time down to 840 nanoseconds
16 Hardware registers for efficient processing
Multiplex channel with 15 subchannels, plus DMA
Up to 63 interrupt lines on 48 hardware levels
Easy interfacing
OEM quantity discounts up to 41%



Mini-computer by Philips, 1973.

Copenhagen 01[illegible] • Essen 02[illegible] 230001
Milan 02 643 6541 • New York 212 697 3600 • Oslo
Stockholm 08 635000 • Tokyo 03 435 5[illegible] • Toronto

Philips considers your reputation

Philips Data Systems

PHILIPS

CIRCLE 47 ON READER CARD

nets for the universities are fraught with such problems as inefficiencies and overhead caused by the many levels of management that are created, increasing controls and politics due to the public visibility of the network, and the difficulty of making innovative use of heavily-controlled large centers.

Saul Rosen of Purdue Univ. illustrated the political aspect by relating neighboring Illinois' experience. First, a committee of computer directors concluded, after a study, that a state network was unnecessary. The dissatisfied state invited consultants to study the same question and their recommendation was to establish a state network. Then the Democrats came into office, threw out the whole study, and contracted a new one.

Rosen noted that Indiana completed its own study last July, concluding that a state network would "add to the cost of computing without commensurate benefits . . . we do favor nets, but we don't want one now." He pointed out that computers and computing are changing; the laws of economy of scale may not be valid in the future because of the development of LSI and new minis. A network set up today, he thought, might not be appropriate in five or 10 years. For now, Purdue is working to tie smaller computers to its large systems—hierarchical computing —which is "not the kind of thing they're talking about with state networks."

In two sessions, the hot topic of electronic funds transfer systems (EFTS) in banking was discussed. The subject of greatest consumer interest is the point-of-sale terminal, with which the buyer's bank account is automatically debited when he makes a purchase using his "cash card." There are numerous POS projects around the country, including the pioneering Hemstead Bank which has had 35 terminals in 32 retail stores since last year. Apparently, despite a poor terminal, the merchants love the system because the number of bad checks has declined, and consumers love it because they get a discount when they use it. Obviously, each bank can't put a terminal in each store, so there are some shared terminal projects, such as one in the works by five Atlanta Banks. The prognosis is not that checks will be eliminated by EFTS but that rather than increasing, the number of pesky checks processed by the banks will stabilize.

Another important topic to which ACM '73 addressed itself was simply that selection of fine hotels like the Regency-Hyatt are important to the success and productivity of any meeting. □

DEC, EAT YOUR HEART OUT.

For the past few months, DEC has been the biggest name in real-time and disk-based standard operating systems.

But the picnic's over.

Now we've got two new standard hardware/software systems. And both of them have price/performance stories that can beat the socks off DEC's corresponding models.

SAVE $20,000 ON OUR NEW DBOS.

DEC's disk-based systems will run you about $60,000.

Our DBOS-II is only $39,500 and it's superior to any disk-based system on the market.

If we haven't got your attention yet, maybe we should mention that our DBOS-II lets you do more computation with less memory in far less time.

You get faster program generation because we give you both scientific and commercial languages.

While other systems are confined to either interactive or batch operation, DBOS-II offers a combination of both. Plus a comprehensive file management system, text editors, interactive debug routines, mathematical functions and commercial libraries. That explains our faster program implementation.

As for program execution, we do it faster because the heart of our system is the SPC-16/65 minicomputer which has the most powerful instruction set available and therefore requires less memory.

AND UP TO $40,000 ON OUR NEW RTOS.

If you want to combine your program generation and computation with control of real-time tasks, DEC's RSX-11D will set you back more than $80,000.

Our new RTOS-II will do the job for $46,950. And if you don't need a line printer and card reader, we can start you out at $29,950.

RTOS-II has all the advantages of DBOS-II in background, with a very responsive foreground for handling events that occur in real time.

And compared to DEC's RSX-11D, we pack more power and features in far less memory.

You can tailor our system to fit your application starting with as little as 16K memory, expandable to 128K.

NOW IT CAN BE TOLD.

Some manufacturers go to incredible lengths to protect their juicy trade secrets.

We publish ours.

The reasons we can give you price/performance advantages are all spelled out in "The Value of Power." For a free copy, or for more information on RTOS-II or DBOS-II, write General Automation, 1055 South East Street, Anaheim, Calif. 92805. If you're in a hurry, call (714) 778-4800.

GENERAL AUTOMATION

News in Perspective

Everything in the Tulsa decision wasn't anti-IBM. The judge had some stern words for Telex too, page 135 . . .

A survey shows use of terminals in 17 European countries will increase tenfold over the next dozen years. This and a seeming epidemic of international meetings on data communications (page 138) indicate Europe is facing a booming demand for networks . . .

Billed as Europe's "specialized fair" for computer users, System 73 in Munich, West Germany (page 139) will include seminars on computer use in a wide variety of vertical industries . . .

Retailers attending this year's NRMA systems conference were sure they are ready for point-of-sale devices but not so sure they're ready to put them to their fullest use, page 142 . . .

IBM has made its expected entrance into the grocery store point-of-sale market, page 146 . . .

Is the Medical Information Bureau in Greenwich, Conn. really a medical CIA? Some have applied this label to the bureau which provides a computerized clearinghouse (page 148) where 700 life insurance companies can exchange records on prospective policyholders . . .

A bill introduced in the Senate would impose tight regulations on dp firms which market stock market information, page 151 . . .

APL is a popular language with educators. Mers Kutt, president of the Canadian Information Processing Society, says his new company, Micro Computer Machines, has developed a device that will take APL to the schools at a rate of 25¢ per student hour, page 153.

Anti-trust

Decision in Tulsa: Biggest Impact Will Be Tangential

The computer industry is synonymous with dynamic growth, innovation, and rapid technological change. The constant that runs through the industry, making it stable and indeed nurturing it, has been the International Business Machines Corp.—a proverbial calm eye in the center of a hurricane of business.

Judge A. Sherman Christensen changed all that in his decision in the Telex-IBM anti-trust case and while many are loath to admit the existence of the decision, there are those who are convinced it is just the first break in the IBM dike.

The decision does not only hint at a new beast as industry, but it hints at a new beast as IBM. Whether they will be beasts we will want to feed remains to be seen.

First, IBM: For the first time, mighty IBM—Judge Christensen refers to it as "this great organization"—has been humbled. Already, plug-to-plug manufacturers—or what is left of that battered subindustry—report a new amicability in their dealings with IBM. The intense competition and belligerence is gone, one PCM reports.

Judge Christensen came out of semi-retirement in Salt Lake City to preside over the case in Tulsa, and very likely made the most important decision of his career. The decision has been widely hailed for its insight into the complex computer industry and while IBM has vowed to press its appeal of the decision, the judge's extensive background in anti-trust and patent law, as well as his grasp of the computer industry itself, will mean that an IBM victory in appeal will be difficult, if not impossible.

Monopoly power

"I find," the judge stated, "IBM possessed monopoly market power in the relevant market of peripheral equipment plug-compatible to IBM cpu's and in the relevant submarkets for magnetic tape products, direct access storage products, memory products, impact printer products, and communication controllers plug-compatible with IBM central processing units."

IBM had argued with great personal conviction that it had the right to monopolize its own product line—e.g., to protect its own edp equipment from attachment of peripherals made by independent manufacturers. But the judge disagreed and IBM lost the case.

"We find unconvincing," Judge Christensen's decision stated, "the idea that separate markets or submarkets (like peripherals) actually recognized by IBM itself in this dynamic and amazing industry could not have been developed eventually from IBM's prior lawful domination of it."

The main thrust of the judge's argument seemed to be that IBM calculatingly *selected* the PCM industry and then systematically analyzed and then took predatory actions against that *selected* market. The decision said in effect that some of IBM's actions would not have been predatory had they been taken willy-nilly or across the board, but they were unlawful because they were aimed solely at the PCM's.

The story of how IBM thwarted the PCM's is now ancient history. The computer colossus used many different tactics in its successful bid to squeeze and crush the PCM industry. The tactics ranged from "mid-life kickers" and price cuts to meshing disc drive controllers into mainframes and manipulating leasing plans.

A question of conduct

"The real problem," the judge said, is "whether IBM has maintained its monopoly position or attempted to do so by unlawful conduct since 1969. In the respects determined here in the critical period at least it must be recognized that its diligence and foresight have included studies and the anti-competitive objectives and intent heretofore found, and that particularly as applied to this case have included an attempt to substantially constrain or destroy its plug-compatible peripheral competition by predatory pricing actions and by market strategy bearing no relationship to technological skill, industry, appropriate foresight or customer benefit."

As for IBM's various moves against the plug-to-plug manufacturers, the judge had this to say:

—The 2319A (Mallard) disc drive for the model 370/145, which was functionally the same as IBM's 2314 drive: "The 2319A price cut was designed by IBM specifically to contain plug-compatible competition . . . Its pri-

mary purpose was to maintain control of the plug-compatible disc market for IBM."

—The 2319B disc drive for all model 360 ind 370 cpu's: "The 2319B announcement was purely a price cut . . . The 2319B was designed by IBM as a predatory action contrived to maintain its 94% control of the plug-compatible disc market."

—FET memory products: "It is found that IBM lowered the price of its FET monolithic memory products and raised prices on its cpu with the primary purpose of creating barriers to entry for potential plug-compatible memory competitors."

Judge Christensen discussed IBM's Fixed Term Plan at length. Announced in 1971, the FTP locked IBM customers into long-term leases in peripheral products. While the judge indicated that there was nothing illegal in the FTP per se, he observed that the "primary intent" of the FTP was to suppress PCM competition and maintain IBM's monopoly in the peripheral area. The decision established that the FTP was the most effective weapon in IBM's extensive arsenal against the plug-to-plug manufacturers.

The judge also placed the blame for the sustained and systematic attack against the PCM's squarely on the shoulders of IBM's top management, although the firm's attorneys had attempted to wiggle top management out of the issue. "The evidence makes clear (that IBM) was finely tuned, organized and managed to reflect to top management the composite of a sophisticated, widespread and coordinated employee organization for the purpose of management decisions."

"A clear understanding"

In this regard, the judge cited IBM's Thomas J. Watson, Jr., who was described in IBM documents as informing the firm's Data Processing Group that he wanted " 'a clear understanding that the company swallow whatever financial pills required now and get ready for the future . . . irrespective of financial considerations of one or two years—must return this business to a growth posture and operate accordingly.' Mr. Watson stressed the need for IBM 'to make the hard decisions today so that the same problems don't have to be faced again and again down the road.' "

Thus, Watson, the last member of his family working in the company, retires at the end of the year, leaving IBM under a cloud. He was the mastermind of the anti-PCM strategies that are now likely to return to haunt his company for years.

One immediate question, of course, was whether it was really worth it to IBM to carry out its battle to squash the PCM's. The judge observed that IBM itself anticipated that it would lose at the most 25% of its tape and disc markets to the PCM's.

In effect, the judge found that IBM did indeed swallow the bitter "financial pills" that Watson thought were necessary. For instance, Judge Christensen said one IBM task force estimated that FTP leases for discs, tapes and printers would cost IBM more than $75 million in 1971 and 1972. Other IBM efforts to squeeze the PCM's—like the price-cutting 2319 drives, for instance—certainly cost IBM substantial amounts of money, but that was the price the firm was willing to pay to contain the competition.

It was well established during the trial, and later in the decision, that IBM's peripherals in 1970, particularly in the disc and tape drive areas, were in many cases inferior to those produced by some of the independent manufacturers. In short, IBM found itself, around 1970, in the position of being "product short" in the peripheral department.

On the cutting edge

Since then, however, the firm appears to have made a concerted effort, and a successful one for the most part, to remain on the cutting edge of advanced product technology. In the past two years, new IBM peripherals and hardware, with a few exceptions, have tended to lead the state of the art. Furthermore, by forbidding various competitive maneuvers like price-cutting and unfair leasing plans, the judge's decision can be expected to

The Judge was Stern with Telex

While Judge Christensen shook the computer industry to its roots by charging a hitherto sacred IBM cow with monopoly, he was particularly stern with Telex in a separate trade secrets decision. Specifically, the judge ordered Telex to pay IBM $21.9 million for what he said was a "programmed and massive invasion" of IBM's trade secrets.

"We have been confronted here," the judge stated in his decision, "by a widespread, purposeful effort of Telex to secure confidential (IBM) technical information concerning the design of products which were then unannounced, for the purpose of duplicating such equipment through use of such confidential information. Telex's patterns on recruitment, job assignment, production growth, and compensation arrangements, were so designed as to lead inevitably to the misappropriation of IBM's confidential information."

The trial and the judge's subsequent decision succeeded in establishing a pattern of industrial espionage practiced by Telex.

Typically, an IBM engineer working on a key new product would receive a phone call from a top Telex executive, often Roger Wheeler, Telex's chairman and chief executive officer. Fat salary increases, bonuses, and stock options were dangled before the prospective employees, who were often flown to Tulsa in Telex corporate jets.

One key ex-IBM engineer, for instance, was John K. Clemens, who had been engineering program manager of IBM's Merlin (3330 disc drive) project. Clemens was lured away from IBM with a $500,000 bonus plus a fat salary and a hefty stock option. For that, Clemens was expected to deliver a 3330-style disc drive for Telex in a specified period of time.

Other IBM engineers were also offered shopping salaries, as well as stock options and bonuses, to entice them to work for Telex, the court record revealed.

The judge also took notice of an unusual contract Telex attempted to negotiate with Japanese computer manufacturer Hitachi. The negotiations, the judge stated, were conducted on behalf of Telex by executive Jack James, an ex-IBMer.

One of the inducements Telex proposed to Hitachi, the judge stated, "was access to information relating to IBM's unannounced disc programs known to Telex employees. Telex also offered to provide Hitachi with information that would enable Hitachi to design an equivalent to the unannounced IBM Apollo (disc drive project)."

While the judge in no manner excused Telex's conduct, he did take notice of unusual circumstances in the computer industry that lead to monopoly of sub-markets, which in turn could encourage industrial espionage as the only way a firm could combat the monopoly. In this regard, the judge said: ". . . this ultra modern setting (of the computer industry) may be unprecedented also because of increased inducements from and vulnerability to sophisticated sub-market control on the one hand and massive industrial espionage on the other."

—W.D.G.

spur IBM to compete even more aggressively in the technological area.

For the PCM's, the decision represents something of a pyrrhic victory. When last seen, Memorex, the largest of the independent PCM's, was sinking in the western horizon with a multimillion dollar Bank of America debt pressing upon its shoulders. The second largest independent PCM, Telex, had been abandoned by waves of its top technical and sales people, this in an industry that must move extremely rapidly, and will likely have severe difficulties rebuilding. True, there are a few small PCM companies that possess superior technology and marketing, and although they are growing, they are small. While IBM probably viewed the large PCM's as pests, the firm undoubtedly looks upon the younger PCM's as gnats.

Nevertheless, the judge's decision does breathe some life into a plug-compatible industry that before gave all the appearances of possessing terminal disease.

Money talks. And money, Wall Street money that is, hasn't been saying very much about the PCM industry since the judge's decision. The feeling that pervades the nation's financial and capital raising markets is that there will be no great rush to finance the PCM industry. These finances, of course, are crucial to the viability of the PCM's. The Bank of America's traumatic experience with Memorex lingers.

In addition, many PCM companies had used extremely liberal, or creative, financial accounting reporting methods which will reinforce Wall Street's caution. Still, the feeling is growing that the life-giving capital will be available for the few PCM companies which were able to compete effectively with IBM during the past year or two and which used more conservative and traditional accounting reporting methods.

Amount in question

How much money will the PCM's get from IBM? It could be years before the answer to that question is known. Initially, Judge Christensen ordered IBM to pay Telex $352 million. Early in October the judge announced he had made a "substantial error" in determining damages. In a later hearing he said he had concluded "the record before me is insufficient to justify the recalculation or a redetermination of anti-trust damages by specific or approximated sums." He said he would leave the amount of damages to be redetermined to another hearing or would grant a new trial solely on that issue. In all, the damages to Telex—and from other PCM's who are expected to eventually line up for their share—could amount to a pittance for the computer goliath, which has annual revenues of $10 billion plus. The monetary settlements, though, could be a boon to the PCM's.

While the judge's apparent about-face on the damages question took many by surprise, his action was not entirely unexpected by those who had read his opinion, in which he said: "But in cases like this, if not in every complex case, it is humanly impossible to trace, find, and specify in detail and quantify in effect the numerous circumstances which cause or contribute to financial consequences."

Perhaps the biggest impact of all concerning the decision will be tan-

Excerpts From The Decision

"This case involves the electronic data processing industry—an industry based upon a concept and system of reckoning (binary) as simple as turning on and off a switch; in which transmissions are timed in billionths of seconds (nanoseconds), storage capacity (memory), measured by millions of combinations of bits of information (megabytes); in which numerous problems involving logic or arithmetic functions are separately but simultaneously worked upon and instantly solved within a single system; in which in their own peculiar language machines communicate with one another (multiprocessing) and then in words understandable by humans may present printouts of results at the rate of as much as 2,000 lines per minute; in which devices facilitate maintenance by the detection and isolation of their own malfunctions or mistakes (diagnostic programs); upon which most other industries of the country and countless businesses, as well as science and space explorations, vitally depend; in which product and market developments seem almost kaleidoscopic when viewed from the outside; which appears unique in monopoly context by reason of its youth and apparent dynamics, but which by the same token in this ultra-modern setting may be unprecedented also because of increased inducements for, and vulnerability to, sophisticated submarket control on the one hand, and massive industrial espionage on the other . . .

"In the aspect of its business relating to the marketing of edp products to IBM end-users, Telex in the past has had a company policy generally of following IBM's product leadership and subordinating any technological product innovation. Telex products are designed as the functional equivalent of previously announced IBM products, except for whatever technological advances Telex is able to introduce because of the later announcements of its products. Telex's plug-compatible tape drives, disk drives and printers have had better performance in some respects than IBM's corresponding products . . .

"Since entering the edp industry and up to 1971, Telex reported a phenomenal growth in revenues. Its revenues from edp products and services sold to customers within the United States as reported in the 'census' rose from $870,000 in fiscal 1967 to $56,840,000 in fiscal 1971 . . .

"The record in this case shows that peripheral devices attached to IBM equipment but manufactured or supplied by others during the relevant period have grown into, and have been recognized as, a significant, distinct and important part of the edp industry. Again, for the particular period mentioned, we are not dealing with mere theory but with a historic, economic fact, transitory or otherwise. The question persists, however, whether such suggested subdivisions of the industry can properly be regarded as relevant markets or submarkets within which economic power can be separately appraised . . .

Peripheral competition

"The only box for box peripheral competition of any substantiality (for IBM) has been and is between IBM and the plug-compatible manufacturers (PCM's). IBM's systems competitors were not directly affected by IBM's pricing and product actions for peripherals and made no competitive price responses to IBM's 2319A and B and Fixed Term Plan (FTP) price reductions for its peripheral products . . .

"The court has not been unmind-

gential. First, IBM has lost its aura of invincibility, and while it still retains its quasi-divine status on Wall Street and among many customers, there is a new suspicion that IBM, like other companies, may have feet of clay.

One reaction among the majority of Wall Street computer followers was to attempt to shoot holes in the decision they found so embarrassing (they hadn't predicted its outcome) but, in the end, even Wall Street will have to live with what the court decides.

There could be a direct impact on IBM's anti-trust stance with the leasing companies. The fact that Judge Christensen found it illegal that IBM systematically staked out the PCM industry for a drubbing can only help to strengthen the Greyhound Computer case against IBM. In this case, Greyhound clearly established that IBM had selected the leasing companies for competitive action and that this competitive action throttled the leasing companies. A federal judge in Phoenix dismissed the Greyhound case last year, ruling in favor of IBM, but Greyhound has appealed the case and it is before the Ninth Circuit Court of Appeals in San Francisco.

The Telex case will undoubtedly have an impact on the Justice Dept.'s long-standing anti-trust case against IBM. Most important, perhaps, will be the psychological factor. The fact that a small law firm in Tulsa, Okla., Floyd L. Walker Assoc., was able to assemble complicated computer industry data and present the Telex case in court in less than 18 months can only serve as an embarrassment to the Justice Dept.

---

ful of . . . circumstances and arguments pressed upon it by IBM in attempted demonstration that since its predatory acts or market power have not been proved in respect to the edp industry or the systems market as a whole, it cannot be vulnerable to a charge of monopoly by reason of the interrelationship among components of the industry . . .

"In late 1969 'peripherals' were designated as a 'key corporate strategic issue'—('KCSI')—by IBM's management committee. The key peripherals issue was limited to selected competitive compatible products which replaced IBM products in an IBM computer system . . .

"The only IBM products forecasted by it to be protected by IBM's Fixed Term Plan (FTP) were IBM's tape, disk, and printer products. The only competitive products forecasted by IBM to be affected by FTP were plug-compatible manufacturers' tape, disk and printer products. When, as here, predatory action is selective and focused, and its anti-competitive effects are similarly shunted away from a more general market, corresponding submarkets should be more readily recognized . . .

"Monopoly power is the economic ability to charge unreasonably high prices and to exclude competition . . . Monopoly power presupposes the power to control what happens in a relevant market. Ease of entry may be an indication of lack of market power on the part of an alleged monopolist. Difficulty in entering, weakness of competing companies and dependence of competitors upon dominant forces in the market are among indicia of market control on the part of an alleged monopolist . . .

"Little or no evidence was introduced in these cases that IBM evidenced an intent to monopolize, or directed efforts toward monopolization of the edp systems market in general, except through its more focused conduct . . .

"There is little or no indication in the evidence introduced in this case that IBM adopted specific programs to throttle or impede general systems competition or that it sought to implement any predatory intent with respect to the edp industry as a whole, as distinguished from efforts directed specifically against the marketers of peripheral equipment plug-compatible to its cpu's . . .

"The requirements of electronic data processing users, and the profusion of companies attempting to fill those needs, have led to a marked increase in the performance of products and significant decrease in the cost per unit of computing. Broadly defined the edp industry appears competitive and dynamic . . .

". . . entry was initially easy for peripheral equipment manufacturers because they could choose to copy only proven successful products. Moreover, they could utilize in many instances systems hardware provided by the system manufacturer and typically would sell only after all systems engineering, systems marketing, side preparation and systems installation work had been completed . . .

"This is not to say that there were any ruthless or nakedly aggressive programs contemplated or carried out (by IBM); anything that was done by way of strategy was sophisticated, refined, highly organized, and methodically processed and considered. But in this day and age such conduct is hardly less acceptable than the naked aggressions of yesterday's industrial powers if unlawfully directed against competition. The organized, selective, subtle and sophisticated approach, indeed, may pose more danger under modern conditions than instantly more obvious strategies . . . □

which has been giving the appearance of fumbling blindly for nearly five years in the preparation of its case.

It has to help

"The Telex decision *has* to help accelerate the Justice Dept. case," says A. G. W. Biddle, executive director of the Computer Industry Assn., a group of IBM competitors. "Congress is beginning to get restless, too. They may want to see some action."

And there may be an important impact, too, upon Judge David Edelstein, the New York Federal Court judge who is presiding over the Justice Dept. case. He has been unable to move the case forward thus far, and IBM has been successful in leading the court off on irrelevant tangents. On the other hand, Judge Christensen sliced through to the core of the issue on the Telex case, and his ability to do this can only serve to act as a spur to Judge Edelstein to attempt to move the government's case.

In its case, Telex didn't address itself to the idea of general systems monopoly, so that issue remains to be taken up by the Justice Dept. suit—or perhaps by the Greyhound case on appeal.

It should be observed that IBM won many of its points in the Telex case besides its trade secrets claim. Judge Christensen, for instance, ruled that IBM could employ its "mid-life kickers" in its products, and users can expect to see that product strategy used by IBM increasingly in future products.

As far as injunctive relief goes, IBM was ordered to cease collecting termination penalties on long-term leases, to price 370 memories and cpu's separately, to disclose product interfacing specifications at product announcement time, and to release detailed product interfacing specs on 360 and 370 peripherals. The giant was also ordered to use the same percentage markup on all functionally similar products.

It still isn't clear whether the easier accessibility of the interfacing specifications will make life easier for the PCM's. IBM can be expected to announce its products much closer to the start of the manufacturing cycle now, so PCM's won't have much, if any, additional time to copy IBM products. Also, IBM's victory in the trade secrets case means that PCM's will have to be extremely careful about the manner in which they employ ex-IBM engineers. If, for instance, ex-IBM engineers are forbidden to work for PCM's on IBM-compatible peripherals, that could represent a real problem for some PCM's.

Most important, perhaps, was Judge Christensen's stipulation that IBM be "enjoined from adopting, implementing or arrying out predatory pricing, leasing or other acts, practices or strategies with intent to obtain or maintain a monopoly in the market for edp peripheral equipment plug-compatible to its cpu's, or any relevant sub-market thereof."

While that measure isn't exactly precise, it covers a multitude of sins, and there is a growing feeling that IBM must now move more carefully when it takes action against competitors.

—W. David Gardner

International

Facing a Booming Demand for Networks

Europeans this fall were beginning to communicate on communications.

First, the results of a survey of data communications for telecommunications authorities of 17 European nations was published, showing that the number of terminals in use in those countries will increase tenfold over the next dozen years. The report described the data communications scene as "one of impending technological upheaval" because dp demands "are not easily met by existing services."

Then there was a seeming epidemic of international meetings and conferences on data communications and networks. At one of these, Dr. A. G. "Sandy" Fraser seemed to set the underlying theme of all the others. "There is a tremendous lack of people who understand both technologies," he said. This was going to make life very difficult, continued Fraser, formerly of Cambridge Univ. and now with Bell Labs in the U.K. But the saddest part is that until this shortage is remedied it will be a long time before computer people are going to get the communications systems needed for computing.

Fraser talked at the Univ. of Newcastle-upon-Tyne before an assembly of senior academicians and researchers from departments of some 30 universities and other institutes.

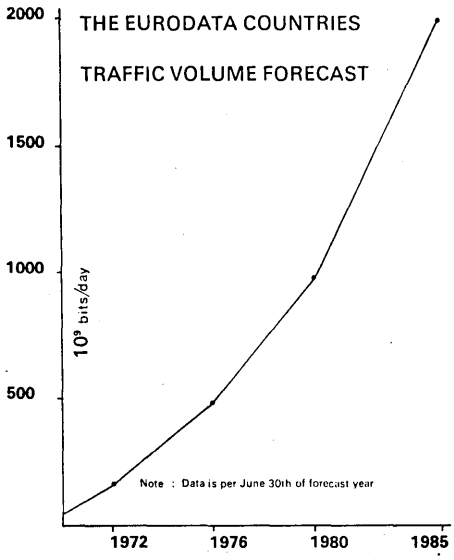
Is Arpa the way?

Fraser listened to Stanford's Douglas Engelbart and UCLA's Leonard Kleinrock draw on their vast experience with the Arpa network to talk about an "augmented knowledge workshop" at Stanford Research Institute, and on measuring the performance of a network, respectively. Then he announced that there were other ways, besides the Arpa project, of developing and using networks. He said he suspected that there were many fundamental technico-economic issues involved in the marriage of computers and communications that were not always appreciated. He suggested it might be right to apply telephone switching and data network ideas to running a distributed system with no central control today, but there would soon come a time when it would be totally uneconomical. One problem is that all the complex control equipment would have to be concentrated in big centers because the availability of trained service engineers with sufficient skill would be a problem.

In fact, Fraser was just as anxious about the local maintenance service as he was over resolving conflicts on the internal control and interface standards for networks. Although long distance transmission was improving rapidly, the situation was getting worse in other respects because local distribution costs were not getting less.

Fraser's cautionary note was timely because the next meeting on the subject was a networks seminar sponsored by the NATO-funded Advanced Study Institute, and the Arpa fan club's contribution at first was overwhelming. The audience included delegations from Mozambique, Hungary, U.S.S.R., Japan, Nigeria, Portugal, Turkey and Greece as well as the other main European countries.

At one point in the conference, it appeared that the Arpa fans were about



to scorn such various other networks as Cyclades in France; Cost 11, the joint European venture; SITA which is the airlines' cooperative communications network; the U.K.'s National Physical Laboratory experiment; the British Post Office's Experimental Packet Switching System; and the German EDS project. But it became apparent, as discussion went on, that not too many people could expect to get a benefactor with the resources of Arpa, the

Advanced Research Projects Agency, a unit of the U.S. Dept. of Defense. And there were doubts whether that was the way to go about it, even if they could.

Cyclades underway

It appears that a number of the networks tailored toward European practices and budgets are making headway. Louis Puzin, of France's Institut de Recherche d'Informatique et d'Automatique, says the French government sees the Cyclades system as essential in overcoming problems of a highly centralized administration and as a stimulus for greater dissemination of information into the regions. Work started on Cyclades early last year. It now has five nodes built on CII Mitra 15 processors—two in the Paris area and the others in Rennes, Grenoble, and Toulouse. Eventually 16 host processors will be incorporated into the network comprised of a mixture of the CII 10070, Iris 80 and Iris 50 processors, an IBM 360/67, CDC 6600 and Philips 1200.

Internode connections are 48 kilobit and 4.8 kilobit circuits. Protocol tests have been run between two of the host computers, but the network ultimately will accommodate eight different operating systems. Eight hosts should be on the air early next year with a packet switching service operating 10 hours a day, and round the clock by the end of the year.

The packet switching format adopted for Cyclades consists of 72 bits for identification, 2040 bits for message text, and 16 parity bits. The 72 header bits contain 16 for origin, 16 for destination, and 16 for reference. The remainder describe priority, the type of packet, and message length.

Initially, the type of data base accessible will cover public information vital for planning and development, including gas and electricity services, school capacities, highways and bridges. Personal information will be specifically excluded from the network. Cost of the whole scheme is budgeted at about $12 million.

Eleventh project

Details were given to the NATO seminar on the state of the Cost 11 network by its director, Derek Barber. It gets its label from nothing more mysterious than being the eleventh project on the list of the projects of Cooperation Europeenne dans le Domain de La Recherche Scientifique et Technique. An agreement was signed by France, Italy, Norway, Portugal, Britain, Sweden, Yugoslavia, Switzerland, and Euratom (the research center of the European Common Market Commission).

A team was formed in February of this year to manage the development which is expected to grow from the first network switching centers to be installed in Milan, Paris, Zurich, London, and in one of Euratom's Institutes at Ispra in Italy. Cost 11 was planned to encourage collaboration, prevent proliferation of dissimilar private networks, make under-used resources available to those in need of capacity, and to arrive at international standards from a background of experience.

That survey for the 17 European nations was a one-year study sponsored by the European Conference of Postal and Telecommunications Administrations. It was conducted jointly by P. A. International Management Consultants, a British firm; New York's Quantum Science Corp.; Italy's Italsiel Societa Italiana Sistemi Informativi Electronici; and France's General de Service Informatique.

Entitled *Eurodata—a Market Study on Data Communications in Europe, 1972-1985*, it confirms the rapid rise in data traffic that has generated the current excitement over networks.

It estimates that the total number of terminals in those countries was 79,600 last year and will rise to 235,600 by 1976, to 437,400 by 1980, and to 815,000 by 1985. Traffic volume in the next dozen years will soar twelvefold. International traffic between the countries will rise five times with demands from banking, air transport, and the activities of multinational manufacturing. Software will remain the principal factor limiting expansion because the demands on software services are expected to be far greater than the rate of development of new techniques and the availability of people.

—Pearce Wright

THE EURODATA COUNTRIES TERMINAL FORECASTS
(Thousands, excluding "in-house")

Country	1972	1976	1980	1985
Belgium	2.2	9.6	17.8	27.7
Denmark	1.8	4.0	6.7	14.5
Finland	1.1	6.9	10.1	14.7
France	11.0	33.9	66.2	135.3
F.R. Germany	14.6	51.5	105.0	220.5
Greece	0.1	0.3	1.1	2.5
Iceland	—	0.04	0.1	0.2
Ireland	0.3	0.8	1.8	3.2
Italy	8.2	21.3	33.4	60.4
Luxembourg	0.06	0.24	0.40	0.68
Netherlands	3.2	16.1	26.4	41.9
Norway	0.8	3.3	5.8	10.3
Portugal	0.4	1.7	2.4	4.0
Spain	3.3	9.4	15.9	29.0
Sweden	3.7	11.4	19.4	30.6
Switzerland	2.2	8.0	16.8	26.2
United Kingdom	26.3	57.5	107.8	193.1
Total	79.6	235.6	437.4	815.0

Traffic volume in the 17 Eurodata nations will soar twelvefold in the next dozen years.

Munich 73: Window To Europe's Users

More than 200 computer vendors from 11 nations will display their wares to Europe's computer market this month at System 73 in Munich, W. Germany.

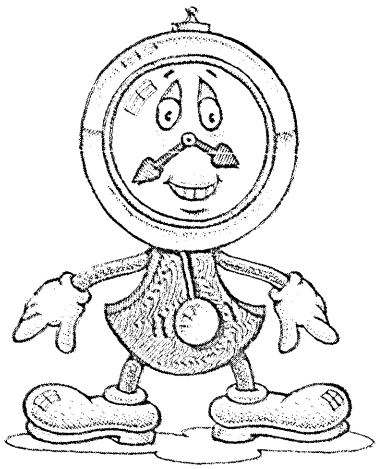
The biennial event, Nov. 27-30, is billed by the sponsors as Europe's "specialized fair" for computer users. Its program includes seminars for users in medicine, public administration, construction, transportation, retailing, insurance, banking, and publishing. The sponsors contend that the affair provides vendors with a window to problems facing users.

It begins with a series of "basic seminars" covering automation of edp organizations and programming, data capture trends, internal auditing, and the automation of company computer centers.

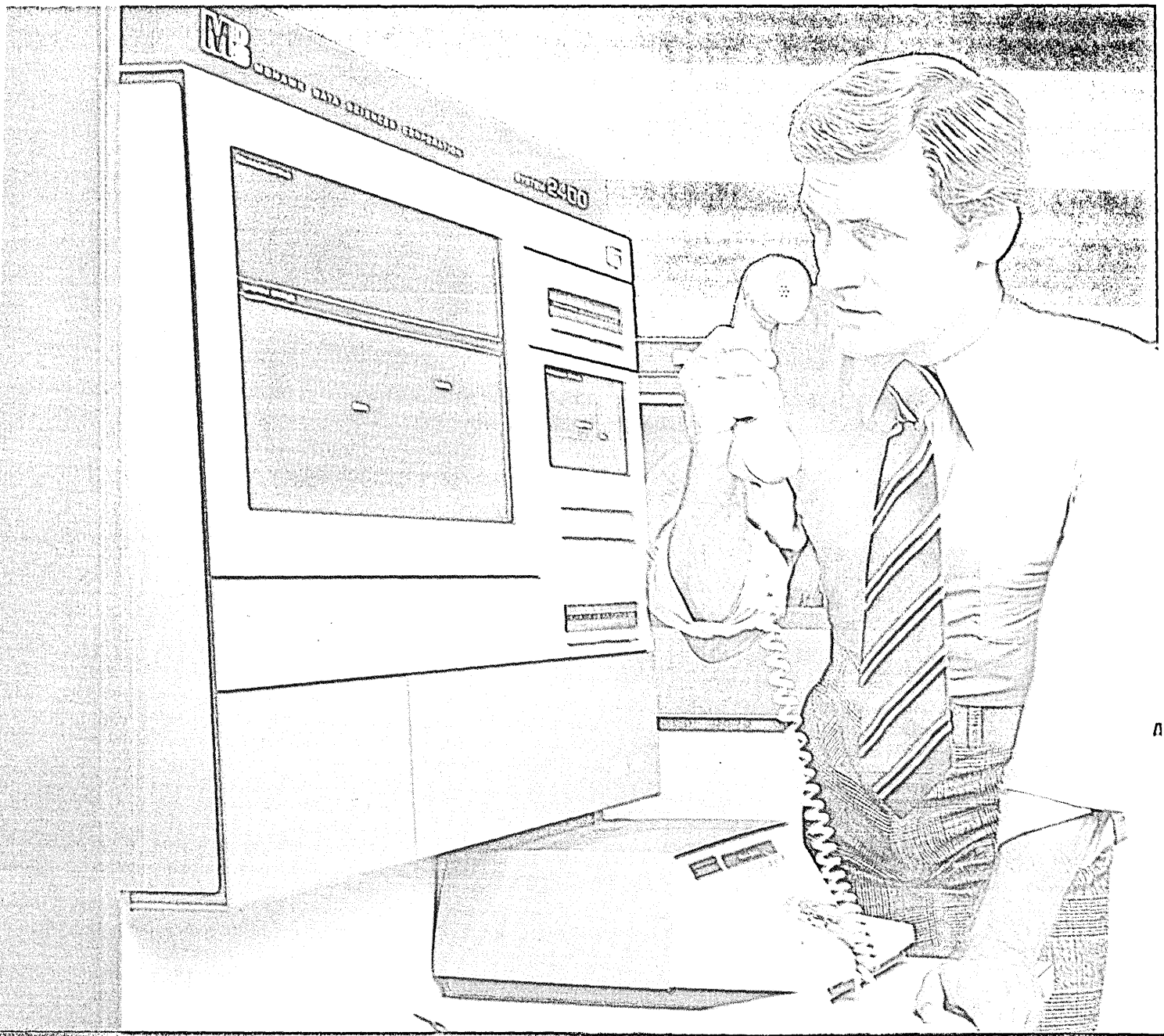
The highly topical subject of point-of-sale terminals will be discussed Nov. 29 at a seminar for users in the retail trade. One session will have a report of the extent and motive of their use in the U.S. followed by a discussion on the special conditions applying to their use in Western European nations.

Sessions on banking applications place much emphasis on methods for planning for future automation because stiffer competition and growing large-scale business is going to involve further automation of banking services. The announcement of these seminars observes that "only enterprises which pursue this aim purposefully and with a view of adaptation to future developments have a chance of maintaining their position in the forefront of competition."

One provocative topic in a seminar on "Press and Publication" is that of the need for publishers to standardize the way they process text and prepare advertisements as a prerequisite for



Now you can have communication full time, while you print or convert. Concurrently.



System 2400.
It earns its place between you and your mainframe.

You're looking at two systems for the rental of one, because that's what System 2400 concurrency delivers.

You can have communication of RJE quality constantly available to access any major mainframe. At speeds as fast as your lines can move the data.

At the same time, you can process a flow of other jobs. Media conversion of all types. On- or offline printing at speeds to 1250 lines per minute.

And, yes, key-to-disk can be part of System 2400 concurrency. So can dual line communications to two other terminals simultaneously.

What's more, your own programming and editing functions can be part of a System 2400 package.

Fact is, there are over 150 hardware options and a growing software library to power them.

Scheduling hassles disappear today, and you're ready to grow into tomorrow.

With over 2000 Systems 2400 in use, we'll level with you. They're out there because they combine what needs doing in a way that wins price/performance hands down.

Call us so we can put together a proposal in terms of your requirements. That's how MDS has grown to have a user list second only to IBM. Phone your local MDS representative or call headquarters at (315) 792-2424.
Mohawk Data Sciences Corp.,
Utica, N.Y. 13503.

CIRCLE 33 ON READER CARD

Mohawk Data Sciences

MDS®

computer implementation. Two speakers at the seminar will ask publishers to "renounce certain individual procedures," an exhortation that may not sit well in the highly individualistic business of publishing.

The sponsors said they were delighted with the response to System 71, also held in Munich, which drew an attendance of 7,400. They attribute to that success the 45% increase in exhibitors at this month's event. A total of 203 companies, 78 from Europe and 125 from abroad, will exhibit, compared with 168 firms in '71. Contributing to the exhibit increase is the DATAMATION Grand Tour, a traveling exhibit of U.S. companies whose five-nation tour of the Continent and Scandinavia winds up at the Munich event. The tour is sponsored by this magazine with the help of the U.S. Dept. of Commerce.

Persons wishing to attend System 73 may contact John L. Wolf, 226, U.S. Dept. of Commerce, Washington, DC 20230, (202) 967-4942.

Retailing

NRMA: What Point Point-of-Sale?

"Just because you know you're not paranoid doesn't mean they're not out to get you."

This phrase, left on a blackboard following one session of the National Retail Merchants Assn.'s (NRMA) 15th annual Information Systems Edp Conference in Los Angeles last month seemed an unnecessary warning. Among the 677 paid attendees (up from 540 last year), top retail edp men from across the country and from other parts of the world too, there was little evidence of paranoia and even less that they could be had.

From the podiums, in the corridors, and over lunch, they came across as professionals who know what they want and will work hard to get it on their terms. They want point-of-sale (POS) systems and all the associated management and merchandising information these can provide, although many admit they don't yet know what they will do with the latter goodies. They want reliable and inexpensive communications with lots of interconnect—and NRMA has a committee and a full time telecommunications counsel working with the FCC and the state public utilities commissions to help make this possible. They also want an industry-wide standard for merchandise identification. Hopefully they will have one early next year when an NRMA task force working on this will make a recommendation.

IBM was there with lots of people, a slide presentation, and a nine-minute film to tout its new 3650 retail system announced in August (Sept., p. 118). But they had no hardware. The consensus among the retailers seemed to be that they wanted to see more; that the system was pretty but too expensive; and that the lack of available software was a serious constraint.

Among those retailers there because they currently are evaluating systems

IBM'S BUCK RODGERS: a note on excellence

for near-future implementation, National Cash Register Co. and Singer Business Machines were most mentioned as prime contenders.

Another thing that seemed to worry many of the retailers about the IBM system was that it locked a user into IBM equipment. Murray Foreman, IBM Retail Store Systems administrator, handily fielded a question from one such retailer during an IBM workshop session originally titled "Salesperson Scheduling," but changed somewhere along the line to "IBM's Retail Store System." Foreman was asked if the system's POS terminals could communicate with anything other than the System 370. His response: "sure, with the 3704, the 3705 . . ."

This IBM session was probably the best attended of the entire conference. This could be an indication of a high degree of interest or it could be related to the fact that earlier that day Irving Solomon, vice president of NRMA's Information Systems Div., had said IBM would make a product announcement. It didn't that day but did two days later (see related story).

Among those warning against a locked-in situation in implementing POS systems was Harvey Braun, Touche Ross & Company who put this seventh on a list of eight graded considerations offered for vendor evaluation. First was service support capabilities, followed by: 2. past installation results; 3. pilot test capabilities; 4. phased implementation capability; 5. capability to install a function at a time; 6. integrated system design; 7. the aforementioned locked-in warning; and 8. continuing R&D efforts.

Another was Bill Jones of the Hecht Co., Washington D.C. division of May Department Stores. "In our minds there is no question that a POS system must support different types of terminals," said Jones. Hecht began installation of NCR 280 POS terminals in September 1971 and now has 1,100 installed in stores throughout the Washington and Baltimore areas. Today the Hecht system includes 20 IBM 3270s for accounts payable input, General Computer Systems key to disc units for back office input, and they will get NCR 725's next spring. Eventually, said Jones, "we're looking to putting devices on top management's desks. We've already spec'd them."

Jones believes communications is the most important single aspect of POS installations, and communications links must have the ability to communicate with various manufacturer's terminals. Hecht's parent firm, May Co., has developed its own POS terminal through a subsidiary—System, Science and Software, La Jolla, Calif. These are in a test installation in a May Co. store in Carlsbad, Calif. Jones said he hasn't seen these terminals yet but will evaluate them when he has a chance and wouldn't be adverse to adding them in a new store should they meet his specifications. He doubts if he'd replace terminals in an existing installation.

Since September of 1971, Hecht has brought up four on-line systems, beginning with credit authorization, and expects to add four more over the fall and next spring. "On the first one you take a bath," he said, "but once the communications are in place the others come relatively cheaply."

Jones said the Hecht system realized a 17% gross return on investment on the first year and he expects this to go to 55% in the fifth year. "Savings were 50% higher than we expected."

Open late too early

He cited discipline as the biggest single benefit Hecht has derived from its system. "Before, one out of every five sales checks were wrong and we only heard about those where the adjustment was to the customer's advantage. Now we have clerk number entry

(Continued on page 146)

Lots of OEMs buy computer systems like they were baking a cake; a pinch of this, a dash of that, a smidgen of something else.

So how come it's true that Xerox customers make it a point to stick with Xerox?

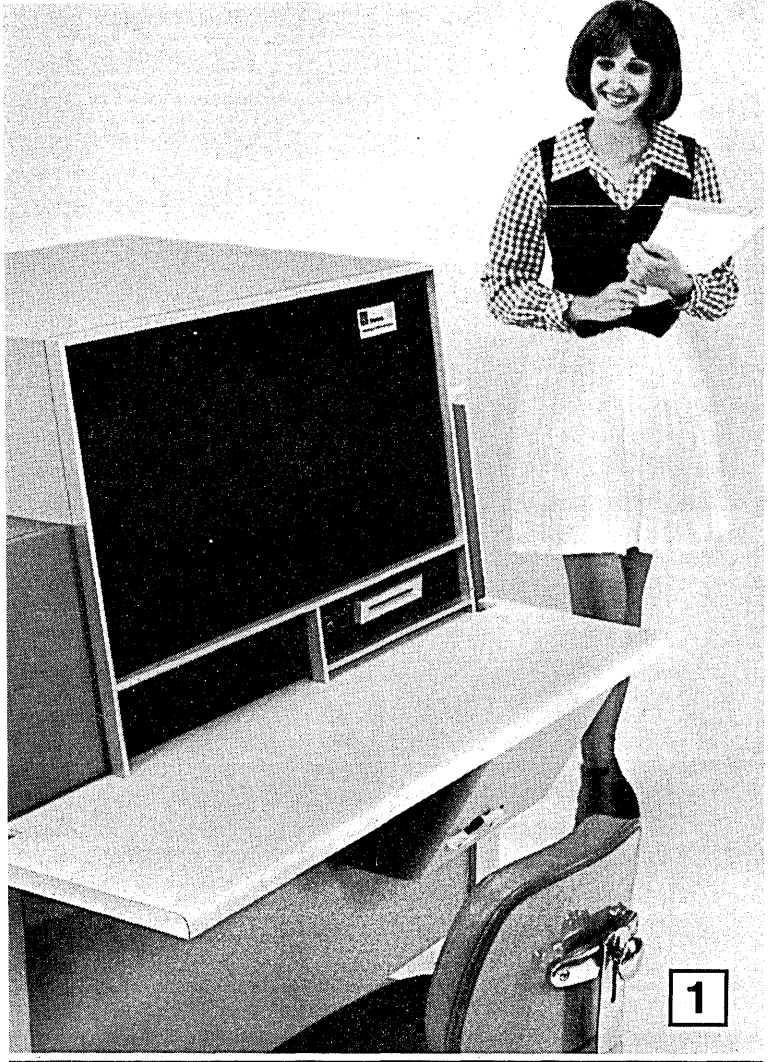
We'll answer our own question.

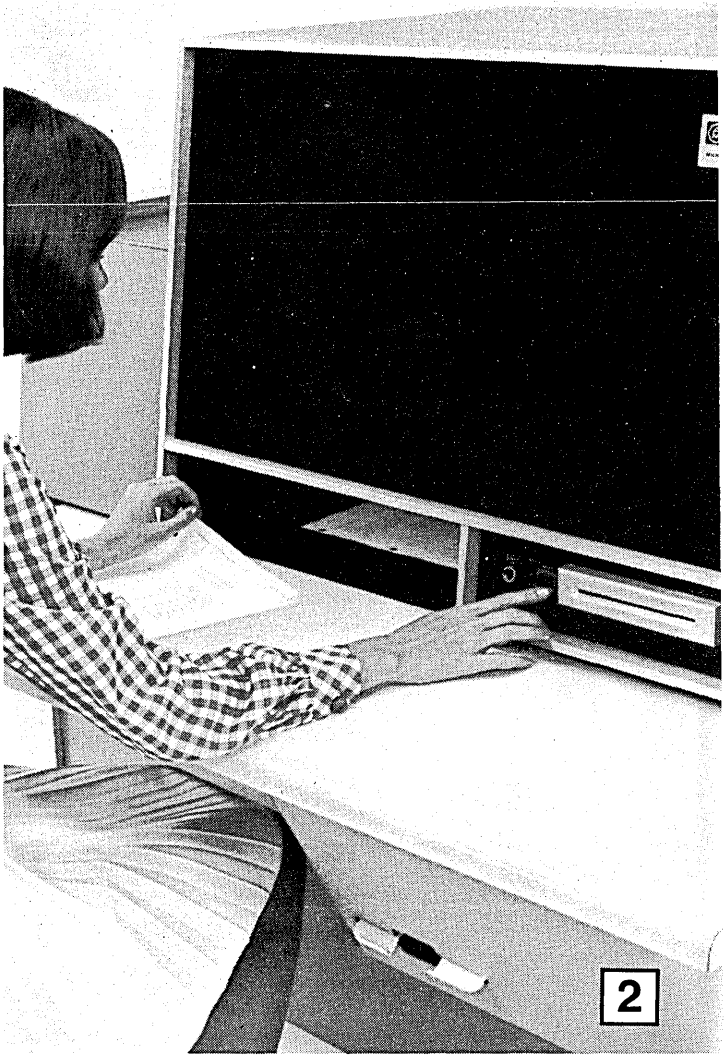
Our OEM customers stick with us because we stick with them. Our systems are ahead of their time. So equipment isn't quickly outdated; and it's easy to add on to, thanks to our broad product spectrum—from modules to mainframes. And now that we've established a dedicated OEM Business Center at Xerox, we're more responsive to your present and future needs than ever, and we can work with you to tailor equipment precisely to your situation.

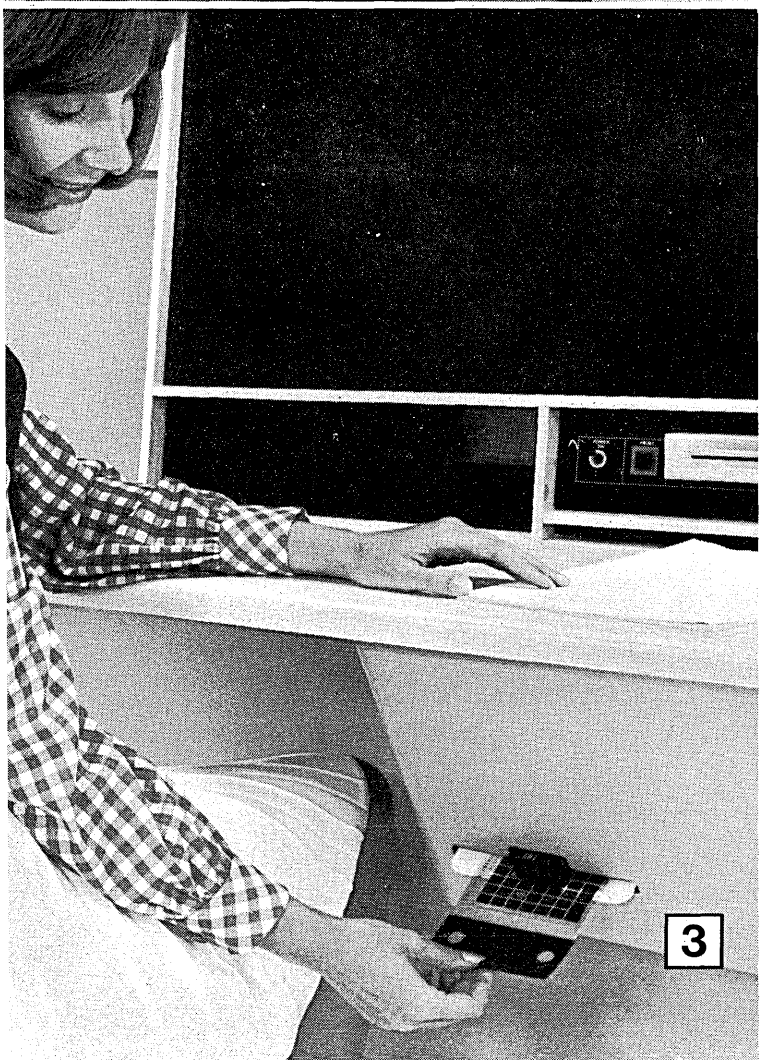
Because we keep coming back to our customers, they keep coming back to us. Xerox is a very good name in computers.

For details write Xerox Corporation, OEM Business Center, 701 South Aviation Boulevard, El Segundo, California 90245. Or call (213) 679-4511.

XEROX


1


2


3


4

Bruning's new system lets you make microfiche right in your office.

Here's big news for anyone using micrographics to store and retrieve information from catalogs, directories, reference works, accounting and purchasing records, and any type of name/number file.

Bruning has put together the first true systems capability for creation, duplication, storage/retrieval and print-back of unitized microforms made from documents. It includes both advanced hardware to get the job done efficiently, and the know-how to custom-tailor a system to your operations.

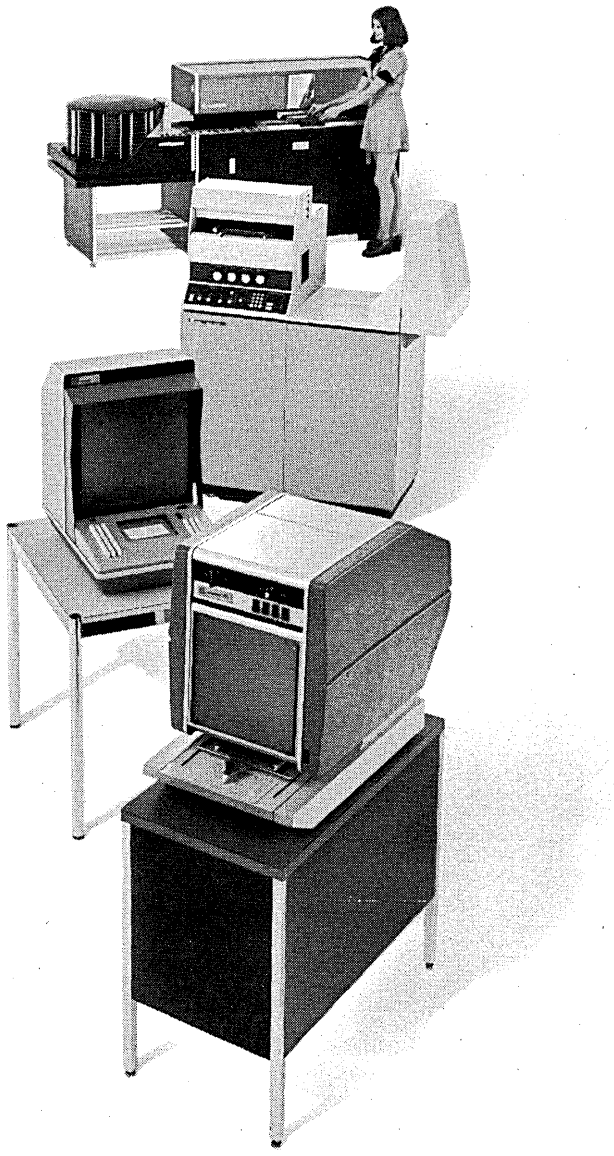
The key element in this system is the amazing new Bruning 750 microfiche camera with built-in processing. For the first time, you can make low-cost, high-quality fiche in your own office—copy up to 900 pages an hour, without specially trained people.

In terms of time savings alone, this is a major breakthrough. By working in-house, independent of suppliers, you can speed up your entire information-handling system. You assure the safety of your documents and the security of your information. And you'll realize significant cost savings.

Once original fiche are in hand, other elements of your Bruning system take over. For example:

- Our OP-40/80 duplicator/collator produces duplicate sets of fiche at high speed.
- Our new Micro-Triever II enlarger/printer turns out 50 hard copies a minute for a couple of cents a copy.
- Our revolutionary new Bruning 95 automated microfiche retrieval/display instantly retrieves information from large data banks.
- Our compact Bruning 550 reader/printer is ideal for locating and printing individual pages.

Bruning micrographics specialists are ready now to demonstrate this hardware and recommend a Bruning system that can increase your payoff from micrographics. Call your local Bruning office today. Or contact Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.



The bold new force in micrographics.

ADDRESSOGRAPH MULTIGRAPH

BRUNING DIVISION

with every sale and we can pin down the problem and retrain where necessary." They also get productivity reports on sales people which, until now, lacked any degree of credibility, and they are using these in personnel review. Customer profiles built with the system permit targeting of direct mail promotions. A dollars-by-hour report showed them last year that they began staying open late too soon before Christmas.

Jones credited the success of his store's systems in large measure to the caliber of his systems and programming staff which numbers nine. "They're good." He said many stores, to consider installing POS systems, must have a higher level of edp sophistication than they now have. But to be competitive, he added, they *must* have POS. "I don't believe you can compete without POS with a store in the same city that has POS."

Mumford Miller, national dp manager for Sears, which has Singer terminals in stores in almost all of the nation's major cities, feel strongly about the people aspect of systems. "People are more important than equipment. If I left Sears all I'd want to take with me would be the people. I couldn't care less about the equipment."

Bill Moxley, Montgomery Ward & Co., touched on people from a different angle, that of the customer. He said Wards, which has NCR 280s, "is using the computer to humanize its operations." He referred to customer accommodation units through which customers, with a single phone call, could schedule a service call, order a catalogue item, and check on the status of his account, because the units are equipped with crt's on which all the necessary information can be called up instantly.

C. Robert McBrier, Woodward & Lathrop, Washington D.C., is concerned about people too, specifically about the people who would have to set up the data for a comprehensive POS system. He described them as people possessing "the lowest skills."

McBrier, introduced as "Mr. Retail Systems," believes retailing is ready for POS terminals. "Sure we are; we can substitute them for our cash registers but are we ready to reap the harvest of benefits from the information they

IBM Drops the Other Shoe

In the same hotel in which Spiro Agnew, some two weeks before his resignation, told assembled Republican women, "I will not resign if indicted," IBM last month told retail edp executives attending the National Retail Merchants Assn. Information Systems Conference it would not make a product announcement during the conference. Then, two days later, it did.

Scene was the Los Angeles Hilton. The product was the expected IBM point-of-sale system for supermarkets, its 3660 system. IBM had been expected to announce the grocery store system before its department store system which it announced in August. For some reason the grocery store offering became the other shoe and now it's been dropped.

IBM will not be up against the entrenched competition with its grocery system that it is with its department store system, where it faces such companies as Singer Business Machines and National Cash Register Co. which have large installed bases.

The competitors are there but they're all relatively new to the field and most grocery store POS installations are still in test phases. Oldest in the business and still the one with the largest number of production systems installed is what once was the retail systems division of Nuclear Data Corp., now a part of Bunker Ramo. This division has been quiet since its change of ownership. Vying for second are Pitney-Bowes Alpex and National Semiconductor. Other contenders include Dymo Industries together with Data General, MSI Data Corp., NCR, Threshold Technology, which has a voice recognition-based system, and, the most recent entry, Sperry-Univac with its acquisition of an RCA-developed system.

IBM's most vocal claim for its new system is on its ability to read the grocery industry's Universal Product Code (UPC), adopted last April (see May, p. 136) as a standard symbol for source marking of products sold in grocery stores. It probably is the first to prove it can do this. At a show staged in Washington, D.C. by the National Assn. of Food Chains (NAFC) in mid-October, one week following the IBM announcement of the 3660, the giant was the only vendor to demonstrate ability to scan the UPC. All companies talking about UPC scanning had been invited to demonstrate.

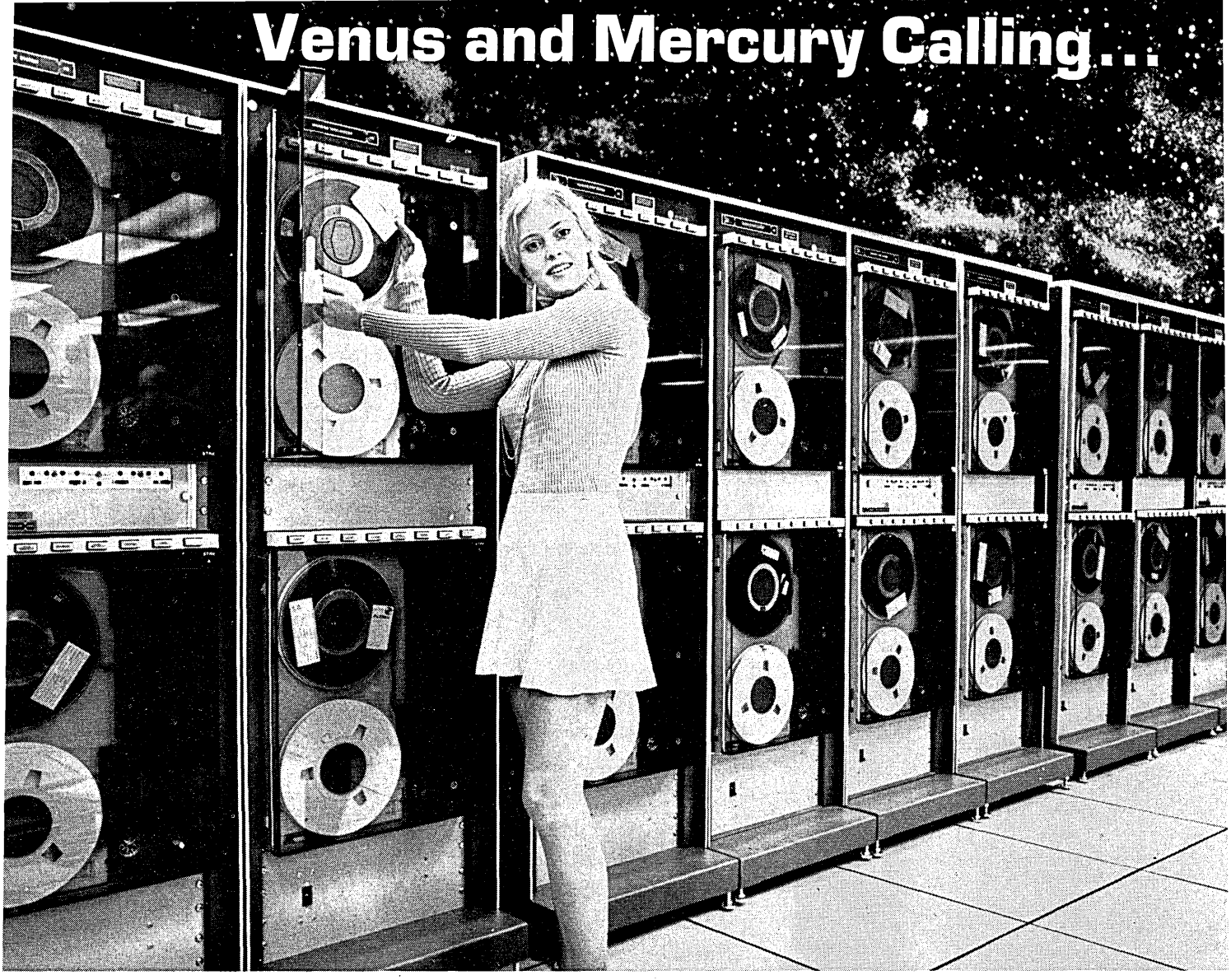
But most of those still feel they'll have the capability to scan and read the UPC before IBM has production models of its 3660 system ready for delivery in the third quarter of next year. Generally the competitors were pleased with IBM's announcement, feeling this entry into the market sanctifies the whole idea of POS in supermarkets.

Bill Bowers, president of MSI Data, said, "It brings more focus on the whole subject and can't help but help those who are in it for real now."

As with its department store system, IBM's grocery system seems high priced when compared to the competition. IBM said a typical store might have eight terminals purchased for $34,000 and eight scanners purchased for $32,000. Such a system also would include a controller and a communications unit for a monthly rental of $922. The entire system could be purchased for $118,760.

The system's slot-type, laser-based scanner locates and reads the UPC printed on grocery packages, as items are pulled across a 6.5-inch scanning window at the top of the unit. □

ONE EASY MOTION: IBM's new supermarket system makes it possible for a checker to check and bag in one motion. Items are simply pulled over the scanner embedded in the slot, then bagged.

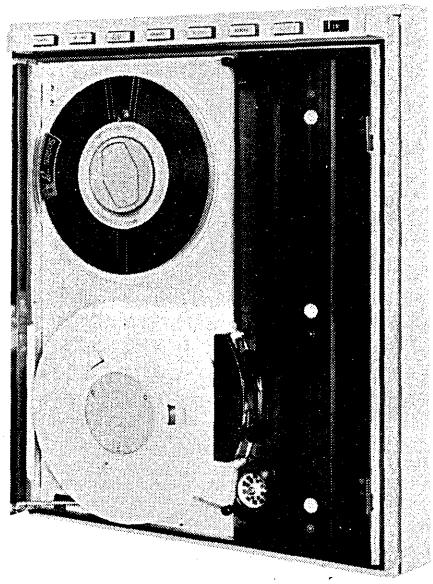


...and **WANGCO** Tape drives get the message...every bit!

When NASA's Mariner 10 flies past Venus and Mercury early next year, telemetry and video signals will be recorded at Jet Propulsion Laboratory on 48 WANGCO Mod 1100 Tape Drives. The reliability of these standard production line WANGCO tape systems gives JPL assurance that they will get these vital messages from deep space. When the data arrives from Mariner 10, it will be recorded in 7 and 9 track modes, and used to generate master data records . . . more than 8000 tapes in all.

The Mod 1100 protects these irreplaceable tapes with the gentle handling provided by vacuum column buffers, at a tape speed of 75 ips. Mod 1100's are available with transfer rates as high as 120,000 bytes-per-second, with data densities of 800 cpi NRZI, and 1600 cpi phase encoded, individually or in switch-selectable dual-density combination.

Low cost, reliability, maintainability and operator convenience . . . that's *our* message. For more information call the WANGCO office nearest you, or write for our latest literature package. WANGCO Incorporated, 5404 Jandy Place, Los Angeles, Calif. 90066. (213) 390-8081.



WANGCO

SETTING THE PACE IN PERIPHERALS

New York, N.Y. 519/294-0893 • Boston, Mass. 617/444-9264 • Washington, D.C. 801/937-2215
Huntsville, Ala. 205/881-7836 • Chicago, Ill. 312/336-1555 • Houston, Tex. 713/785-0581
Dallas, Tex. 214/620-1551 • Denver, Colo. 303/355-3521 • Phoenix, Ariz. 602/956-5300 • San Francisco, Calif. 408/732-6210 • Seattle, Wash. 206/632-0710

can provide? No we are not."

Noting that he believes hardware problems have been licked, he addressed the manufacturers. "Boy, we need you. We need you in the software area. We don't have the human or financial resources to write the kind of software needed for the future."

McBrier believes there will be no advanced merchandise information systems developed until the advent of a standardized merchandise identification. "I'm not going to buy my terminals until I know what the standard will be."

Hans Rubner of Montgomery Ward, head of NRMA's merchandise identification task force, in telling the conference his group would have a recommendation to make early in 1974, didn't say which way the group was leaning but feeling was strong throughout the conference that it will be an OCR symbol. He said the adopted code will have to contain 20 human readable characters and ten machine readable characters. Considered codes are being measured against 130 criteria, each with a different weight.

As for the technologies involved in coding, Rubner said magnetics affords the required density (IBM has a big investment in magnetics for its system) but is expensive. He said three color optic codes are difficult to lay down and black and white optic codes, such as bar codes, take up a lot of space and are meaningless to clerks and customers. He said optical character codes are easier to put down than bar codes and don't take up so much space but currently are more difficult to machine read. He believes technology, with LSI and hand held readers, is beginning to overcome this limitation and the task force "will take another hard look."

Then there is the matter of incompatibility in the grocery industry's Universal Product Code, a source of worry to suppliers who sell through both grocery and regular department stores. "If they could agree on one which could easily be incorporated on our boxes when they're printed," said one, "it would be great for us. We could even use the code for our internal use. But, if we have to use two different codes it will just be a meaningless double marking."

Rubner said his task force has met with the UPC committee and will meet with it again as "we both see the benefits of a standard code and technology." He said the two groups are considering such things as chips in readers which would give them the capability of reading both symbols and/or use of a machine readable character under the symbols which could give them a commonality.

Interconnect is vital

William H. Borghesani, Jr., of Keller & Hickman in Washington, D.C., NRMA's telecommunications counsel, told conferees that POS could be an overriding factor in beating efforts of local regulatory bodies, particularly the North Carolina Utilities Commission, to ban use of devices interconnected to the Bell system on an intrastate level. He said retailers, through POS, have become the most prominent among users of interconnected facilities and, therefore, a voice to be heard and hopefully listened to. He mentioned Montgomery Ward as one retail organization which is saving to the tune of half a million dollars a year through use of private equipment connected to telephone lines in "a couple of data centers." He said NRMA is challenging the right of the North Carolina commission on grounds it is preempting federal jurisdiction (the Carterfone decision) in trying to prohibit intrastate interconnection because it would have the effect "of the tail wagging the dog" and because "other states are watching, notably Tennessee and Nebraska."

David Sailer of MCI told the group that retailers were prominent among the 250 users already signed up by the private line service which was about to open its newest link encompassing New York City. But many in attendance noted it would be a long time before MCI and others like it reached the many areas in which they have stores and, in the meantime, they must live with what Bell has to offer.

David Kratz, Abraham & Straus, Brooklyn, N.Y., pleaded the cause of distributed networks for retail users against large scale centralization. He said additions to a distributed system have little detrimental impact to existing systems; malfunctions in one part of a distributed system need not effect another; a distributed system offers greater opportunities for security; distributed systems require less complex operating systems with the result that less experienced operating personnel is required; often an entire segment of a distributed network can be operated by its user; and a distributed system makes each individual user responsible for his own data processing which results in improvements in timeliness and accuracy.

He was supported in his plea by Sam Harvey of Singer (whose role as a substitute for Singer's Janet Norman he described as being like that of a football player being told by his coach to get in and run for O. J. Simpson). Harvey said operators of large centralized systems become like high priests, keeping users at arm's length. He said today's technology has brought a fourth generation of information processing—a now mode—away from families of computers into levels of computation in an intelligent sub-system network.

And, if IBM didn't offer the conference anything else it would have done well with the offering of its perpetually handsome director of marketing, F. G. "Buck" Rodgers, who was one of the luncheon speakers.

Rodgers' talk on the "Constant of Change" might have been sub-titled "The IBM Story." He said any company that wants to stay on top must be willing to change everything about itself except for three basic underlying principles: respect for the individual; a commitment to giving the best service of any company in the world in any industry; and excellence."

It was the way he said it.

—Edith Myers

Privacy

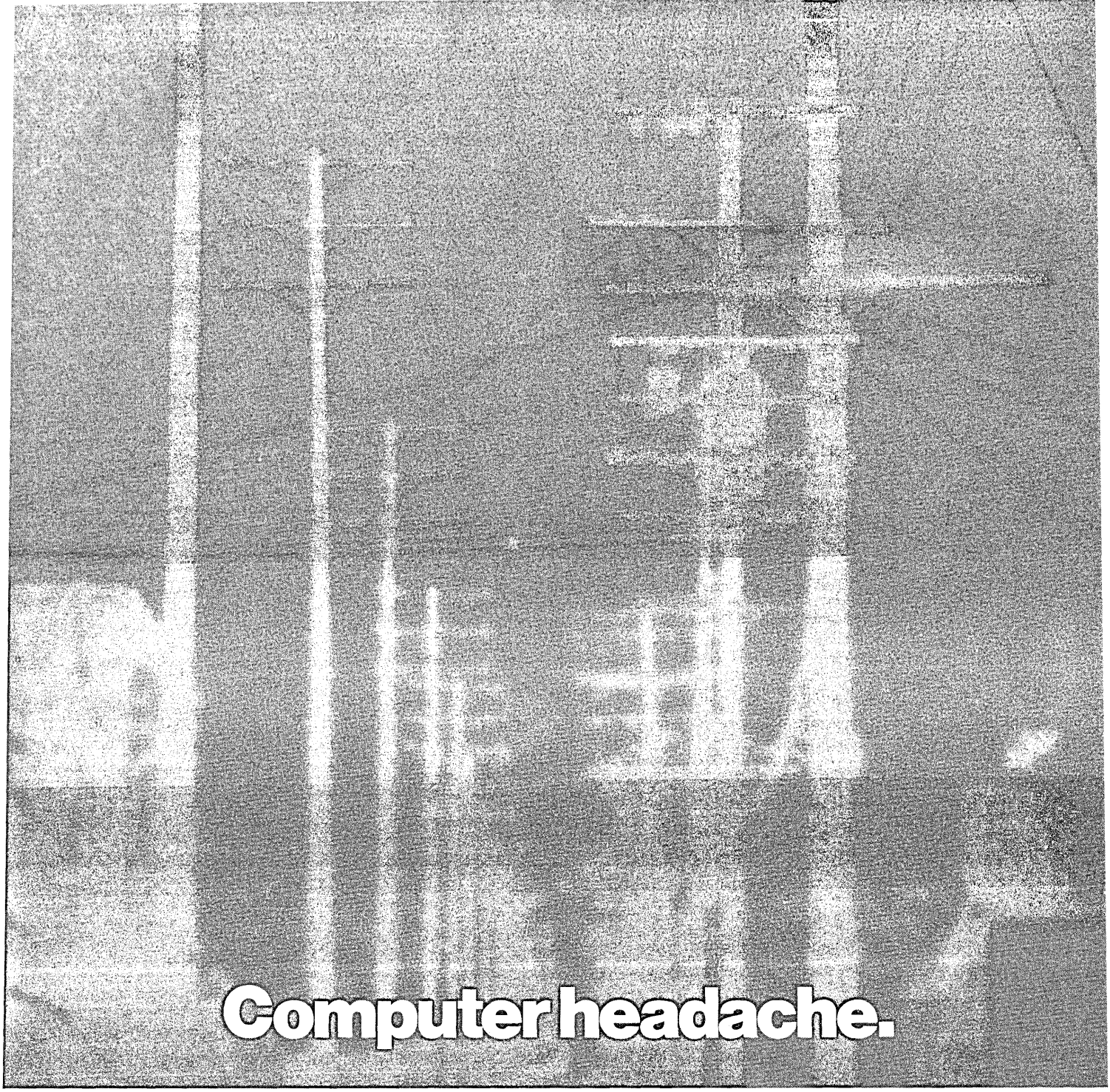
Only Your Doctor Knows . . . Maybe

One witness called it "a medical CIA."

The official name is the Medical Information Bureau. Headquartered in Greenwich, Conn., MIB provides a computerized clearinghouse where 700 life insurance companies can exchange records on prospective policyholders. Alcoholism, sexual deviations, social maladjustments, reckless driving, and prostitution are among the personal traits noted in MIB's files, which cover 11 million individuals. Most of these people are completely unaware of the agency's existence, according to testimony presented last month to a Senate banking subcommittee.

All of this inspired Sen. William Proxmire of Wisconsin to suggest, only half humorously, that the "plumbers" who burglarized the office of Daniel Ellsberg's psychiatrist could have saved themselves a lot of trouble. "All they had to do was go to one of the 700 companies and, if they had a buddy there, they could have gotten all the information they needed without breaking in."

The subject of the Senate subcomittee hearing in October was S 2360, a bill drafted by Proxmire which proposes several changes in the Fair Credit Reporting Act (FCRA). Joseph Wilberding, MIB's executive director, insisted that his agency's operating rules com-



You can't afford to run a computer working with real-time data on raw power. Line transients, blackouts from natural disasters and brownouts can cause shutdown, severe damage, and even loss of the memory.

But dependable, precise power from a Garrett Uninterruptible Power System (UPS) can protect your computer operation and other vital electrical or electronic systems.

Garrett specializes in power systems designed and engineered to protect your computer operations. Our UPS protect the incredibly sensitive operations of America's Air Route Traffic Control Centers—where even a momentary outage could mean disaster.

The ARTCC specifications were the most severe ever established for this type of system, including a reliability requirement of better than 200,000 hours continuous operation. That's double the industry standard, and good reason for you to look to Garrett UPS.

Protect your vital systems with Garrett Uninterruptible Power Systems.

Garrett Uninterruptible Power Systems. Positive protection from brownouts, blackouts and line transients.

For more information, write to Garrett, specialists in power technology. The Garrett Corporation, AiResearch Manufacturing Company. 2525 West 190th Street, Torrance, California 90509

Name

Position Firm

Street City

State Zip

D-11

The Garrett Corporation

One of the Signal Companies

CIRCLE 28 ON READER CARD

Re-introducing the "other end" of the 3M COM system.

Usually, when we talk COM, we tell you about the proven 3M Electron Beam Recorder.

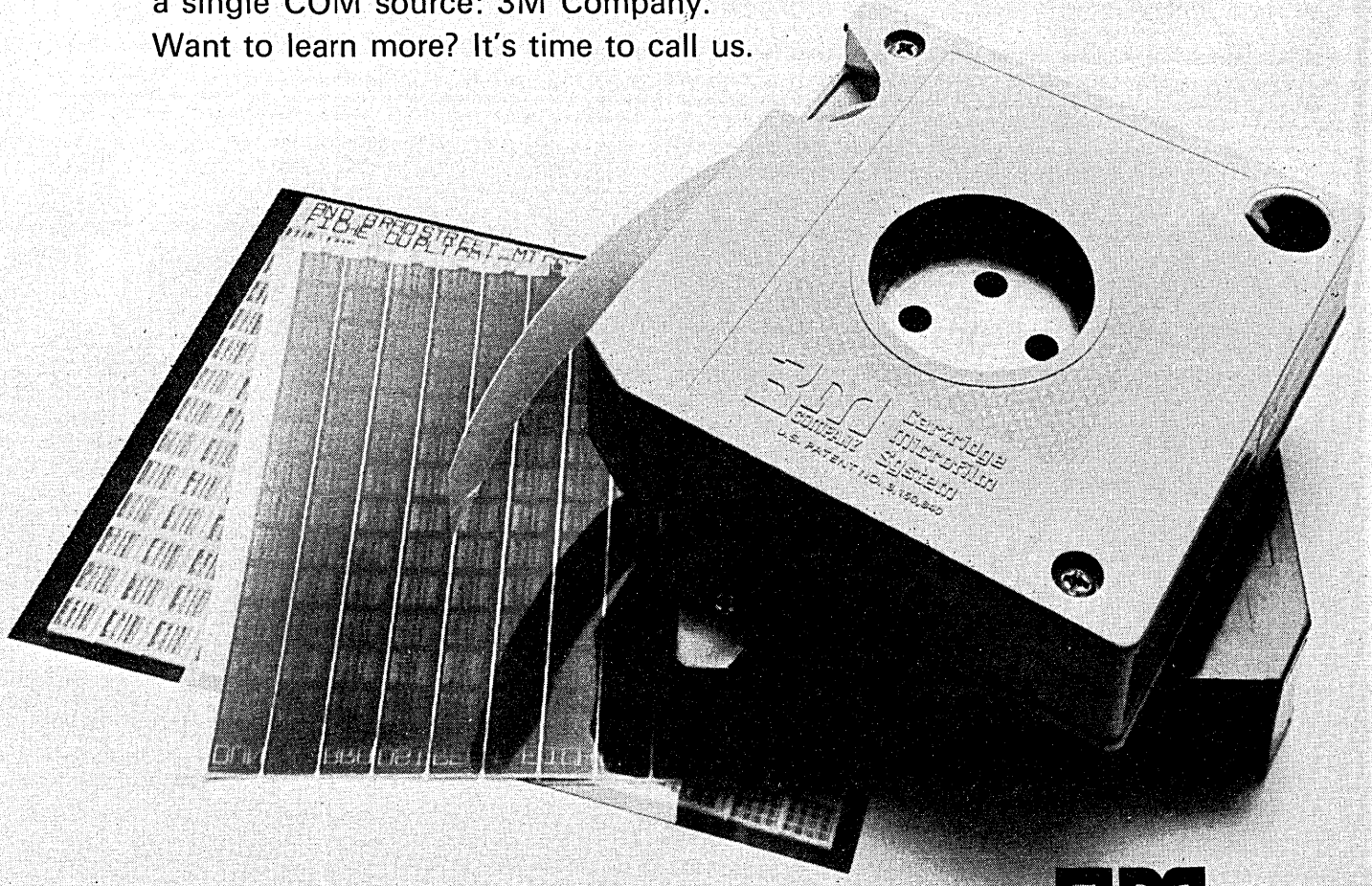
But there are two other important 3M COM capabilities you may not know about: Microfilm duplication and COM data retrieval, the "other end" of the 3M COM system.

So let it be known that 3M offers 16mm reel and cartridge duplicator equipment, plus microfiche duplicators.

Let it be known also that 3M offers a complete line of readers and reader-printers for retrieving COM data from microfilm reels, cartridges and fiche. Which provide visual display if you select a reader. Or visual display and copies if you select a reader-printer.

What does all this mean to you? Simply this. You can obtain EBR-Computer Output Microfilm with dry film processing, plus duplication and retrieval units in one complete COM package from a single COM source: 3M Company.

Want to learn more? It's time to call us.



The age of microfilm is here... 3M COMPANY

CIRCLE 53 ON READER CARD

ply with the FCRA, but Proxmire and Sen. Ted Kennedy both made it clear that the act is particularly weak as regards medical information. The proposed changes attempt to remedy this situation, notably by requiring a medical record in the hands of a "consumer reporting agency" to be disclosed to a physician chosen by the subject of that record. The basic aim is to give the consumer a chance to have his own physician evaluate what's said, so that errors can be corrected, or at the very least, so that the record will show the facts in dispute. Present law provides a way of correcting errors and noting differences of opinion concerning facts, but it explicitly bars disclosure of medical information.

The other major amendments to the FCRA would:

1. Authorize a consumer to inspect his credit file directly; now, all the credit information reporting agency has to do is provide an oral summary.
2. Require a credit grantor to tell a consumer in writing why his credit application was rejected. The applicant would also be entitled to a copy of the adverse report. Now, all he gets is an identification of the investigating agency.
3. Force the credit grantor to get a consumer's permission before investigating him. This isn't necessary under the present FCRA. The agency would also have to describe the scope of the inquiry in much greater detail.

Wall Street

The SEC and Stock Quotation Services: Will Commercial Dp Now be Regulated?

Dp firms that market stock market information would be tightly regulated by the Securities and Exchange Commission (SEC) under a bill introduced by Sen. Harrison Williams of New Jersey. Hearings are "likely" before the end of this year, said an aide to the senator who added that representatives of firms dealing in computerized securities information will be among the witnesses.

Meanwhile, efforts to establish a consolidated last-sale tape were moving forward, albeit slowly. The tape is significant because it represents the first major step in development of a "national market system" capable of reporting quotation and sales information on all listed securities to all interested parties via an integrated, computerized data communications network (see April, p. 108).

Key provision of the Williams bill, S 2519, is section 11A, which requires "securities information processors" to register with the SEC in order to do business. The registration statement would include "such information and documents as the commission . . . may prescribe" with regard to performance capability, "collection, processing, distribution, and publication" of securities quotation and transaction information, financial condition, personal qualifications, and other "germane" matters.

Within 90 days after the statement is filed, says the bill, the commission must either approve it or "institute further proceedings to determine whether the application should be denied." These proceedings must be completed within another 90 days. The bill requires approval unless the SEC "finds that the . . . processor is unable to assure the prompt, accurate, and reliable performance of its functions."

Section 11A also empowers the commission to revoke a registration, or suspend it for up to 12 months. In addition, the agency is made responsible for "the form and content" of quotation/transaction information distributed by processors; for assuring that "current, accurate, and informative" data is supplied; and for allocating—among exchanges, securities associations, and processors—the costs, functions, and responsibilities associated with distribution of securities information. Section 11A requires the commission to prescribe, in each of these cases, "such rules as it deems necessary or appropriate in the public interest, or for the protection of investors."

Regulating dp

Industry sources who were asked to comment on the bill noted that, if enacted, it will, for the first time, make commercial dp subject to federal regulation. None of these sources had seen the bill, and declined to say any more.

The Williams bill grows out of a lengthy study, completed last February, by a Senate banking subcommittee. The subcommittee said, among other things, that the present system of marketing securities must be improved so that buyers and sellers can analyze prices in all markets before deciding where to do business. Three other bills were drafted earlier, as a result of the report: S 470 regulates activities of stock exchanges' members; S 2058 regulates clearing agencies and transfer agents; and S 2234 provides for public disclosure of securities transactions involving institutional investors. Taken together, the four bills "constitute the most substantial and significant revision of the . . . Securities Exchange Act of 1934 ever undertaken by Congress," Sen. Williams said in a recent Floor speech.

S 470 and S 2058 have already passed the Senate, and hearings are underway on S 2234. In the House, the major securities market bill is HR 5050, authored by Rep. John Moss of California. It calls for establishment of a national market system by Feb. 1, 1975, but doesn't include any provisions for registering and supervising securities information processors. A final version of HR 5050 was being drafted last month by a House Commerce subcommittee.

While Congress proposes, the SEC disposes—or at least it's trying to.

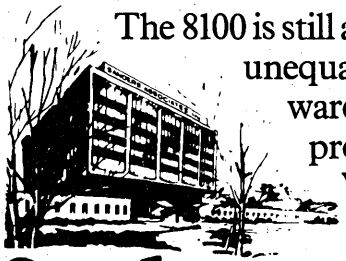
Chief focus of the commission's activity at the moment is a plan, drafted by a consortium of securities traders, for distributing a consolidated ticker tape which would report sales of the most heavily traded securities in all the major markets. The drafters included the New York (NYSE) and American (AMEX) exchanges, plus the National Association of Securities Dealers (NASD), representing the over-the-counter market. The tape would be produced by the Securities Information Automation Corporation (SIAC), a service bureau established last year by NYSE and AMEX, and the venture would be managed by the Consolidated Tape Association (CTA), a corporation formed by the exchanges and dealers who drafted the plan.

SEC reviewed the plan and suggested several changes: It thought securities information vendors should receive "last-sale" information via a high-speed communications channel, in addition to a ticker tape channel, so their data input and output would not suffer if the tape failed to keep up with trading activity. Also, the commission objected to giving the exchanges final control over the terminals used by customers of independent securities information vendors—firms like Bunker Ramo, Ultronics, and Scantlin. "We should have this control," the commission said in effect. Underlying its recommendation is a quiet but intense competitive struggle between independent securities information vendors and the New York and American exchanges.

The exchanges market their own ticker tape services directly to end users, and consider the independents as competitors. So NYSE and AMEX have an incentive to look for a competitive advantage wherever they can find one.

The Sanders 8100 Remote Batch Terminal System can promote savings from all angles. It has exceptional remote-site data entry capabilities in a cost-affective hardware/software package.

The programmable, clustered 8100 system (up to 4 CRT's) offers 5-megabyte disk storage, source-document screen formatting, broad error-checking and editing and Sanders-supplied software for complete system integration. It eliminates card-punch operations, reduces CPU line charges. It simplifies, controls, standardizes and improves turnaround time.



The 8100 is still another answer from Sanders technology rooted in unequalled terminal-industry experience. We have the hardware, the software, the maintenance support — and the proven reliability. Sanders Data Systems, Inc., Daniel Webster Highway-South, Nashua, N.H. 03060. Call (603) 885-3727.

Sanders...the intelligent answer

European Sales Offices: Sanders Data Systems, Ltd., 51/53 Brick Street, London W1Y 7DU, England; Sanders Data Systems, GmbH, 6 Frankfurt am Niederrad, Rennbahnstrasse 72/74, West Germany.

The consolidated tape plan provides an opportunity because it will require modification of many existing crt terminals to permit identification of the market in which a particular transaction occurs. One solution is for the user to key in the market he wants. Another, much more difficult way is for the terminal to generate the ID automatically.

Perfectly clear?

The exchanges are likely to insist on the latter scheme. But the SEC apparently is trying to foil this maneuver by insisting that the commission should have final jurisdiction over terminal acceptance. To make its position perfectly clear, the commission recently "interpreted" one of the system requirements originally given to developers of the composite tape plan.

Initially, they were told that the terminals, in displaying last sale reports, would have to "identify the marketplace where such transaction was executed." The interpretation says that a terminal "will be deemed to comply" with this requirement if it displays the last sale of any given security in any market, regardless of whether the market is identified, and if, in addition, the terminal can display the last sale price of a security in a particular market "upon specific inquiry for each market center's last sale information as to that security."

Other changes recommended by SEC would give it more control over amendments to the consolidated tape plan, and over system specs in general; also, independent vendors would be able to retransmit consolidated last sale prices on a continuous basis, so long as they didn't output a moving ticker display. The plan, as originally submitted, called for a total ban on such retransmissions. "This language could be interpreted to preclude retransmission for 'monitoring' services, to satellite computers for interrogation purposes, and for other valid uses," observed the SEC, although we doubt that such a broad construction of the prohibition was ever intended." Some sources, however, aren't so sanguine; they suspect the retransmission ban represents another attempt by the exchanges to curb outside competition.

At press time, an SEC spokesman said he was "hopeful" the commission would approve the consolidated tape plan, with changes, "within a couple of weeks." CTA members had said earlier they would begin transmitting 20 weeks after receiving the SEC's blessing.

Meanwhile, waiting in the wings is another securities automation project. This one, proposed by the SEC in March '72, would require all the exchanges, plus NASD, to set up a consolidated securities quotation system. However, according to a knowledgeable source, the commission won't push this proposal until the consolidated last sale tape is operating.

—Phil Hirsch

Communications

FCC Rules: Ma Bell Must Close the Loops

Microwave Communications, Inc., (MCI) won a major victory last month against Ma Bell.

The FCC, in a letter signed by Chairman Dean Burch and approved by a 6-0 vote of the members (one commissioner was absent), told the phone company to provide local loop facilities to the specialized carriers without delay.

Bell has been "deferring" MCI's local loop orders for the past several months in several cities, claiming that it first had to file state tariffs and get them approved. MCI argued that this was just an excuse by the phone company to stave off competition as long as possible.

The commission, in last month's letter, flatly rejected Bell's argument, saying prior FCC decisions have clearly established that all tariffs for interstate facilities must be filed at the federal level. This applies to tariffs covering facilities located wholly within a state which are used partly for intrastate service—e.g. local loops. The commission added that Bell can file state tariffs for such facilities if it wants to, but can't legally delay making local loops available to specialized carriers until the state tariffs are approved. Nor can Bell stall while its FCC tariff applications are being processed: "Until such tariffs are filed and effective, there should be no delay in honoring requests of specialized carriers for interconnection facilities required . . . to terminate the services they are authorized . . . to furnish. Such facilities can be provided under contracts on an interim basis and we assume this will be done," said Burch and his fellow commissioners.

On the same day the FCC letter was issued, AT&T filed two petitions with the commission: one, consisting of 39 pages plus several exhibits, asked the commissioners to reevaluate their 1971 decision allowing wholesale entry of specialized carriers into the private line market; the other opposed ITT's recently-announced plan to offer specialized service between NYC and Houston via Atlanta, through a subsidiary called United States Transmission Systems, Inc.

No new markets

A key point underlying both petitions is the assertion that the FCC, in 1971, clearly assumed the new carriers would tap undeveloped communications markets. This hasn't happened, AT&T insisted; rather, "the majority of specialized common carriers are offering and promoting, over selected routes, voicegrade private line channels essentially the same as those the Bell system has provided for many years."

Bell insisted this competition is diverting significant revenue from the established carriers, which inevitably will raise rates for telephone users, intrastate as well as interstate, and particularly those on low-density, sparsely-populated routes. The only beneficiaries, the company argued, will be "a few large customers (who) can enjoy lower rates at the expense of the vast majority of telephone users."

By 1976, Bell estimated it would suffer a "potential" loss of $250 million from specialized carrier competition. This estimate apparently was based largely on AT&T's experience in competing with MCI between Chicago and St. Louis.

"Since beginning operation, MCI has taken almost 60% of the Bell system two-point voicegrade and telegraph private line market between premises in Chicago and St. Louis," said the petition. ". . . The limited experience of N-Triple-C on its Chicago-Omaha route indicates that it also is merely providing substitutes for existing Bell system services."

—P.H.

Education

APL for Teachers . . . With 16-22K Bytes!

Mers Kutt has gotten his wish. The former professor of computer science at Queen's Univ. (Kingston, Ontario), and president of the Canadian Information Processing Society has been looking around for a "radical new product" to bring to the edp field since leaving Consolidated Computer, Inc., where he served as entrepreneur-developer and initial president of one of the first data entry firms.

The MCM/70 he and his all-Canadian team at Micro Computer Ma-

We talk terms

When you're in the market for 360/370 add-on memory, you're not just looking for a piece of equipment. You're looking for the solution to a problem. That solution has to make as much sense in terms of cost, lease commitments, and site support as it does in equipment performance. That's why we tailor our terms to meet your needs.

Why EMM? Let's start with *experience.* EMM is one of the world's largest independent memory manufacturers. Most of the mainframe computer companies use our memory systems or components.

Our *technology* goes right down to basics. We manufacture our own cores. Design and build our own stacks and system modules. Add the electronics for the total memory. And give them all the same degree of manufacturing control that put us on the Apollo program. EMM is the only independent memory company to receive IBM approval for 360/65 CPU maintenance when add-on memory over 1 megabyte is installed.

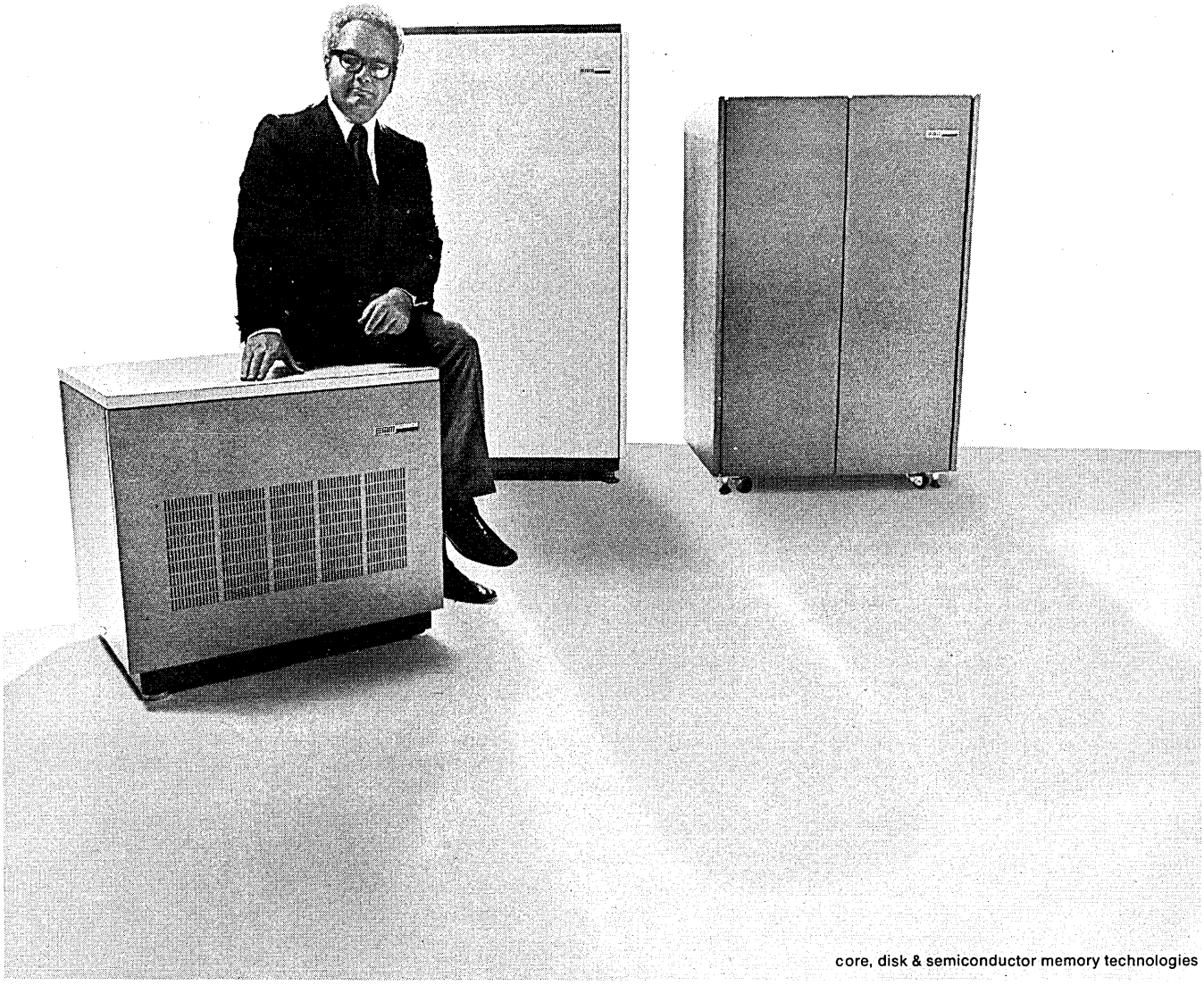
We have the *stability* of a major company committed to the memory market. We'll be around tomorrow and a lot more tomorrows to come.

But the main reason for our success has been *satisfied customers.* Satisfied with terms as well as performance.

If you're interested in 360 or 370 compatible memory, call Dick Bravo at (213) 644-9881, or contact our nearest office.

We'll talk terms.

EMM COMPUTER PRODUCTS
A Division of Electronic Memories & Magnetics Corporation
12621 Chadron Avenue, Hawthorne, Ca 90250

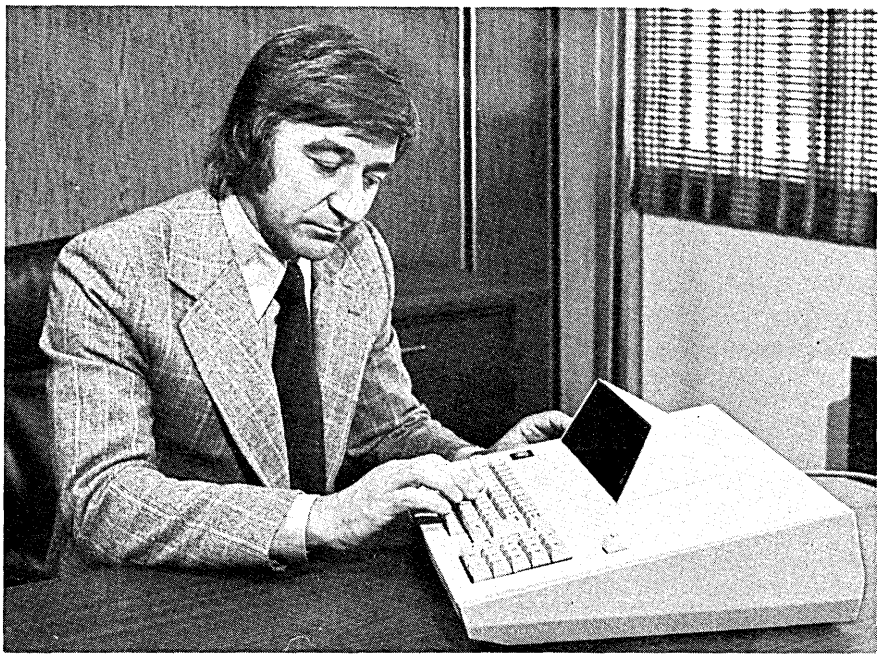


core, disk & semiconductor memory technologies

chines, Inc., has developed certainly seems to qualify as a radical new product. It is a portable typewriter-size computer with built-in display unit designed specifically to run the APL language, and priced at only $3,500 complete with 16K bytes of memory. MOS/LSI circuitry is used extensively in the MCM/70, including an MOS memory that runs at approximately 1 usec speed, yet draws so little power that battery operation for up to two hours is offered as an option. The basic unit comes with a plug for standard wall outlet operation.

If the MCM/70 sounds like an overgrown calculator, forget it. Though the basic 16K unit contains only 2K of user-programmable storage (which can be expanded up to 8K), users familiar with APL can tell you that one of the beauties of the language is that common operations such as averaging and sorting numbers are accomplished with single commands, instead of the 15-20 statement subroutines required in languages like COBOL and FORTRAN. Portable (20 lbs.) models of the MCM/70 line can also be equipped with 150K bytes of virtual memory running from a Philips-type cassette drive, while intelligent terminal configurations are offered with a variety of supporting peripherals, including floppy disc stores, impact printers, crt displays, card readers, etc. A plasma display on the MCM/70 can represent either 32 characters of output, or input coming through the 46-key IBM 2741-type keyboard.

Kutt is in the process of subcontracting manufacturing for the new product line, aiming for mid-1974 deliveries. At the same time he is traveling from Toronto to Europe in an effort to set up exclusive distribution arrangements with major firms in individual countries. In the U.S. market, Kutt plans to either distribute the product on a similar basis by region, or possibly by specific market. Kutt thinks the natural markets for the machine range from desk top applications in business, engineering, insurance, and chartered accountancy, to being the primary computational tool in very small (micro?) businesses—a market he couldn't pin a size on, preferring to say it's gigantic. But it's likely that the primary marketing thrust will be in education, where APL is highly regarded and enthusiastically taught. Micro Computer Machines will be telling schools that the typical cost per student hour of computer time with the MCM/70 is 25¢, compared with charges approaching $25/hour for time-sharing systems. Those figures might well make the MCM/70 the "APL" of any teacher's eye!



MERS KUTT AND THE MCM/70: APL for 25 cents an hour.

Benchmarks

Rent Increase: IBM's rental revenues are beginning to soar again after a somewhat lackluster performance in 1972 when many 370 customers began buying instead of renting equipment. Its revenue from rentals and services have soared 14.2% in the first nine months of 1973, compared with a 9.2% increase for all of 1972. And it's

We're capable of anything. To help your computers do everything.

The Communications and Terminals Division of Sperry Univac specializes in developing total communications systems.

And it doesn't matter whether your mainframe comes from Sperry Univac or anybody else you can name.

It doesn't matter whether your communications requirements are room-to-room, plant-to-plant or nationwide.

It doesn't matter how you want to communicate. Or how fast you want to communicate.

What does matter is the experience, equipment and worldwide service organization we can offer you.

Beginning with the UNIVAC® 3760 communications controller, your system builds. With the UNISCOPE® 100 display terminal, the DCT 500 keyboard-printer, the DCT 1000 remote-batch terminal, 610 tape cassette, card readers, paper tape equipment, etc.

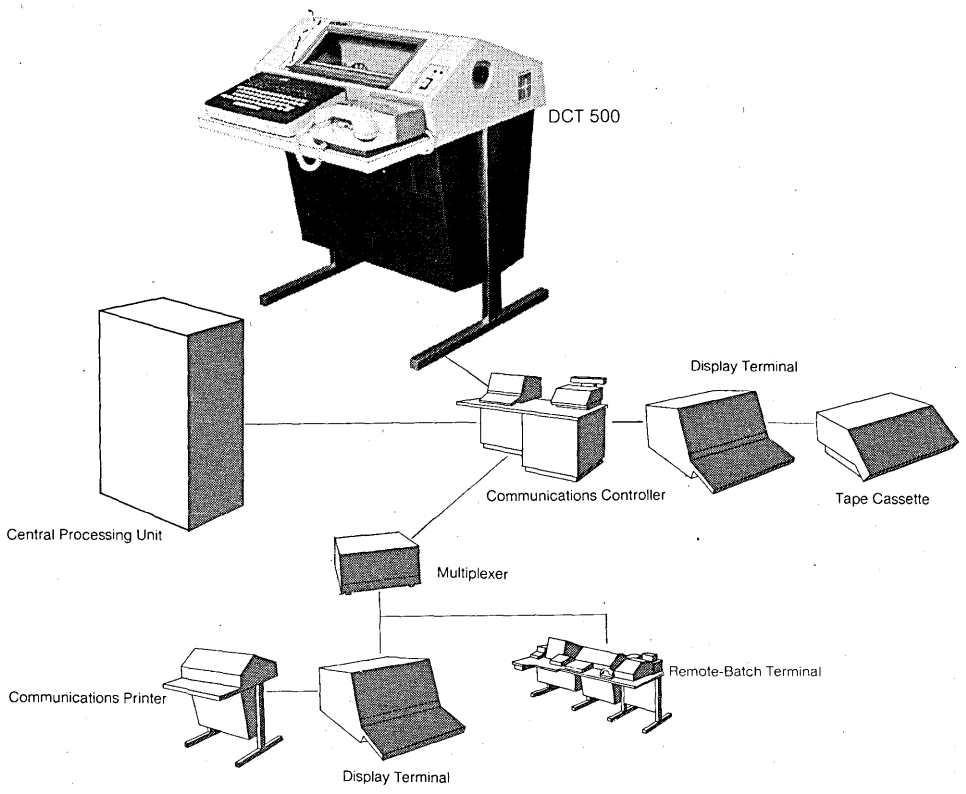
The result is a complete, flexible data communications system compatible with your computer.

All with the assurance of high-performance equipment.

The UNIVAC DCT 500 data communications terminal, for example, has 30 cps, 132 print positions, computer-quality print-out, up to 6-part use. It's one of the most wanted hard copy terminals in the industry.

For a brochure on our total systems capability, contact the Sperry Univac representative in your area.

Or call free 800-453-5323.



COMMUNICATIONS AND TERMINALS DIVISION

SPERRY+UNIVAC

Only when our customers succeed do we succeed.

SPERRY UNIVAC IS A DIVISION OF SPERRY RAND CORPORATION

been gaining at a rate of about 2% a quarter all year. The company set a record in third quarter profits of $409.9 million, pushing its total net for the first nine months up by 18% to a record $1.11 billion. Its revenue for the third quarter totaled $2.76 billion and for the first nine months, $7.75 billion.

Burroughs' earnings for the nine months rose 35% to a record $66 million (which included $2.4 million received from the sale of securities) on revenues of $895 million, a 24% increase. Control Data Corp.'s earnings in the first nine months increased to $45.6 million from $43.8 million the year before, but its third quarter earnings dropped to $13 million from $16 million the year before. CDC's revenues soared in the first nine months to $661 million over the $466 million reported the year before. This was due, however, to the operations of Service Bureau Corp. which it acquired in January from IBM in the settlement of its antitrust suit against IBM.

Loose Ends: The Equitable Life Assurance Society and Informatics, Inc., the Canoga Park, Calif., software company were close to signing a deal for the insurance company to acquire Informatics for about $12 million. The companies already operate a joint venture computer services operation called Equimatics. Computer Machinery Corp. signed the final papers in its acquisition of Cipher Data which supplies the key-to-disc maker with tape drives. Collins Radio Co. called a special shareholders meeting early this month to ratify its merger into Rockwell International Corp., already approved by directors.

Health Care Plumb: An $8.9 billion/year plan for the federal government to supplement health care benefits for victims of long-term illness will make health care dp a much bigger business. The "Catastrophic Health Insurance and Medical Assistance Act of 1973" (S 2513) has been introduced by Sen. Russell B. Long of Louisiana and Sen. Abe Ribicoff of Connecticut. If passed, the program would be administered the same way as Medicare and Medicaid—i.e. through insurance carriers and such fiscal intermediaries as Blue Cross who would be supervised by the Social Security Administration and who presumably would subcontract their claims processing work to private dp firms. Electronic Data Systems, Wyly Corp.'s UCC, and McDonnell Douglas are among the companies now processing Medicare/Medicaid claims.

Peripherals Outlook: The government is becoming a major factor in the well-being of peripheral manufacturers. Frost & Sullivan, Inc., the market research firm, says 1973 sales of peripherals to the federal government will rise 6% to $300 million and climb to $385 million by 1976, as government buyers turn more and more to independent suppliers for products to extend the life of present equipment. The study predicts the government will triple its use of data entry devices by 1979. It also finds that output peripherals comprise "the least dynamic peripheral category" for sale to the government. It notes that computer-microfilm, slowly gaining ground, may take the lead in sales over line printers in the 1980's. Sales of storage peripherals (tape, drum, disc and core and semiconductor memory) account for 60% of the total sales value of government peripheral purchases, but will drop to the 50% range during the latter part of the 70's. □

Hardware

Off-line

We asked Microdata Corp. the obvious question regarding the decision to name its new minicomputer system REALITY: did the idea come from IBM's recent advertising message--"Not Just Data, Reality"--and were told that it did. When reminded that IBM recently scrapped the reality slogan in favor of "Think of the Computer as Energy..." a public relations spokesman quipped, "Well, there's always next system!"

Another big semiconductor house has gone into the retail pocket calculator business. National Semiconductor joins Texas Instruments in being able to manufacture and sell calculators at prices so low that they may wipe out smaller manufacturers that must come to these--or similar companies --for the chips necessary to make their own products. NS Electronics' first product features mixed or chained calculations, automatic summing and squaring for six-digit numbers. The unit is scheduled to be available in time for Christmas from approximately 50 department store chains for $39.95.

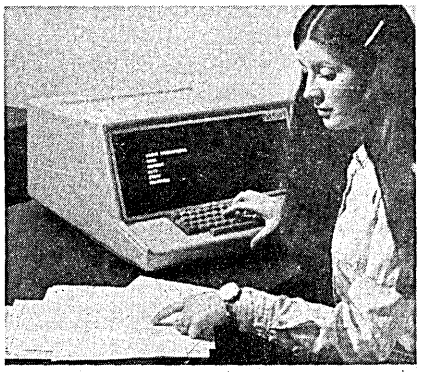
A computer tape capable of withstanding temperatures as high as 400°F. and as low as -65°F. has been developed by Graham Magnetics, Inc., Graham, Texas. It will be available in quarter- and half-inch widths and lengths up to 1000 feet for digital and analog recording. The tape uses a special binder said to be highly resistant to temperature, wear, radiation, and many chemicals.

The VIP-100 speech recognition system developed by Threshold Technology, Inc., Cinnaminson, N.J., has been selected by Industrial Research magazine as one of the 100 most significant new products of 1973. The system, which is tuned to individual speakers' voice patterns, has thus far been used in supermarket checkout and airline baggage routing applications.

Intelligent Display

Adding a programmable processor to a crt terminal makes it into something that is not exactly a terminal. For instance, the Dasyn 101 will become a key-to-disc or key-to-tape data collection system, or a media conversion system (tape to print, etc.) on demand. It can be connected to up to 10 peripherals, and could operate off-line its whole lifetime.

The terminal has its own programming language, 4KB of read/write memory, and 4KB of read-only memory. It can be ordered with either a 9-



inch or 12-inch crt for showing either 256-character or 512-character pages. With either display size, four pages of display reside in the buffer and paging through them is automatic.

The screen can show variable intensity, blinking, and reversed fields, and field definitions are user-programmable. (Field validity and range checking come as a by-product of the built-in processor.)

The company has adopted an unusually flexible method of supporting its customers' changing needs. Peripherals that are outgrown can be traded in on others. In addition, the first production units will come with erasable ROMs so that installed units can be retrofitted if the vendor adds new features or program improvements; that will take much of the risk out of being a pioneer.

First deliveries are slated for early 1974. Prices start at $3,950 plus peripherals. DASYN INTERNATIONAL, INC., Santa Ana, Calif.

FOR DATA CIRCLE 260 ON READER CARD

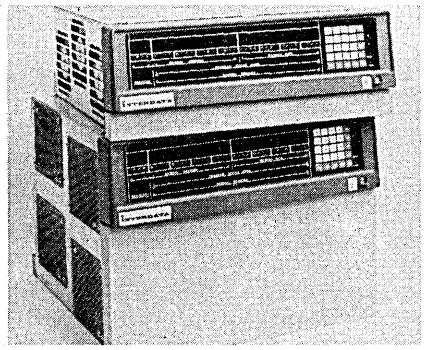
Large-scale Mini

Not long ago, computers with 32-bit word sizes were called medium-scale machines; they were sold to end-users and had medium-size price tags. The Interdata 7/32 confuses all of that. It will be sold as an oem system component, will compete with 16-bitters like the Digital Equipment PDP-11, will be downward compatible with 16-bit machines, and will cost less than $6,000 if you buy 100. To further blur the distinction between medium size and mini, the 7/32 has a 16-bit counterpart, and that smaller cpu can be upgraded to the larger word size.

The 7/32 has been built for applications where large memories are required, and its first advantage over large-memory 16-bit machines will be its ability to directly address all of its core (up to one megabyte). Other hardware features include byte, halfword, and full-word addressing, 2.6MB direct memory access channels, a 300KB multiplexor channel, 32 registers, 1,536 words of 60-nsec ROM, plus a choice of 750-nsec or 1-usec core modules. An optional display panel that reads out in hexadecimal rather than binary will be appreciated by users even at $300 extra.

A single-thread operating system will be ready for deliveries of the first units in the second quarter of 1974, and a multiprogramming monitor will be ready by late next year. Unbundled software includes FORTRAN V, BASIC, and a text editor.

At $9,950 for a single unit, the 7/32 is down there with the least of them, but if the price is still too much, a buyer can take half of the machine for $3,200 and end up with 7/16 as a model designation and only a 16-bit



word. (The 7/16 can then later be field-upgraded for $5K.)

The smaller system comes with 2MB direct memory access channels, a 66KB multiplexor, 8KB to 64KB of core, 768 words of ROM, and a good deal more software than is ready for the large machine. (Software includes four operating systems, for instance, and two FORTRANS.) It will be available during the first quarter and sells for under $2,000 in quantities of 100.

Programs written for the 16-bitter can be run on the 7/32, as can programs for other Interdata machines. INTERDATA, Ocean Port, N.J.

FOR DATA CIRCLE 251 ON READER CARD

Custom Terminals

Sneaky RCA didn't go out of the dp business after all. At least one West Coast division that produced terminals for the computer div. stayed alive. This division has been quietly marketing an updated (refurbished) version of RCA's crt terminal for over nine months, and has announced three other models.

Including the first, little-touted Model I crt, there are now four models in the Flexiterm line. Model II is an intelligent display with a 12-inch tube. It shows up to 24 lines of 80 characters using upper case ASCII symbols, and has the facilities to establish protected fields, show reversed characters (light on dark), or blinking characters. Its imbedded 16-bit RCA microprocessor enables it to perform validity checks and range checks, as well as to emulate other devices like IBM's 2260 and 3275.

Model III is designed as a transaction terminal. It has a five-inch screen that can show up to 16 lines of 40 characters (although eight lines are much more readable), a 50-column printer, and a reader for embossed cards.

Model IV is a configuration of the III, with a line printer replacing the other peripherals.

None of these terminals are being pitched as general purpose devices. They are offered as custom solutions to specific applications and will be delivered to customers with individualized keyboards and tailored programming (programming that the end user is expected not to modify). Prices range from $5,000 to $6,800. RCA CUSTOM TERMINAL SYSTEMS, Van Nuys, Calif.

FOR DATA CIRCLE 252 ON READER CARD

Computer for the Masses

This is to serve notice that Reality has come to the data processing environment. And it's trade-marked too. Taking a cue from IBM's massive advertising campaign, Microdata has named its newest computer product just that, "Reality." In this case, reality takes the form of a 16KB-64KB miniprocessor from the firm's 1600 series which has been firmware-tuned to support display terminals in commercial applications.

A break from the company's normal mode of operation, Reality is not compatible with the firm's other machines' software. It has its own virtual memory operating system which can support up to 32 on-line users using a 40MB disc as the backing store. The architecture has been biased toward character handling and character string handling, so the product will be used in accounting, billing, and inquiry response systems.

The machine's programming language has been carefully structured to resemble our own everyday language. It's called ENGLISH. (Watch how you use that term from now on; it has been trade-marked too.)

At this point the seriousness starts. For all the screwiness the company displayed in naming its product and that product's language, the resulting system makes good sense. For example, how well-received will a system be that can respond to a command like "sort personnel by name," or "sort personnel by length of service"? Very well-received, we expect.

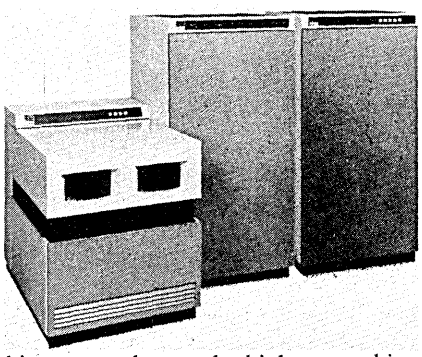
ENGLISH (TM) includes verbs like "list," "sort," "count," and "total"; connectors like "with," "only," "each," "in," and "every"; plus nouns for file names, Boolean operators, and synonyms. The synonym feature makes it possible to refer to a single file by many names, to change the names of things, and to invent names for attributes of things. And the memory manager keeps it all straight, reportedly. Data on people can be referred to by their badge number, clock number, or name, and updating any one of those things doesn't interfere with their relationships.

Those folks who cannot stand to

product spotlight

Mass Storage System

Taking IBM's technology a step further, this vendor has developed a fixed-media oversize counterpart of the IBM 3330. Retaining compatibility with that subsystem's interface, the company has built clusters of drives with

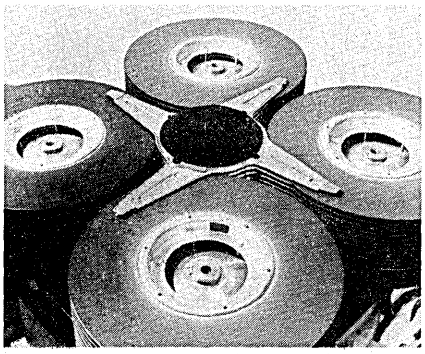


bigger packs and higher packing densities.

The system is called the 8000 Series. Its basic component, the 8800, is a four-pack drive cluster that shares the mechanism for positioning read/write heads. Four drives are pushed together in one. The read/write heads for each are at the ends of a mechanism that looks like a four-bladed airplane propeller. There is a separate "propeller" for each side of each platter of each disc pack. This means that when one seek is being made on one platter, three other read/write heads track with the one being used. The concept seems extremely inefficient at first, but the machine compensates by reading up to 1500KB on each seek (equivalent to six cylinders' worth on a 3330).

Each disc pack has 16 discs; 29 sides for data, one for timing, and two spares. That's half again as many usable surfaces as there are on a 3336 11-disc pack. Data is recorded at 4040 bpi with 250 tracks/inch. This leads to 200MB per pack just like IBM's new 3330-11.

Each drive can have two channels, and the drive controller (called the 8000) can be connected to four computer channels, adding to the configuration flexibility. Each controller can support up to eight of the four-spindle clusters, for a total of 6.4 billion bytes of on-line store. (There is also a disc model called the 8400 which provides exactly half the storage per drive. The



full-capacity drive is the 8800.)

Fixed-media drives seem too limiting, but the vendor explained that statistically, for every disc pack drive in use today there are only one and one quarter packs, suggesting that people use disc drives as fixed-media devices anyway.

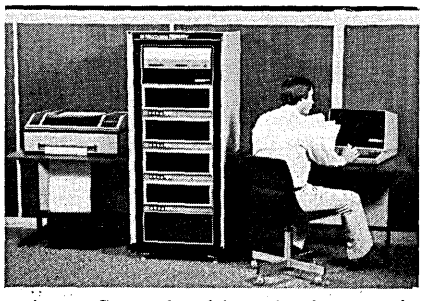
In operation the 8000s are much like the 3330s. The transfer rate is 806KB, average access time is 27 msec, and the position sensing performed is just like IBM's.

Lease prices will run in the ballpark of $1,000/month for the half-density drive cluster, $1,600/month for the 800MB four-drive cluster, and $1,500/month for the controller. A 3.2 billion byte configuration (16 spindles and a controller) will sell for something under $500K, about $100K less than IBM's price for equivalent removable-pack storage before the price of the removable packs is added. STORAGE TECHNOLOGY CORP., Louisville, Colo.

FOR DATA CIRCLE 250 ON READER CARD

talk to a computer in English are free to use RPG II (a version which is claimed to be perfectly compatible with IBM's).

There are two more twists. First, the system is being offered to oem's and not to end-users. Presumably the oem's will tailor the system to specific appli-



cations. Second, although the terminals are expected to be remote from the cpu, the line printer is near the cpu. This seems a little out of place except for short-answer inquiry response applications.

With a single crt, the system will sell for $49,950 before oem mark-up. Three more crt's can be added without building up the rest of the hardware. MICRODATA CORP., Irvine, Calif.

FOR DATA CIRCLE 254 ON READER CARD

370/145 Add-on Memory

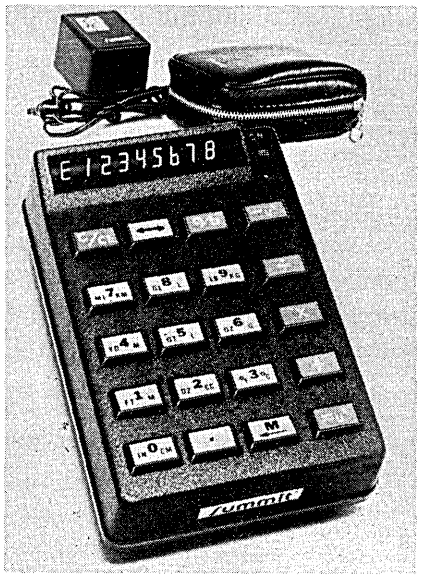
Memory failures are transient and seldom happen twice in succession (which is what gives customer engineers high blood pressure). These 145 memories are organized so that a failure on a single card only affects one bit in any of the memory words—and this one-bit failure can be righted by memory error correction logic.

Memories are offered above the 160K byte minimum. One popular 145 upgrade is to take a Model GE with 160K up to a model I with 512K. The purchase price for this amount is $155,064 or $3,560/month on a two-year lease, including 24-hour-a-day maintenance. Maintenance is performed by the vendor's own personnel. The initial check-out installation has been running two months, it's claimed, and 30-60 days ARO is being quoted for delivery times. CIG COMPUTER PRODUCTS, INC., Stamford, Conn.

FOR DATA CIRCLE 255 ON READER CARD

Metric Converter

The Metric Conversion Computer can run 36 programs for converting between U.S. units like miles, pounds, and yards and their metric equivalents, or for converting between Fahrenheit and Centigrade temperatures, or for converting between square and cubic measurements in the U.S. and metric systems. The unit has an eight-digit display plus an overflow indicator, can run off rechargeable batteries or wall current, and weighs only eight and a quarter ounces (they didn't say what



that was in grams). Although it can be used as a five-function calculator, its $169.95 price precludes its being sold for that purpose alone now that calculators can be had for less than $50. SUMMIT INTERNATIONAL CORP., Salt Lake City, Utah.

FOR DATA CIRCLE 253 ON READER CARD

Display Cluster

The 700 is one of the least expensive display clusters we have seen; starting at $5,600 for two crt's and a shared controller, or four crt's and controller for $8,100. The device has all the usual features, including a 1920-character display capacity on a 12-inch screen, 5 x 7 dot matrix ASCII symbols, and cursor controls. A 525-line raster scan is used, and the display is refreshed from the terminal's buffer rather than from the controller.

The separate controller provides the line interface (to 9600 baud on asynchronous or synchronous full- or half-duplex phone links), and understands codes like ASCII, BCD, and EBCDIC. Its built-in microprocessor knows 29 instructions and can do them in 4-20 usec. In stock form it has 4KB of mixed read-only memory and programmable read-only memory, which can be expanded to nearly 64KB.

General purpose applications software has not yet been developed, although IBM 3270 compatibility is eventually intended. It is expected that most of the units will be operating on fixed applications in banking, consumer finance, and the airline industry.

Deliveries are being quoted as three to four months. DATA MEASUREMENTS CORP., Santa Clara, Calif.

FOR DATA CIRCLE 257 ON READER CARD

Tape Cartridge Terminal

The TCT 300 looks like a simple-minded tape cartridge peripheral, but its built-in microprocessor makes it operate something like a text editor. It allows for inserting characters and replacing characters, performs its own block parity error checking and auto-

matic retransmission, and even performs searches for strings of up to 16 characters.

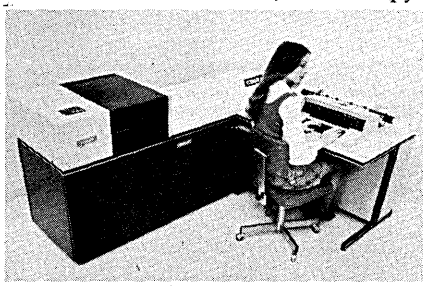
The 300 uses 256-character records and is double-buffered. Its RS232 interface can be used at rates to 2400 baud. 3M's half-inch tape cartridge is used with 1600 bpi recording. Priced at "just over" $3,000, models stripped of the text editing and error correction features can be bought for $1,780. THREE PHOENIX CO., Phoenix, Ariz.

FOR DATA CIRCLE 256 ON READER CARD

Disc Billing System

Accounting machines did not run away and hide when IBM introduced its System/3. In fact, they are alive and well and living in many small installations where the /3 wasn't even invited. One of the advantages they still hold over the more general purpose computers is ease of start-up. In two weeks a customer can supposedly run his own tailored order entry, invoicing, accounts receivable, inventory, or sales analysis; and he isn't forced to learn very much in the process or to hire even a single computer-savvy staff member.

The 6800 is one such system. It offers up to 30K characters of storage, fixed and removable discs, a hard-copy



workstation and optional crt and line printer. The system sells for under $30K with a 20K processor, and for under $40K with the crt and line printer. Unbundled software, tailored at ex-

tra cost, runs about $1,200 per package (general ledger, general accounting, or payroll) except for a $3,900 multiple-package set for sales accounting (including invoicing or order entry, accounts receivable, inventory, and sales analysis). Most packages can run in a tutorial or a production mode.

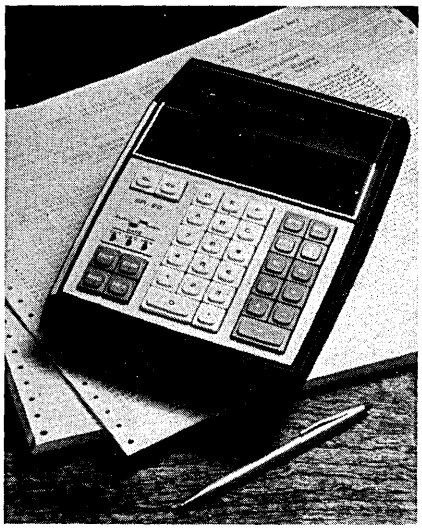
Singer adds one benefit that IBM has not gotten around to: the 6800 is upwards compatible with the System Ten. Also, the 6800 can be configured with two workstations; its operating system can multiprogram; and there is no designed-in limitation on the number of workstations that might be added in the future. SINGER BUSINESS MACHINES DIV., San Leandro, Calif.

FOR DATA CIRCLE 258 ON READER CARD

Hex/Octal/Decimal Calculator

Only in the last two years have we seen advances in circuit design technology that permitted powerful calculators to be designed into pocket-size packages. Now we are seeing very special-purpose designs surfacing. The SR-22 calculator is probably most useful to systems analysts in IBM shops, as it is basically a hexadecimal organized calculator that can be used to calculate addresses in hex, octal, and decimal equivalents. The SR-22 is also a standard four-function calculator for performing those operations in any of the three number bases.

MOS/LSI circuitry performs the computations and drives the 14-digit



display (10-digit mantissa, two signs, and a two-digit exponent). One nice standard feature is that the SR-22 can be permanently mounted so that someone doesn't get so carried away with it that *it* gets carried away (it measures 6¼ x 8¼ x 2⅜). The calculator can also be obtained with a battery operation feature. The SR-22 has been priced at $350. TEXAS INSTRUMENTS INC., Dallas, Texas.

FOR DATA CIRCLE 262 ON READER CARD

Cartridge Program Loader

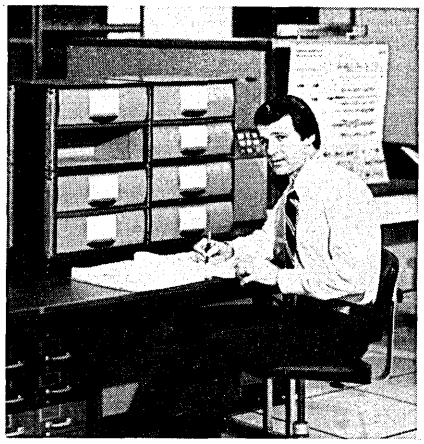
This cartridge tape drive for the PDP-11 can be used as a stock peripheral, but will primarily be used as an engineering tool. It mounts on a slide in a rack so that the user can have access to the read-only memory, which is removable. ROM is provided so that the tape can be used to bootstrap the cpu, with a second ROM for dumping the contents of memory onto tape. The tape holds up to 55K 16-bit words but bootstrapping covers only 8KB.

The peripheral runs at 300 cps reading and will compete primarily with high-speed paper tape devices. Software read/write drivers are included in its price of $2,450, and maintenance is offered through the mails. APPLIED DATA COMMUNICATIONS, Tustin, Calif.

FOR DATA CIRCLE 263 ON READER CARD

Printout Storage

The Data-Pak 617 provides a convenient medium for storing nylon post binders, as it makes each bundle of printout available individually (rather



than forcing you to slide one out from underneath others). The storage unit includes the binders, which are four and three quarter inches across the spine and can hold 12,000 sheets, plus the self-stacking reinforced corrugated fibreboard shelves. A module with eight binders costs $42.95.

A companion product without the metal frame can be purchased one binder's-worth at a time for $4.25; even without the frame these can be stacked three or four high using metal clips. Similar Data-Pak products are offered for storing cards, film, and unburst forms. BANKERS BOX/RECORDS STORAGE SYSTEMS, Franklin Park, Ill.
FOR DATA CIRCLE 261 ON READER CARD

Long Distance Interface

There are literally thousands of minicomputers hidden away on campuses and in labs monitoring or controlling processes and experiments. In many of these installations, data collected by the mini is hand-carried to a central data center for final reduction. The LLI-16 can put those mini's on-line if they are within 1,000 feet of the central site cpu. Similarly, it can connect any peripheral controller and cpu that are that close.

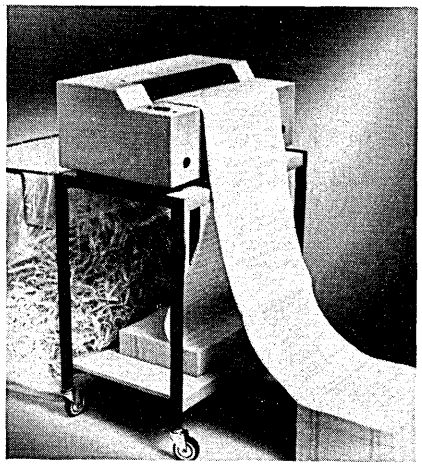
Basically a "smart cable," the product incorporates a 38-twisted pair cable with logic circuits for error checking and automatic retransmission. It provides two 16-bit plus parity data paths. Priced at $880 plus cabling, it terminates in rack-size cards. KANTRONICS, INC., Lawrence, Kan.
FOR DATA CIRCLE 259 ON READER CARD

Univac-compatible Drives

While the rest of the company gears up to go to court with IBM, someone back at the CalComp foundry is taking on Univac. CalComp offers alternatives to the Uniservo 20, 16C, 12C, VIIIC, and VIC, in an assortment of 200KC and 320KC 7- and 9-track drives. Touted as "low cost alternatives," six drives and controller sell for $125,700. CALCOMP COMPUTER PRODUCTS, INC., Anaheim, Calif.
FOR DATA CIRCLE 266 ON READER CARD

Wide-throat Shredder

Documents which are not destroyed immediately after use can later prove embarrassing. To avoid this possibility, the Model 46 is offered to installations which need to destroy lots of computer printout, fast. The machine shreds forms to 16 inches wide at a rate of 60 feet per minute. Fully loaded, it can gobble up 25-35 sheets of paper at once,



for a total ingestion of 1,000 pounds/hour.

It's a small unit, despite its appetite, and measures only 24 x 15 x 10 inches. Its carbon alloy blades are said not to need sharpening or lubrication, even when working on a diet of credit cards or metal offset plates. The 46 costs approximately $1600. CUMMINS-ALLISON CORP., Glenview, Ill.
FOR DATA CIRCLE 265 ON READER CARD

9000-lpm Printer

Xerox had the on-line xerographic page printer field to itself for only a short time. This product allows for printing computer output on untreated paper at rates to 9000 lpm, for reducing page sizes to 8½ x 11 inches while still displaying 132 columns, and for forms generation too. Called the Model II Non-Impact Printer, the device allows for printing up to 99 copies of any page, and offers a character set with 175 symbols. It is available with an interchangeable character set—for ASCII or EBCDIC codes—can print up to 160 characters per line, and buffers a full page at a time.

The device's ability to generate lines gives the user an alternative to using preprinted forms. Also, the stored forms image is not fixed; it can be loaded along with the data to be printed.

Its standard version will use ASCII and be available with interfaces for Data General, Digital Equipment, and Sigma computers. IBM-compatible models are expected. Priced at $27K plus options (both the multicopy feature and the 160-character line are optional), the II can be delivered in 90 days. UPPSTER CORP., Stamford, Conn.
FOR DATA CIRCLE 264 ON READER CARD

Software & Services

Updates

Smart shoppers for data base management systems will want to know about all possible sources of supply, and one that might easily be overlooked is the Integrated Data-base Management System (IDMS) developed by B.F. Goodrich. The package has recently been acquired and will be supported by Cullinane Corp., Boston, Mass. IDMS has a number of "name" users, including Boeing Computer Services, Western Electric, RCA, and others.

Members of the information science community--regardless of age, formal labels, or specialties--are urged to apply for travel grants to attend the International Federation for Information Processing (IFIP) in Stockholm next August. Qualified U.S. citizens whose accomplishments in and potential contributions to the field are most noteworthy can apply for a grant before Dec. 31 to the Math Division, National Research Council, Washington, DC 20418.

The U.S. Dept. of Commerce has computerized a data base containing sales leads filed from over 200 American embassies and consulates in 127 countries. Subscription rates for the service vary from $25-$125 (50-250 leads) and firms receive leads relevant only to their particular business interests. More information can be obtained from any Dept. of Commerce district office.

While on the subject of data base services, it should be noted that the market for these services will reach $700 million this year, climb to $1.1 billion by 1978, and hit $1.7 billion by 1983, according to a study just issued by Frost & Sullivan, a New York technological research organization. The firm has also developed some big numbers on the specialized communications market: a $1.45 billion business in '72 that will grow to $7.6 billion by 1980, with carriers purchasing more than $500 million in transmission equipment by that year.

CICS Reference Aid

A pocket-size card that contains definitions, formats, and schematic drawings of some of the more frequently referenced facilities in IBM's Customer Information and Control System is available from a firm that appears to be making the data base transaction monitor its specialty. The 10-panel accordion card contains such information as messages, dump codes, return codes, storage chains, and record formats for task, storage, program, interval, dump, file, transient, temporary storage, and trace control modules. An initial run of 2,000 of the reference cards was sold out, due in part to the pricing policy. The cards are free when ordered in any "reasonable" number. ONLINE SOFTWARE INC., Hackensack, N.J.

FOR DATA CIRCLE 231 ON READER CARD

Language Conversion

If your installation is among the large number that would like to move from a first- or second-generation computer to a more efficient third-generation system, but is hesitating because of the havoc that might be played with working software, perhaps you need some TACOS. The Tool for Automatic Conversion of Operational Software is a stack-oriented language processor that provides programming departments with the means for converting from one programming language to another. Equations are used to describe program constructs in the current language (say, Autocoder) and those of the target language (COBOL, for example). While it is true that many old computer programs weren't written in forms that can be described in equations, some undoubtedly were and could be processed under TACOS.

Among the specific capabilities that TACOS is billed as being good for are: manipulating textual strings, building symbol tables, converting text strings to and from binary representation, scanning arguments, parsing statements, defining syntax and semantics of input and output source languages, and conditionally altering/modifying sequences of statements. TACOS is written in DUAL—a machine independent language—and has been used to convert IBM 1130 application programs onto another manufacturer's 16-bit product line. The conversion software requires at least 90K bytes but ideally should have more than that, depending on the complexity of the programs being converted.

At $25K, TACOS isn't cheap—and such amenities as user documentation are non-existent; only technical documentation has been prepared. But some shrewd programming section looking for a way to convert a JOVIAL library into something more portable might save their company a lot of time and money by at least checking into it. PROPRIETARY SOFTWARE SYSTEMS, INC., Beverly Hills, Calif.

FOR DATA CIRCLE 232 ON READER CARD

Public Domain Software

The Computer Center at the Univ. of Georgia has a standing agreement with NASA to distribute programs developed with public funds to the general public. The COSMIC distribution program, as it's called, has some particularly good programs and routines this month that should interest many installations. Included in the selection is an I/O buffering scheme with skipping capability for CDC 6000 series users; a logistics/services control program developed at Boeing, and two subroutines, for reading and writing binary arrays in FORTRAN on 360s, that are said to really speed up the process even when loading small amounts of data.

BLKIO, written in COMPASS for large CDC machines, performs file manipulation operations that allow backward and forward spacing of records and files in addition to blocking the records. The intent is to reduce system overhead by cutting down the number of subroutine calls to disc and tape. The program is supplied as a listing of 903 card images and is priced at $200. The program reference number is LAR-11414.

FOR DATA CIRCLE 234 ON READER CARD

The Logistics hardware and services control system was written in COBOL and ran on a 360/65 (one of many) at Boeing, where it was used to integrate all logistics actions and control receipts, issues, loans, repairs, fabrications, and modifications to allocate parts and services. User inputs from paper tape are used for posting a ledger and maintaining a real-time inventory posting file. The program is priced at $550; documentation for evaluating the program for suitability to particular applications is priced at $26. The program reference number is KSC-10819.

FOR DATA CIRCLE 235 ON READER CARD

The Fast Universal Fortran Tape Read and Write Subroutines, program reference number MFS-16790, consists of approximately 200 statements to be used instead of standard read and write instructions for loading binary arrays.

The routines are said to be so much more efficient than the standard READ and WRITE commands that performance improvements are shown even when small arrays are loaded or written. The subroutines are priced at $25. COSMIC, Athens, Ga.
FOR DATA CIRCLE 236 ON READER CARD

Library Description

DOSSIER is a tool for providing current information about selected programs catalogued on an IBM DOS user's core-image library. The central program provides a report showing characteristics of these programs and a description of all standard access I/O files defined within. The program is written in assembler language for use by 360 users of DOS versions III and IV. DOSSIER can be used to provide a great deal of information about installation program characteristics, primarily in the areas of file conventions, partition allocation, program language and design-level planning and management, etc.

The self-relocating program accepts user-provided control statements to select individual programs, groups of programs, or an entire library for analysis. The programs are then examined to determine the programming language being used, file information, etc. These attributes are printed using a user-supplied subprogram. DOSSIER is priced at $400, plus $100 for each additional on-site cpu. SHAYLOR DATA PROCESSING SERVICES, Portland, Ore.
FOR DATA CIRCLE 237 ON READER CARD

Nova Software

A number of software packages are offered for users of the Data General 16-bit Nova computer line, including an ANSI COBOL compiler, sort/merge, file maintenance, data entry modules, and report generators. You can also obtain the metalanguage used to generate these programs, called BLIS for Business Language Interpreter System.

The BLIS language processor *includes* a partitioned operating system for the Data General computers that is expandable from two to six 4K partitions, with 8K reserved for itself. It operates in a round-robin fashion, executing one statement from partition A, one from B, and so on, around the chain. Protection between programs is said to be assured because BLIS procedure statements are interpreted rather than compiled into machine code, and the file control and file directory modules from Data General's Real-time Disc Operating System have been duplicated to insure file compatibility with that monitor. The BLIS operating system/language processor is priced at $1,650.

The ANSI COBOL compiler subset is said to retain all the vital commands from the language, with only the very fanciest bells and whistles stripped off to get it to fit into the Novas. The compiler is priced at $2K.

The COBOL compiler will be available in December. BLIS will be made available next year together with a number of application programs that include accounts receivable and payable, general ledger, payroll, inventory control, on-line invoicing, project control, and budget estimating. INFORMATION PROCESSING INC., Orlando, Fla.
FOR DATA CIRCLE 238 ON READER CARD

Purchasing

"Purchasing" is an IBM program product that actually consists of nine separate PL/1 programs providing the following functions: purchase order planning, quotation planning, requisition writing, purchase order release and maintenance, and purchase order status and review. It's thought that the programs, which operate under both

software spotlight

Edp Industry Visibility

A new service has been formed by Arthur D. Little, Inc., headed up by Frederic G. Withington, to provide trend analysis and forecasting information to executives concerned with their companies' futures. Withington was one of the few people around who saw the shakeout of industry suppliers, the 1970-71 downturn in computer shipments, the wave of returns of installed equipment after IBM's 370 introduction, the change in IBM's strategy toward easier-to-use systems with virtual memory and multiprocessing, and the growth of the dp services sub-industry —all long before these industry trends occurred.

The cost of the service is $4K/year, and for this the subscriber gets a monthly newsletter analyzing new product announcements, management strategies, legal and legislative developments, and emerging technologies; an annual five-year forecast; a special study on an emerging area in which the competitive environment is especially fluid; group meetings; and access to A.D.L.'s staff of more than 50 experts in the dp industry. ARTHUR D. LITTLE, INC., Cambridge, Mass.
FOR DATA CIRCLE 230 ON READER CARD

software & services

the DOS and OS monitors on System 360s and 370s can be applied across a wide range of industries, including manufacturing, process, distribution, retail, finance, aerospace, and transportation. A 64K partition will be needed by DOS users; 146K for OS/MFT users, and 170K will be needed under OS/MVT. The DOS price is $300/month, jumping to $450 for the OS versions. IBM CORP., White Plains, N.Y.

FOR DATA CIRCLE 233 ON READER CARD

DOS Device Assignment

Two programs comprise the Job Control Statement Editor System, which is intended to reduce the number of Job Control Language packs IBM DOS users require to run programs in various system partitions. The first program examines all ASSGN and CLOSE statements and modifies them to become valid device addresses for the partition where the job is actually being run. This assembler language coding is added to the job control portion of the system.

The second part of the package is an 8K COBOL program that is used to generate reports of the current device address table, indicating all changes made. The two programs are sold separately; the controller for $300 and the maintenance program for $200, or both for $450. They are supplied in object deck form for a two-week trial period. At the end of the evaluation customers are supplied the source coding if they purchase the programs. GENERAL ELECTRONICS, Lyons, Ill.

FOR DATA CIRCLE 240 ON READER CARD

CICS Enhancements

Here's another firm that seems to have settled on the market for improved software routines for IBM's Customer Information and Control System (CICS) data base transaction monitor. Three routines are offered; two are probably of most interest to application programmers, and the third provides warm restart capability.

QCORE can be used to make on-line pogram patches or table changes without having to take CICS off the air. It displays any selected partition, region, or resident CICS table, with a "page-forward" feature facilitating memory scanning. Interpretive memory dump displays are available with hexadecimal address translations to aid in debugging assembler programs. Requiring less than 1K of memory, QCORE is priced at $650.

QPPTC might be particularly valuable for systems designers, as it makes it possible to assemble, link, and access a new version of the CICS application module while CICS is active. QPPTC keeps track of which modules are permanently or temporarily resident and are in or not in memory at the time an update is desired. Requiring less than 1K of memory, QPPTC is priced at $800.

QTSREC is a change to the CICS terminal control module that alters the commands GET, PUT, and RELEASE so that they refer to the data items in auxiliary temporary storage. This warm restart capability is priced at $1,700.

Programs are supplied in macro form with parameter cards for establishing the operating system (OS or DOS), the terminal type (2260 or 3270), and the number of characters that are displayed on the screens. QUANTRA DEVELOPMENT CORP., New Rochelle, N.Y.

FOR DATA CIRCLE 241 ON READER CARD

COBOL Optimizer

Version one of this code optimizer was introduced in 1970, and is reported to be functioning in more than 200 installations—a big number for software products in this price range. OPTIMIZER II is claimed to generally reduce IBM 360/370 ANS COBOL programs by 20% in memory requirements, and by about 15-20% in execution time. The program runs under OS MFT, MVT, VS1 or VS2 for Version 2, 3 or 4 COBOL jobs. (A model of the original optimizer for COBOL F programs is supplied at no extra charge.)

A one-time license for the product runs between $8,000 and $20,000. Rentals run $333 to $833 monthly; leases $265 to $750. Current OPTIMIZER users are offered a trade-in on their old model. CAPEX CORP., Phoenix, Ariz.

FOR DATA CIRCLE 242 ON READER CARD

Sequential File Utility

For $195 you can have 88KB worth of code which can dump, copy, print, or search any sequential file. The user controls which records are to be dumped or printed or copied by codes which specify record numbers or even data values as control parameters. Multiple files can be copied to multiple tapes or a single tape, default options are assumed to be the most common choices, and statistics are recorded because the files are records processed.

Important features include the ability to convert from ASCII-8 to EBCDIC, the listing of control statement choices and defaults (so that you need not remember them every time), and the ability to handle "all" record types. Written in PL/1 and assembler, the program is mailed in source form and backed by six months of problem-solving assistance. SPECIALTY SOFTWARE CO., Athens, Ga.

FOR DATA CIRCLE 243 ON READER CARD

We celebrate our 1,000th shipment with a 20% reduction in price.

Our 600 LPM Electrostatic Printer/Plotter. Now just $5,900.00

Your turn to celebrate.

For over three years we've been producing Matrix Printers, Plotters and Printer/Plotters like there's no tomorrow. One after the other. Sending them to hundreds of U.S. companies. To 18 countries. To four continents.

To some places—far from our service reps—where an MTBF of 3,300 hours is a godsend.

To work with 29 midi and mini-computers.

Shipping them as fast as we could make them.

And in three years our Matrix units have become the industry standard.

This has put us in a position to do what no one else in the industry can do.

Thanks to plummeting electronic costs (remember, Matrix has only three moving parts) . . . and manufacturing processes that have matured . . . we are making the price of our plotters and printer/plotters more competitive than any comparable units.

Starting at only $5,100 for the Model 200 Plotter.

Consider the price. And consider that these are no ordinary output devices.

Profile of the "standard of the industry."

Matrix units have the highest reliability in the business.

A yearly maintenance contract **50% less** than anyone else's.

A warranty for parts and labor **four times longer** than anyone else's. (One year vs. 90 days.)

Unbeatable price/performance ratios in 8½, 11, and 20-inch-wide Matrix units.

More proven controllers and more powerful software.

And better paper-handling capabilities than anyone else's. Matrix units alone use our MEWT™ writing—a **true** electrostatic writing technique with outstanding legibility.

A choice of resolutions—up to 160 points per inch. No one comes close to that.

No wonder that everybody in the electrostatic business uses us as the standard of comparison.

So celebrate with us. Our success affects you right where it feels best . . . in the pocketbook.

This good news is brought to you by Versatec. Electrostatic specialists with the broadest line of electrostatic devices anywhere. Leading the silent generation.

Versatec Inc., 10100 Bubb Road, Cupertino, California 95014
(408) 257-9900

VERSATEC

After three years, Matrix is still the industry standard.

CIRCLE 62 ON READER CARD

Literature

Display Terminal Review

Started in 1966, this reference work on computer-driven displays currently presents information on over 200 devices in four volumes totaling 2,000 pages. The basic description of displays is accompanied by information on hardware and software technology, new developments, and comparative analysis of the devices. Updated every four months, the review has an initial subscription cost of $450 and an annual renewal fee of $175. GML CORP., 594 Marrett Rd., Lexington, MA 02173.

CDP Study Guide

A study guide for the 1974 Certificate in Data Processing (CDP) examination gives a study outline, with references, of the exam's five subjects: dp equipment, computer programming and software, principles of management, quantitative methods, and systems analysis and design. The guide also includes sample questions and information on qualification requirements and administrative procedures of the test. DPMA INTERNATIONAL HEADQUARTERS, Park Ridge, Ill.

FOR COPY CIRCLE 220 ON READER CARD

Dp Salary Survey

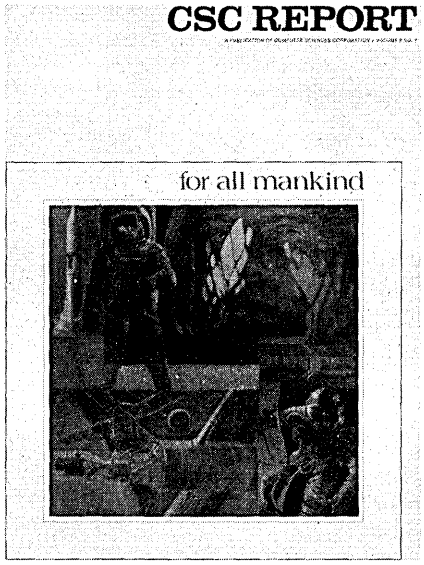
The *1973 Weber Salary Survey Report on Data Processing Positions in the United States* contains salary information on 93,095 employees of 1,265 companies. Data on 82 dp positions is presented in four sections: country-wide reports, individual city reports (57 cities), size of dp installation reports (five sizes), and type of industry reports (10 industries). Cost: $55. PHILIP H. WEBER SALARY ADMINISTRATION SERVICES, A.S. Hansen, Inc., 1080 Green Bay Rd., Lake Bluff, IL 60044.

Dp VIPs

The 1973 *Directory of Top Computer Executives* lists top edp management (over 2,300 names) for approximately 1,700 of the largest companies in the U.S. Each entry includes the complete company name and address, location of the major computer facility if not at corporate headquarters, phone number, names and titles of top executives, and, for about 60% of the companies, the make and model of the computer system(s). The directory is organized into the following classifications: manufacturing and service, commercial banking, diversified financial, life insurance, retailing, transportation, and utilities; there is also a geographic cross-index. The directory is published semi-annually, for an annual subscription price of $80, and a single issue cost of $50. APPLIED COMPUTER RESEARCH, P.O. Box 9280, Phoenix, AZ 85068.

Space Age Software

A special 20-page, full-color issue of the *CSC Report*, "For All Mankind," reviews the use of computer software



in space exploration. Focusing on three NASA centers (Huntsville, Goddard, and Ames), the report commemorates the creation of NASA 15 years ago. COMPUTER SCIENCES CORP., Los Angeles, Calif.

FOR COPY CIRCLE 221 ON READER CARD

Modular Furniture

A series of data sheets shows a modular data desk system for computer equipment. The desks, which combine functional engineering with good looks, are designed especially for use in multi-station terminals, printer stands, and office/computer work stations. The basic desk consists of a top, a leg structure, and a modesty panel, and has options for cable cutouts and ducts, desk drawers, and colors. Furniture prices range from $95 to $900. SYSTEMS FURNITURE COMPANY, Gardena, Calif.

FOR COPY CIRCLE 222 ON READER CARD

Banking System

A 32-page guide for bank executives and officers describes the marketing, operations, and edp implications of computer-based teller information systems. The booklet also includes a

Big data needs protection

Nothing is more important, or more vulnerable, than your computers.

The data center world is buying the extraordinary Ruscard® electronic access control systems almost faster than we can produce and install them.

Why? Security means access control.
Who goes where, and when.

If you can confine traffic only to those authorized individuals who require access to the computers... with an automatic printout of every access, by individual—point of access—and time of access... and if you can do all this economically... you have, in effect, a 24-hour guard on every door.

A 24-hour guard costs $35,000 a year. That's why you don't have one on every critical door today.

Now you can.

Rusco's access control systems give you all that, and much, much more. These are the electronic access control systems that are revolutionizing the entire world of security.

For full information, circle the reply card number, write or phone: Rusco Electronic Systems, Box 2848D, Pasadena, California 91105; phone toll free (800) 423-4194, or call collect in California: (213) 682-3691. Ask for Mr. Martin.

RUSCO ELECTRONIC SYSTEMS
A RUSCO INDUSTRIES COMPANY

CIRCLE 40 ON READER CARD

Literature

description of Datatrol's turnkey approach to manufacturing teller information systems and a glossary of technical terms. DATATROL, INC., Hudson, Mass.

FOR COPY CIRCLE 223 ON READER CARD

Systems Development

A 14-page report to management, *Information Systems Development: The Problem, the Reasons and the Answer,* reviews the problems in systems development, informs management that their actions (or lack of action) may be the reason for some of the problems, and concludes by saying what they, with their systems people, can do to improve their systems development efforts. BARNETT DATA SYSTEMS, Rockville, Md.

FOR COPY CIRCLE 224 ON READER CARD

Used Computers

The Computer Price Guide—the Blue Book of Used Computers—gives up-to-date information about used computers and peripheral equipment, listing current market asking prices, list prices, and the percentage relationship between the two. Updated quarterly, the cost of a year's subscription is $10, and the cost of a single issue $3. TIME BROKERS, INC., 500 Executive Blvd., Elmsford, NY 10523.

Computer Art

A flyer and a complete catalogue describe a line of computer art cards (including Christmas cards), prints, and framed originals. Drawings include the works of three well-known computer artists: Thomas J. Huston of Indiana, Lloyd Sumner of Virginia, and Herbert W. Franke of Germany. COMPUTRA, Upland, Ind.

FOR COPY CIRCLE 225 ON READER CARD

Bay Area Installations

A new guide to over 600 computer installations in the San Francisco Bay Area, called *Dp Index 73,* has over 300 pages of information in six sections: computer installations, computer cross reference, city cross reference, dp industry associations, buyer's guide, and computer profile and area map. Information on each installation includes: company name, address, phone number, dp manager's name, number of employees in dp, information on the computer (type and model; core; operating system; whether rented, leased, or owned; availability of time to outside users), and information on peripherals. Cost: $30. HORNER ASSOC., 999 Commercial St., Palo Alto, CA 94303. □

The first VTY* to break the $1,000 price barrier.

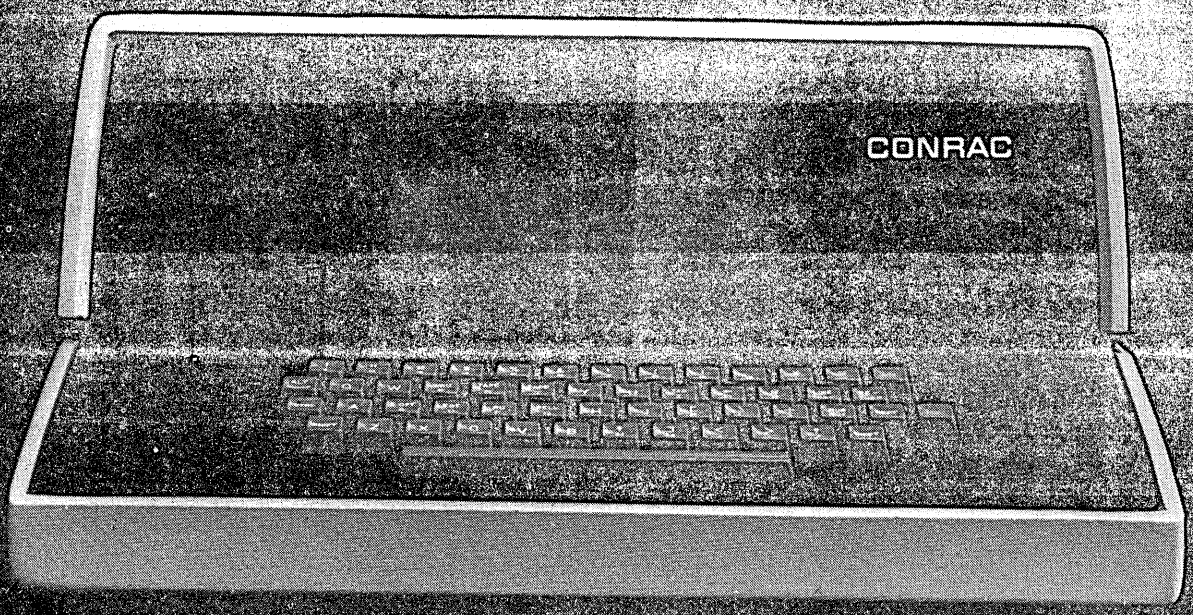
CONRAC TTY PLUS

The new Conrac Model 480 TTY PLUS—the first teleprinter compatible VTY* to break the $1,000 (in quantity) price barrier. With its size, styling, and TTY compatibility, it fits into just about any soft copy application—credit verification, data entry, or interactive information systems.

Basically, the TTY PLUS was designed to be a direct replacement for impact-type teleprinters. But, as the PLUS in its name indicates, it's a whole lot more too.

To get the full story, contact Elton Sherman. At the same time, ask him about the Conrac 401 Adaptive Terminal, big brother to the TTY PLUS.

*VTY—Video Teleprinter Terminal



Conrac 401 Adaptive Terminal

CONRAC

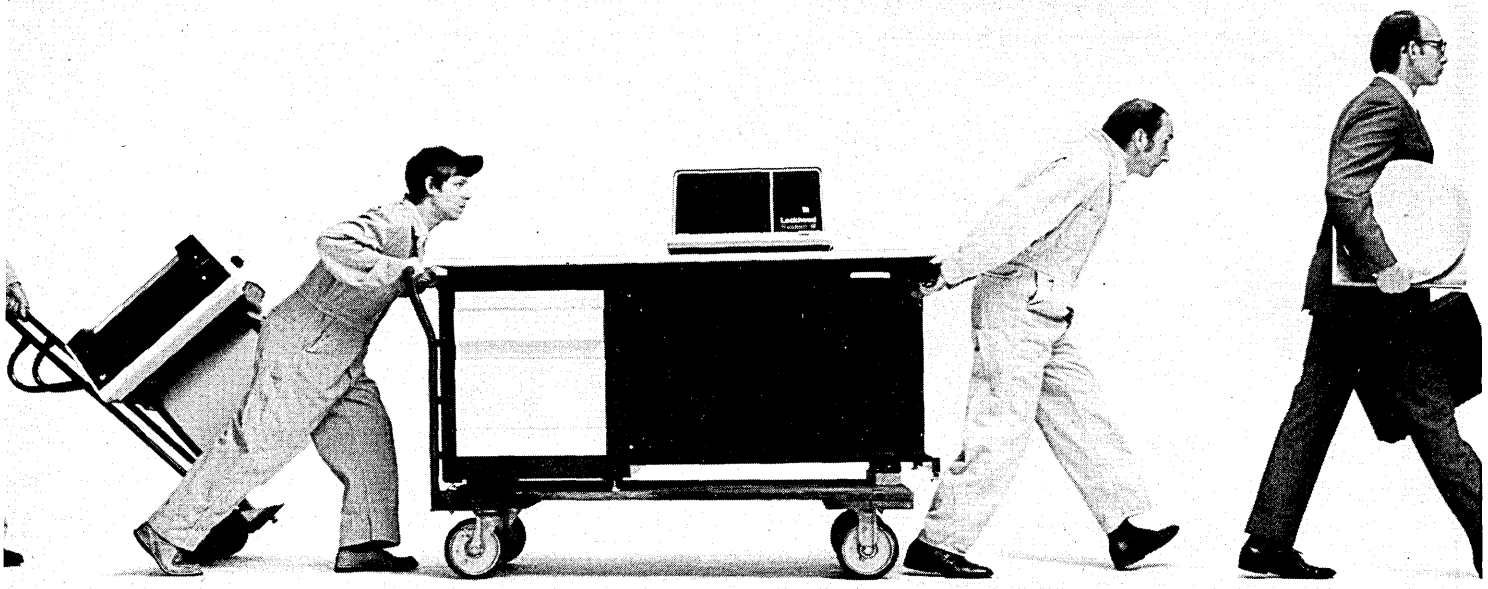
the OEM supplier
to industry

Conrac Division 600 N. Rimsdale, Covina, CA 91722 (213) 966-3511. Telex 670437

In Europe, call E. Wechselberger at Elektron, GmBH, Munich—0811/37 65 28

CIRCLE 70 ON READER CARD

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



The Lockheed System III

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

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

How unique? Let System III speak for itself:

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

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

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

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

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

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

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

Lockheed Electronics

Data Products Division

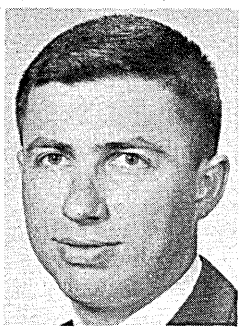
Boston 861-1880 • New York metro (215) 542-7740 • Philadelphia 542-7740 • Washington (703) 525-3600 • Atlanta 266-0730
Detroit 557-5037 • Chicago 833-4600 • Dallas 231-6163 • Houston 682-2617 • San Francisco (408) 257-3357

CIRCLE 46 ON READER CARD

People

Computers Everywhere

A computer in every home, one in every car, and computerized educational devices in schools have long been discussed. But the realization of this may not be too distant. "There's no reason not to put a computer into anything," says Dr. William H. Davidow, recently named manager of the Micro Computer Systems Group at Intel Corp., Santa Clara, Calif. He says microprocessors will become a part of all word processing systems, most terminals, and most laboratory instruments, which has already begun, as well as cash registers and peripherals controllers.



Dr. William Davidow

Somewhat facetiously, he adds that in the two years Intel has been delivering microprocessors, it's close now to shipping each month as many of them as there are computers, including minis, installed in the world.

Davidow, who was general chairman of the 1968 Fall Joint Computer Conference, was most recently marketing vp for Scientific Micro Systems in nearby Mountain View. Prior to that he was marketing manager for the Data Products Group of Hewlett-Packard, the minicomputer arm. But he says the microprocessor brings costs down an order of magnitude below that of the minis.

RICHARD C. WARREN, vp of IBM World Trade, has been elected a corporate vice president . . . ALEXANDER E. PATTERSON, JR. was named president of GTE Information Systems, Inc. . . . ROBERT G. CHAPMAN, JR. was appointed vp of engineering for Compata, Inc. . . . DR. HALINA MONTVILA was elected a vp of Bradford Computer & Systems, Inc. . . . DR. GENE GRABBE's long-time interest in the impact of technology on society makes him well-suited for his current position as director of The Hawaii State Center for Science Policy and Technology Assessment.

Packet Over Pipes

Not many people are succeeded by a predecessor, but Dr. Larry Roberts was. When he left the post of head of the Information Processing Branch of the Advanced Research Projects Agency (ARPA) to become president of Telenet Communications Corp., he was followed in the job by J.C.R. Licklider, the first to hold the position back in the early sixties. It's been back-and-forth between MIT and ARPA for both men, but Dr. Roberts got off the seesaw into the private sector in assuming the presidency of the new Bolt Beranek and Newman subsidiary, formed to pursue commercial applications for ARPA network technology.

Dr. Larry Roberts

Dr. Roberts, who joined ARPA in 1966, was principal developer of Arpanet. He believes there is a $3-$5 billion commercial market for the technology which connects many specialized computers of different makes offering their capabilities to a multitude of remote users. Telenet on Oct. 9 became the second company (Packet Communications, Inc. was first) to file for FCC authority to offer a commercial version of the Arpanet. Dr. Roberts wasn't anticipating

people

problems with the FCC application and was expecting Telenet's authority to be forthcoming within six months. But FCC observers were saying last month that the agency's Common Carrier Bureau staff was drafting a Notice of Inquiry which would lead to hearings which could delay indefinitely the granting of authority to the so-called value added networks. And, as one said, "The lawyers are beating this to death."

The soft-spoken Dr. Roberts is a strong believer in the packet switching technology on which Telenet's proposed network would be based. He became interested in the network question, "What are the problems in getting two or more computers working together?" while a graduate student at MIT. He pursued this interest at Lincoln Laboratories and again at MIT. "I determined early that the main problem was communications, and that communications became more effective with packets than through pipes."

DR. PETER WEINER, organizer of the computer science dept. at Yale Univ., is new head of the Rand Corp.'s information sciences dept., succeeding DR. BARRY BOEHM who left to become director of software and research technology at TRW, Inc. . . . JAMES B. BOCKIAN has joined the Equitable Life Assurance Society as assistant vp in charge of computer-assisted policyholders services . . . DU WAYNE PETERSON is new staff vp, computer systems planning, for RCA.

A User at Heart

Bob Farmer is a long-time advocate of computer resource sharing among state and local governments. He worked toward this end for seven years as dp director for Orange County, Calif., and as an active member and recent president of the California Assn. of County Data Processors.


Bob Farmer

Now this advocacy has become a vocation. Bob is the new manager, State & Local Government Systems, for Computer Sciences Corp. CSC recently won a seven-year facilities management contract with Orange County (see Sept., p. 122). He believes efforts of organizations like CACDP have been only moderately successful in advancing sharing because they have been handled on a volunteer basis, with the result that potential savings have not been clearly identified. He says savings in sharing are available in three areas: hardware, software, and data exchange.

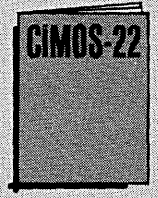
Farmer got into data processing via the military. Having been a physics and math major at the Univ. of Texas, he was pressed into dp service in the Air Force. He gained experience in both phasing in and phasing out of sizable dp operations and this, he believes, is why he was chosen from a field of 250 applicants when Orange County applied for a dp director in 1966. "What they needed done was what I had done."

Bob is a Texan who doesn't talk Texas until someone tells him he doesn't, and then it comes through. His tenure as Orange County's dp director saw that effort grow from one with a yearly budget of $700,000 to one of $4.1 million. As an RCA user he was, during the RCA users group meeting which came close on the heels of RCA's big withdrawal announcement, a vocal volunteer to head a "committee on class action suits," and also was one of the first to express satisfaction with Univac's take-over efforts. He's on the vendor's side of the fence now but he's a user at heart. □

Minicomputer SOFTWARE

Here's an exciting new operating system with RPG that dramatically simplifies and speeds data processing applications

CiMOS-22 is a disk-based operating system for the CIP/2200 minicomputers which consists of language processors, programming and debugging aids and services that simplify data processing applications. The capabilities of CiMOS-22 are packaged in a flexible system design so that each user can tailor the operating system to his individual needs. From either RPG or assembly language programs, the user can take advantage of the high-level data management facilities of CiMOS-22. These facilities include the ability to organize, catalog, store, retrieve and update data files. From a system console or assembler language program the user can create and delete disk-based files. On-line editing capability permits the user to build and maintain data files as well as source and object program libraries. There is much more to CiMOS-22 that you should know about. It's all detailed in our new brochure shown here . . . and it's yours free. Cincinnati Milacron, Process Controls Division, Lebanon, Ohio 45036.



FREE

minicomputers

CINCINNATI MILACRON

Machine Tools
Process Controls
Chemicals
Plastics
Plastics Processing Machinery
Abrasives

Cincinnati area (513) 494-5444 • Chicago area (312) 439-5726 • Los Angeles area (714) 847-2576 • Detroit area (313) 557-2700
New York area (201) 687-4500 • Houston area (713) 622-4620 • San Francisco area (408) 735-0701 • Atlanta area (404) 634-6312

CIRCLE 22 ON READER CARD

Some people get the picture quicker than others.

Thanks to graphics.

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

Applications? By the hundreds! Today, our graphics terminals are giving new, quick insights to leaders in research, education, business, math and science.

And getting the picture doesn't have to be costly. You can move up to graphics for as little as $3,950.

There's more. Thanks to our CRT direct view storage screen, you can see clear graphics and alphanumerics in standard ASCII and APL on either 11″ or high resolution 19″ screens. In minutes they plug into most computers and minis. And our broad-ranging software support turns them on. Copy your result on our dry process, grey scale hard copy unit. Add to that displays, monitors, and paper tape units that enhance your graphics power.

Business forms are programmed and ruled fast with our 4023, the first alphanumeric terminal with upper and lower case and optional forms ruling.

No matter who you are or where you are, our worldwide Tektronix service backs you up. Which is another reason you should get our picture . . . and we should get acquainted.

Tektronix, Inc.
Information Display Division
P.O. Box 500
Beaverton, Oregon 97005

Graphics. The mind's eye, for those who think tomorrow.

TEKTRONIX®

CIRCLE 50 ON READER CARD

Look Ahead

(Continued from page 18)

540 members, will become an Informatics profit center. Levin and McGovern will be bought out, and Ferguson, Gene Jacobs and Sherman Rifkin will become Informatics employees. The deal hinges on profitability...if Group Three achieves certain profit margins over a certain span of time, they'll get a healthy cut. Ferguson will report to Informatics executive vp Frank Wagner, and undoubtedly will be freed to unleash his significant programming talents (he's the holder of the first software patent) for the development of System/3 software packages.

THEY'D BETTER NOT TAKE AWAY MR. IPPOLITO'S CLOROX

The best tape cleaner in the world is Clorox, swears Robert Ippolito of the state of Pennsylvania's 1108-based central management information center. At a recent Univac Users' meeting, he recalled how last year's floods sent muddy, oily water surging through the computer building soaking and staining 15,000 reels of mag tape. Using Clorox to wash the tapes and store-bought hair dryers to dry them, he and his staff had the files up and operating 18 days after the flood -- just in time to get out the state's payroll.

CENSUS ADD-ON PROBLEMS SOLVED

The Census Bureau plans to have installed by February all 13 Univac add-on memory systems it ordered from Ampex and then rejected last spring (see June p. 17). The Bureau's Joe Marean told a recent Univac Users' meeting in Minneapolis that cable and power supply troubles discovered during acceptance tests last April have been corrected on two systems now installed. The remainder will be installed in January and February. The Bureau acquired the memories in a conversion of three 1108s and an 1106 from the Exec 1 to Exec 8 operating systems at a savings of 80% over Univac's prices.

BROMBERG BRANCHING

Humble Howard Bromberg, notorious COBOL Godfather and software package entrepreneur, is branching out. He's left Information Management, Inc., the company he founded, and has set up International Computer Trading Corp., a multinational computer consultancy and marketing firm. In addition to software and consulting, the firm will offer, through its international marketing network, a complete line of computer-based security packages and a new application-program generator. Offices will be located in San Francisco, Geneva, and Tokyo.

PRIME, STRONG, AND SILENT

Prime Computer is developing an image as a strong silent type. The company is less than two years old, shuns hoopla, but we hear that the Natick, Mass., minicomputer company is shipping one system with a $170,000 plus price tag. Beyond that, we hear that more than 100 Prime minis have gone out the door and the company is building a 60,000 sq. ft. plant. Prime is taking aim at the market pioneered by DEC's PDP-11/45.

RUMORS AND RAW RANDOM DATA

Singer Business Machines, we hear, is deep into minicomputer development and will be making major announcements in January...Add Xerox's name to firms taking aim at the installed IBM 1130 base. Its entry, via its new 530, was made through a benchmark program with lots of floating point arithmetic and disc access. Time comparison: six hours and 40 minutes on the 1130 vs. 41 minutes on the 530.

IN CASE OF POWER FAILURE, DIAL (714) 565-1155. COLLECT.

You'll be in the perfect frame of mind to talk to us about our Elgard Uninterruptible Power Sources. When we tell you they can provide up to ten minutes of reserve power instantaneously or that they supply 40 db line transient reduction and ±2% voltage regulation you'll be interested. You'll probably even buy one.

Of course if you'd rather not wait for a power failure, call us now. While you can still see the phone.

Elgard Uninterruptible Power Sources are available in .5kVA, 1kVA, 2.5kVA, 5.0kVA and 10kVA models. They supply up to ten minutes of instantaneous reserve in case of power failure; and they have self-contained, maintenance-free batteries. Ideal for IBM Systems 3 and 7, DEC PDP/8, PDP/11, and Data General Super Nova. Priced from $1,895.

ELGAR
8159 Engineer Road, San Diego, CA 92111 Phone (714) 565-1155.

CIRCLE 23 ON READER CARD

Books

Computers: Auditing and Control
Elise G. Jancura and Arnold H. Berger, ed.
Auerbach Publishers, Inc., 121 N. Broad St., Philadelphia, Penna. 1973
500 pp. $12.50

"To hit a moving target you have to aim ahead of it. And if the target is accelerating, you must aim further ahead. In essence, this portrays the dilemma the professional auditor faces today as a result of the increasing use of electronic computers."

With the preceding statements, Jerome Lobel began his article, "Auditing in the New Systems Environment," in the September 1971 issue of *The Journal of Accountancy*. If you have forgotten what followed that introduction and if you have mislaid your September 1971 issue of the *Journal*, don't despair. Mr. Lobel's article has found immortality beginning on p. 268 of one of the newest Auerbach books.

Computers: Auditing and Control is a collection of 46 articles previously published in various business magazines. The majority of the articles were published in *The Journal of Accountancy, Financial Executive,* and DATAMATION between 1967 and 1971. Since the editors contributed only 20 pages of original, introductory material throughout the 500 total pages, one may well question whether the effort is worthy of the $12.50 price tag. After two readings, the question is still difficult to answer.

The timing of the release of this effort could not have been better. The publication date of April 1973 coincides with exposes on what were alleged to be the two largest computer-oriented frauds detected to date, the Union Dime Savings Bank and Equity Funding frauds. Computer-assisted fraud is, therefore, a hot topic. It provides for interesting reading as we learn not only how the fraud was perpetrated, but also the sinfully extravagant manner in which the ill-gotten gains are often spent. Controls for the prevention and detection of computer assisted fraud is also a hot topic. Unfortunately, the latter makes for less interesting reading.

There are two essential problems which face editors who attempt to assemble a book from a series of previously published articles by various authors. The first has to do with continuity—the second with timeliness.

One often sees an attempt to solve the continuity problem in the editor's inserting his originality in transitional prose between articles. Doctors Jancura and Berger have carefully avoided this pitfall. The book is divided into four parts (11 chapters) and the editors limit themselves to a single page introduction for each chapter. They insert no material between articles nor do they provide conclusions at the end of chapters or parts. Although this means most of the book is "meat," it also results in abrupt changes in writing style and a certain degree of redundancy.

Timeliness is a unique problem when writing in a technical field. The rate of expansion of the computer technology is such that last year's "what if" became this year's "standard" and next year's "remember when." In the midst of such a technological explosion, here is a collection of articles which are, on the average, three to four years old.

This is not to say *Computers: Auditing and Control* is without merit. The articles are authored by experts in their fields. One gets a taste of Felix Kaufman, John Wagner, Gordon B. Davis, W. Thomas Porter, Jr., Richard Canning, and others. All attempt to give an accountant's view of the "computer revolution."

After establishing a perspective on computers and the accountant's role in the computer revolution, one gets into the central theme: How does the accountant, internal auditor, or financial executive satisfy himself that the unique disciplines of the accounting/auditing professions have been incorporated into the unique design considerations of the application processing systems?

The articles cover organizational considerations, data control and verification, plus standards and controls. Internal control considerations and techniques for auditing are covered in some depth. The "newest" audit techniques, the use of generalized audit software packages and the integrated test facility (the so-called "mini company" approach), are only briefly touched upon. However, the dates of the original articles almost preclude any expanded discussion in this field.

The last part of the book deals with improving edp effectiveness. An article in the section by Henry C. Lucas, Jr., on "Performance Evaluation and

Monitoring" is exceptionally interesting, lucid and well-referenced (59 references in its bibliography) for those who wish to pursue the subject in greater detail.

If you are an auditor (internal or external) who has been so busy putting out fires that your reading has suffered, or if you wish to review for reinforcement of principles, or if you simply need one more book to fill that space on your office book shelf, *Computers: Auditing and Control* may be for you. As for me, it was something like mother's oatmeal—bland, lukewarm and with only an occasional lump to chew on.

—Richard L. Ryan

Book Briefs

Bibliographic Control of Microforms

by F. Reichmann and J. Tharpe
Greenwood Press, Inc., 51 Riverside Ave., Westport, Conn., 1972
256 pp. $12.50

More than 2 billion negative microform exposures have been made, yet inadequate bibliographic control has resulted in diminished access and duplication. In response to this problem, in 1969 the Assn. of Research Libraries, through a grant from the U.S. Office of Education, arranged to study the bibliographic control of microforms. Steps in the survey were an exhaustive search of literature on bibliographic control; analysis of responses of 190 American libraries; study of the methods of control in 75 countries. The findings indicated that the majority of local librarians were unhappy with local bibliographic control; not even the rudiments of an international bibliographic control system exist; and the National Register of Microform Masters is an important bibliographic tool, but an additional instrument is needed to provide analysis of microform series.

The AEDS Large School System Survey

by Robin C. Smith
The Assn. for Educational Data Systems, 1201 16th St., N.W., Washington, D.C., 1972
51 pp. $15 ($8 to AEDS members)

In March/April 1972, AEDS conducted a mail survey of administrative computer applications in 99 large U.S. school districts; 55 of the replies were usable. The study showed that financial applications are the most frequently implemented function; pupil and personnel applications are next; and instructional / noninstructional material applications rank next to last, before facilities and equipment applications. The financial applications were also considered the most successful.

Generally, in-house staff is used. Roughly 25% of the applications are currently operating on first- or second-generation equipment, and as many as 25% of the school districts using third-generation equipment are operating the application in first- or second-generation mode on that equipment. This supports previous conclusions that public school districts are as much as a half-decade behind the times in the use of computer technology. However, it should be noted that well over half of all applications are operating on third-generation hardware.

Analysis of the survey points up the need to find a workable means of effecting software exchange among public schools and to examine ways for standardizing terminology and documentation and for disseminating information about the development activities of public school districts.

Computers in Architectural Practice

by B. Guttridge and J. R. Wainwright
Halsted Press, John Wiley & Sons, 605 Third Ave., New York, N.Y., 1973
121 pp. $7.75

The purpose of this study is to discover the potential of the computer as a tool for promoting greater efficiency within the architect's office and to determine whether it provides data which the

architect has not had readily available before. By investigating the work being carried out by architectural practices in the U.K. and abroad, it has been possible to assess the feasibility of computer applications in this field and their potential for the future. The book contains case studies and an overview of applications and problems. The authors, both architects, conclude that the use of computers in architectural practice is still in its infancy and "has been undertaken in the main part by a small group of enthusiasts." However, they offer several reasons why many firms should become involved in computers.

Accountability: Systems Planning in Education

Creta D. Sabine, ed.
ETC Publications, 18512 Pierce Terrace, Homewood, Ill., 1973
242 pp. $8.95

The authors describe how to implement a humane accountability system in the classroom, school, district office, state office, the community college, and the university. The book is based on the philosophy that public school education depends upon the taxpayer for support; if it is to be supported, administrators must be accountable for the learning to be achieved as stipulated before the process begins, for the wise expenditure of the funds allocated, and the task of keeping the public informed of such activity. The first section of the book covers the conceptualization of systems planning in education, and the second section develops systems planning at the several levels of management. The appendices include classification structures, cost-effective forms, and a glossary of accountability and systems planning terms.

Planning for High-Density Storage and Automated Warehousing

W. Blanding and H. E. Way, ed.
Marketing Publications Inc., 221 National Press Bldg., Washington, D.C., 1973
64 pp. $6

This book is for the firm that is considering automated warehousing but isn't quite sure where to begin. The 10 chapters explain when and how automated warehousing can be justified, the space savings and construction cost savings that can be realized, labor savings, how to analyze and compare costs with conventional warehouses, the investment write-off and cash flow aspects of automation, and some important pitfalls and do's and don'ts. Included are numerous tables showing costs of different storage methods and two case histories. A list of names and addresses of 28 principal manufacturers of automated warehousing systems is included.

Scheduling Computer Operations

by V. Sahney and James May
American Inst. of Industrial Engineers, 25 Technology Park, Atlanta, Ga., 1973
126 pp. $6 ($3.50, AIIE members)

This monograph addresses the problem of scheduling both serial and multiprogrammed computers in a large data processing center. Written for dp executives and computer operations managers, basic macro- and microscheduling methods are discussed. Also covered are system performance measurement, commercially available packages to perform scheduling, and system monitoring.

The Skyline of Information Processing

H. Zemanek, ed.
North-Holland Publishing Co., P.O. Box 1270, Amsterdam, The Netherlands, 1972
146 pp. $7(U.S.), Dfl. 20.

These Proceedings of the Tenth Anniversary Celebrations of the International Federation for Information Processing (1970) contain papers by leading IFIP people including: "Ten Years of IFIP," by A. A Dorodnicyn; "The Need for a Systems Theory," I. L. Auerbach; "Computers and Technology," A. P. Speiser; "Administration and Computerized Information Systems," D. Chevion; "From Scientific Computation to Computer Science," F. L. Bauer; "IFIP and the Expanding World of Computers," E. L. Harder. □

Advertisers' Index

Addressograph Multigraph Bruning Division 144, 145
Addressograph Multigraph Data Systems Division 5
Advanced Systems Incorporated ... 53
Airpot Corporation 173
American Telephone and Telegraph Company 116, 117
Amoco Oil Company 163
Applied Data Communications 168
Applied Digital Data Systems, Inc. 14, 15
Avtel Corporation an Airtronics Subsidiary 131

Bell & Howell, Business Equipment Group 2
Boorum & Pease 105
Burroughs 16

Cadillac Associates, Inc. 188
California Computer Products, Inc. 96
Cambridge Memories, Inc. 56
Cardkey Systems A division of Greer Hydraulics, Inc. 173
Centronics Data Computer Corp. ... 22
Cincinnati Milacron, Process Controls Division 175
Computer Optics, Inc. 29
Conrac 171
Control Data Institute 34
Cummins-Allison Corp. 114, 115

Data Disc 31
Data Processing Digest 160
Data General 68, 69
Data Products 6, 7
Datapoint Corporation 57
Digital Computer Controls, Inc. 54
Digital Equipment Corporation ..32, 33
Documation Incorporated 12

Eastman Kodak Company, Business Systems Markets Division 127
EDP Personnel 181
Elgar 178
Electronic Memories & Magnetics Corporation 154, 155

Fabri-Tek 24
Fenwal Incorporated 30
Florida Department of Commerce .. 4
Floating Floors, Inc., Subsidiary of N L Industries, Inc. 123

The Garrett Corporation 149
General Automation 132, 133
General Electric 112, 113
Goodyear Aerospace Corporation 181, 186
Grumman Data Systems 190

Robert Half Personnel Agencies ...179
Hazeltine Corporation 8
Hewlett-Packard 19
Honeywell Information Systems 35, 36, 48, 49

Incoterm Corporation 28
Inforex, Inc. 128, 129
Informatics Inc. 165
Innovation Data Processing 162
Interdata 106, 107, 108, 109
Itel Corporation 121
ITT Data Equipment and Systems Division 187

Lear Siegler, Inc., Electronic Instrumentation Division ....Cover 2
Lockheed-California Company, A Division of Lockheed Aircraft Corporation 182
Lockheed Electronics, Data Products Division 172

The James Martin Books on Computers

at a savings of $24.59

1. Security, Accuracy and Privacy in Computer Systems

A practical guide for designing security, error control, privacy and fraud prevention procedures into any computer system. *It hands you a complete, ready-to-use ninety page design checklist,* you'll use right now for tightening hardware, software, program and terminal user controls. Cost conscious, the guide details cryptography programs and techniques, alarm and surveillance procedures.
Pub. Nov. 1973 608 pp. illus. $19.95

2. Design of Man-Computer Dialogues

"...concentrates on a critical, but often neglected, aspect of man/machine interaction."
— COMPUTING REVIEWS

Here's the first all-inclusive guide putting the vast array of available options for designing terminal dialogues at your fingertips—*with design techniques enabling you to maximize terminal effectiveness by developing dialogues ideal for your purpose.* You'll find the most successful strategies for setting up terminals for the most effective management use. *Pub. 1972 496 pp. illus. $16.50*

3. Systems Analysis for Data Transmission

"A clear, easy-to-read handbook for the designer of data communication systems by a prolific and well-qualified author..."
— CHOICE

The definitive reference manual on data transmission giving you scores of step-by-step techniques for designing and implementing any system. Includes detailed calculations, check lists and formulas for every aspect of design. Here are ways of controlling user errors at the terminals and treating errors in transmission. *Pub. 1972 909 pp. 391 illus. $22.50*

4. Teleprocessing Network Organization

"This book is virtually a must."
— COMPUTER DECISIONS

Here's a complete analysis of multiplexors, concentrators, line control computers, shared line adaptors, private exchanges, and other devices *along with the techniques you need for effectively minimizing network costs.* Clear, to-the-point illustrations covering the different organizations of line control methods and mechanisms help you select and design the best communications line for your data transmission.
Pub. 1970 290 pp. illus. $17.25

5. Future Developments in Telecommunications

".....important reading for both managers and technicians concerned with data transmission, information networks, radio communications and communications in general.
— R&D MANAGEMENT DIGEST

Here's all you need to stay on top of the techniques, devices, and systems revolutionizing the entire field in the next few years. Martin shows you how future strategies in telecommunications will be effected by such break-throughs as *picturephone, cable TV, new transmission links such as the CLOAX cable. Pub. 1971 413 pp. illus. $16.00*

6. The Computerized Society with Adrian Norman

"The classic book of the subject...comes from a rare combination of long professional experience, hard thought and lively, tradition kicking imagination"
— THE OBSERVER, London

A careful, rational view of the world of 1984 and the computer impact on society discussing the many developments in communications and data processing technology over the next 15 years *and their effect on our way of life. Pub. 1970 544 pp. illus. $11.80*

7. Introduction to Teleprocessing

".....a worthwhile investment of time and money."
— BUSINESS AUTOMATION

A non-technical handbook giving you a practical foundation for working with data transmission systems. You'll quickly gain a thorough understanding of system considerations and factors effecting the design and the master-plan, user considerations and response time requirements. *Pub. 1972 267 pp. illus. $10.50*

8. Telecommunications and the Computer

"A must for those who would understand the past, present, and future of data communication links."
— COMPUTING REVIEWS

Here's a description of the world's telecommunication lines and their use in computer data transmission. A practical, easy-to-read guide promoting comprehension and cohesion between data processing personnel and telecommunications personnel it brings both groups the technology they need to advance in the data transmission field.
Pub. 1969 470 pp. 185 illus. $17.25

9. Design of Real-Time Computer Systems

"The Gospel in the field."
— COMPUTER DECISIONS

Here's the overall working knowledge you need for designing and implementing real-time systems. From methods used in on-line and real-time systems, to practical applications, *this unique guide provides approaches for sizing up and setting up new systems.*
Pub. 1967 656 pp. illus. $16.50

10. Programming Real-Time Computer Systems

"Of inestimable value."
— DATAMATION

Answer every question and problem you may face in using real-time computer systems—whether it be in planning, programming, testing, or installing. *Pub. 1966 384 pp. illus. $15.65*

——FREE 15-DAY EXAMINATION COUPON—

SAVE $24.59 by purchasing all ten Martin volumes

☐ Yes, send me the complete Martin ten volume library at the special 15% discount, saving me $24.59. After 15-days' examination I'll remit $139.31 plus postage and handling. If not completely satisfied I'll simply return them within the FREE trial period and owe absolutely nothing.

☐ Please send only those individual volumes I've checked below for a FREE 15-day examination. After 15-days I'll either remit the amount indicated, plus postage and handling, or return my selection and owe not a cent.

☐ 1. (79899-1)	$19.95	☐ 6. (16597-7)	$11.80
☐ 2. (20125-1)	$16.50	☐ 7. (49981-4)	$10.50
☐ 3. (88130-0)	$22.50	☐ 8. (90244-5)	$17.25
☐ 4. (90244-5)	$17.25	☐ 9. (20140-0)	$16.50
☐ 5. (34586-8)	$16.00	☐ 10. (73050-7)	$15.65

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

SAVE! If payment accompanies order, plus your state's sales tax where applicable, we pay all postage and handling charges. Same return privilege; full refund guaranteed.

Dept. 1 D-DATA-IH(2)

PRENTICE-HALL, Englewood Cliffs, N.J. 07632

advertisers' index

Manpower Temporary Services ...184
Microdata Corporation 95
M&M Computer Industries Inc. 50
Modular Computer Systems 67
Mohawk Data Sciences Corp. 140, 141
Monarch Marking Systems 51

NCR 180, 185
NCR, Accounting Computer Division 170
NCR Paper 94
NCR Retail Systems Division 162
NCR Terminals & Computers 124
Nixdorf Computer Inc. 59

Oktronics Data, Inc. 188
Omron Information Products Division .....Cover 3
On-Line Software, Incorporated ...161

Peripheral Dynamics Inc. 131
Pertec Corporation/Peripheral Equipment Division 70
Philips Data Systems 130
Photophysics, Inc. 170
Prentice-Hall 183
Princeton Electronic Products, Inc. ..126

Quest Systems Inc. 184

Raytheon Data Systems 125
RCA Global Communications, Inc. . 47
RCA Service Company, A Division of RCA, Technical Products Service 160
RSVP Services 180
Rusco Electronic Systems, A Rusco Industries Company ...169

Sanders Data Systems, Inc. 152
Source EDP 185
Sperry-Univac 93
Sperry-Univac, Communications and Terminals Division 156
Storage Technology Corporation ...122
Sycor Inc. 120
Sykes Datatronics Inc. 166
Systems Engineering Laboratories 20, 21

Tally Corporation 1
T-Bar Incorporated 104
TEC Incorporated 35-46
Tektronix, Inc. Information Display Division 176
TeleSwitcher Corporation, A Subsidiary of Astrodata, Inc. ...100
Teletype Corporation .....27, Cover 4
Teradyne 58
Texas Instruments Incorporated, Digital Systems Division 23
3M Company 150
3M Company, Data Recording Products Division 55
Topaz Electronics 4, 157

Union Carbide 103
United Air Lines 52
Universal Data Systems 174

Varian Data Machines 10, 11
Versatec Inc. 167

Wangco Incorporated 147
Wavetek Data Communications 9
Wiley-Interscience a Division of John Wiley & Sons, Inc. 189

Xerox Corporation 143

tpc Technical Publishing Company

Arthur L. Rice, Jr., Chairman of the Board
James B. Tafel, President
Gardner F. Landon, Exec. Vice President
Calverd F. Jacobson, Financial Vice President
Edwin C. Prouty, Jr., Secretary and Director of Data Processing

Advertising Offices

Sales Manager and Vice President
John Brennan: Greenwich, Ct. 06830
35 Mason St. (203) 661-5400
Cable: DATAMATION, Greenwich, Connecticut

Eastern District Managers
A. Treat Walker,
Warren A. Tibbetts: Greenwich, Ct. 06830
35 Mason St. (203) 661-5400

New England District Manager & Vice President
Warren A. Tibbetts: Manchester, N.H. 03104
112 W. Haven Rd.
(603) 625-9498

Midwest District Manager
John M. Gleason: Chicago, Ill. 60606
205 W. Wacker Drive
(312) 346-1026

Western Manager and Senior Vice President
Hamilton S. Styron: Los Angeles, Calif. 90035
1801 S. La Cienega Blvd.
(213) 559-5111

District Manager
Alan Bolté, Jr.: Los Angeles, Calif. 90035
1801 S. La Cienega Blvd.
(213) 559-5111

Western District Manager
James E. Filiatrault: Redwood City, Ca. 94061
61 Renato Ct.
(415) 364-3171

U.K., Scandinavia, Benelux
Wallace K. Ponder, European Director
31 Lyncroft Avenue
Pinner, Middx. HA5 1JU
England
Tel: (01) 868 9289
Cables: PACOM, Pinner

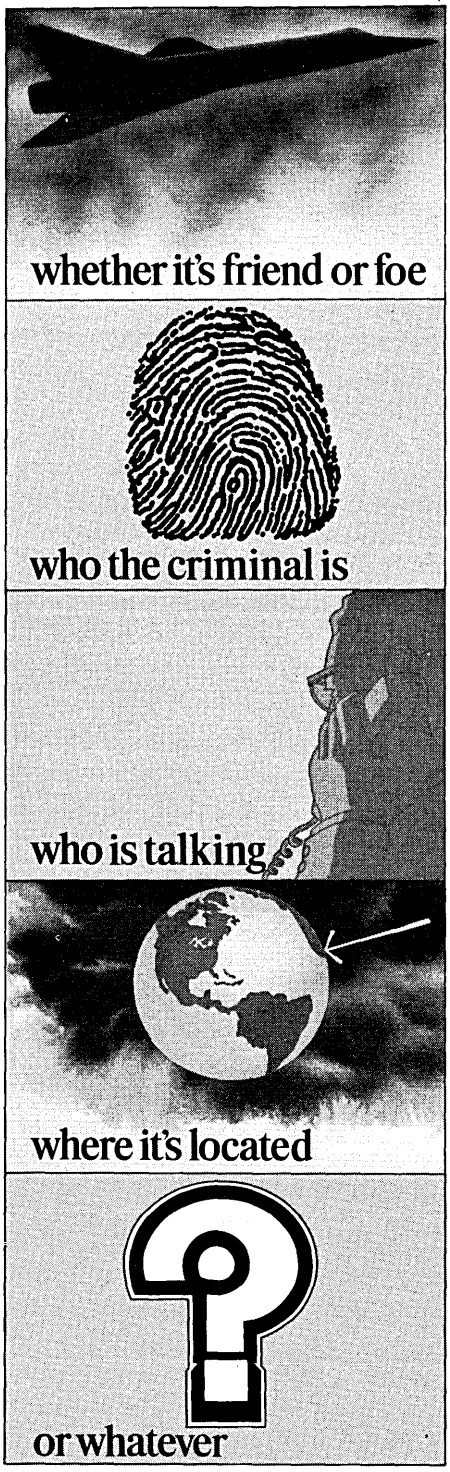
France, Switzerland, Italy
Gerard Lasfargues
48 rue Vital
75016 Paris
France
Tel: 288 90 22

Germany
Bohn International KG
6000 Frankfurt/Main 1
Hansaalee 7
Germany
Tel: 0611/55 80 77

Other tpc Magazines

Plant Engineering
Pollution Engineering
Power Engineering
Purchasing World
Research/Development

Nothing matches Staran for matching. It can tell you in micro-seconds:



Goodyear's STARAN™ associative array processor has no match for correlation capability. Its true-content addressibility (matching data in memory) allows STARAN to search its entire memory in micro-seconds to match given data. Correlation of radar or infrared signatures, map areas, fingerprint files, waveforms from voiceprints, EKG's, etc., are all possibilities. There are more.

STARAN is not everyman's computer. But for those who have problems that require high speed searching of a dynamic data base—or those whose problems require high speed operations on similar data streams—the STARAN associative array processor may very well be the most cost-effective solution.

STARAN is a combination system that does both associative array and sequential processing. It can be added to your system or used in new system developments.

A minimum basic STARAN system sells for as little as $250,000 and software costs can be reduced to one-third of amount required for a conventional system.

Goodyear invites you to try your system problems on the STARAN Evaluation and Training Facility at our plant in Akron, Ohio. See for yourself how STARAN can handle your specific data processing problem.

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

This forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

The Forum

In Continued Defense of IBM

Mr. Valentine's letter and my response in the August issue (p. 25) concerning my April Forum piece have drawn me into an inevitable conflict of the "put up or shut up" variety, so common in data processing publications. In other words, I have been asked to specify those areas in which curtailment of IBM would represent a benefit to the industry greater than the much-discussed and inoperable breakup.

What will solve the "problem" of IBM market dominance? The Telex decision will not. On the face of it, and if sustained on appeal, it might make life a little easier for peripheral manufacturers. However, underestimating IBM and its marketing skill is sheer folly; its marketing supremacy did *not* come from its Fixed Term Plan or its Extended Term Plan, nor from the secrecy of its specifications. The restrictions placed on IBM by the court apply principally to practices initiated in the past two years, *long after* IBM became a dominant force in the marketplace. In fact, it might even appear that IBM established practices in the past few years to use in ultimately settling the anti-trust actions on a basis less severe than breakup or market share curtailment!

In looking for a meaningful solution we have to examine the anti-trust laws and their objectives. The fostering of "free and open competition" provides for two clearly separable benefits: allowing competitive organizations to enter the market freely with possibly superior products, and in addition, giving the consumer the benefit and choice of competing products.

Thus, any solutions to potential market dominance must provide for competitive freedom *and/or* user protection or user benefit. My list of suggestions below covers both categories.

1. Suggestions for the fostering of free competition:
   a. The availability, on a nominal cost basis, of specifications of all new equipment on or after initial delivery.
   b. The right to license manufacture of such equipment on a royalty basis comparable to the normal net profit percentage expected from the sale of such equipment.
   c. The unconditional right to attach components to equipment supplied by IBM, with the provision that any damage done to such equipment would be reimbursable wholly to the owner of the equipment.
   d. Restraints on marketing practices generally considered anti-competitive, such as "knocking" competition, low-balling, and the like. These are defined quite explicitly in the December 1968 complaint of

Control Data Corp., which has been settled out of court.

2. Suggestions for user protection or user benefit:
   a. The establishment of a mandatory standard contract whose terms are protective of the user as well as the vendor. Included should be terms which provide for protection even during the pre-sales cycle: the inclusion of the proposal and all other correspondence as a part of the contract (by reference) would eliminate false claims or overstatements in the pre-sales situation, now neatly taken care of by printed disclaimers. Other terms might cover reliability guarantees; rights to purchase parts, maintenance, and supplies in perpetuity; rights to software use, and the like.
   b. The elimination of all personnel placement or recommendation functions now performed officially or unofficially by vendor employees. No employee of IBM should ever comment in any way, positively or negatively, about the employees of its customers.
   c. The development or funding of development of a set of uniform standards and disciplines for documentation, programming, systems design, and computer operations. This of course must include the use of such techniques in all software, and the dissemination of these to all users to simplify interchange of programs, personnel and so forth.

Standardization of Diagnostic and Error Messages in COBOL and

An interesting concept which will be most worthy of users' support is the standardization of diagnostic and error messages in the two major programming languages, COBOL and FORTRAN.

Judging from my experiences with the existing literature and the trends currently taking place in the standardization of COBOL and FORTRAN, it appears that very little work has been done to consider the standardization of diagnostic and error messages during the compilation and execution of computer programs.

COBOL and FORTRAN have been around for the past 15 years and so have most of the common errors committed by users of these two programming languages. The two committees currently considering revisions and extensions to the standards of both COBOL and FORTRAN, respectively, should also address themselves to the problem of standardizing the diagnostic and error messages of these two languages.

Virtually every nontrivial COBOL or FORTRAN program, when first written, contains one or more errors in syntax or semantics. Today's processors will detect many of the more common types of syntactic and semantic errors. However, no two processors, even from the same computer manufacturer, will display and flag these errors in the same manner.

Some processors give crypt type diagnostics while others pinpoint the exact location of the errors. The crypt type diagnostics often consist of numeric or alphanumeric error codes which force the user back to the manufacturer's manual for further information. Surely during the past 15

3. Suggestions to benefit both competition and users:
   a. The provision, at reasonable charges, of a full set of training programs for equipment maintenance personnel.
   b. The agreement to provide spare parts, blueprints, and engineering changes, in perpetuity, to allow customers to provide their own maintenance.
   c. Defined and mandatory pricing practices, such as established and firm purchase/rental ratios, firm maintenance cost as a percentage of either purchase or rental, quantity purchases discount, long-term leases at fixed rates, deep software discounts for multiple cpu usage, and the like.
   d. Firm definition of equal rights for *all* users of IBM equipment, whether initial or subsequent, whether purchase or rental, whether competitive or not.
   e. The funding by IBM of an installment purchase plan, at realistic interest rates, to allow anyone to purchase should they so desire.
   f. The publication of a firm trade-in schedule for used equipment.
   g. The agreement to recondition equipment under continuous IBM maintenance at a fixed rate, dependent solely on age of the equipment.

It is clear that this list can be expanded ad nauseam, and I welcome any contributions. The major objective is still to foster a continuing dynamic industry, with competition which benefits the end user. This objective cannot be achieved by an *arbitrary* breakup or curtailment of IBM.

—Dick H. Brandon

Mr. Brandon is president of
Brandon Applied Systems, Inc., New York,
and a frequent contributor to DATAMATION.

FORTRAN

years we should have been able to develop better diagnostics and to standardize them in COBOL and FORTRAN so that these diagnostics are at least meaningful to the beginner as well as to the professional programmer.

It should also be pointed out that there are literally thousands of possible coding errors, both syntactic and semantic, which will go undetected by the processor until an abend occurs during the execution of the program. I don't expect the standards committees to consider every conceivable type of programming error. There is plenty of evidence among the users and computer manufacturers suggesting which types of programming errors occur frequently in a computing and data processing environment. In addition, even though no present day processor can produce good diagnostics or error messages, we can at least research this area of programming for better ideas in order to assist the end users with their debugging tasks.

Some research has been done in the area of minimizing common errors, such as the construction of "forgiving" type processors at various academic institutions. However, these "forgiving" type processors serve to correct errors that beginners often make.

We have come a long way in standardizing the COBOL and FORTRAN language statements. It is time we examine the standardization of the diagnostics in these two languages.

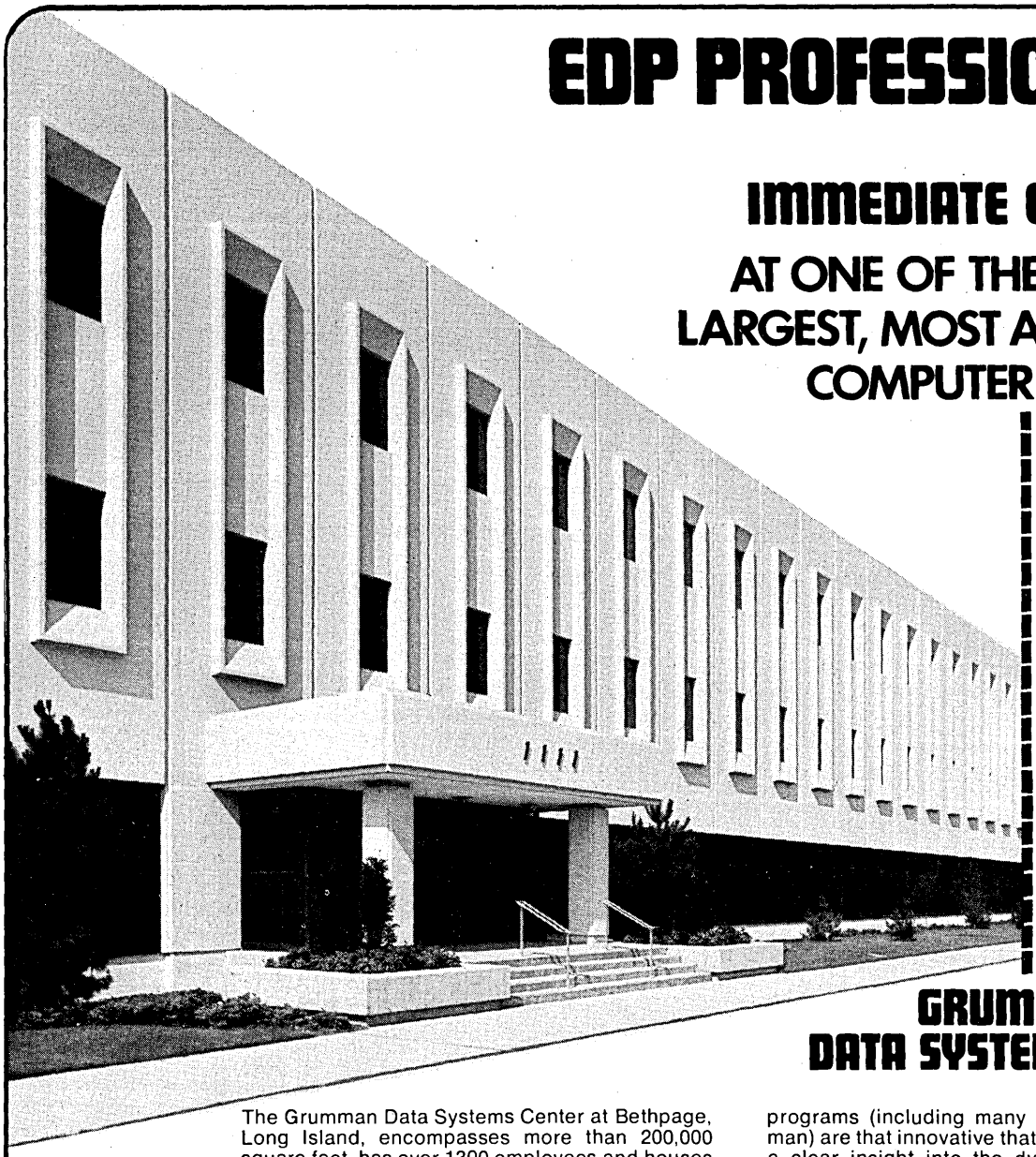
John Maniotes

Professor, Computer Technology
Purdue Univ., Calumet Campus

EDP PROFESSIONALS:

IMMEDIATE OPENINGS

AT ONE OF THE WORLD'S LARGEST, MOST ADVANCED COMPUTER FACILITIES



GRUMMAN DATA SYSTEMS CENTER

The Grumman Data Systems Center at Bethpage, Long Island, encompasses more than 200,000 square feet, has over 1300 employees and houses most of the most sophisticated equipment extant including:

- 370 SERIES/168 (3 million bytes) /155/135/145/158
- 360 SERIES/75/67/30, CDC CYBER 70, CDC 6400, CDC 1700

Work activity of the broadest spectrum, dictated in part by the diverse nature of our customer's business, include systems for: BANKING • MANUFACTURING • PRODUCTION CONTROL • HOSPITALS • SPACE FLIGHT • TELEPHONE & COMMUNICATIONS • CIVIL & MUNICIPAL • EDUCATION • UTILITIES • RESEARCH & DEVELOPMENT • PRODUCT DEVELOPMENT.

Operating in an up-to-the-minute environment, programs (including many developed by Grumman) are that innovative that they not only present a clear insight into the dynamic interaction of jobs in process and system resources, but actually identify system deficiencies and bottlenecks.

The kinetic atmosphere at Grumman is conducive to accelerated career growth and a major expansion of our capabilities is now under way. EDP Professionals don't have to peer too far into the future to see the benefits conferred by working in an advanced data center such as Grumman's. Other, more formal, benefits include excellent salary, major medical, life insurance, tuition reimbursement, in-house training by senior people and a comprehensive pension plan that calls for no contribution other than the company's. Your attention is directed to the following immediately available positions in our Bethpage and Calverton facilities.

■ PROGRAMMERS ■ SYSTEM/SR. SYSTEMS ANALYSTS ■ PROGRAMMER/SR. PROGRAMMER ANALYSTS ■ SYSTEMS AND SR. SYSTEMS PROGRAMMERS ■ COMMUNICATIONS ANALYST ■ TELEMETRY ENGINEERS ■ DATA BASE DESIGNER/IMS2 ■ SYSTEMS ENGINEERS ■ MAINTENANCE TECHNICIANS

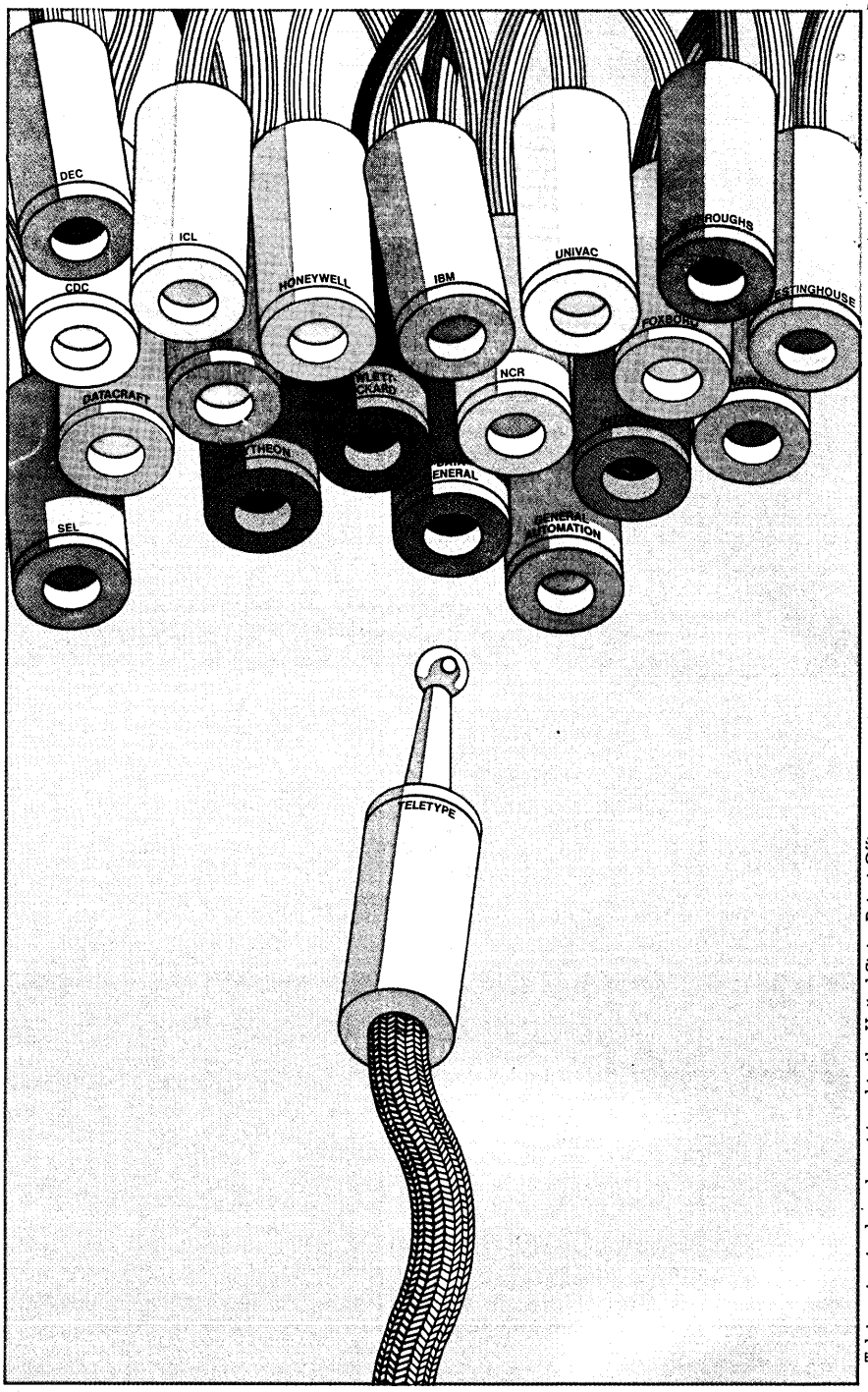
For a convenient interview please send resume in confidence to H. Mayors,

Grumman Data Systems

Computer services and equipment that lower the cost of computing.

BETHPAGE, N.Y. 11714.
An equal opportunity employer. M/F

For years, people thought Teletype® machines only talked to themselves.



Fact is, Teletype machines have been carrying on intelligent iversations for years with some the fastest information movers the world. Computers.

We've earned a good, solid ame for ourselves in computer ommunications because our equipment is compatible with practically any computer-based system.

Our product line proves the point.

The number one standard-duty data terminal in the industry is our model 33 series. And our new wide-platen model 38 offers big system features at economy system prices.

Heavy-duty operation with minimum maintenance? Check out our model 35. And our model 37 series delivers the utmost in flexibility and vocabulary for complex data systems.

We also build equipment for paper tape systems, as well as a magnetic tape terminal for greater on-line savings. As you can see, our reputation in point-to-point communications has served us well in computer terminals. No one comes close to us in reliability, flexibility and economy.

It takes more than manufacturing facilities to build the machines Teletype Corporation offers. It also takes commitment. From people who think service is as important as sales. In terminals for computers and point-to-point communications.

That's why we invented a new name for who we are and what we make. The computer-cations people.

TELETYPE

CIRCLE 3 ON READER CARD

For more information about any Teletype product, write or call TERMINAL CENTRAL: Teletype Corporation, Dept. 81F, 5555 Touhy Avenue, Skokie, Illinois 60076. Phone 312/982-2500.

Talk about response to a new idea.

Mercy!

When we introduced the first programmable CRT terminal with "variable I.Q." at the June, 1973, NCC, we were not quite prepared for the heavy response.

Since that time we've been on the receiving end of a barrage of very good questions from many highly qualified individuals.

For example:

"What's meant by 'variable I.Q.'?"

A: Stated simply, it means you can plug in a card to add memory—plug in another card to add or change programs. Fact: The OMRON 8025 CRT is field expandable to meet your needs, look at the available slots in the card cage.

"When can I run my fingers over that keyboard?"

A: November 15. First come—first served.

"When can I expect deliveries?"

A: January. How many do you want and how would you like your system configured?

"What about price?"

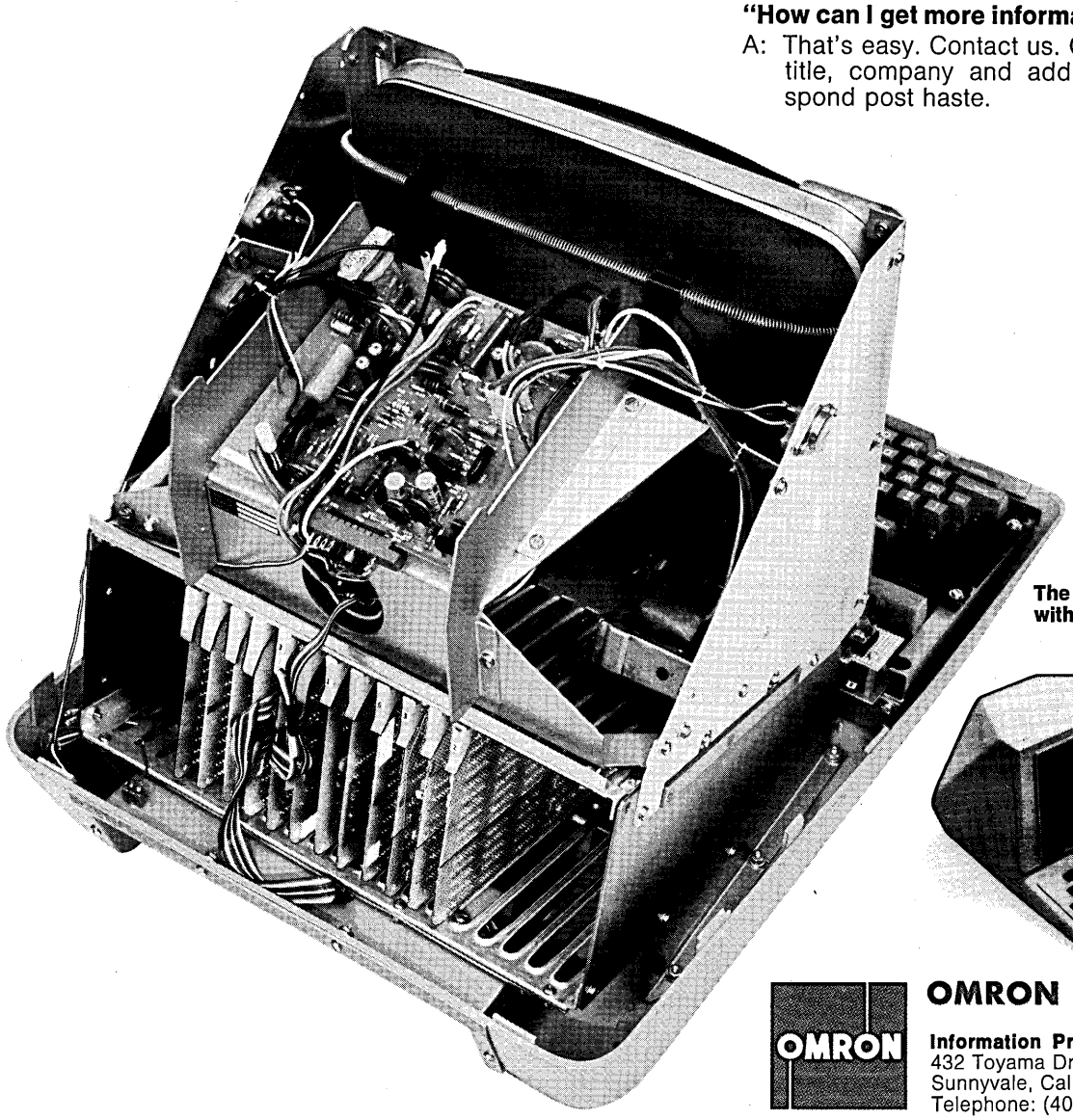
A: Price is determined by quantity, the memory required and the particular system configuration specified. Fair?

"What about service?"

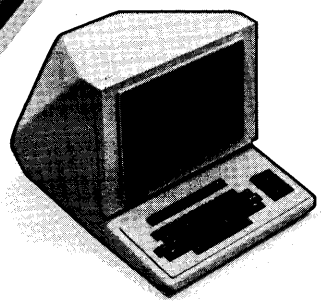
A: Nationwide service available in January.

"How can I get more information?"

A: That's easy. Contact us. Give us your name, title, company and address and we'll respond post haste.



The Terminal with "Variable I.Q."



OMRON R & D

Information Products Division
432 Toyama Drive
Sunnyvale, California 94086
Telephone: (408) 734-8400

CIRCLE 2 ON READER CARD