DATAMATION

78

May
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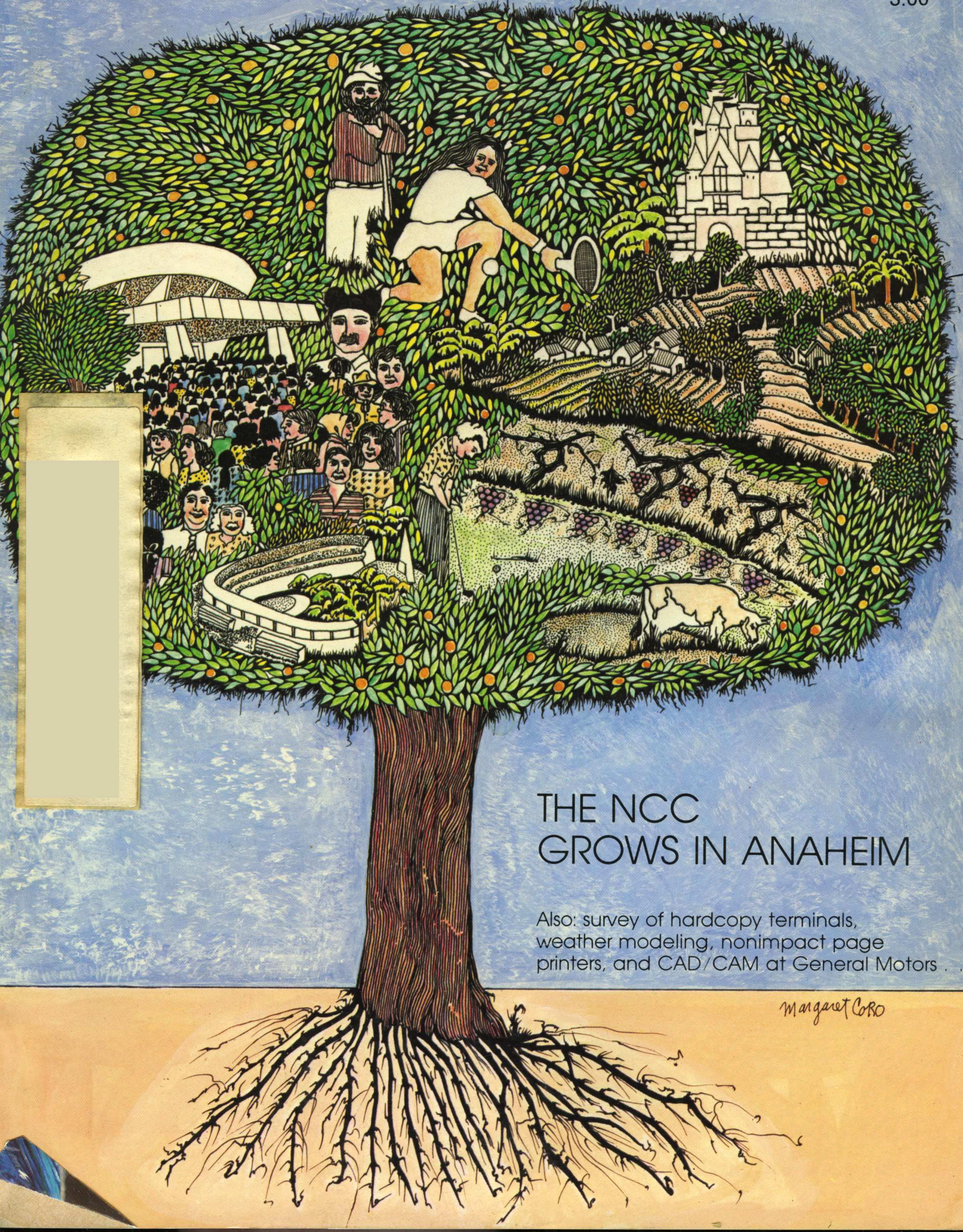


THE NCC GROWS IN ANAHEIM

Also: survey of hardcopy terminals, weather modeling, nonimpact page printers, and CAD/CAM at General Motors . . .

Models 9100/9300 Vacuum Column Tape Transports . . .

Proven. Period.

Kennedy's vacuum column digital tape transports weren't designed yesterday to grab a piece of a growing market. In fact, they virtually founded the vacuum column market. They were the first to have such features as a capacitive tape-location detector for improved tape life; air bearings and hardcoated read-after-write heads to reduce tape wear and improve data integrity.

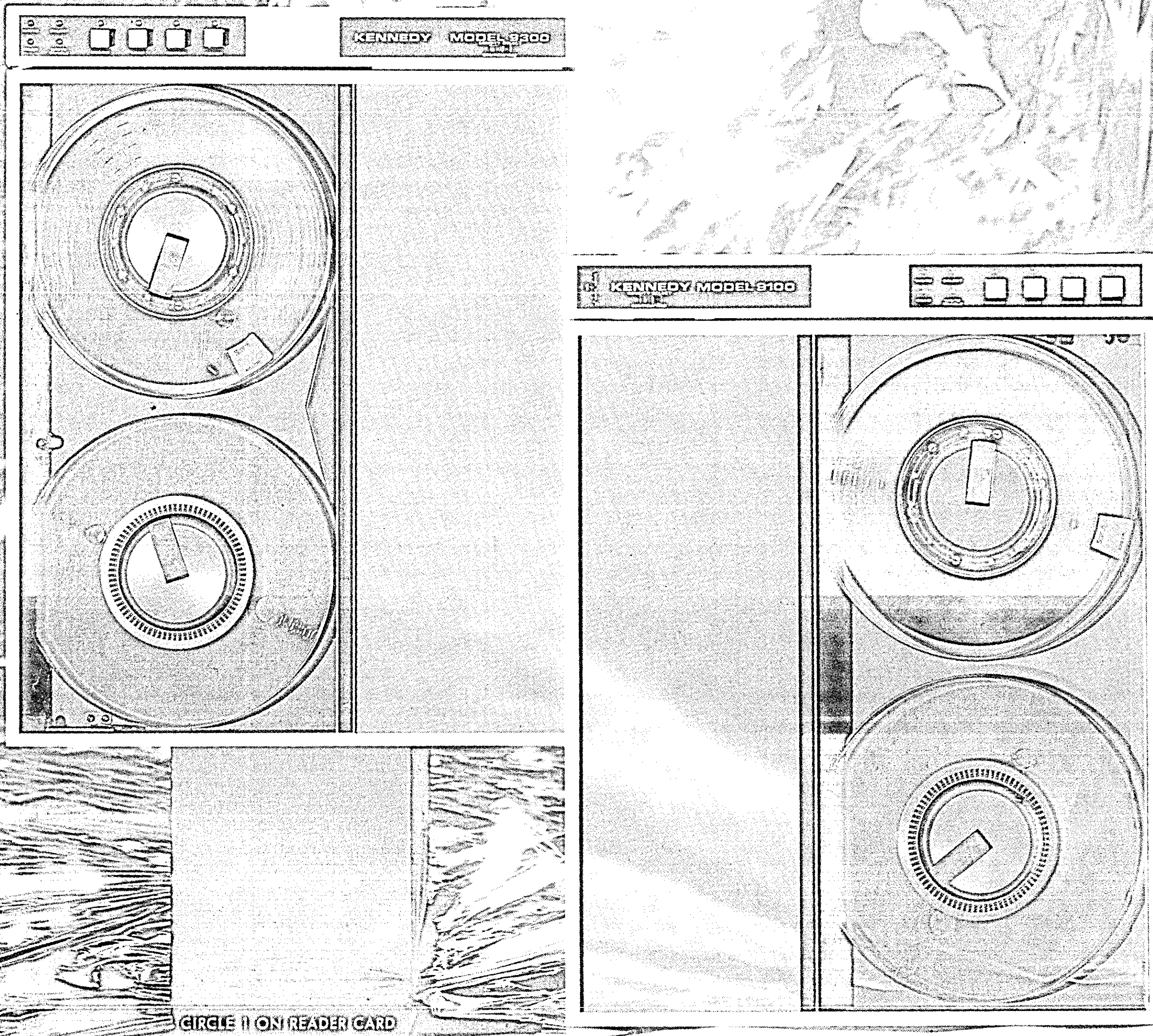
Model 9100 (75 ips) and 9300 (125 ips) offer crystal-controlled timing, read-after-write shortened skew gate, front-accessible test panel, quick release hubs and simplified tape loading.

Data densities are 200/556 cpi or 556/800 cpi in 7-track units and 800 cpi, 1600 cpi or 800/1600 cpi on 9-track transports. The format is NRZ1/PE.

Models 9100/9300 offer more features, more performance, and most important, more time-in-the-field than any competitive units.

Why do we think so? Simple. Our figures show that we are about 3000 satisfied users ahead at this point.

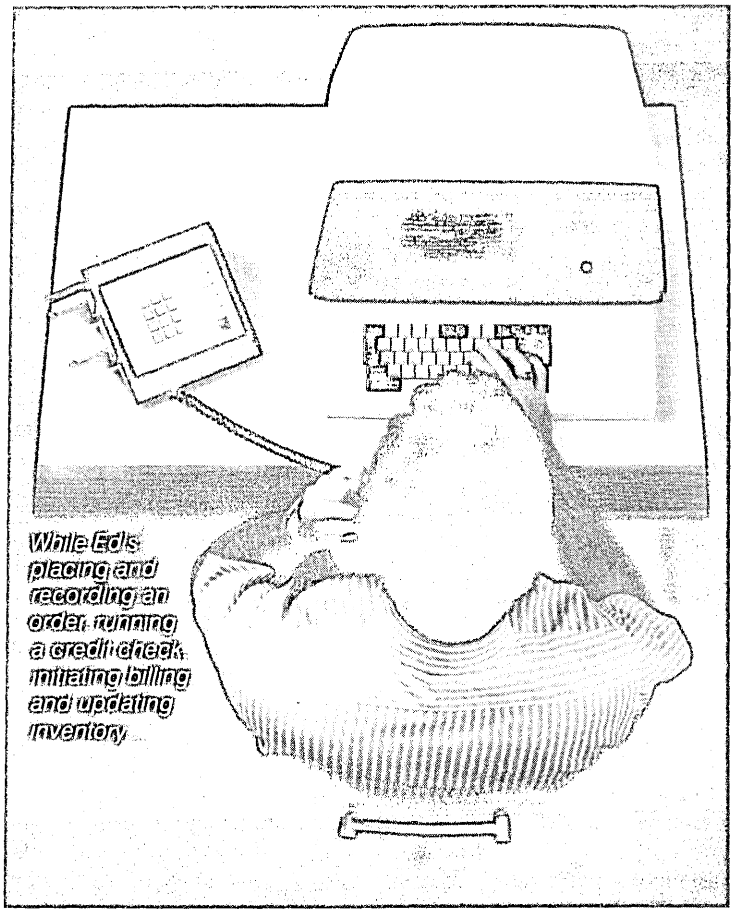
KENNEDY CO.
540 W. WOODBURY RD., ALTADENA, CALIF. 91001
(213) 798-0953

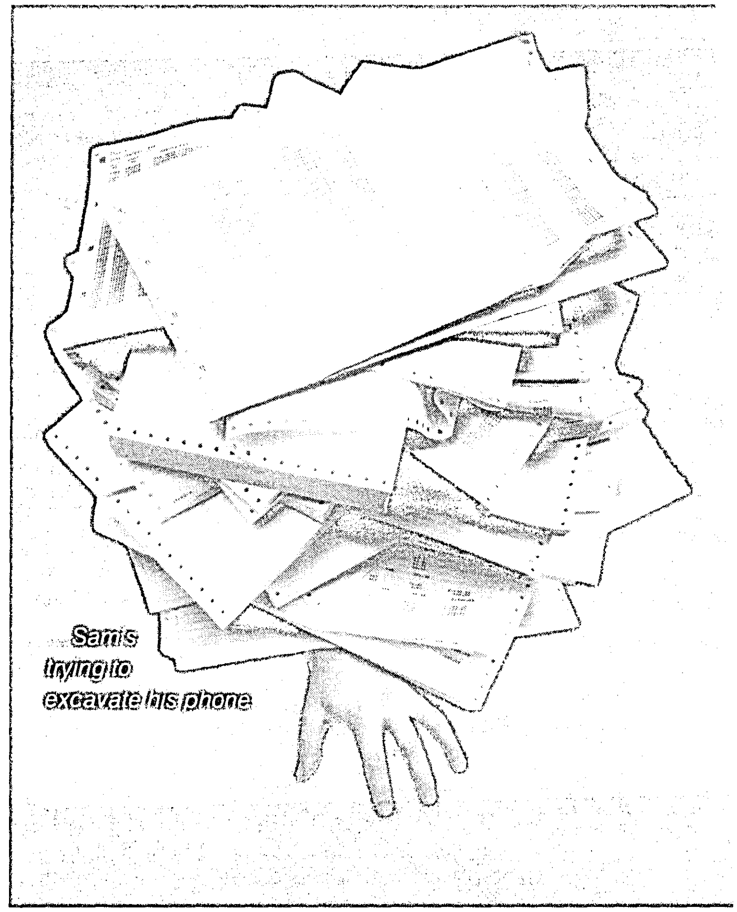


CIRCLE 1 ON READER CARD

KENNEDY-QUALITY-COUNT ON IT

With XL40 Distributed Processing, your people will be doing business...





...while your competition's doing paperwork.

The XL40 Distributed Processing System delivers decision-making data fast to the people in your company who need it most. So they can be making decisions—while the competition's still sorting through yesterday's printout.

Faster, more accurate information management.
Accuracy and speed increase—and costs decrease—when information is managed by the people who know it best. That's why the XL40 distributes data processing power to source departments.

Staff personnel—not computer specialists—operate the system, using centrally provided programs. They're familiar with the data they're handling, so they make fewer mistakes. And if corrections have to be made, they have all the source data they need—usually right in the same room.

Concurrent—no waiting in line.
While operators are entering data, the XL40 can concurrently generate a report and communicate with your central computer. Files can be retrieved, accessed and updated from source departments, creating a real-time data base and providing up-to-the-minute information.

Ready for business.
The XL40 was designed for simplicity and reliability. Getting the system up and running is fast and easy. The XL40's professional education program will train operators—even Harry on the loading dock—in no time. And the XL40's modular hardware and flexible, COBOL-based software enable your staff to go right to work once the system is installed.

Built and backed by Pertec Computer Corporation.
The XL40 is manufactured, marketed and supported by PCC, the world's leading independent producer of computer peripherals, distributed processing and data entry systems, and microcomputers.

Call us today for more information on the XL40. We'll send you a brochure that explains the system in detail. Or we'll be happy to arrange a demonstration.

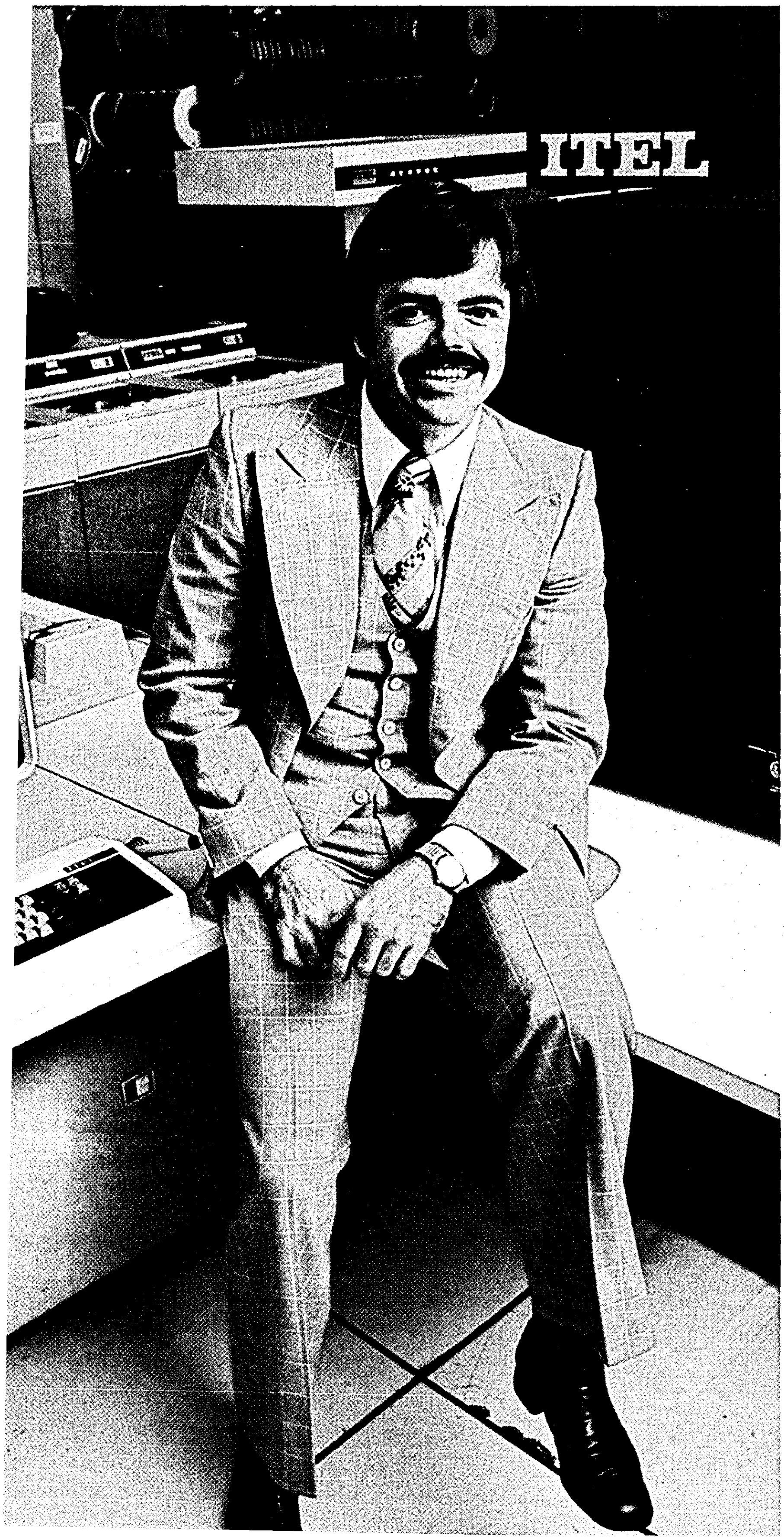
PCC
PERTEC COMPUTER CORPORATION

CMC Division
12910 Culver Boulevard, P.O. Box 92300
Los Angeles, California 90009
(213) 822-9914 TWX (910) 343-6451

PCC and Columbia Pictures invite you to visit Booth 2103 at NCC and let the XL40 help you find your long lost love.

CIRCLE 4 ON READER CARD

"Itel's technical staff is one of the best I've ever encountered."



Tony Thompson
Vice President/General Manager
Computer Service Division
PRC Computer Center, Inc.
A Planning Research Company,
McLean, Virginia

"From the very first pre-installation meeting until our AS/5 went on-line, Itel kept everyone informed, on a day-to-day basis, of exactly what was going on. Not just the management in our data center, but also our operations staff—the same people who would eventually be using the equipment.

"Unlike a lot of other hardware manufacturers we've seen, Itel followed through completely on their original installation plan. In fact, I've never seen a computer installed so fast. Within two hours, they were ready to start running diagnostic tests.

"We're thoroughly pleased with the cost-efficient performance and total reliability that our AS/5 provides. And we continue to be impressed with the benefits of its compact internal design. For example, a reduction in power consumption—up to 50% less than our previous computer—requires less air conditioning and gives us more breathing room for additional peripherals.

"With a product as advanced as the AS/5 is, backed up with the quality personnel that we've seen, we know that Itel was the right choice."

The Advanced System™ is the most significant product Itel has brought to the world of data processing in the tradition that has always made Itel the financial and systems alternative.

ITEL CORPORATION
Data Products Group
One Embacadero Center
San Francisco, California 94111
Telephone: (415) 955-0000

See the Itel Advanced System™ 5 in operation at Booth #3000 during the 1978 NCC show.

CIRCLE 27 ON READER CARD

DATAMATION®

VOLUME 24 NUMBER 5 This issue 145,128 copies **MAY 1978**

FEATURES

NEWS IN PERSPECTIVE

DEPARTMENTS

About the cover
All the good things that grow in Anaheim aid and abet the growing NCC. Design is by Margaret Coro: Joan Lesser/Etcetera.

DATAMATION.

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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. 420 Lexington Ave., New York, N.Y. 10017, (212) 682-7760. 134 Mt. Auburn St., Cambridge, Mass. 02138, (617) 354-2125. 6605 Burlington Pl., Springfield, VA 22152. (703) 569-3383. **Southwestern:** 11500 Stemmons North, Suite 152, Dallas, TX 75299, (214) 247-5221. **Western:** 2680 Bayshore Frontage Rd., Suite 401, Mountain View, CA 94043, (415) 965-8222. **Foreign:** 15 A St. Ann's Terrace, St. John's Wood, London, NW8, England; (01) 722-5088; 24 Stafford Road, Artarmon, Sydney, NSW 2064, Australia, 41-5748.

GRAPHIC DESIGN AND PRODUCTION

Art & Production Director	Cleve Marie Boutell
Advertising Production Manager	Marilee Pitman
Production Assistant	Alberta R. Martin

CIRCULATION
35 Mason Street, Greenwich, CT 06830

Circulation Manager	Suzanne A. Ryan
Marketing Research Manager	Deborah Dwelley
Publisher	James M. Morris
Assistant Publisher	F. Douglas De Carlo

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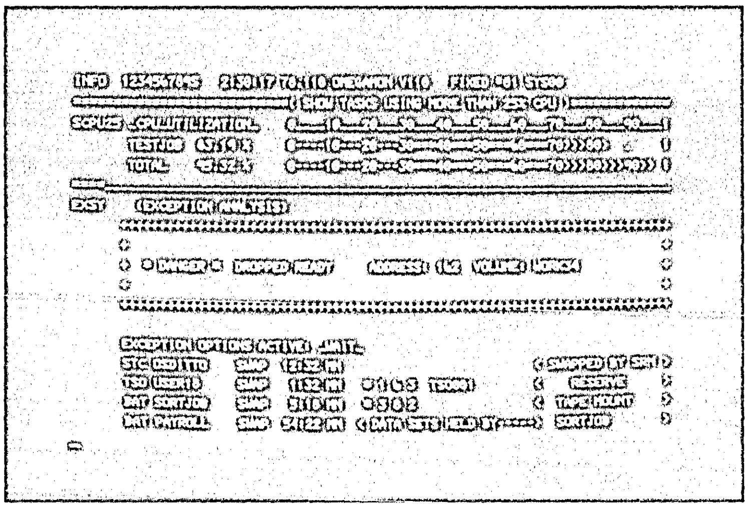
OMEGAMON

New Monitor Warns of MVS Problems in 5 Seconds!

State of the art in Software



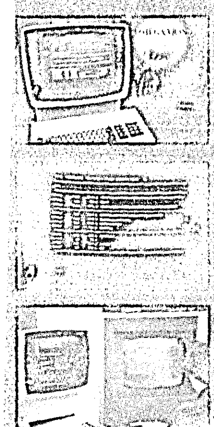
Breakthrough

Automatic Exception Analysis diagnoses performance and availability problems in realtime!

Comprehensive Analysis

Hardware—Disks Dropped Ready, Reserve Lockouts
MVS Internals—SRM Problems
User Impact—Poor TSO Response, Batch Throughput

(See Page 7 of the May, 1978 issue of DATAMATION)



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User Experiences

"Our Operators like the idea of warning messages coming to them automatically"
"Surprised that no hooks are required"
"Enabled us to complete our MVS Conversion one month ahead of schedule"
"Discovered our Poor TSO Response was caused by SRM Problems"

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Marina Del Rey, Calif. 90291
1-213-821-2902

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CANDLE SERVICE CORPORATION
P.O. Box 280 Station "A"
Toronto, Ontario
Canada M5W 1B2
1-416-483-9041

Looking Back in DATAMATION

May/June 1958

Companies: Seven downstate Illinois engineering firms, all of them competitors, have formed a unique corporation around a Bendix G-15D computer which will allow them to give stiffer competition to larger firms. The organization is the Midwest Computer Service, Inc. with E.M. Chastain as president.

Conferences: Panelists at a Western Joint Computer Conference session in Los Angeles: Cuthbert C. Hurd, B. J.

Schafer, WJCC chairman Willis Ware, and Harold D. Lasswell. Close to 2,000 attended the conference.

Products: NCR's National 304 Electronic Data Processing System, the first wholly business-designed large-scale system with all solid-state circuitry is now entering production. With a 2,000-word memory (of 10 character words), a minimum system sells for $800,000.

Innovations: Michigan State Univ.'s computer, MISTIC, now plays "Waltzing Mathilda" thanks to a tape given to the university by the Univ. of Sydney.

May 1968

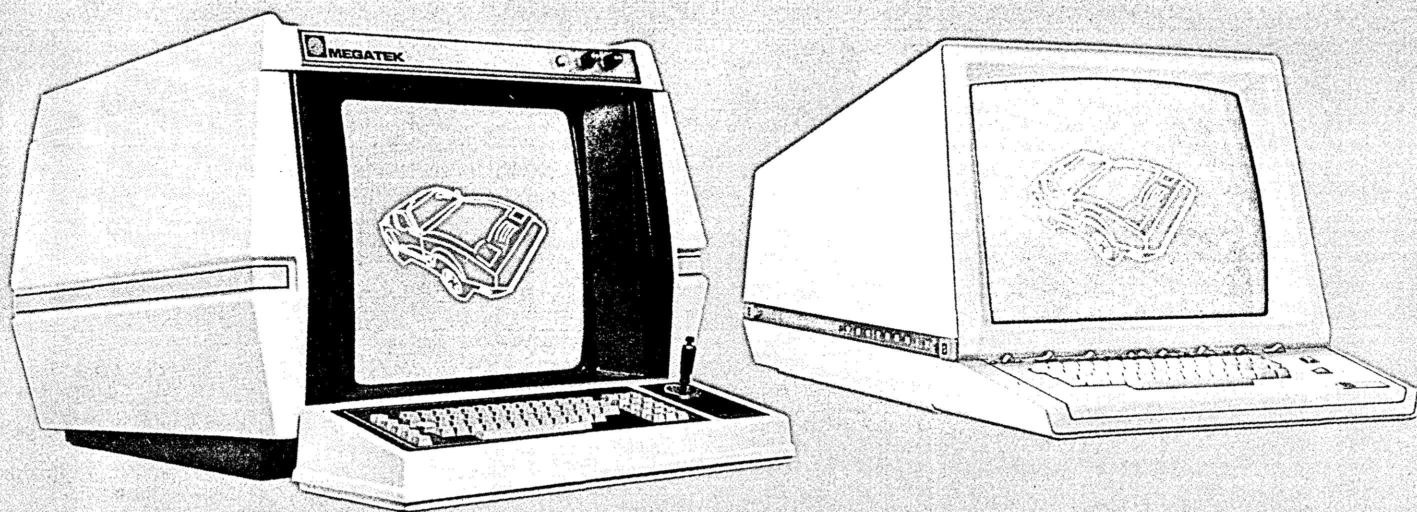
Schools: Too many private data processing schools specifically set up to train the novice are not doing their job; they are short-changing their students. Recently an ACM committee was formed to deal with the problem.

Services: Computicket Corp., subsidiary of Computer Sciences Corp., expects to start its Los Angeles operation July 1, offering computer reservations for theaters, sports events, and musical attractions.

IBM: IBM ended its Industry Information Service Feb. 15 and with it went the 2½-year-old contract with Dun & Bradstreet to market D&B census data.

Associations: Eleven programming service companies have formed the Association of Independent Software Companies to promote the interests of their segment of the industry.

Twins.



Your computer can't tell them apart.

Good product, the 4014.™ So good, in fact, that we designed our MEGRAPHIC 5014 Refresh Graphics System to do everything the 4014™ does, and more.

The secret? A high performance graphic processor coupled with a high resolution electromagnetic CRT. A built-in minicomputer. And EMUTEK,™ our proprietary *TEKTRONIX® emulator that makes your computer think it's talking to a 4014.™

But, right away, you'll see that one system delivers more graphics for the money.

Zoom, scale, clip, rotate, and "rubber band" images to your heart's content. The 5014 is a refresh graphics system and that means there is no need to erase the whole screen to make changes. The 5014 does it in real time. Plus a full FORTRAN OS.

And, unlike storage tubes, the 5014 has variable brightness levels. So you can see clearly even under the strongest office lighting.

But, best of all, the MEGRAPHIC 5014 costs substantially less than comparable systems. For the OEM, that means better margins. And, for the sophisticated end user, it simply means more interactive graphics for the money.

So before you buy any graphics system, call MEGATEK at (714) 455-5590.

Don't wait. And don't pay more for less. If your 4014™ just isn't enough system, call Peter Shaw today and ask for a demonstration of the MEGRAPHIC 5014 System.

Thirty days later, you could have twins.

*"TEKTRONIX®" and 4014™ are registered trademarks of Tektronix, Inc., use of which in no way constitutes endorsement.

The refreshing alternative.

MEGATEK CORPORATION

3931 Sorrento Valley Blvd.
San Diego, California 92121
Telephone: (714) 455-5590
TWX: 910-335-2056

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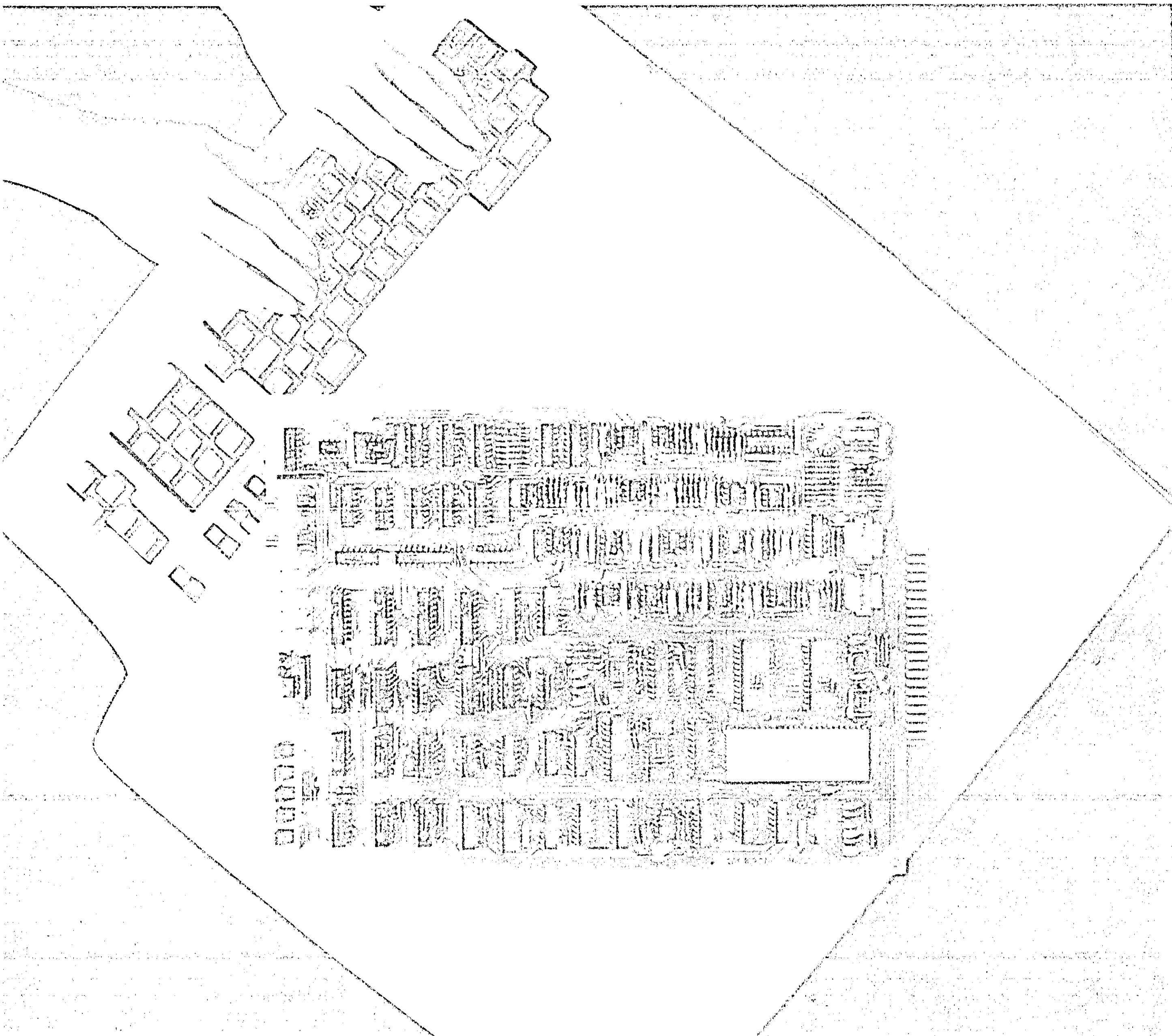
CIRCLE 22 ON READER CARD

See us in Booth 1715 at NCC



UDS has t 4800 bps Bell-compatibl OEM modem- <100 square inches

UDS has leapfrogged current LSI technology with nanosecond microprocessor performance! All components are industry standards — no custom or single source parts are used.

- First chance to build-in. Radically reduced space requirement (including .5" maximum component height) and low power consumption ease design constraints.
- Design flexibility. Most parameter changes require firmware alterations only. Physical layout can be adapted to your specifications.
- Adaptive equalization. Innovative design accommodates diverse line conditions.
- Bell compatibility. Available in 208A (four-wire) and 208B (two-wire) configuration.
- Cost/effectiveness. Microprocessor power and advanced design make the integral UDS 208 your most cost-effective buy for OEM applications at 4800 bps.

For further details, contact us at Universal Data Systems, 4900 Bradford Dr., Huntsville, AL 35805. Phone 205/837-8100. TWX 810-726-2100.

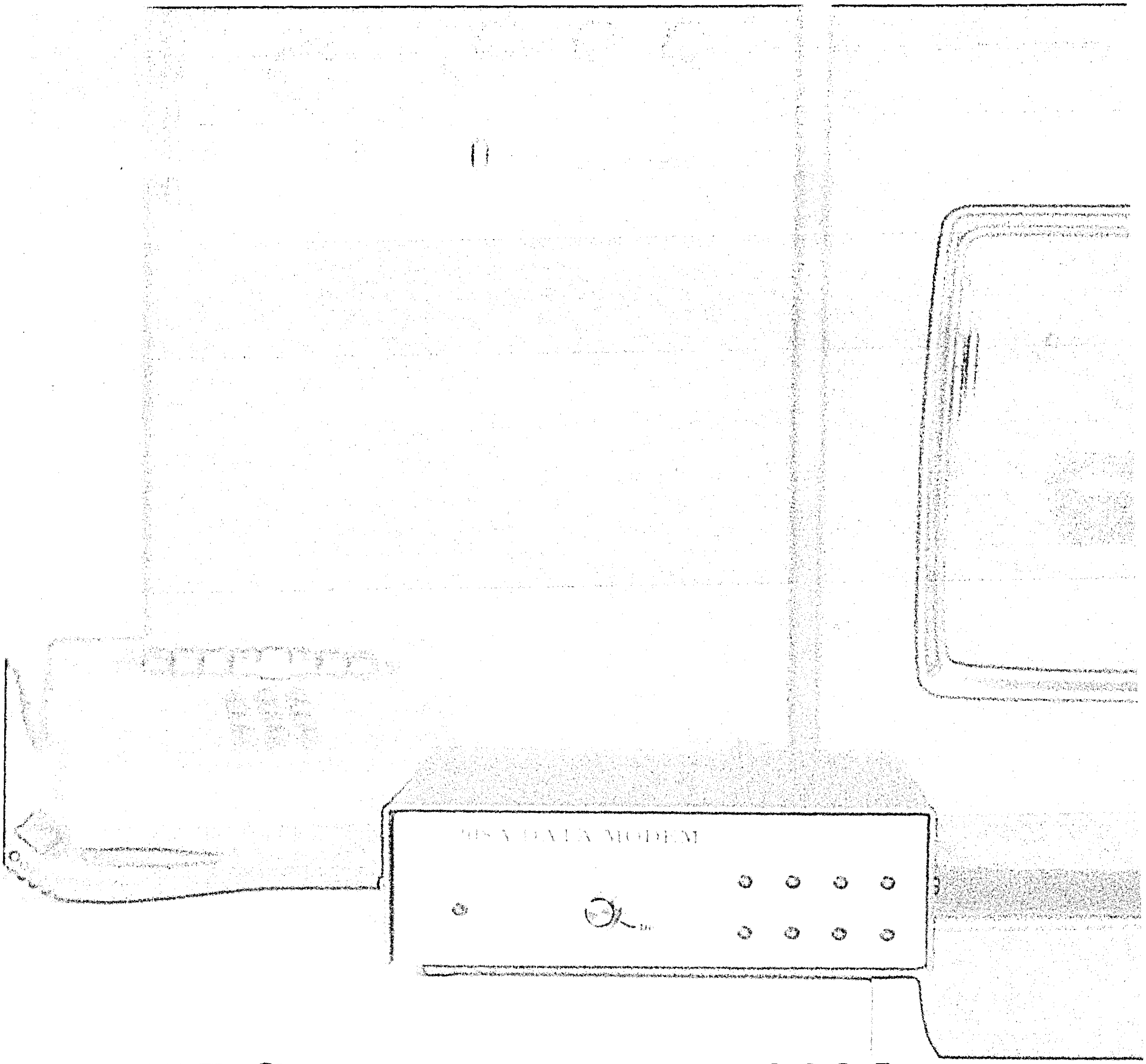
UDS universal data systems 1977

Confidence in Communications

See us at Booth 2117-2119 NCC

Created by Hall & McKenzie Inc. Winter Park, Florida

CIRCLE 74 ON READER CARD



UDS announces a 4800 bps Bell-compatible microprocessor modem.

UDS has leapfrogged current LSI technology with nanosecond microprocessor performance! All components are industry standards — no custom or single-source parts are used.

- **Bell compatibility.** Available in 208A (four-wire) and 208B (two-wire) configurations, one-third Bell's size.
- **Reliability.** A drastic reduction in total number of components results in a longer MTBF.
- **Multi-channel opportunity.** A 7" x 19" rack-mountable enclosure accommodates up to eight single-channel cards.
- **Cost/effectiveness.** Microprocessor power and innovative design make the UDS 208 your best buy for data communications at 4800 bps.

For further details, contact us at Universal Data Systems, 4900 Bradford Dr., Huntsville, AL 35805. Phone 205/837-8100; TWX 810-726-2100.

See us at Booth 2117-2119:NCC

IDCMA

universal data systems

Confidence in Communications

Created by Hall & McKenzie, Inc., Winter Park, Florida

CIRCLE 137 ON READER CARD

"Towns you've probably never heard of" are now key locations in major data communication networks. And they're big in using terminals in many local applications.

That's why Trendata expanded its nation wide service facilities to cover places such as Victoria, Texas. Any data communications terminal manufacturer could have shipped a system there. We backed up a recent Victoria installation with a full training and service program.

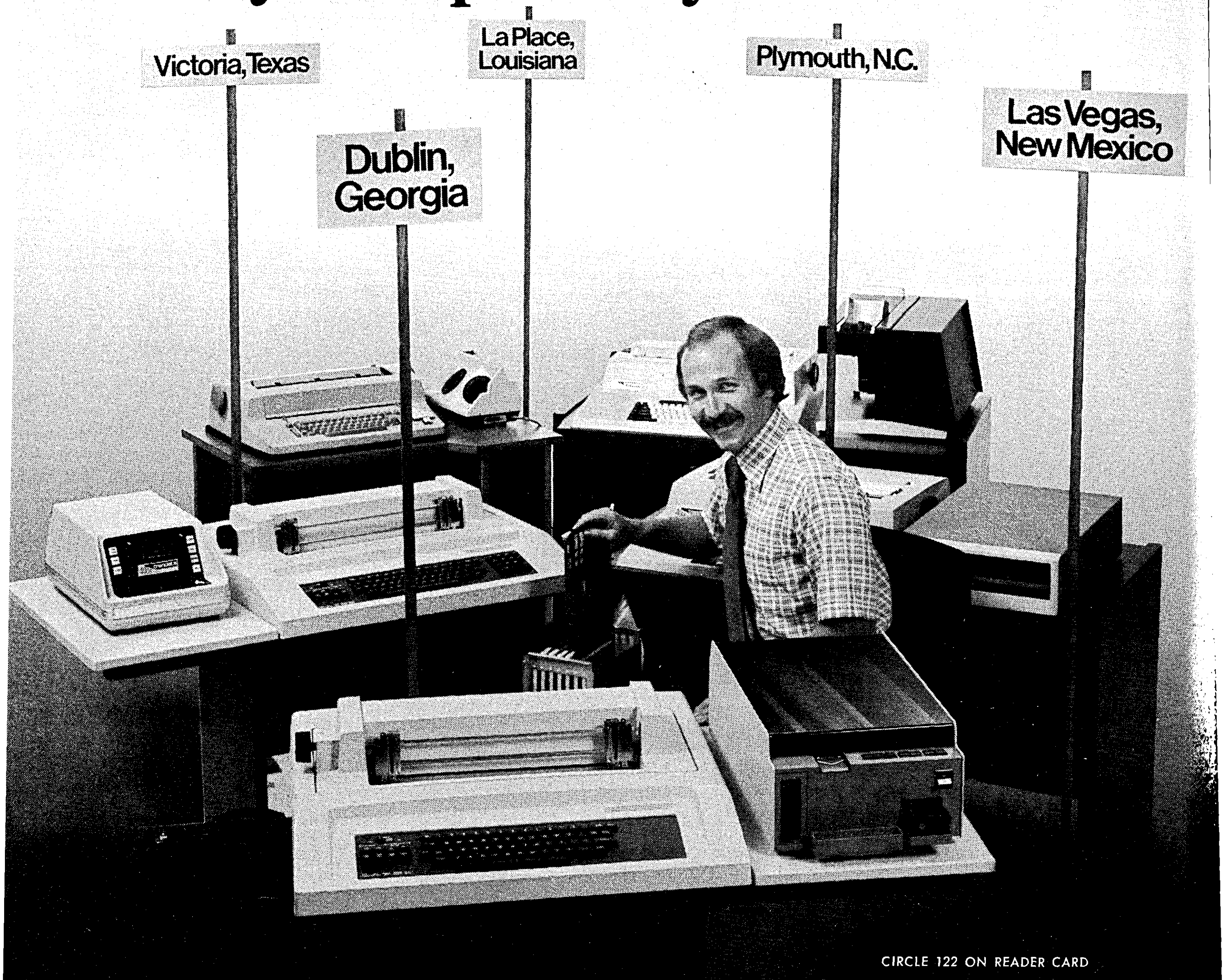
We like towns like Dublin, Georgia because we offer everything from a system for wide flexibility and high production to a single reliable machine for limited applications. We handle the purchase, lease or rental program to keep it simple. And we provide peripherals and supplies to avoid further complications.

Trendata communication terminals are designed to be as reliable and trouble-free as possible, but when you do need service, our factory trained serviceman will be there in a matter of hours...because we realize that downtime on a system in Las Vegas, New Mexico can be just as costly as one in New York City.

Applied Magnetics
Trendata

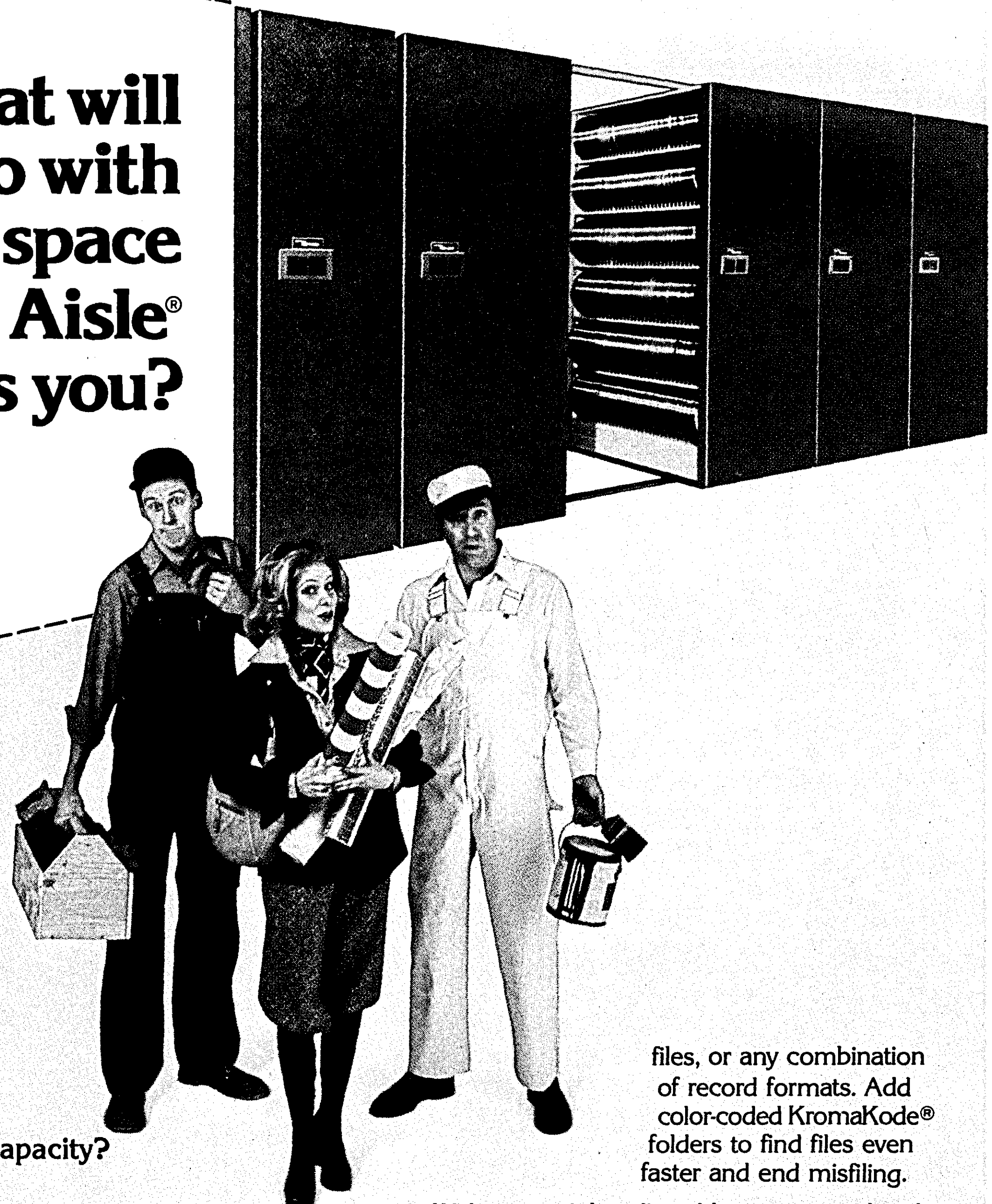
610 Palomar Avenue, P.O. Box 5060
Sunnyvale, CA 94086
(408) 732-1790

Our service reaches towns you've probably never heard of



CIRCLE 122 ON READER CARD

What will you do with all the space Magic Aisle® saves you?



Add an office?
Enlarge a room?
Widen a hall?
Or triple your filing capacity?

Let's face it. Conventional filing cabinets and open shelf units waste space. Lots of it that could be put to better use. That's reason enough to consider Acme Visible's Magic Aisle high density filing system, with 5 second access.

Magic Aisle's compact mobile shelving is secured on floor-mounted tracks—until you press a button. Then the Magic Aisle lights up and slides open where you wish entry. In seconds, you have two-way access to computer reels, microforms, print-out reports, binders and books, small parts, insurance policy/claim folders, purchasing/inventory master files, or any combination of record formats. Add color-coded KromaKode® folders to find files even faster and end misfiling.

With up to eight adjustable tiers on each side, Magic Aisle utilizes every cubic foot of space available! So you can control up to three times as many records in the same space.

Acme Visible offers the Magic Aisle in five manual, mechanical and motorized systems. Whatever system you select, you'll get the strongest, all-steel carriages for long-life, the largest track for flexibility, and Acme Visible service for dependability.

Write for our free booklet today. It's filled with space and time-saving ideas that can save you money and substantially increase efficiency.

Canadian Sales: Acme Seeley Limited, Highway 17, Renfrew, Ontario, Canada. Office in Principal Cities.

MA-77R

ACME VISIBLE Infocenters

We Simplify

Acme Visible Records, Incorporated, Crozet, Virginia 22932

CIRCLE 24 ON READER CARD

THE PROGRAMMABLE TWO-WAY LINK TO YOUR COMPUTER

For years it's been a problem . . . your people compiling field data by hand to be fed into your computer. Or perhaps you simply couldn't find a device to do what you need to do . . . your way.

That was yesterday. Today, there's the Norand® 101 Portable Data System. It uses an ordinary telephone to send data to . . . and receive it from . . . your central computer.

The microprocessor technology built into the Norand 101 makes it totally programmable. Your particular business procedures don't have to change to fit the unit.

Your Norand 101 control program assures the accuracy of the data entered, and the full alphanumeric display guides your people through the program sequences. The display "instructs" your operators in their own language, whether it's cases, pounds, hours, dollars, etc.

Error free information is stored in solid-state memory, which can be reviewed, changed and updated. It has up to 64,000 character capacity.

An optional wand scanner reads bar codes, to further increase the speed and accuracy of data entry.

Applications of the Norand 101 Portable Data System are virtually limitless. For more information write the Norand Corporation, or call 1-800-553-5427, Ext. 101.

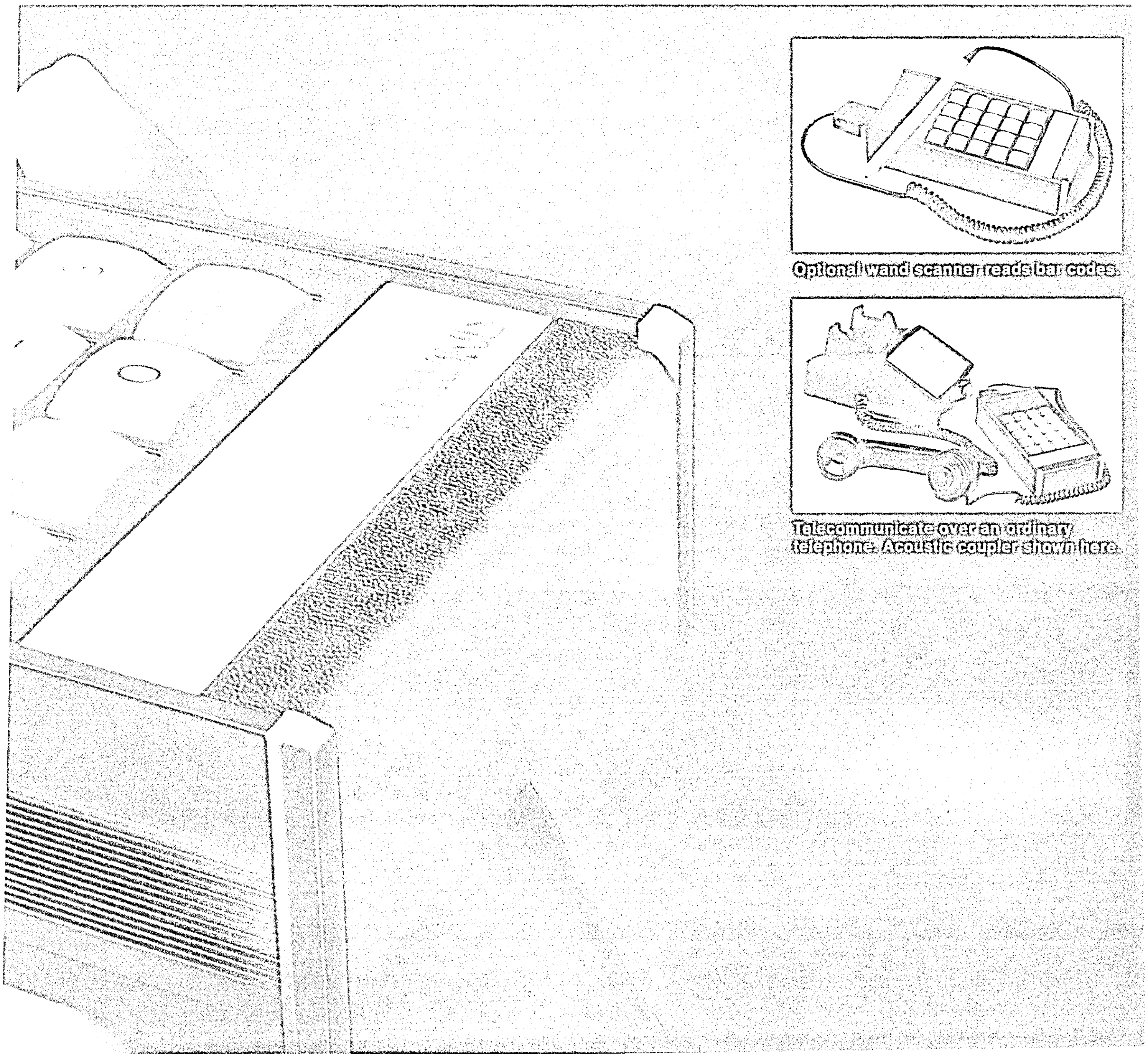
There is a difference.

COMPUTER SYSTEMS

Norand Corporation
550 2nd Street S.E.   Cedar Rapids, Iowa 52401

A subsidiary of Pioneer Hi-Bred International, Inc.

Norand Corporation is a full-line manufacturer of point-of-sale systems, in-pharmacy computers and data communications systems.



Optional wand scanner reads bar codes.

Telecommunicate over an ordinary telephone. Acoustic coupler shown here.

CIRCLE 16 ON READER CARD

LOOK AHEAD

MAGNUSON'S FIRMWARE ISN'T PIE IN THE SKY

The newest kid on the block in the computer business -- IBM plug compatible cpu manufacturer Magnuson Systems Corp. of Santa Clara, Calif. -- may be farther along in its business plan than was generally known. The firm has booked space for a press conference in New York later this month and Magnuson is expected to publicly unveil its first machine at that time.

Potential customers who have seen specs of the machine -- a 148 knockoff cpu -- have been impressed with its novel design. For 30% less than a 148, the Magnuson machine offers more than 10 times main memory at more than two times cycle speeds. Coming next is a 158.

Channel throughput also is significantly higher on the plug compatible gear. Largely because the Magnuson machine uses firmware, the equipment easily supports all popular IBM 370 software and, more important, is capable of adding new software releases in the future. Moreover, it's not pie in the sky -- Magnuson already has produced prototype systems and one of them reportedly is operating alongside IBM gear at a Fairchild Camera and Instrument plant in Sunnyvale, Calif.

- - -

Magnuson's future may even be more interesting. While Fairchild has become a financial backer of the plug compatible company, Control Data, too, could play an important role in the firm's future. CDC is said to be preparing to market the gear. And there's more to come, certainly, since Magnuson's designers are working on plug compatible machines spanning the IBM line from the 125 up to and including the 3031. There are no current plans to go higher than that range and if Magnuson did it would present an awkward problem. The firm's chief designer is Carl Amdahl, whose father's firm, Amdahl Corp., makes high-end IBM compatible cpus. The Amdahls have no interest in competing with each other.

"THEY COULDN'T KILL THE SIGMA 9"

When Xerox pulled the plug on its general purpose computer business almost three years ago, one person who wanted to buy it all was Sam Edens, president of Telefile Computer Corp., Irvine, Calif. manufacturer of Xerox compatible peripherals. He may make it yet in what could be considered an end-around play. Telefile currently is working on a Sigma 9-like computer it will begin to deliver this fall and last month had lured such key former Xerox people from Honeywell as Walter Hollingsworth, called by some the father of Sigma 9, and Henry Haugland, II, manager of product planning for Xerox products for Honeywell. Also joining the Telefile effort to bring the new Sigma 9 to market will be Randy Best, long a vocal member and a former chairman of Exchange, the Xerox user group, who left a long-time position with the data processing applications group at Motorola Inc. because he felt users of XDS equipment deserved "an honest to God alternative" to going to Honeywell hardware.

"In spite of the best efforts of two big companies (Xerox and Honeywell) they just couldn't kill that Sigma 9," said Best. He said the new Telefile operation, which will be housed just across the street in Phoenix from a facility set up by Honeywell to accommodate the Xerox user base, has been innundated with "stacks" of resumes from Xerox-turned-Honeywell employees including the "best software people, the best in education and the best in marketing. We (the users) gave Honeywell every chance but there are problems of inertia in a big company."

DATA GENERAL'S NEWEST BUSINESS MICROCOMPUTER

Data General will make a major addition to its small business line this month with the introduction of a $15,000 microcomputer that operates on Cobol. Called the CS/20, the system will open a much broader market -- businesses that generate as little as $1 million in annual revenues -- than DG was able to address with its earlier entry into the field, the CS/40. DG also plans to add to the top end of its business line with the concurrent announcement of the CS/60, which sells in the $100,000-plus area. Additionally, Itel which signed an agreement with DG to market the CS/40 about six months ago, has been working with DG in developing the entire product line.

STANDARDS BUREAU MAY OPT FOR IBM 3033

The National Bureau of Standards is in the market for a big new number cruncher. As an interim step, the NBS had their sights set on a dual processor Univac 1110-type machine which they plan to use for a couple of years before switching to a larger system. That system, according to an NBS insider, will be "essentially an almost fully configured IBM 3033 or CDC 176. We are not after the super dooper Cray-1 type hardware but possibly one big notch below that."

The bureau's computer center, currently powered by a Univac 1108, handles mostly scientific number crunching for report generation. That's expected to be increased substantially as management information systems processing as well as modeling and simulation tasks are added to the center's computer chores. The pressing need for more machine muscle to handle this stepped up work load was recognized by NBS some time back but the interim upgrade route, according to one candid NBSer, was the bureau's only option "because we didn't start on the purchase and justification cycle for the big machine soon enough."

FEDS TIGHTEN DP SECURITY PROCEDURES

A standardized computer security program for federal dp personnel is due out this month from the Office of Management and Budget. These new security guidelines, bundled into an OMB draft circular that was sent out for comment to all government agencies last September, are designed to plug potential security loopholes in federal computer operations.

Backed by Connecticut Senator Abraham Ribicoff, the chief sponsor of the Congressional computer crime bill, the new rules spell out certain agency security standards that should be followed in handling sensitive computerized data. One recommended technique for stepped up security is background investigations of key federal dp personnel -- a chore that mainly will be tackled by the Civil Service Commission.

AT&T NETWORK USERS MAY FACE A LONG WAIT

AT&T is preparing to announce its widely heralded nationwide digital data network at the NCC, but potential users may have a long wait before they can become plain customers. AT&T is planning to file for a tariff with the FCC and the network, variously code named Bell Data Network (BDN) and Advanced Communications System (ACS) internally, could disappear into the FCC's legal thicket for months -- even years.

The network, of course, is the brainchild of former IBMer

(Continued on page 288)

CIRCLE 120 ON READER CARD

The Rapifax 100 Electronic Mail System

The mail is great if you've got time. A minimum of 24 hours and more likely 48 hours. If your communication has time value and if you can't wait that long, the Rapifax 100 can send a letter size document almost anywhere in the world in 35 seconds. Smaller sized documents in as little as 20 seconds. That's the kind of high speed throughput that makes electronic mail a reality...today.

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Telephone line costs increase with distance and length of time used. The Rapifax 100 makes your communications more effective because it can move a 200 word letter or hard copy information over voice grade lines at ¼ to ½ the time and cost of phone calls, TELEX, or TWX.

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If you're sending a few facsimile copies a month, we're probably not for you. But if you're sending 10-15 copies a day, the Rapifax 100 can transmit these copies at less cost than most conventional facsimile systems.

It pays to do business with the leader

Rapifax is the leader in high speed facsimile systems. That's why, when we introduced the world's fastest facsimile transmission system three years ago we didn't just decide to rest on our laurels. Today, the Rapifax 100 is a reflection of our leadership and proven reliability in thousands of installations worldwide. Sure, one of these days, someone may match our speed and low cost. But, we're not going to sit around and wait. Neither should you. Just return the coupon today, or call toll-free, 800•631-1155. Rapicom, Incorporated, Seven Kingsbridge Road, Fairfield, New Jersey 07006

RAPICOM

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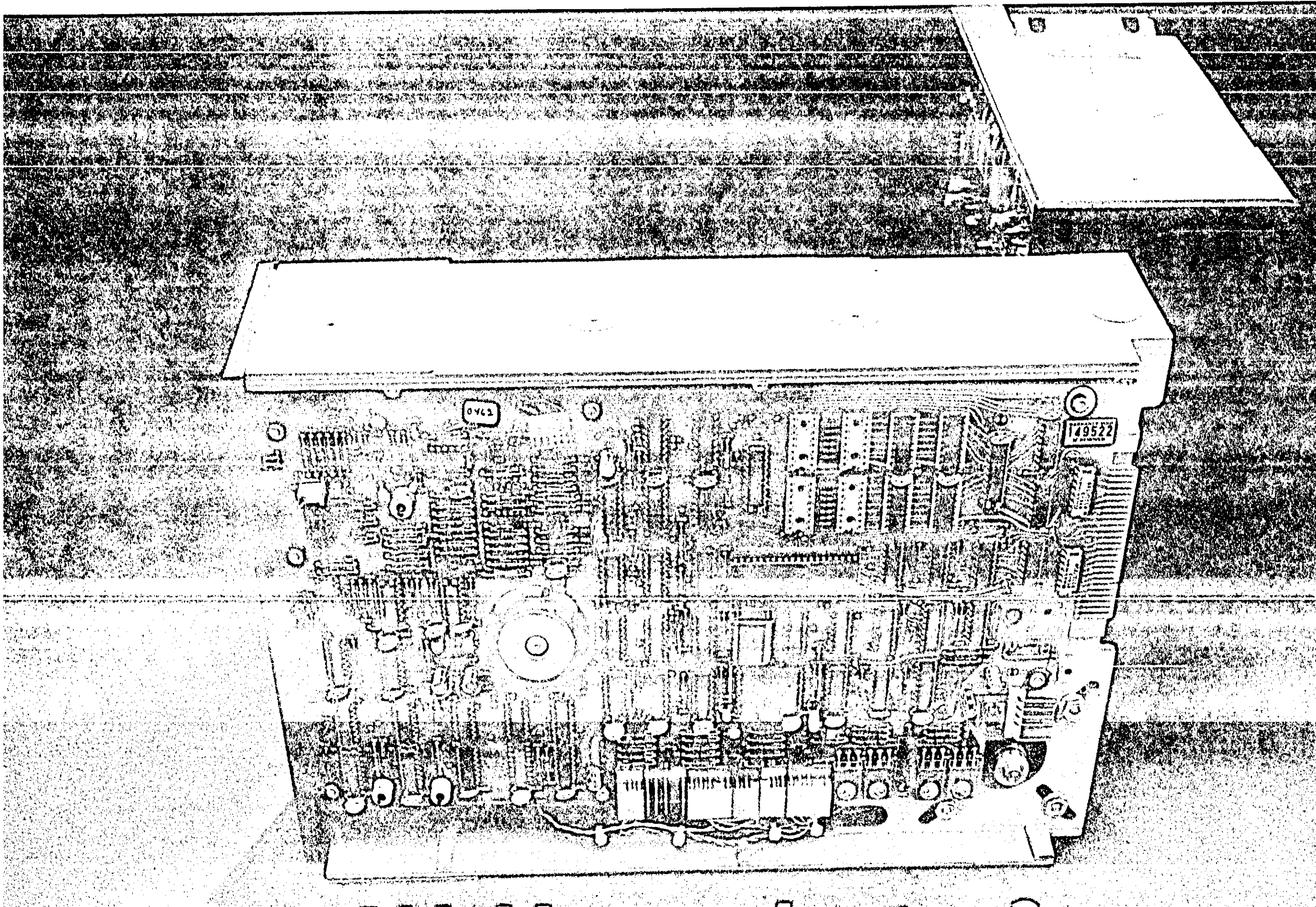
CIRCLE 111 ON READER CARD



Disk drives or subsystems?

Remex announces two low-cost controller/formatter/drives.

The RFS 1100 and micro-based 1200 are part of the Remex family of disk drive subsystems, complete with built-in controller/formatters.

Now time and money you might otherwise spend developing your own controller/formatter can be concentrated on application software and total systems — where you can make the greatest contribution.

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Both units are media compatible with the IBM 3740, 3540 and System 32. In fact, they'll read sectors of any length, provided standard IBM header information is used.

And both feature the Remex high quality disk drive hardware, with head geometry identical to IBM, assuring precise media interchangeability now and later on.

The RFS 1100 is available in 3 models, including 2 with buffers that permit greater CPU efficiency in your system.

The RFS 1200 has its own integral microprocessor for maximizing system speed and minimizing software overhead. It's available in a master/slave configuration for reducing costs in multiple drive applications.

Only Remex offers so much for so little in such neat, integrated packages — with nearly 20 years of electro-mechanical experience and nationwide field service to back it up.

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CIRCLE 112 ON READER CARD

letters

Managers and non-managers

I thoroughly enjoyed John Gilbert's crystal ball glimpse into the not-too-distant future of data processing ("Can Today's MIS Manager Make the Transition?" March, p. 141). I believe, however, that a real opportunity will be lost if the future roles of many dp executives are not radically different from his predictions.

While doing state-of-the-art systems work and application/hardware feasibility studies for Air Force Logistics Command, I watched great battles fought to determine the location and cpu time priorities for second generation equipment, with base level supply, maintenance, and comptroller as the principal adversaries. Although valid arguments were presented by all parties, history shows us that the comptroller won, with provision, as a compromise, for a committee to set actual cpu loads and priorities; the arena was shifted, but someone always knew they had come up a loser. The economics of the times dictated this as the only feasible way.

Similar actions repeated elsewhere laid the groundwork for the large centralized data centers of today. It seems to me that the two important trends we are now observing—a rapid increase in personnel and administrative costs and a significant downward trend in hardware costs—indicate that the time may be near for us to heed those valid earlier arguments and give executives in charge of large functions their own data processing responsibility and capability.

While breaking the dp department away from the primary user and making it an in-house utility has supposedly been a way to make these large data centers more cost effective and responsive to users' needs, my experience as a dp consultant tells me the actual results are that dp administrative and hardware costs have skyrocketed, user services suffered initially but were usually brought up to acceptable levels by the expenditure of considerable amounts of money, and many marginal or unprofitable applications were placed on the computer. Evidently Parkinson's first law has a corollary, "Dp requirements expand to fill available dp capacity."

Many of these dp-utility "managers" don't even know what ROI stands for, and the foremost question in their minds is, "Can I get this by next year's budget?" and not, "Is this a necessary business expense?" Bluntly, they are not managers, but empire builders. And to add insult to injury, they usually have a "fair" formula to prorate their ever-spiraling costs automatically back to their captive audience. That's neat as long as you can get by with it! But I know of one such case where a trapped user could conservatively save $100,000 the first year of operating his own computer, and perhaps $200,000 a year thereafter.

Top level management has long known how to evaluate conventional functional managers—if cost per widget is too high or unrealistic you replace that person with someone who can meet reasonable goals. But it has been my experience that, for a myriad of reasons, top level management often fails miserably in exercising reasonable control over the ever-volatile high technology dp function. By de-emphasizing dp by putting into its natural place—as one of a number of financially justifiable resources used to accomplish specified goals—we will take a giant step forward in bringing the dp function under control.

Normal management-by-function will not come about without a great battle, but each day Armageddon comes a little closer. On that, and that things will be radically different afterwards, Gilbert and I are in total agreement.

SID O. GLOVER
Manager
Texas International Data Services, Inc.
Portland, Texas

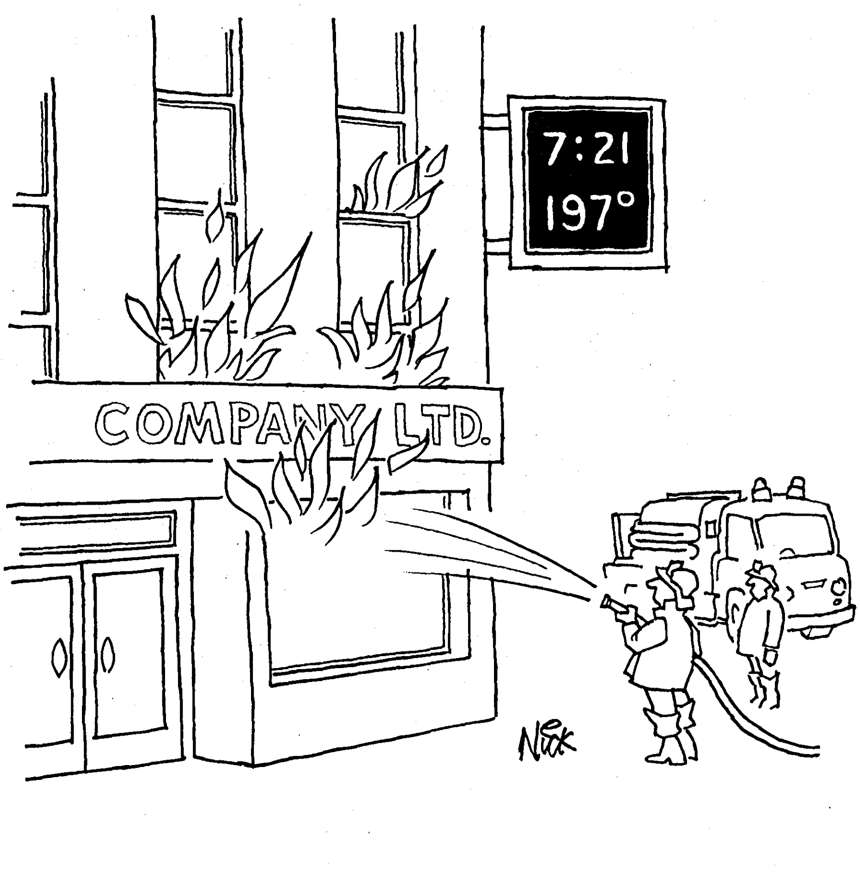
Almost-frozen Assets

The distributed processing theme articles in DATAMATION's March issue opened with a photograph of a lady at an MDS Series 21 crt in the middle of New York City's snowed-in Central Park. The idea behind the photo was to illustrate that dp intelligence now can be distributed nearly anywhere.

The photo looked simple, but getting it required the services of one photographer (Steve Phillips), two manufacturers reps (from Mohawk Data Sciences), one DATAMATION editor (Laton McCartney), and one very chilled model (Laton's wife, Nancy).

This crew spent the better part of a day carrying equipment through the snow, taking pictures, and stamping their feet to keep warm. And then they received no credit for their efforts due to a printer's error. Our apologies to the entire crew, and to Herman Miller, Inc., which supplied the furniture after being given the implausible story about how someone needed it in the middle of Central Park in the snow.

—Editor



letters

Patent solution

It is erroneous to believe that the CONTU recommendations would not entirely preempt trade secret law. The principles announced in the closely analogous field of patent-unfair competition law in the *Sears* and *Compco* cases are clearly applicable. The scope of federal preemption is broad. It would preclude application of trade secret law to more than "simple copying" and would affect many contractual arrangements which two parties would otherwise freely reach. This is apparent from the cases decided after *Sears* in the area of patent and know-how licensing. Argument in the *Sears* case, attempting to distinguish between "simple copying" and a commercial conduct which involved unfair acts in addition to copying, was rejected. Copyright-trade secret protection is binary.

The disadvantages to the program originator listed for patents (i.e., expense, time, and disclosure), may be in the best interest of all parties. High cost will discourage attempts to protect frivolous ideas, insulating small entrepreneurs from the threat of spurious litigation. The time to issuance will further separate the significant developments from the trivial—the pace of programming development will obsolete all but the truly meritorious programs in two to three years. If only patent protection existed there would be fewer "properties," but at a higher qualitative level. The problem with patent protection is more of a conceptual one than a matter of a sound business environment which will foster technology.

Finally, if an argument is to be made

for a new type of protection, it should not be based on a simplistic notion about the scope of protection now afforded by patents or copyrights. To state that a patent is for hardware and copyrights are for books and media evidences a lack of understanding of basic intellectual property concepts. Patents for processes and methods (no hardware—just "steps") are the backbone of property rights in the chemical processing industry. Copyrights for statuary and three-dimensional designs have been approved by the Supreme Court for more than twenty years. If we need a new law for software, will we need still another new law for "firmware"? One of the advantages of existing protective schemes is that the law is well-defined, reducing the uncertainty and complexity that would be produced by a new genre of property.

Perhaps the best result for all members of the data processing community would be to bring the matter to rest, with less regard to the "best" solution. A rational businessman would prefer imperfect certainty to a perpetual quest for a utopian solution.

PAUL ADAMS
Attorney
Canoga Park, California

Likes lots of loops

Mr. Rojeski in his February letter criticized COMAL for having three different loop structures. He further stated that a "requirement" of any language was that it have one and only one method of producing identical results. *Bull!*

The only "parsimony" I am interested in is of *my* efforts. My computer works for me and should accommodate my desires, not the other way around. When a colloquial English compiler becomes available I shall buy it, and to hell with "structure."

WALTER E. WALLIS
Mountain View, California

Sorting out sorting

I read with interest and amazement of Dobosiewicz's new sorting algorithm in the February issue (News in Perspective, p. 200). The surprise is due to the fact that the theory of sorting is very well developed and the claims of the article are flatly contradictory to this theory.

To explain the contradiction, I must use a small amount of algebraic notation. It is obvious that the (cpu) execution time of a sort routine is directly proportional to the number of comparisons it actually makes while sorting. Let this number be n. The slow sorts (bubble sort) and the (highly unlikely) worst case Quicksort require $n^2/2+0(n)$ comparisons ($0(.)$ is read "on the order of"—note that n is negligible compared to $n^2/2$ for n greater than 100). The contradictory points are:

1. *The new sort is thirty times faster than Quicksort.* At best, the average time for disordered, distinct data can be 28% faster than Quicksort. If there are m objects to be sorted, the number of possible arrangements is

$$m! = m(m-1)(m-2)\cdots 3\cdot 2\cdot 1$$
$$= \sqrt{2\pi m}\,\left(\frac{m}{e}\right)^m (1 + 0(\frac{1}{n})).$$

On the other hand, the largest number of items (permutations) which can

(Continued on page 32)

A 32K byte dual floppy microcomputer system for only $2900*complete.

Standard Features:
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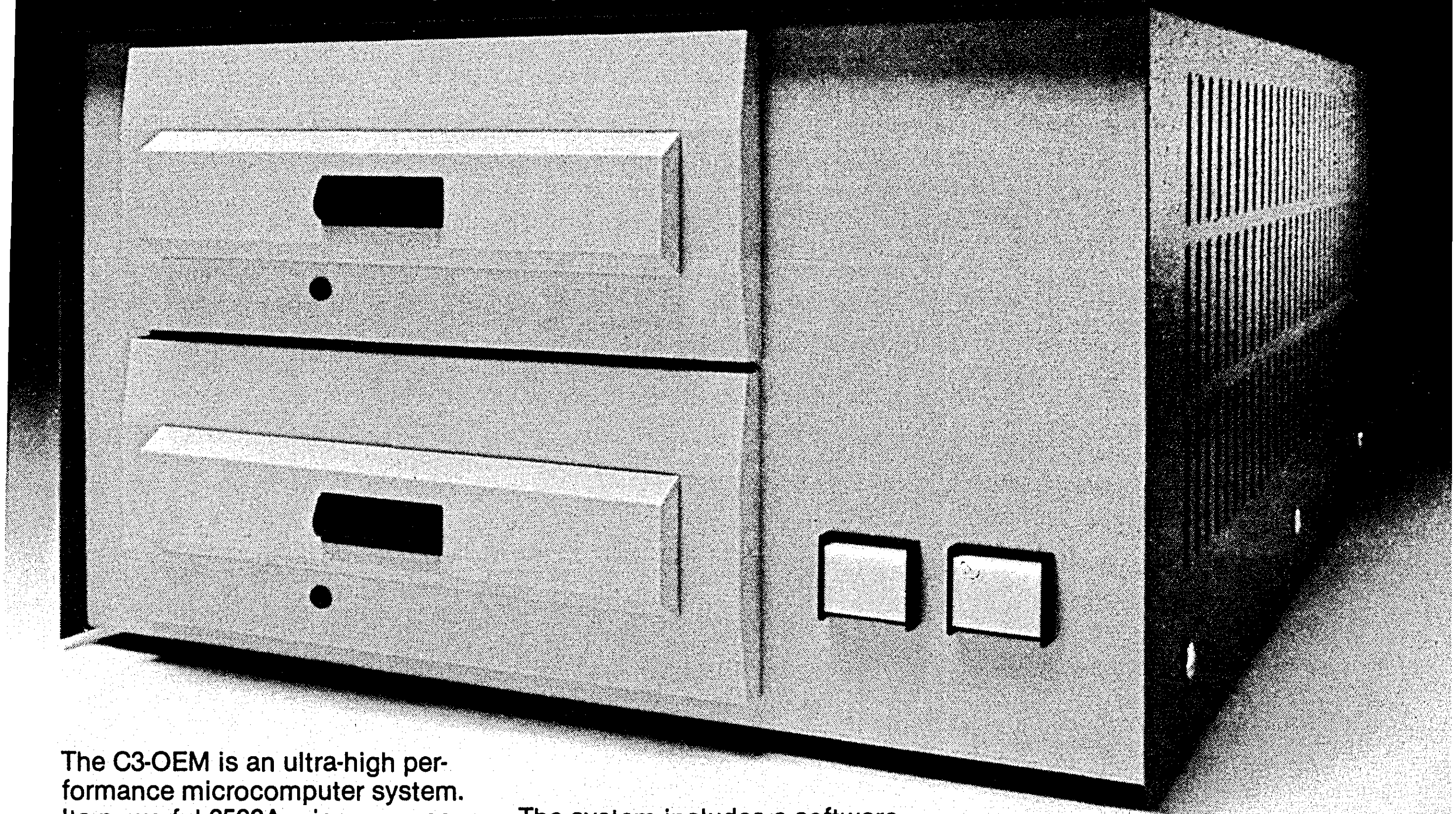

The C3-OEM is an ultra-high performance microcomputer system. Its powerful 6502A microprocessor (now triple sourced) outbenchmarks all 6800- and 8080-based computers in BASIC and machine code using the BASIC and assembler provided standard with this system.

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So, one can start with existing 6800, 8080 or Z-80 programs while developing new software for the ultra-high performance 6502A.

The C3-OEM isn't cheap. It's a quality product with mechanical features like UL-recognized power supplies, a three-stage baked-on enamel finish and totally modular construction.

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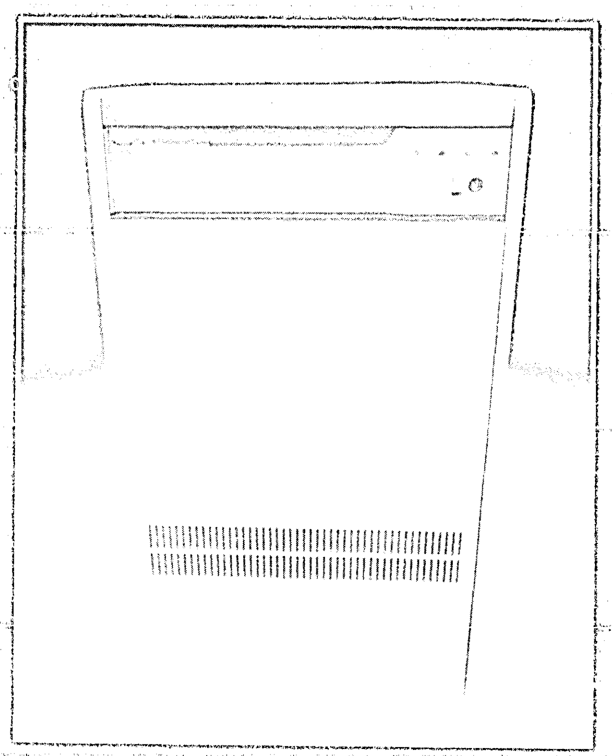
CIRCLE 108 ON READER CARD

The new DECSYSTEM-2020 mainframe.

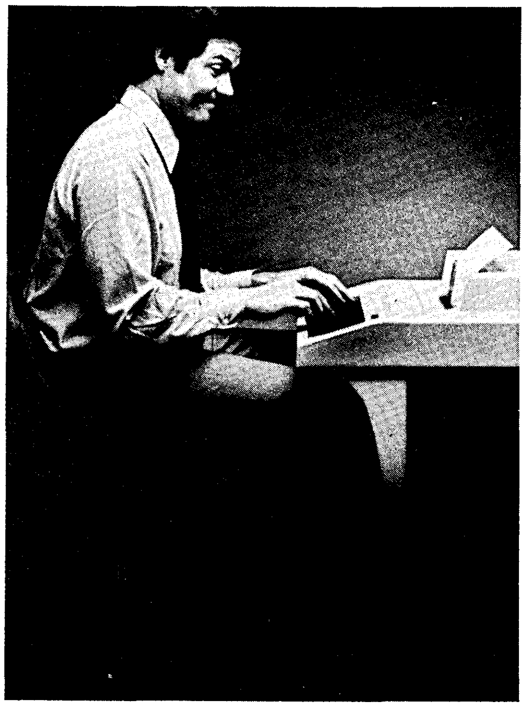


Surprisingly easy to use.

The new $150,000 DECSYSTEM-2020 is more than the world's lowest priced mainframe.

It's also the easiest to use.

The secret is in the software. The TOPS-20 virtual memory operating system and the high-level language compilers. The same proven software that runs on our larger DECSYSTEM-20 family mainframes. Designed from the start to let both skilled and unskilled programmers learn quickly, get more work done, and make fewer mistakes.



Here's what you get:

Unique PUSH/POP commands. PUSH lets you interrupt what you're working on and go to new programming—as many times as you like. It gives you essentially another virtual machine. POP gets you back to the previous program.

Interactive debugging at the source language level at run time without recompilation. And you debug in English, not octal like other systems.

Superior tutorial aids. If you have a rough idea of a command, you can type in an abbreviation and the system will list all similar ones. When you recognize the command you want, you just type it in. You can abbreviate commands you're expert at, and get instant help when you're unsure. So you can use the system without the manual in your lap.

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All of which makes the DECSYSTEM-2020 as easy to use as a programmable calculator.

Since the DECSYSTEM-2020 is so easy to use, it can be run by the people who need it. So you don't need a whole separate operating staff. In fact, all you need is someone to mount disks and tapes, or to feed card readers and line printers. A claim no other mainframe maker can match.

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With people representing 65-70% of DP center costs, the DECSYSTEM-2020's ease-of-use features are looking just as attractive as its incredibly low price.

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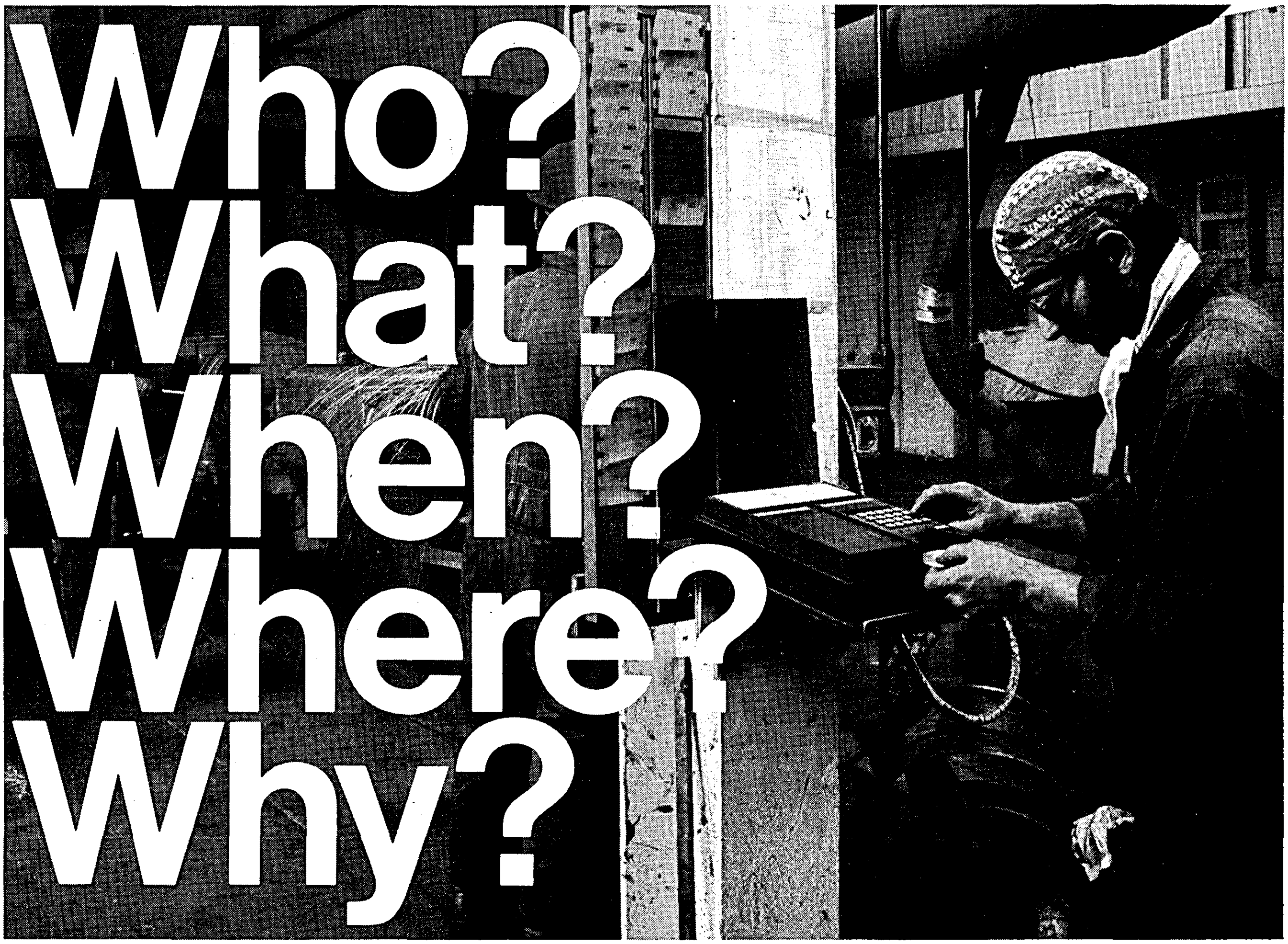

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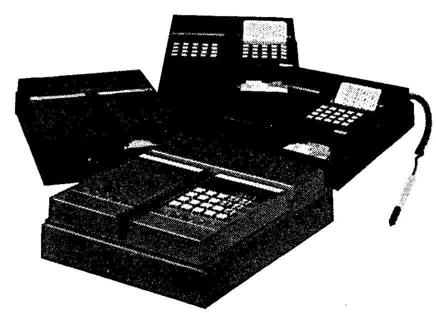

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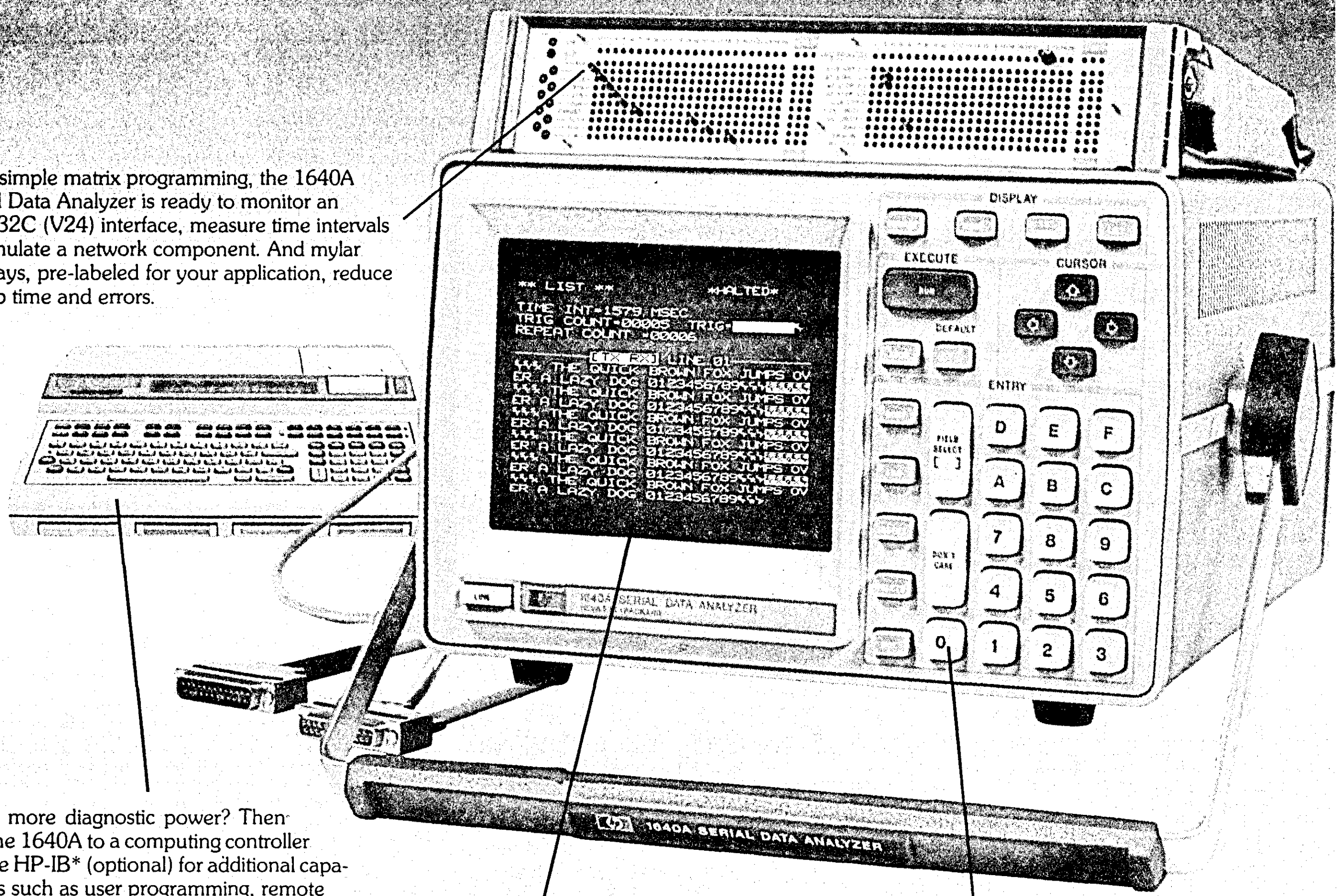
Meet the logical solution to those illogical computer network problems... HP's new Serial Data Analyzer. It's easy to use, flexible and low cost.



With simple matrix programming, the 1640A Serial Data Analyzer is ready to monitor an RS-232C (V24) interface, measure time intervals or simulate a network component. And mylar overlays, pre-labeled for your application, reduce set-up time and errors.

Need more diagnostic power? Then link the 1640A to a computing controller via the HP-IB* (optional) for additional capabilities such as user programming, remote control, mass data storage and data manipulation.

Real-time display of FDX data in ASCII, EBCDIC or Hexadecimal (other codes optional), continuous display of trigger specifications, and clear display of measurement results all add up to a convenient presentation of "what's happening" in your computer network.

You don't have to be a programmer to use the 1640A; no instruction sets to learn . . . no writing or debugging programs. A menu set-up concept with keyboard parameter entry, pre-programmed measurement execution and transparent "wake-up" mode make the 1640A easy to use—even for semi-skilled operators.

This new, low-cost Serial Data Analyzer lets you quickly identify and isolate problems to the network component level. Flexible triggering lets you trap on data errors, time-interval violations, or invalid protocol sequences. You can find most problems in a non-intrusive, "monitor" mode. But for subtle problems, or for loop-back tests, the 1640A also simulates the CPU, terminal or modem. Of course, you can operate with any combination of transmission modes—Simplex, Half Duplex, or Full Duplex, two- or four-wire links, synchronous or asynchronous operation, and up to 9600 bps (19200 HDX) data rates.

Whether you're integrating a minicomputer with a few terminals, or analyzing a complex, centralized CPU-based communication network, HP's 1640A, priced at $5800**, gives you a sensible solution that reduces costly system debugging time.

Available options include the HP-IB interface($300*), SDLC/HDLC ($200*) and LRC, CRC-16 and CRC-CCITT Checking/Generation ($150*).

Find out how HP's 1640A can help simplify your computer network analysis. Get the details today from your local HP field engineer.

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CIRCLE 58 ON READER CARD

letters

(Continued from page 26)

be distinguished with n comparisons is 2^n since each new comparison doubles the number. Therefore,

$$2^n \geqslant \sqrt{2\pi m}\,(\frac{m}{e})^m\,(1 + 0(\frac{1}{n})).$$

Taking logarithms

$$n \geqslant m\,\ell n_2 m + 0(n).$$

(Recall that $\ell n_2\,100 = 6.64$, $\ell n_2\,1000 = 9.66$, and $\ell n_2\,5000 = 8.97$.) The number for Quicksort is easily shown to be $2m\,\ell n\,m$. So Quicksort is only 40% ($2\,\ell n\,2 = 1.39$) worse than the theoretically best general sorting algorithm.

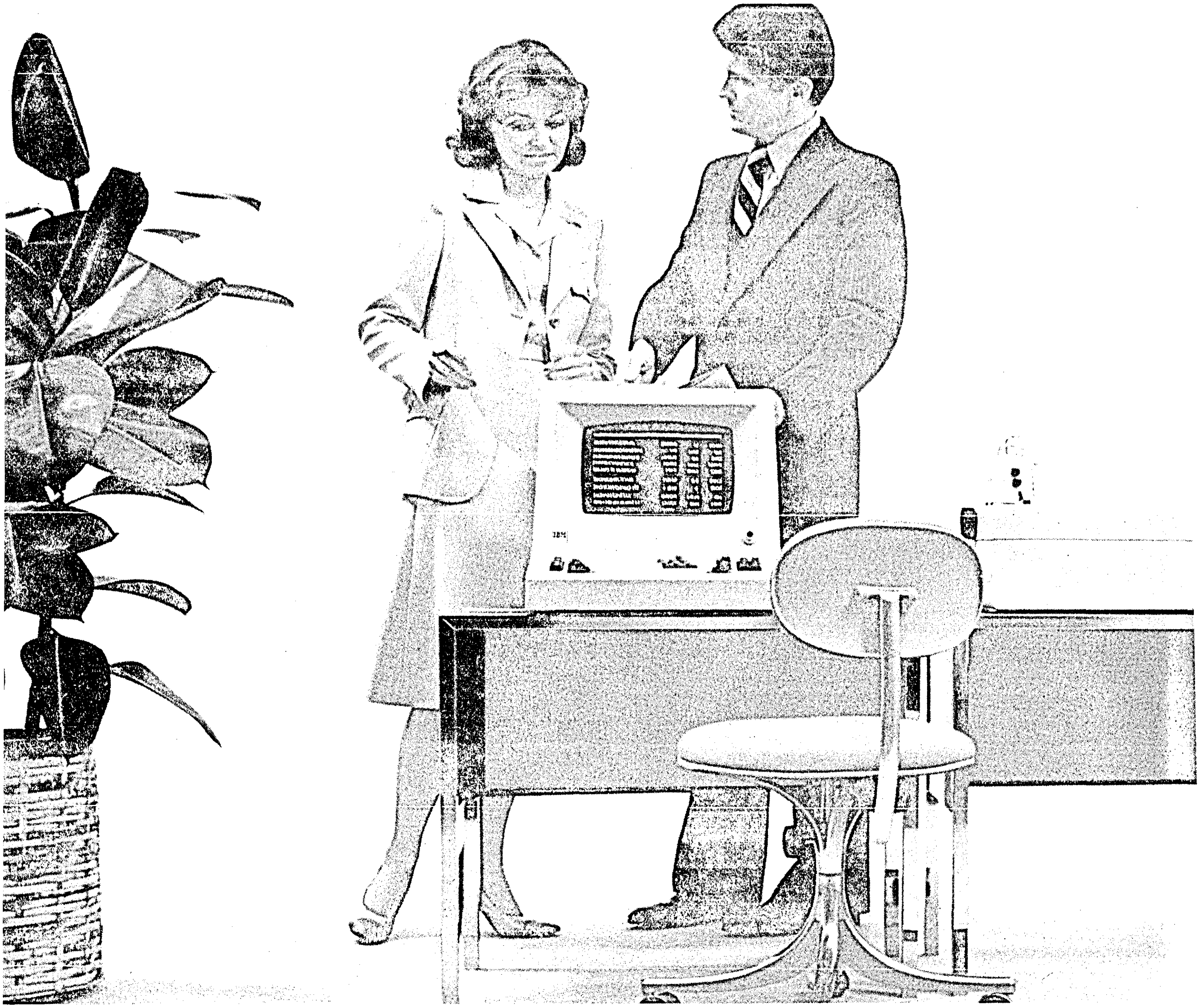
One should note that most Quicksort implementations make an initial pass to set sorting keys and check for already sorted data. It takes only m comparisons to check whether the data are already sorted. (If the number of transportations is very small, a merge is called for rather than Quicksort.) For 5,000 already sorted data items, the

check takes only 1/17 (=½ log 5000) of the time of Quicksort, and only 1/12 (= $1/\log^2 5000$) of the time of Quicksort (see point 3 below).

2. *The Quicksort worst case was 28,500 times worse than the Quicksort best case for 1,000 items.* As shown above, this ratio should be $(m^2/2)/m\,\ell n_2\,m) = 50$ times faster. This wild discrepancy indicates that the implementation was poor. It is likely that the worst case has all items equal except for one oddball. As is well known, this case threw the early implementations into a frenzy. The newer codes explicitly check for items equal to the sorting key at the end of each pass, thus eliminating this problem.

3. *The new algorithm is NEW.* The reported ratio of *best* times for 1,000 is 1.421, which is almost exactly the ratio of Quicksort average to Quicksort best time of 1.39. This strongly suggests that the *best case* is simply the time to sort an ordered array, *and* that a primitive implementation of Quicksort was used. In the first version published in the

(Continued on page 319)



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Series/1 is a family of small, powerful, general-purpose computers that puts the emphasis on productivity.

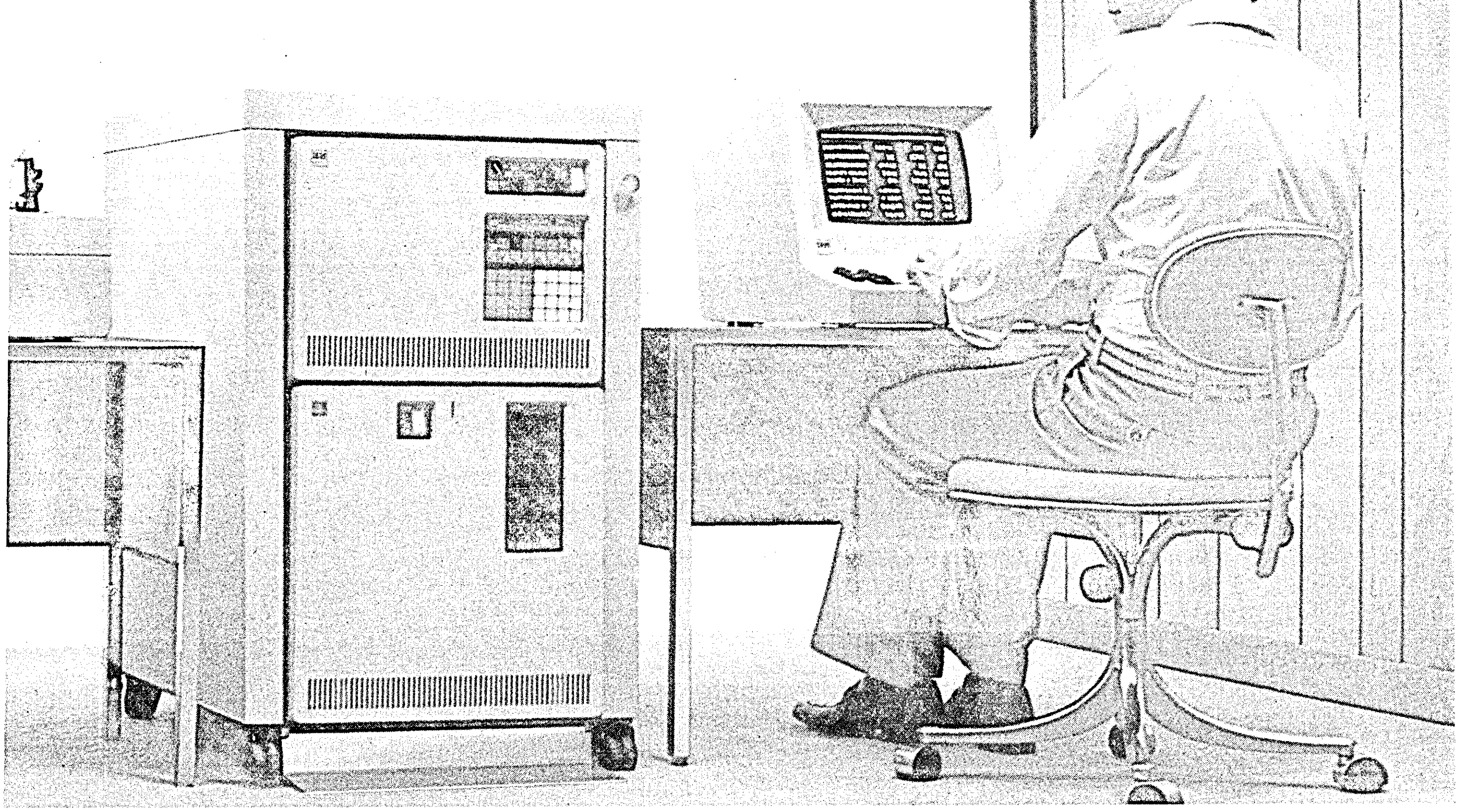
Series/1 offers a choice of two processors in a variety of storage sizes, plus a full range of I/O units, high-speed disk storage, dual-sided diskette capability, both digital and analog sensor I/O, line and matrix printers and a choice of standard or customized display stations. And well-documented user attachment features make it possible to directly attach non-IBM equipment you may already have.

In addition, communications capabilities include asynch, bisynch and SDLC. IBM's new Programmable Communications Subsystem gives Series/1 the flexibility to simultaneously handle multiple line disciplines or protocols and an extremely broad range of communications I/O, from a variety of manufacturers. And because it is programmable, the user can meet changing communications requirements without having to add new hardware.

But that's not all. The real news of Series/1 is the extensive nature of the architecture. Both processors—the 4953 and the more powerful 4955—feature realtime 16-bit design, proven bipolar LSI logic, MOSFET N-channel storage, microprocessor device control and a comprehensive priority interrupt structure. In addition, you get hardware multiply and divide, power fail/auto restart, full double-word arithmetic, parity checking on all I/O data transfers and storage busses and a full-function instruction set including up to 207 microcoded instructions on the 4955 (with the Floating Point Processor feature) and

Series/1.

Approximately $29,000 as shown.
Includes a 4953 Model D (48K) Processor with Programmer's Console, 4962 Model 2 Disk/Diskette Unit, 4974 Matrix Printer, 4997 Model 1B Rack Enclosure and two 4979 Display Stations.



bility. Service. You can't beat Series/1.

168 on the 4953.

The Series/1 Realtime Programming System manages system resources for batch, realtime, communications and sensor-based applications in a multiprogramming environment. The Realtime Programming System also provides IBM Systems Network Architecture (SNA) support for Series/1, enabling it to function as a cluster controller communicating to host System/370 processors over SDLC lines.

In addition, Control Program Support provides task and data management, I/O device support and operator interface services for users developing a tailored operating system.

For application development, PL/I provides the ability to write both commercial and scientific applications in one high-level language. Two other languages, FORTRAN IV and Assembler, are also offered.

Series/1 is supported by IBM's extensive service organization, backed by a sophisticated parts inventory system and a variety of portable diagnostic tools to supplement special diagnostic features built into the system.

On site installation by IBM Customer Engineers plus a three month parts and labor warranty are included in the Series/1 purchase price. Ongoing IBM maintenance is available under the IBM Maintenance Agreement at a fixed monthly charge.

To find out more about Series/1, contact your IBM Series/1 marketing representative or write the IBM General Systems Division, P.O. Box 2068, Atlanta, Georgia 30301.

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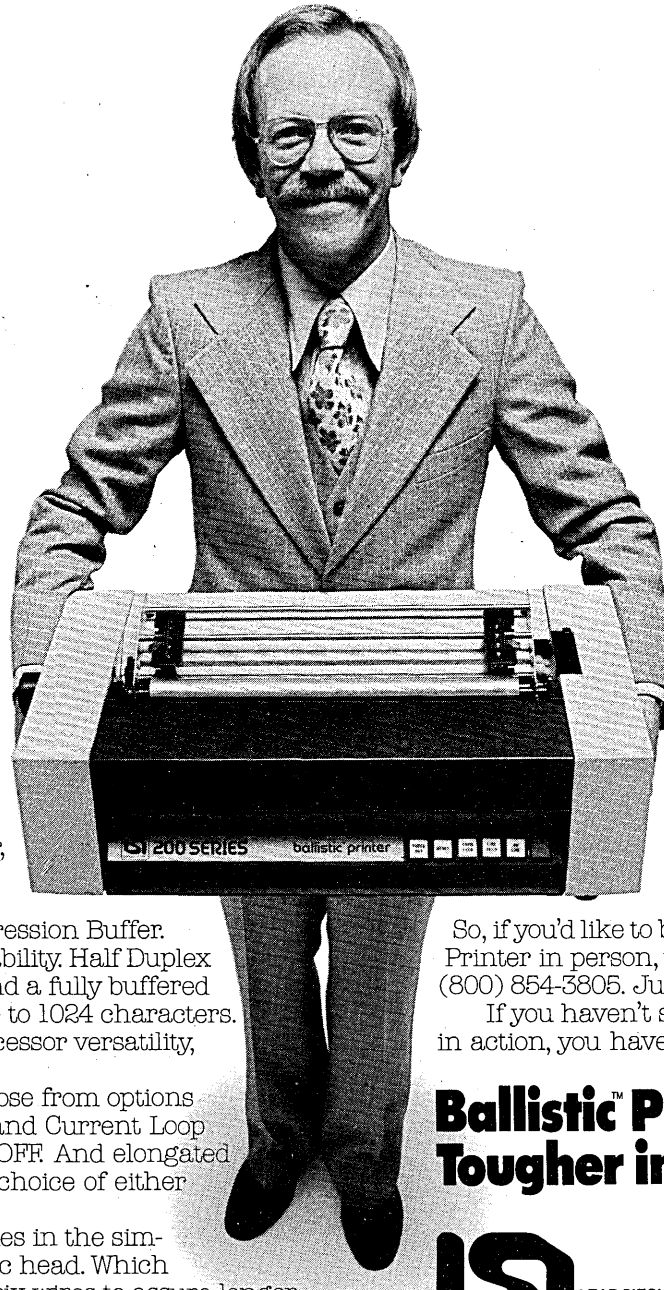
You won't believe our Ballistic™ Printer until you see one in print.

And in person.



Unless you've been in hiding, you've probably heard about LSI's family of Ballistic Printers. Built with the same proven dependability of the Dumb Terminal and his Smarter Brothers.

Our latest matrix printer, the 200A, comes with standard features like a Space and Blank Character Compression Buffer. Tabbing over Blank Spaces ability. Half Duplex or Full Duplex Operation. And a fully buffered input, optionally expandable to 1024 characters. Not to mention its microprocessor versatility, and firmware flexibility.

To top it off, you can choose from options like Serial, RS232, Parallel, and Current Loop interfaces. Polling. X-ON, X-OFF. And elongated character capability with a choice of either 10, 12 or 16.5 Pitch.

The Printer's reliability lies in the simplicity of its patented Ballistic head. Which ballistically propels the matrix wires to assure longer head life. Eliminating tube clogging with inks, dust, and paper fibers. Even wire tip wear is substantially reduced.

The Ballistic Printer uses a five-start lead screw and servo to print bi-directionally at 180 cps. Direct, simple, positive. And very accurate.

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If you haven't seen the Ballistic Printer in action, you haven't seen ballistic printing.

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people

Evolution in Parallel

"We'd solved that problem and we wanted to go around solving other neat problems."

This is Elizabeth Rather's explanation for the formation of Forth, Inc., a five year old software and systems house in Manhattan Beach, Calif. The company was formed by Rather and Charles H. Moore with others who shared their belief in the potential of Forth, an operating system and programming language developed by Moore in the late '60s for use with scientific minicomputers used to operate telescopes and to process the data they gather for astronomers.

Rather worked wtih Moore in the early '70s, implementing Forth on a telescope in Arizona for which she had software responsibility. Both were employed at the time by the National Radio Astronomy Observatory. Rather said they were able, by implementing Forth, to make it possible for an 8K mini (PDP 11/40) to do more than previously had been done on three computers: a CDC 6400 in Charlesville, Va., and a DDP 116 (installed in 1967 and produced by Computer Control Inc., a company subsequently acquired by Honeywell), and a Honeywell 316 at the Arizona site. This is the "that problem" to which Rather was referring. She said this is still a "near state-of-the-art" system.

What is Forth? A company statement calls it "a capability which has grown out of a philosophical commitment that any productive and well run computer environment must use software tools which have evolved in parallel with existing hardware technology." Rather feels that much of the current popular software is "ill-matched to the demands of today's sophisticated computer users and applications, particularly mini and microcomputer users."

She said Forth software is "designed for smart people where other software is designed so a real dummy isn't going to be able to screw up too badly. Ours is a tool for professionals." With Forth, Inc., software, she said, it is possible for minicomputers to handle tasks thought only possible with big computers and to do them better and quicker and at less cost.

Forth, Inc. recently installed a turnkey system for the Pulmonary Research Center of Cedars-Sinai Medical Center in Los Angeles. It involves use of a large data base. Rather said the hospital had budgeted $250,000 for hardware alone. Forth, Inc., she said, was able to do the entire system, hardware and software, for under $200,000.

Among the "other neat problems" Forth, Inc. has solved are simulation of the aft flight deck of the Space Shuttle, development of an artificial kidney testing machine, development of a cardiac event monitor, and a microwave radiometry image processing system.

ELIZABETH RATHER
On to "neater problems."

Rather has become familiar with a wide variety of nonscientific endeavors as well in doing such work as a system for analysis of municipal bond data in California, analysis of data on all telephones in California and Nevada, and in work for a zipper manufacturer.

Forth, Inc. today has two business thrusts: first, licensing and support of its Forth operating system and programming language for minicomputers (mini-Forth) and for microprocessors (micro-Forth) and, second, application programming and complete turnkey systems developed to meet unique requirements using the Forth operating system and programming language.

Rather believes, "we have the best microprocessor software available," and this leads to something of a problem: what to do about the hobby market. So far, Forth has stayed away. Their software is too expensive. But both Rather and Moore feel they can't ignore this market and are considering such things as implementing Forth on a chip or licensing someone to do this.

Virginia-born Rather has a slight southern accent which comes and goes depending on with whom she is talking. Other Southerners, she said, bring it out as do the English whose accent, she claims, is closer to that of the U.S. South than to those of other parts of this country which have become "more contaminated."

She was educated at the University of California at Berkeley, first in math and physics and later (MA) in legal history. She has been involved with computers since 1962 when she was introduced to them while with Oakridge National Laboratory doing processing for a laboratory experimental reactor.

She is a strong believer in learning by doing where computers are concerned. "I'd never hire a computer science graduate. I don't believe anything useful ever was taught in a computer science course."

At Forth, Inc. she has implemented what she hopes will be an on-going program of giving high school students an opportunity to learn about computers first-hand. The company has its second "intern" now who was introduced by its first, now in college, and Rather hopes this is the beginning of a chain reaction. Forth's first high school student found out about the company from Rather's daughter who met him at a party and learned he was interested in computers.

"My mom has a computer company," said Rather's daughter. That was enough for the student who wanted to meet Rather and ended up working for Forth, Inc. This earned him not only some education and some money but a special certificate when he graduated from high school, something not even Forth expected.

Enjoying Hospitality

When M&M Computer Industries, an intelligent remote batch terminal firm he helped found in 1969, was acquired by Harris Corp. in early 1976, Frederick J. McKee decided he'd take a year off to go sailing in his 46 ft. sailboat.

His plans changed when he and his wife learned, rather unexpectedly, that they were going to become parents for the first time. "Our sailing plans were canceled. We stayed home and redecorated our house," he recalled. And McKee, an engineer by training and experience, in a sense got into a new business—the hotel business. In February 1977 he joined Electronic Engineering Co. of California (EECO) as director of hotel systems. He is now vice president, hotel systems, and says he's "learning new things all the time" about hotels and how they are run and what they need.

EECO, which has been around since

(Continued on page 50)

Tektronix 4020 Series

When you make your next investment in terminals...

Get something to show for it.

The new Tektronix 4020 Series may be your first long-term terminal investment. It's a series of refresh terminals designed to fit your needs today... and your growth picture tomorrow.

For example: The 4025 terminal expands from smart alphanumerics...to forms ruling...all the way to graphics. You start with basics like expandable memory. Familiar typewriter keyboard with complete, easy editing. Scrolling. Easy-on-the-eyes green display with variable brightness.

Now or later, add forms ruling. You can construct separate on-screen workspace and monitor areas that scroll independently. You can recall complex forms with a single key.

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See us at NCC

Our companion 4024 provides secondary growth... from alphanumerics to forms. So you can closely plan and manage your terminal investment with optimum cost control.

Ask your local Tektronix Sales Engineer for a personal demonstration. We'll show you a priced-right, expandable approach to your input and display needs, with the promise of proven reliability and worldwide Tektronix support. The new 4020 Series. It's an investment you can grow with. Even when you're too busy for words.

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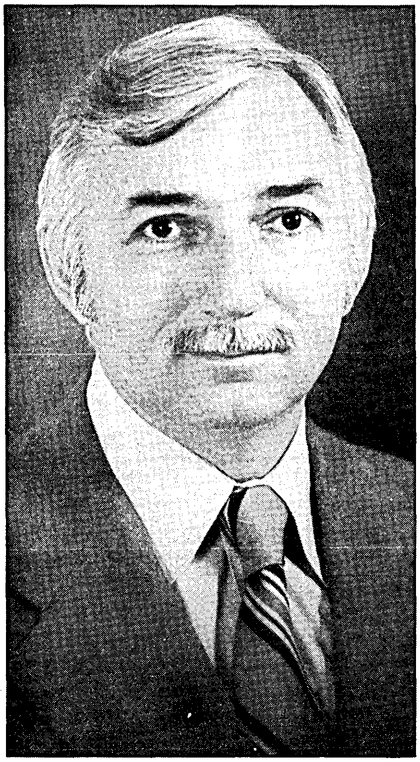
CIRCLE 86 ON READER CARD

OEM information available


Tektronix
Tektronix

(Continued from page 47)

1947 and was best known as a producer of punched paper tape equipment, introduced its EECO Hotel Computer System in 1970, a time when the lodging industry was wary of automation due to a number of highly touted failures. McKee believes this wariness is relaxing. "There's some reluctance. People in hotels have heard of disasters and they're attuned to personally serving the public. But they're highly profit-and-loss oriented and labor costs are increasing. They're learning that computer systems are economically justified."



FREDERICK J. MC KEE
He canceled his sailing plans.

EECO had two hotel installations in 1970. Today it has more than 30 in hotels in the U.S. and abroad. The systems handle reservations, accounting, posting and billing, and guest check-in and check-out. They also maintain guest history files so hotel personnel know the needs and desires of returning guests in advance.

McKee said architecture and hardware for the systems is much the same as it was eight years ago but that software has been "substantially improved." In 1970, EECO was offering a room management package and a guest lecture package. Today, McKee reported, "we have 900 programs in our software library." He said a typical hotel will use between 200 and 225 software packages. "Hotels have different kinds of needs. Resort hotels in Hawaii and Puerto Rico, for example, have to deal with large groups of people arriving at one time on a 747 airplane. A ski resort hotel or one catering to businessmen handles arrivals on a one-by-one basis."

The EECO system is used by hotels of varying size, ranging from the Tamarand Ski Resort in Colorado with from 200 to 250 rooms and condominiums to the largest installation, the MGM Grand in Las Vegas with more than 2,000 rooms. The company recently installed a system at the new MGM Reno Hotel which opens this month with a 727 airplane scheduled to be part of the grand opening.

EECO systems have been installed in Hong Kong, Singapore, Manila, London, Paris, and Canada and the company expects to have completed an installation in Caracas, Venezuela, by the end of this year.

McKee said the system has the capability of interfacing with external reservations services and is talking with two clients, Hilton International and Sheraton, about linking with theirs. "We are defining the specs for Sheraton," he said.

McKee holds a BSEE degree from Fairleigh Dickinson University, Rutherford, N.J., and completed advanced management studies at Stevens Institute of Technology.

He founded M&M Computer Industries with Jerry Murphy, now director of engineering for EECO. M&M was acquired by Singer Corp. in early 1973. It became part of Singer's now defunct Business Machines Div. in July of 1974. Singer sold the company to Harris which moved it to Dallas. McKee said he still sees pictures of M&M terminals in Harris ads. "They have a different logo but they're the same terminals."

Before founding M&M, McKee was a vice president of Bunker Ramo. Earlier he held senior management positions at ITT and Digital Industries. How did he get into the hotel business. "Pat Cadigan (EECO president) was looking for someone with business experience who had had profit and loss responsibility and who was used to dealing with end users. I was it."

And he likes it. He likes the travel. "I've been to the Far East, Europe, Canada, and South America." He likes learning the hospitality business. He also likes his now 20-month-old son, Frederick III. And he'd like young Fred to have a brother or sister or two, if "there isn't 40 years in between."

In New Posts

JACK GAMMON has been named vice president of engineering and development for Applied Digital Data Systems Inc., Hauppauge, N.Y. . . . ROBERT V. NEARY is the new Director of Corporate Systems and Data Processing for Harvey Hubbell, Inc., Orange, Conn., manufacturer of electrical products . . . EDGAR M. REYNOLDS was elected president of Digital Products Corp., Fort Lauderdale, Fla. . . . New group vice president communications and center operations for National Data Corp., Atlanta, is DENNIS E. PUCKETT . . . DR. ARTHUR E. SMITH was named to the newly created position of vice president of marketing development for the educational services division of National Computer Systems, Inc., Edina, Minn. . . . DONALD S. BATES was promoted to vice president and general manager of the General Electric Co.'s Information Services Div. . . . MICHAEL G. DICKEY was appointed to the new post of director of product management and support for Cray Research, Inc., Minneapolis, Minn. . . . DOUGLAS C. ALTENBERN, president of NLT Computer Services Corp. since 1972, was named chairman of the board and chief executive officer . . . PHILIP S. NYBORG was elected vice president and general counsel for the Computer & Communications Industry Assn. . . . BRUCE COLEMAN, president, Boole & Babbage, Inc., Sunnyvale, Calif., is the new vice president and chairman of the Computer Software Committee for the Association of Data Processing Services Organizations (ADAPSO) . . . JOHN F. GRIFFIN joined GAF Corp. as director of management information systems at the company's Wayne, N.J., financial complex . . . GERARD A. FORD was appointed head, Systems Planning Dept., Bell Laboratories . . . THOMAS J. ANTHONY was named Industry Director, Automotive and Telecommunications at National Semiconductor Corp., Santa Clara, Calif. . . . Burroughs Corp. appointed EVELYN BEREZIN as director of planning for electronic systems and equipment with its Office Products Group . . . ROBERT J. DEFFEYES was elected president and chief executive officer of Graham Magnetics, Inc. of Graham and Fort Worth, Texas . . . ROGER V. JOHNSON was named director of information systems for Crutcher Resources Corp., Houston, Texas . . . Insco Systems, Neptune, N.J., promoted GORDON F. GILCHREST to senior vice president . . . JACK KAPLAN was appointed vice president of John Harvey Personnel, a recruitment firm specializing in the word processing industry . . . WILLIAM GOODALE was appointed vice president, engineering for Western Peripherals, Inc., Anaheim, Calif. ☼

Imagine:

A large-scale computer system.

Functionally dispersed data processing.

A common, integrated data base.

Unlimited growth without economic penalty.

The ARC System

from Datapoint.

Put
Your
Imagination
to
work.

Turn
the
page.

Imagine. A large-scale computer system that would solve all of the problems that system planners have complained about in conventional computer architecture. That would work and grow without interruption, without extensive operator re-training, and without endless new model upgrades. A system that will adapt itself to your budget, and not the other way around.

The Attached Resource Computer™ System is Datapoint Corporation's solution to the inherent problems of conventional computer system architecture. It will eliminate the headaches which until now have seemed inevitable. Like updating several data bases, costly programming changes, and complete system failure. Not to mention the huge expenditures involved in hardware upgrades.

The ARC System is an *attached processing* system — based upon the idea of functionally dispersed processing resources, located in a company's offices, stockrooms, transaction counters, and warehouses. Operating independently, and yet as parts of a whole.

Because ARC allows all of these task-oriented processing stations access to the common data base, in as large (or small) a capacity as each company's needs dictate.

A unique modular architecture

How can ARC combine the effective throughput of a large traditional computer with the flexibility and convenience of a small computer?

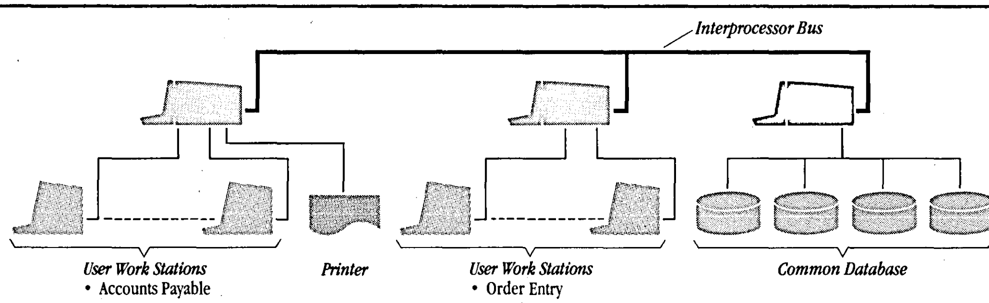
Because it takes the two basic functions of any conventional computer — applications program execution and data file management — and distributes them among two or more specialized computers: the applications processor and the file processor.

By attaching these two types of functionally specialized processors to an ARC System, each company can select just the right amount of processing power and on-line data storage that it needs. Without over-buying to stave off some future requirements. Or over-burdening an existing, insufficient computer.

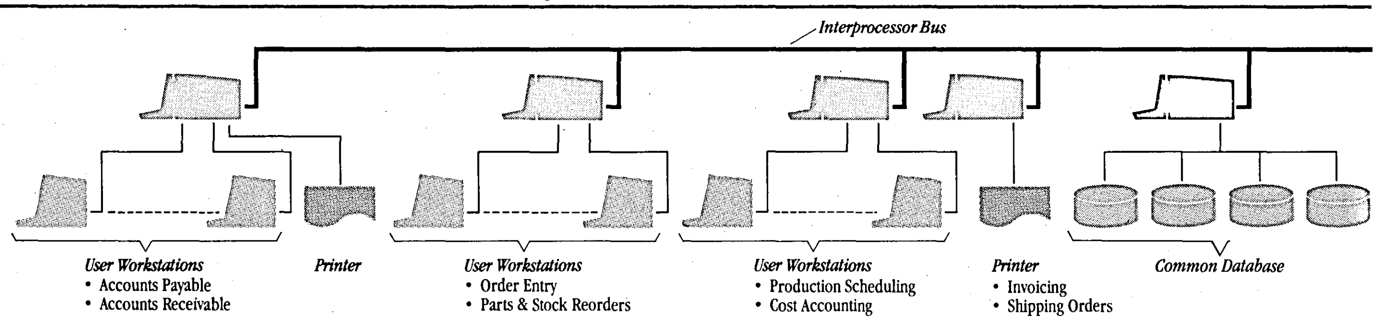
Unlimited growth without economic penalty

If more processing muscle becomes necessary as time passes, just add another Datapoint applications processor. Right where the work gets done. And if data

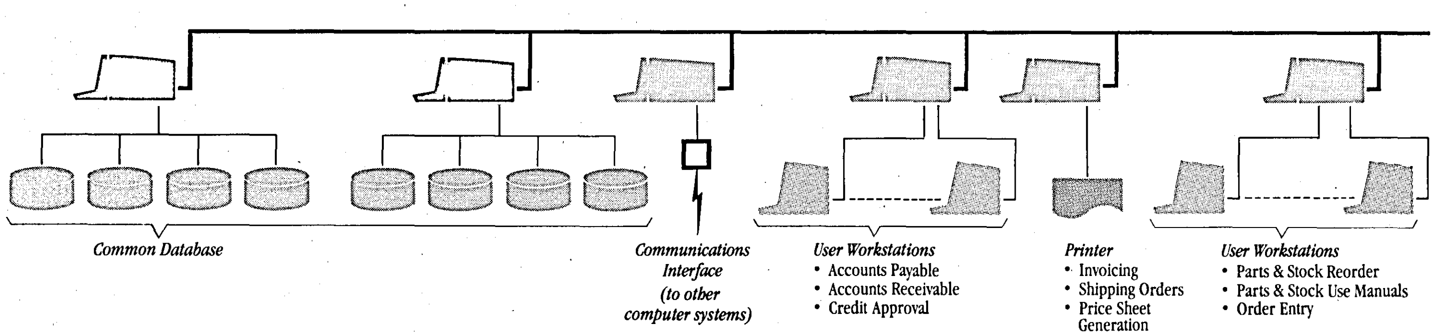
A small ARC system.



A medium ARC system.



A large ARC system.



handling capacity (or speed) needs to be boosted, additional file processors will each provide up to 200 megabytes more disk storage. While preserving the commonality of the data base. And at predictable, economical costs.

Every ARC system comes equipped with user-definable security software that allows each company to restrict access to the data base in several ways.

But the best news is that there is no central processing unit to get bogged down. No single component that will drag the whole system under if it fails. With the Attached Resource Computer, adding (or removing) any attached component requires no system downtime, no re-programming, and no re-training.

Functionally dispersed resources

The ARC System uses an electronic pathway called the Interprocessor Bus to communicate requests and data from one attached resource to another. This communication takes place at such high speeds that applications processors can get the data they need faster than if it were on their local disks. Even though the source of the data may be in another department.

Any number of applications and file processors may be connected to the Interprocessor Bus and located in the offices where they're needed. Each applications processor can have the printers, card readers, magnetic tape, or local disk storage that a traditional computer would have. And each applications processor can be dedicated to its own function, using any of the software in Datapoint's extensive library:

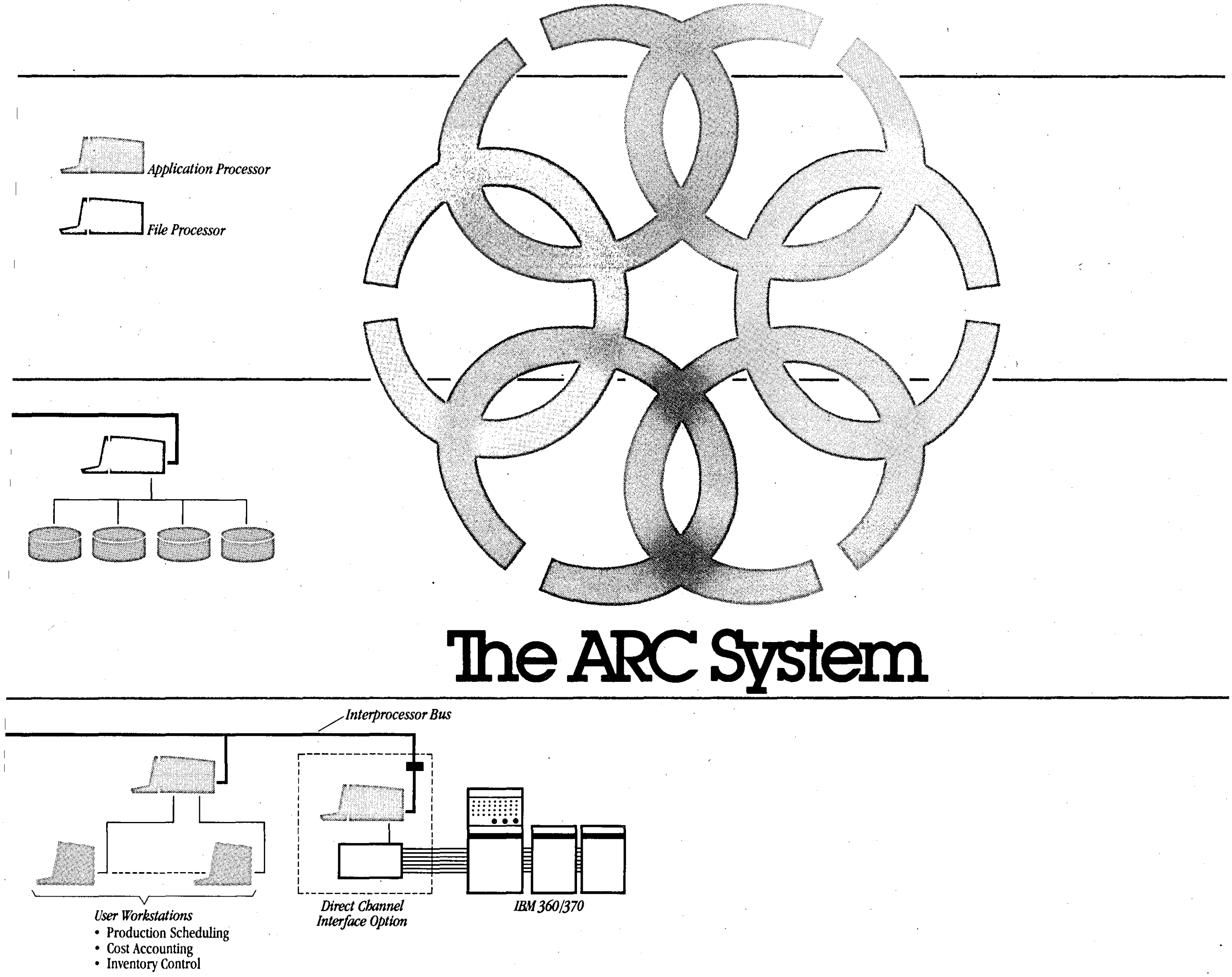
- DATASHARE® for multi-user, on-line transaction processing;
- COBOL for industry-standard batch processing;
- DATABUS®, RPG, SCRIBE®, and BASIC for other business needs;
- Telecommunications to other computer systems with Datapoint's networking software.

In fact, ARC even enables an existing IBM 360/370 mainframe to come on-line as an applications processor, using Datapoint's Direct Channel Interface Option.

ARC supports all of the functionally dispersed tasks to be carried out at the same time — all on the common data base of the file processors.

Use your imagination.

Take a look at some typical ARC Systems. And just imagine how they could be put to work for you.



calendar

MAY

CIPS Session '78 Canadian Computer Conference, May 23-25, Edmonton, Alberta. The theme is "To 2000—the Next 22 Years." Sessions on hardware, software, computers and education, applications, and social issues will be featured, as well as computer chess workshop, computer film festival, technology seminars, and an equipment show. Contact: C. Christie, Athabasca University, 14515 122 Ave., Edmonton, Alberta, T5L 2W4.

Discussion meeting and conference: "The Computer Revolution—Industry and People," May 25, London. An informal discussion meeting sponsored by the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Production Engineers, and the British Computer Society, no charge for attendance and open to the public. Purpose of the meeting is to set the scene for the October '78 conference, which will explore likely opportunities for beneficial change in industrial performance and organization created by developments in computing technology, and will consider human consequences of those developments. IMechE., 1 Birdcage Walk, London SW1H9JJ, 01-839-1211.

JUNE

History of Programming Languages Conference, June 1-3, Anaheim. Programming languages that were in use by 1967 and are still in use will be discussed in terms of the significance of their technical development. The conference will aim to provide a "permanent historical record"; speakers were given questions to address and guidance from a historian; their papers will be distributed before the conference. Speakers are key contributors to the original technical development of each language. Keynote speaker will be Captain Grace Murray Hopper. Contact: Rorrie Ratkevich, Ground Systems Group, Hughes Aircraft Corp., 1901 West Malvern, Mail Drop 606-K126, Fullerton, CA 92634.

Isratech '78, June 4-8, Jerusalem. This exposition of Israel's high technology industries is held in conjunction with Israel's thirtieth anniversary. Attendees will be able to tour industrial plants and research and development facilities. Industries exhibiting include metal processing, equipment and machinery manufacturing, electrical systems and parts, systems and components, electronics, computers, instrumentation, aerospace and military applications. Contact the Government of Israel Investment Authority, 641 Lexington Ave., New York, NY 10022 (212) 486-8530.

National Computer Conference, June 5-8, Anaheim. For details see NCC preview page 000.

MUMPS Users Group, June 7-9, San Francisco. All-day tutorials on programming in MUMPS, ambulatory care information systems, and technical aspects of ANSI-Standard MUMPS; panel discussions on applications of computers in medicine. Contact Ms. Pat Zimmerman, Dept. of Biometry, Wearn Research Bldg., University Hospitals, Cleveland, OH 44106.

26th annual DCA meeting, June 9, Culver City, Calif. Festivities begin at 6:00 p.m.; dinner will be served at 7:30. Chairwoman Mary Rich of Mathematica Products Div., asked for a public statement, said "You can't backspace the card reader," and "It doesn't matter what you eat at DCA, so long

Distinguished rabbit and friend at past DCA meeting.

as you don't eat it together." Make your reservation for this tradition-rich celebration by sending $13.50 per person to Mary Rich, 14332 Dickens St. #6, Sherman Oaks, CA 91403.

69th Annual Special Libraries Association Conference, June 11-15, Kansas City. "Managing for Change" will be the theme of this meeting of more than 3,000 special librarians and information scientists. Also discussed will be the White House Conference on Libraries and Information Services and a review of developments of the new copyright law. A two day meeting of the Continuing Library Education Network and Exchange (CLENE) will be held concurrently (June 10-11). Special Libraries Association (SLA), Attn: John S. Rock, 235 Park Avenue South, New York, NY 10003 (212) 777-8136.

Symposium on Microcomputer-Based Instrumentation, June 12-13, National Bureau of Standards, Gaithersburg, Md. An overview presentation will be given for each of the major areas to be covered, which are: microcomputer technology, applications to scientific instrumentation, microcomputer interface standards, and applications to industrial process control. Major papers include: biomedical and clinical applications, microprocessor-based satellite-controlled clock, fault tolerance in distributed architectures, microcomputers in the linear world, control of a 1 gigahertz CCD transient digitizer, and automating analytical instrumentation. Contact Bradford M. Smith, Room A130 Technology, NBS, Washington, DC 20234 (301) 921-2381.

Ninth National Conference on Computers in Undergraduate Curricula, June 12-14, Denver. Papers presented will reflect actual experience using computers in a wide variety of subjects, including history, chemistry, earth sciences, economics, environmental science, psychology, music and fine arts, statistics, and many more. Contact Dr. William Dorn, Dept. of Mathematics, University of Denver, Denver, CO 80208.

MIMI '78—the 4th International Symposium and Exhibition of Mini- and Microcomputers and Their Applications, June 12-15, Zurich. Subjects to be addressed include hardware, software, technology, networks, systems, education, peripherals, personal and home computers, instrumentation, control, and others. Secretariat MIMI '78, Interconvention, c/o Swissair Postfach, 8058 Zurich, Switzerland.

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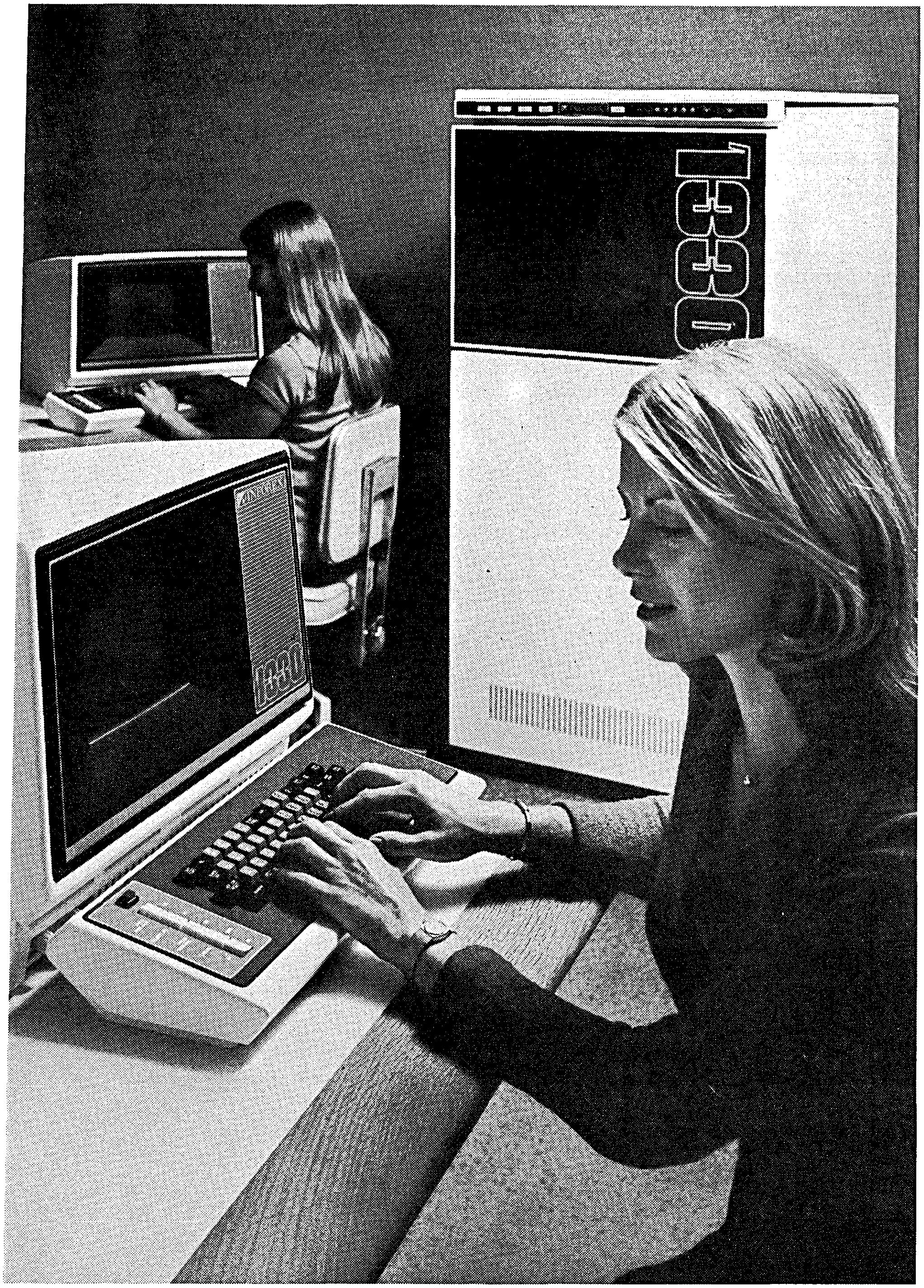


With the 1330, you can consolidate remote job entry and batch data entry applications without compromising either function. The system features expandable disc storage (up to four—10 Mb. drives) foreground and background editing and bisync communications.

INFOREX: THE SIMPLEST SOLUTION TO ALL YOUR DATA ENTRY PROBLEMS.

The simplest and best solution to all your data entry problems is right here: the Inforex data entry family.

Simplest because we design them for ease of use and speed of throughput.

Best because we've been a leader in the innovation and development of key-to-disc data entry products and capabilities right from the start.

Which is why our family's got it all. From the basic keypunch replacement 1300 IKE System to the tremendously powerful maxi-editing System 3300.

So whatever your needs—modest, middling, or immense—the growing Inforex data entry family will meet them.

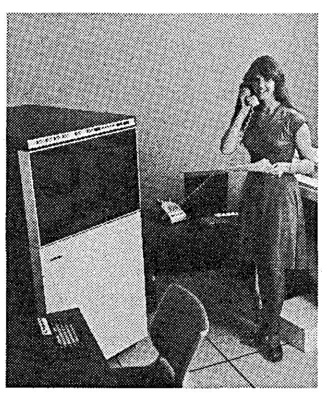
You don't have to settle for a compromise system. You don't have to sweat out an unsatisfactory price/performance choice. All you have to do is choose the system that's best for you.

And that's where an Inforex Support Team comes in. They'll help you select just what you need. They'll provide expert installation. And they'll give you the benefit of their years of experience in other installations.

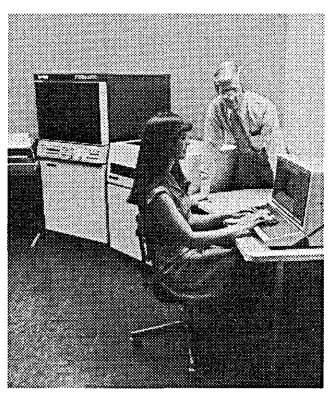
But even after all that, you won't be left high and dry. Whenever and wherever you need help, an Inforex Support Team will be available with the support you need.

The Inforex data entry family. You shouldn't settle for anything less.

Inforex 1300 and 1301 offer highly cost effective data entry capability for smaller installations (4 to 8 keystations) or remote locations where you can take advantage of our communications capabilities.



The 1303 provides medium range data entry capacity, with about triple the disc capacity of the 1301. It supports up to 16 keystations and the addition of edits, table look-ups, range checks and cross-footing. The 1303 also offers communications capabilities such as *spooling, HASP* and *RJE*.



The Inforex 3300 is a powerful pre-processing system that allows you to edit data at the point of entry, enabling you to offload your mainframe. Its sophisticated editing capabilities can also handle many of those applications which you haven't had time to put on your present mainframe.

See the System 1330 at the Computer Caravan—Expo '78.

I would like more information on the following:
- ☐ Key-to-disc data entry ☐ Distributed processing
- ☐ Computerized records management
- ☐ I would like to talk with an Inforex Sales Representative

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Title ____________

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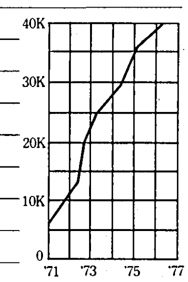
DM-5



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a complete, high resolution, color graphics computer for $8995*

It's also:

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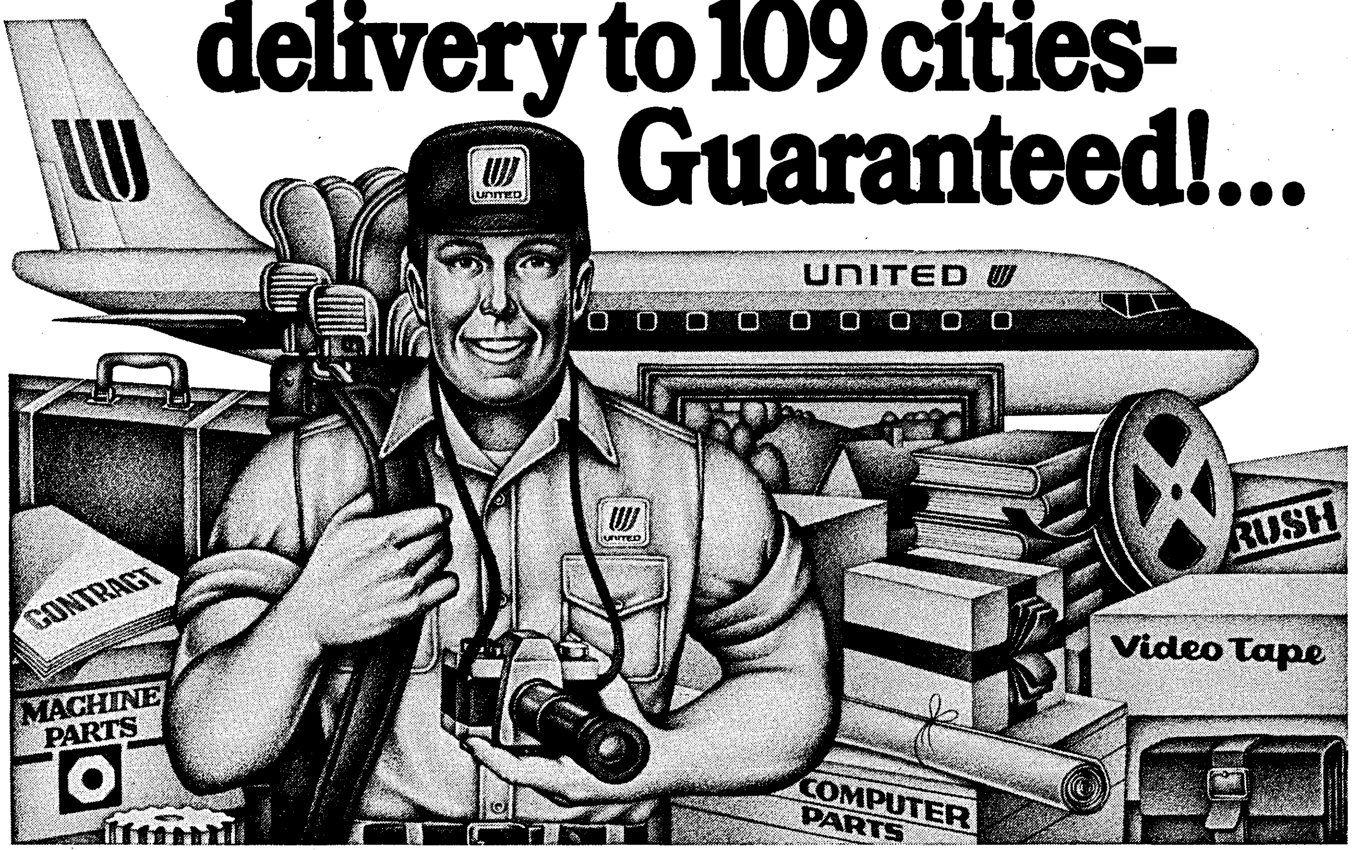

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calendar

(Continued from page 56)

Computers in Banking, June 13-15, Zurich. An international symposium and exhibition. Topics to be covered include: distributed dp, customer-activated terminals, communications networks in banking, management information systems, distributed data bases, electronic funds transfer, and real time bank applications. Contact the Secretariat, Computers in Banking, Interconvention, c/o Swissair, Postfach, 8058 Zurich, Switzerland.

Institute of Internal Auditors 37th International Conference, June 18-21, San Francisco. Speaking will be Harold M. Williams, chairman of the Securities and Exchange Commission, on "Questionable Business Practices." Also, Senator Abraham Ribicoff on computer crime legislation. IIA, Inc., P.O. Box 7886 San Francisco, CA 94120.

6th International Conference of the EDP Auditors Assn., June 19-21, Dearborn, Mich. The theme will be "Executives Demand Professionals." Topics included are auditing applications, on-line systems, database, EFTS, and security/privacy. Contact: EDPAA 1978 Conference, P.O. Box 61, Sterling Heights, MI 48078.

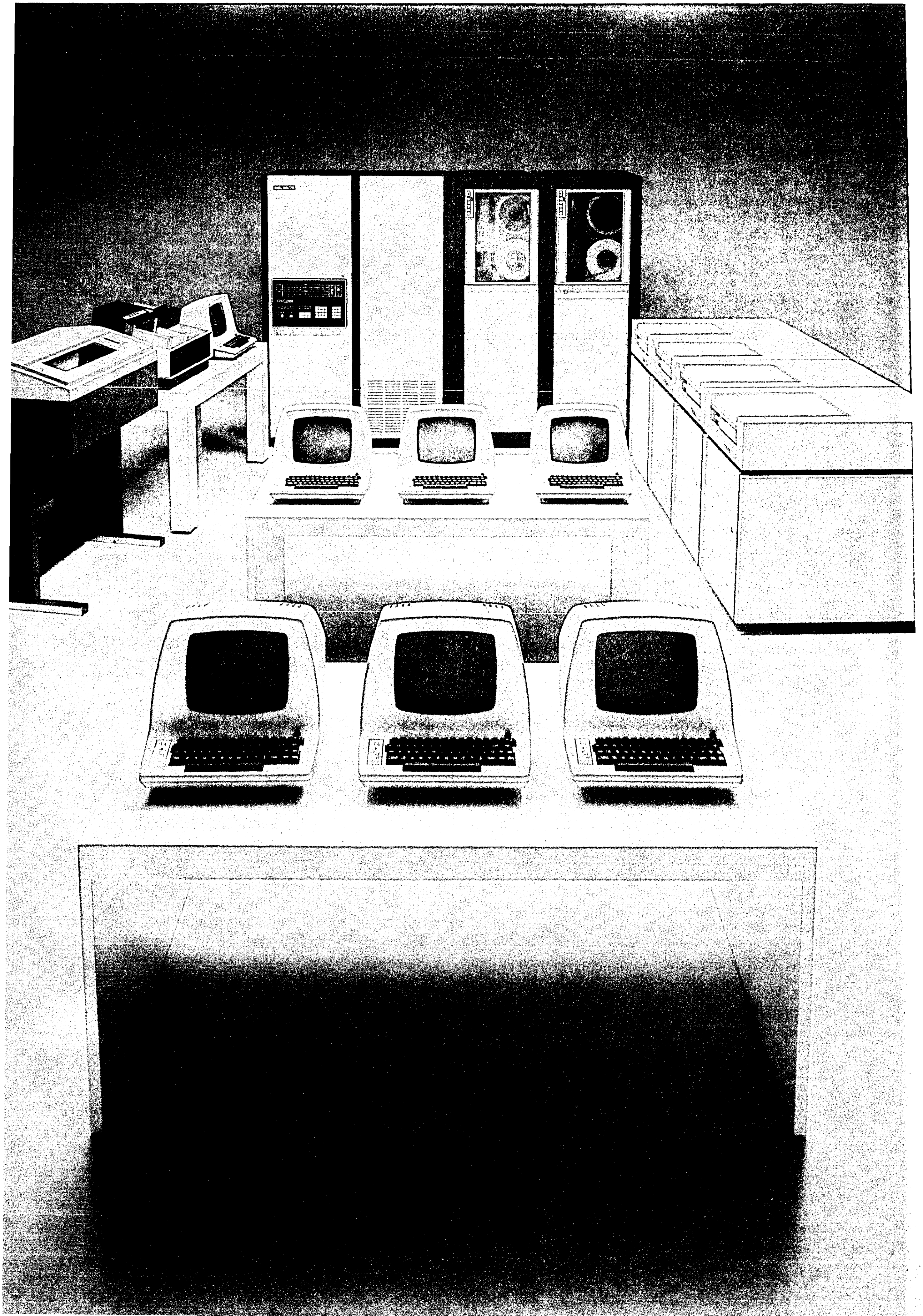
First World Computing Services Industry Congress, June 20-23, Barcelona. Sponsored jointly by ADAPSO and the European Computing Services Assn. Two themes have been set: operations at a multinational level, such as data and telecommunications, transport of data flow, privacy and security, and licensing; and commercial operations of computer service companies, including personnel, marketing, and standards. Keynote speaker Frank R. Lautenberg, chairman and chief executive officer of Automatic Data Processing, Inc., will present "A New Profile for the Services Industry." ADAPSO, 210 Summit Ave., Montvale, NJ 07645 (201) 391-0870.

CALLS FOR PAPERS

Papers on **local computer networking** are being sought for a conference on that subject to be held in October in Minneapolis, sponsored by the University of Minnesota. Contact Dr. Abe Franck, University of Minnesota, University Computer Center, 208 Union St. S.E., 227 Experimental Engineering, Minneapolis, MN 55455 (612) 376-7291.

Practical experiences with **internal auditing** will be the focus of the IIA's 4th annual conference, to be held in Orlando, Florida. Papers about new approaches and techniques for auditing and audit management are invited. Abstracts are due by June 1 to: D. Eugene Shaeffer, Director of Education, The Institute of Internal Auditors, Inc., International Headquarters, 249 Maitland Ave., Altamonte Springs, FL 32701 (305) 830-7600.

The First European Conference on **Parallel and Distributed Processing,** to be held in February 1979 in Toulouse, France, invites survey or tutorial papers on the following topics: expression of parallelism (languages, schemata), semantics of parallelism, compilation problems, implementation and use of formal models, parallel architectures (multi-, array, data flow-associative, pipeline-processors), communication problems, operating systems, simulation, evaluation, applications. Five copies of the ready-for-publication paper, not to exceed 15 double-spaced typed pages, may be sent to C. Girault, Institut de Programmation, 4 Place Jussieu, 75230 Paris Cedex 05, France. Deadline is June 15, 1978. ❊



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SOURCE DATA provides information on books, courses, references, reports, periodicals, and vendor publications.

books

Computing Law
Peter Seipel
LiberForlag, Stockholm, 1977
340 Pages + Appendix

This is a complex and difficult book written by a highly knowledgeable author working in a largely unexplored field. In spite of the extensive bibliography, there have been few publications that sought to cover the totality of a rapidly emerging, consequently still dynamically changing, interface between two so totally diverse disciplines.

There is a serious structural problem with the work that makes reading especially hard. Seipel adopted a rather convoluted organization which attempts to peel off one layer of the onion at a time. The reader is left with an impression, too often, that the material previously has been read.

The American reader will find Seipel's use of the English language somewhat at odds with conventional practice both in syntax and semantics. However, one must salute the effort as an extremely good try for an author not working in his mother tongue. Although hard, it is not impossible if the reader takes care and does a bit of transliteration on the fly.

Seipel is trying to cover a vast range of instances where the law and data processing meet, sometimes tangentially and sometimes head-on. He deals not merely with such known matters as contracts and the patent/copyright issue but is also very deeply involved with the legal issues surrounding the privacy and the social impact of computing. His suggestions regarding legal education should be required reading for those who deal with curricula in law schools.

Certainly this volume would be required reading for those who are going to attempt to practice law with respect to the data processing industry. Whether the typical senior manager in the industry could struggle through the volume is quite another matter, but those who give it a go will be rewarded with some interestng new ideas and perspectives.

At SKr 125, $27.20 (U.S.) at this writing, one would have hoped for a sturdier binding, a more readable typeface for aging eyes and a better attempt at right-hand margin justification. LiberForlag ought to obtain the hyphenation/justification routines available under UNIX to improve their products.

—Philip H. Dorn

The Standard Data Encryption Algorithm
by Harry Katzan, Jr.
Petrocelli Books, Inc.
384 Fifth Avenue
New York, NY 10018
144 pp. $12.00

The author has written a compact and authoritative book for anyone who may be seriously involved with the understanding and use of the NBS standard data encryption algorithm, as recently published ("Data Encryption Standard," U.S. Dept. of Commerce, National Bureau of Standards, FIPS publication 46, January 1977).

His presentation is divided into three sections of rapidly increasing detail and complexity: (1) introduction of data security and a survey of cryptographic techniques; (2) description of the standard data encryption algorithm; and (3) detailed implementation of the standard algorithm.

Over the last ten years, considerable attention has been given to the problems of encryption and decryption as one method of providing data security and privacy when applied to computerized file systems. The book briefly mentions the six standard data security measures—access management, process limitations, auditing and threat monitoring, privacy transformations, integrity management, and level of authorization and data file protection—but it quickly focuses on the specifics of cryptography. It is at this point, albeit halfway through the text, that the author makes several key assumptions about the reader; first, that he has struggled through and comprehends at least some of the bibliography and, second, that he is conversant in APL, which is used in the text to define formally the enciphering computation. Let the potential reader be forewarned.

Professor Katzan has taken a rich, complex subject of current importance and has written about it as intelligibly as possible in this short essay.

—J. C. Alrich

Statistical Analysis for Business Decisions
by Jedamus, Frame & Taylor
McGraw-Hill Inc.
1221 Avenue of the Americas
New York, NY 10020
636 pp. $14.95

This college text presents the necessary and important principles of statistics in a way that is both interesting and relevant to the business-oriented student.

The book is composed of self-contained segments of particular topics which the authors call modules. Learning objectives are presented at the beginning of each of the 23 modules and specific objectives are clearly presented in boxes introducing each submodule or section. Exercises and problems are liberally sprinkled throughout the text with a sufficient number of answers so that the student can use it for self-teaching.

Another important feature is the tone of the writing style; it is informal and relaxed without being banal and it does have content and sufficient rigor so that even Bayes and the Bernoullies would find the presentation acceptable.

The subject matter covered is broad and about what one expects in an applied statistics text; time-series analysis, forecasting, inference, distributions, decision rules, hypotheses testing, regression analysis and sampling plus binomial and normal probability distribution tables and several others of more specialized content.

Altogether a carefully and cheerfully written text that may not always delight but can greatly reward the interested student.

—J. C. Alrich

reports & references

Datacomm Market

A microwave communications equipment market of $1.3 billion over the next ten years is predicted by this study of political and economic factors surrounding "value-added" and specialized common carriers. Also estimated are predictions for the short-haul intra-city market, hardware for which is still largely in the development stages.

The report includes discussion of major FCC decisions since 1969 (when MCI was first granted permission to offer private line service), basic configurations and equipment, specific

(Continued on page 68)

source data

(Continued from page 65)

companies, and a summary of the intents and potential effects of legislation such as the government's antitrust suit against AT&T and the "Bell Bill" (The Consumer Communications Reform Act of 1976). Also mentioned are various ingredients of competition expected in the next several years, such as satellite communications, packet carriers, and the continued development of facsimile communication. User confidence in specialized common carriers, which some say plummeted after the Datran bankruptcy, is discussed and the Datran situation is explained.

"Specialized Common Carrier and Associated Equipment Markets" is available for $675 from FROST & SULLIVAN, INC., 106 Fulton Street, New York, NY 10038 (212) 233-1080, reference report #412. In Europe contact Chloe Haslam, Frost & Sullivan, Ltd., 104-112 Marylebone Lane, London W1M 5FU 01-486-8377.

The Modem Market

Line quality and diagnostic facilities are listed as the major difficulties with modem use in this Datapro survey of over 300 users. The report features a brief industry analysis, a summary of recent market activity, a review of relevant FCC decisions since the Carterfone case, and a discussion of modem characteristics, as well as user ratings of more than 11,000 modems. Also compiled with the user data are charts showing usage of modems by feature and by communication facilities. *All About Modems* is priced at $12.00. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, NJ 08075.

Director Directory

The *Directory of Top Computer Executives* lists user installations across the country and includes name, address and phone number, who to talk to and what system is in use. Updated semiannually, the latest edition is the largest and clearest version yet. Typeset on 8½ x 11 inch size, the directory is organized geographically, with a cross-index providing industry classification and alphabetization. Newly included are government listings. Price: $75, with discounts offered for multiple copies and for annual subscription. APPLIED COMPUTER RESEARCH, P.O. Box 9280, Phoenix, AZ 85068 (602) 944-1589.

All About X.25

Aimed at a "broad-brush" understanding of X.25 (the CCITT protocol entitled "Interface between data terminal equipment and data circuit-terminating equipment for terminals operating in the packet mode in public data networks"), this report features straightforward discussion of the need for and features of packet switching. The booklet, filled with lucid diagrams, sells for only $10. From LOGICA INC., 801 Second Ave., 13th Floor, New York, NY 10017.

Micrographics Directory

This 64-page guide to products and services is available free of charge. Data is included on manufacturers, distributors, consultants, service firms and trade publishers in the micrographics industry. The services section includes a geographical index. The *1978 Buyer's Guide to Micrographic Equipment, Products Services* is available from NMA Publications Sales, 8728 Colesville Rd., Silver Spring, MD 20910.

Electronics in Europe

The fifth annual edition of the *Yearbook of Western European Data* predicts an annual average growth rate of 7.7% between 1976 and 1981 for the European electronics markets. Thirteen countries and more than 40 product categories are covered in this compendium of market, production and import/export data.

The largest market seen is for components. The highest growth rates predicted are for the U.K., Norway, and Spain, while West Germany is pre-

(Continued on page 74)

$20,000 Energy Saving With Computer Cooling System

THE CONNECTICUT NATIONAL BANK

BRIDGEPORT, CONNECTICUT 06602

March 17, 1976

Mr. George Sporie
J. P. Salmini Company, Inc.
101 Gulf Street
Milford, Connecticut 06460

Re: Economiser System

Dear Mr. Sporie:

About one month has expired since the completion of the economiser system installation at our computer facility. A few days ago I received our monthly electric bill from United Illuminating Company which covered a period of about 25 days during which time the economiser was in operation. This bill showed a decrease of 35,000 kilowatt hours and a savings of $1,110.13 over the previous months bill.

It may be interesting to note that prior to my receiving this bill I was called upon by a representative of the United [illegible] Company who was [illegible] that [illegible] error may have

Since the above letter of March, 1976 from R. T. Stone, building manager, the bank has saved $20,000 using EDPAC "ECX" with glycol winter cooling coil.

The system was installed and monitored by J. P. Salmini Company. Data is available from AC Manufacturing Company — 609-428-9800.

EDPAC

Process Cooling for Computers

EDPAC is a product of
AC Manufacturing Company,
Cherry Hill, N.J. 08034

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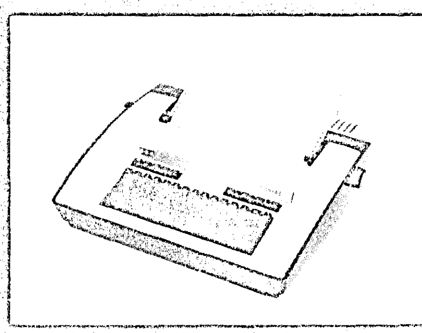

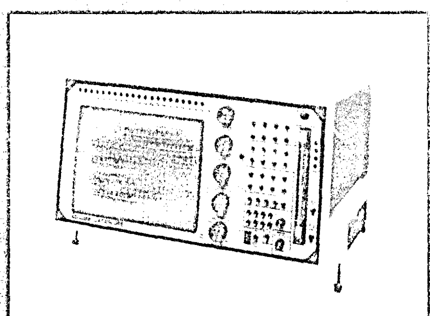

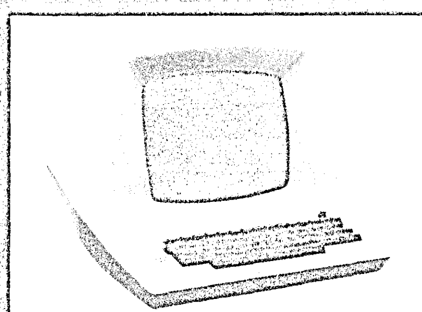

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TOLL FREE NUMBERS: Outside California 800-227-0280, Outside New Jersey 800-631-7030, Outside Maryland 800-638-0838, Outside Illinois 800-323-2518

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SERIES 700
Distributed Processing Systems

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(Continued from page 68)

dicted to continue to dominate the electronics market in Europe with more than one quarter of the total market.

An analysis of the 50 largest electronics organizations operating in Europe is presented in a companion report, the *Yearbook of European Electronic Companies 78,* in which sales are indexed "where possible" by product, division, and geographic area.

$175 for the set; individually, $145 for the Data yearbook and $50 for the Companies yearbook. MACKINTOSH CONSULTANTS, INC., 2680 Bayshore Frontage Road, Mountain View, CA 94040 (415) 965-4763.

vendor literature

2400bps Modems

Primary features and applications of this vendor's 24 LSI Mark II and CS 24 LSI modems are illustrated in this eight-page, two-color booklet. Photographs and text explain the indicators and controls on the units' front panels. Diagrams show test features and options in typical configurations. A table of specifications and a list of sales offices is included. RACAL-MILGO INFORMATION SYSTEMS, INC., Miami, Fla.

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Line Printers

A six-page, illustrated brochure describes this vendor's line printer offerings for minicomputer users. The printers covered range from a 100 lpm matrix printer to a 1,200 lpm chain printer. Also described are the vendor's interface and 80-column card reader. A postage-paid card is included for requesting additional information on specific products. DIGITAL ASSOCIATES CORP., Stamford, Conn.

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Test Data Generator

Datamacs, a program for generating test data for program check-out and debugging, is the topic of an eight-page, illustrated brochure. The brochure explains how the package saves both machine time and programmer effort. It is pointed out that the test data generator can create test cases for programs written in any language, or can be embedded within COBOL programs. Illustrations show the package in use, embedded within a COBOL program; the data file generated and Datamacs' description of the file also are shown. A postage-paid card is included so readers may request more information or a demonstration. MANAGEMENT AND COMPUTER SERVICES, INC., Valley Forge, Penn.

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4800bps Modem

Compatible with Bell's 208 data set, this vendor's model 7208 modem is described in a 12-page, four-color brochure. The brochure discusses the 7208's functions which go beyond Bell-compatibility. Both the company's service capabilities and the service features of the modem are covered, as are reliability and cost effectiveness. Finally, a table of specifications lists the vendor's line of modems, their Bell counterparts, and other specs. TELE-DYNAMICS, Div. of Ambac Industries, Inc., Fort Washington, Penn.

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Graphics Survey

A four-page flier describes this consulting organization's computer graphics study, *Computer Graphics: A Study for Designers of Printed, Integrated, and Hybrid Circuits.* The flier explains the background and need for the study, its principal objective, and its authors. The study outline is included, along with an order form. INTERNATIONAL TECHNOLOGY MARKETING, Newton, Mass.

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Communications Equipment

Describing every major product in this telecommunication equipment manufacturer's line, this 40-page brochure includes photographs and prose covering a wide range of data transmission devices. The booklet also profiles the company, its facilities, personnel, manufacturing capabilities, and service. Equipment of interest to dp users includes data sets operating from 75bps to 56,000bps. References to more detailed product publications are given. For the curious, the booklet also covers microwave and co-ax transmission systems, and other communications devices. GTE LENKURT INC., San Carlos, Calif.

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Satellite Communications

"What every company president should know about domestic satellite communications" poses and answers the 34 questions said to be most commonly asked by executives. Questions are divided into seven categories: who, what, when, where, why, how, and how much. Examples of the questions include "who's using satellite communications now and what do they think of it," "will we hear any differences," and "what's my capital investment." A post card is included for requesting more information. RCA AMERICAN COMMUNICATIONS, INC., Piscataway, N.J.

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Computer Interconnections

An application note explores three methods for interconnecting this vendor's 9825 desktop computer with the vendor's model 1000 computer systems, in instrument control, measurement, and analysis applications. Three communications methods—the vendor's implementation of the IEEE 488-1976 instrument bus standard, RS232-C, and that used by the vendor's 3070A terminal—are shown. For each, the booklet lists advantages and constraints, and provides the information necessary for completing the interface. Flowcharts and sample communication programs are included in the 20-page, illustrated booklet. HEWLETT-PACKARD CO., Palo Alto, Calif.

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Microprocessor Family Album

An illustrated, 40-page booklet describes this semiconductor manufacturer's 8080A microprocessor family of bus-compatible parts. Among the more than 60 parts listed are components for peripheral control, communications, I/O, and memory. The vendor's Microbus is covered, and system support services are discussed. Six pages are devoted to listing and defining the 8080A's instruction set. An order form is included offering reference books of interest to designers and users of 8080A and other microprocessor based systems. NATIONAL SEMICONDUCTOR CORP., Santa Clara, Calif.

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Word Processing Accessories

Word processing accessories—acoustical machine enclosures, magnetic media filing systems, and consumable supplies—are described in this 64-page catalog. A form is included for mail orders, and the vendor also gives an 800-series phone number. AMERICAN WORD PROCESSING CO., Tarzana, Calif.

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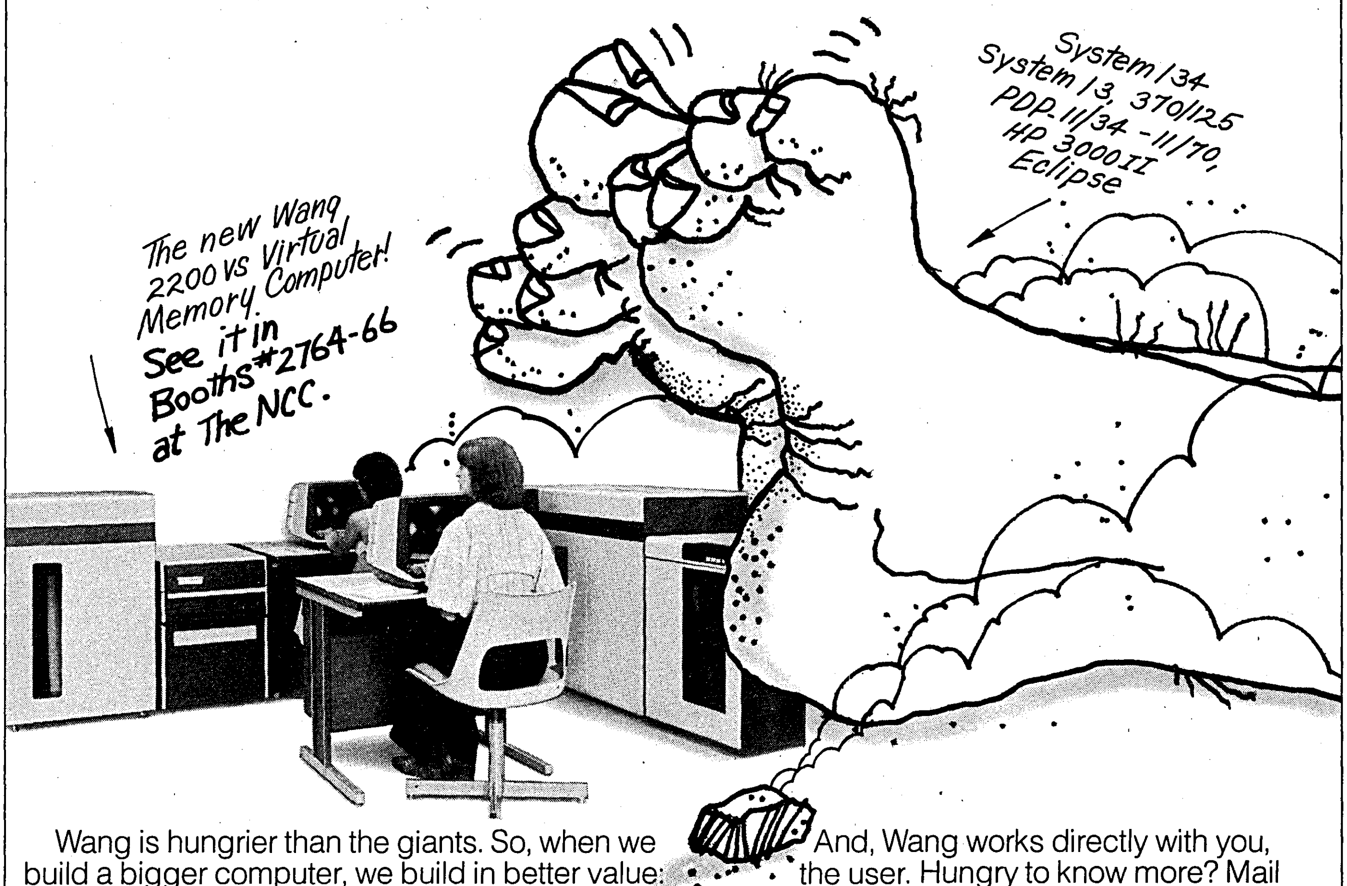
periodicals

Digital Systems Journal

The British Institution of Electrical Engineers now publishes quarterly a new periodical, *Computers and Digital Techniques.* The journal will cover the structure, design and technology of systems, subsystems and components, as

(Continued on page 85)

Wang's VS computer. The bigger giant killer.



Wang is hungrier than the giants. So, when we build a bigger computer, we build in better value: Wang's new 2200VS is the only virtual memory system at an entry level price under $50,000.

It's interactive. Responsive. 2.3 billion bytes of online storage. ANSI '74 COBOL, RPG II, BASIC and ASSEMBLER. IBM 360/370 instructions.

Multi-terminals; multiprocessing; multiprogramming. Software automatically adapts to system size. High, immediate programmer productivity.

2200VS is the first-time computer that protects your investment. The replacement computer for the yield you never got.

The remote computer to which you distribute 90% of the application's processing.

It's modular. Expandable without system conversion.

And, Wang works directly with you, the user. Hungry to know more? Mail this coupon to Wang Laboratories, Inc., Lowell, MA 01851. Or call (617) 851-4111.

Dear David:

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Name ____________________

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WANG

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(Continued from page 74)

well as applications, software and languages. CDT's aim is to be a forum for the presentation of work by research and development workers internationally, and to keep up-to-date the "computer fraternity in general." Conference reports and book reviews will be featured, as well as papers. Subscription is £35, £29 in the U.K. THE INSTITUTION OF ELECTRICAL ENGINEERS, Station House, Nightengale Road, Hitchin, Herts, SG5 1RJ, England.

Networks

Another new British journal is now available, the bimonthly *Computer Communications.* Articles in the first issue include: standards for open network operation, an architectural approach to protocol design; the problems and solutions of interfacing IBM 360/370 hosts to Euronet in accordance with X.25; and a story about point-of-sale terminals. Also covered are conferences, an update on British Standards, a listing of pertinent literature, and a new product review. Subscriptions in the U.S. are $70.40 from IPC BUSINESS PRESS LIMITED, 205 East 42nd Street, New York, NY 10017 (212) 867-2080. In England subscriptions are £32 from IPC BUSINESS PRESS LTD., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH.

Computers and Law

Recently announced is the new quarterly publication Computer/Law Journal. The first issue, available for $15.00 per copy ($16 outside the U.S.), carries the theme Patent Protection for Computer Software and is over 300 pages long. Included are three feature articles, a series of case digests, a chart giving a chronological overview of the development of the software patentability issue, and an extensive bibliography of "all published materials on software patentability." Upcoming issues will feature topics such as computer crime, the CONTU commission, computer contract negotiations, and the Electronic Funds Transfer system. Subscriptions are $50.00. THE COMPUTER/LAW JOURNAL, 675 South Westmoreland Avenue, Los Angeles, CA 90005, Attn: Michael D. Scott.

World Dataflow

An interesting new periodical *Transnational Data Report* seems to live up to its subtitle, "The International Report on Information Politics and Regulation." The first issue contains a "Focus on France," which goes over recent legislation in France, gives a detailed summary of the issues involved in the prelegislation debate between business and political interests, discusses the economics of the French information industry, and profiles some of the leading figures in the French information flow controversy. This issue also features a report on recent and upcoming UNESCO concerns, and work of the Council of Europe and EEC. A report on the new Portugese Constitution's reference to data processing (Article 15) contains an official translation of that section. Unofficial translations are also provided, as in the case of references to information, media and communications in the draft Spanish Constitution and the French Data Processing, Files and Freedom Act of January 1978. Since unofficial translations are presumably undertaken when an official version is unavailable, this seems an invaluable reference service. TDR is published eight times yearly. The second issue will offer a special feature on Germany, a report on the Brussels Transnational Data Regulation Conference, European parliaments' consideration of privacy, news from Algeria, and more. Annual subscription is $140, with single issues available to subscribers at $10. The publisher also offers various specialized references and research work as the Transnational Data Reporting Service. THE WAYNE SMITH CO., Suite 810, 500 12th St., S.W., Washington DC 20024 (202) 484-5620.

courses

The Automated Office

Featured will be a panel discussion on "How to Justify Office Automation," and examples of "Life in an Automated Office." Concurrent workshops will include management policy issues; the technologies of micrographics, ocr, and photocomposition; the technologies of office system architecture, communications networks, and display and delivery systems; text processing; and telecommunications. There will be more than 30 industry and government speakers. Theme of the third day session is "Toward the Automated Office: Dreams and Realities," under which three topics will be discussed: the potential impact of government policy, potentialities and difficulties in the corporate environment, and functional relationships within and between working elements in the automated office. Offered in Los Angeles June 7-9. AIIE Seminars, P.O. Box 3727, Santa Monica, CA 90403 (213) 450-0500.

Applied Datacomm

A workshop all about data communications systems for corporate users.

(Continued on page 88)

CIRCLE 26 ON READER CARD

source data

(Continued from page 85)

Analysis, design, development, implementation, and support skills will be covered. The intent will be to provide attendees with the knowledge of current and potential systems requirements with respect to configuration network costs, flexibility and system recovery in a way that is amenable to change. Fee: $475 including course materials and lunches. June 7-9 in Arlington, Va., July 12-14 in San Francisco. IPE (the Institute for Professional Education), Suite 601, 1901 North Fort Myer Drive, Arlington, VA 22209 (703) 527-8700.

Modeling

The Production Automation Project is an applied research project conducted in collaboration with industry. Technologies, systems and theories of mechanical manufacturing, design and assembly are the subject of the research effort. The project is offering a course in Geometric Modeling of Rigid Solids June 12-16, with an optional supplement June 19-20 in which some of the key algorithms in a modeler based on constructive solid geometry will be discussed. Enrollment will be limited. Fees: part 1, $500; supplement, $200. Contact: Holly Peirce, Administrator, Production Automation Project, College of Engineering & Applied Science, University of Rochester, Rochester, NY 14627 (716) 275-3775.

Cryptography

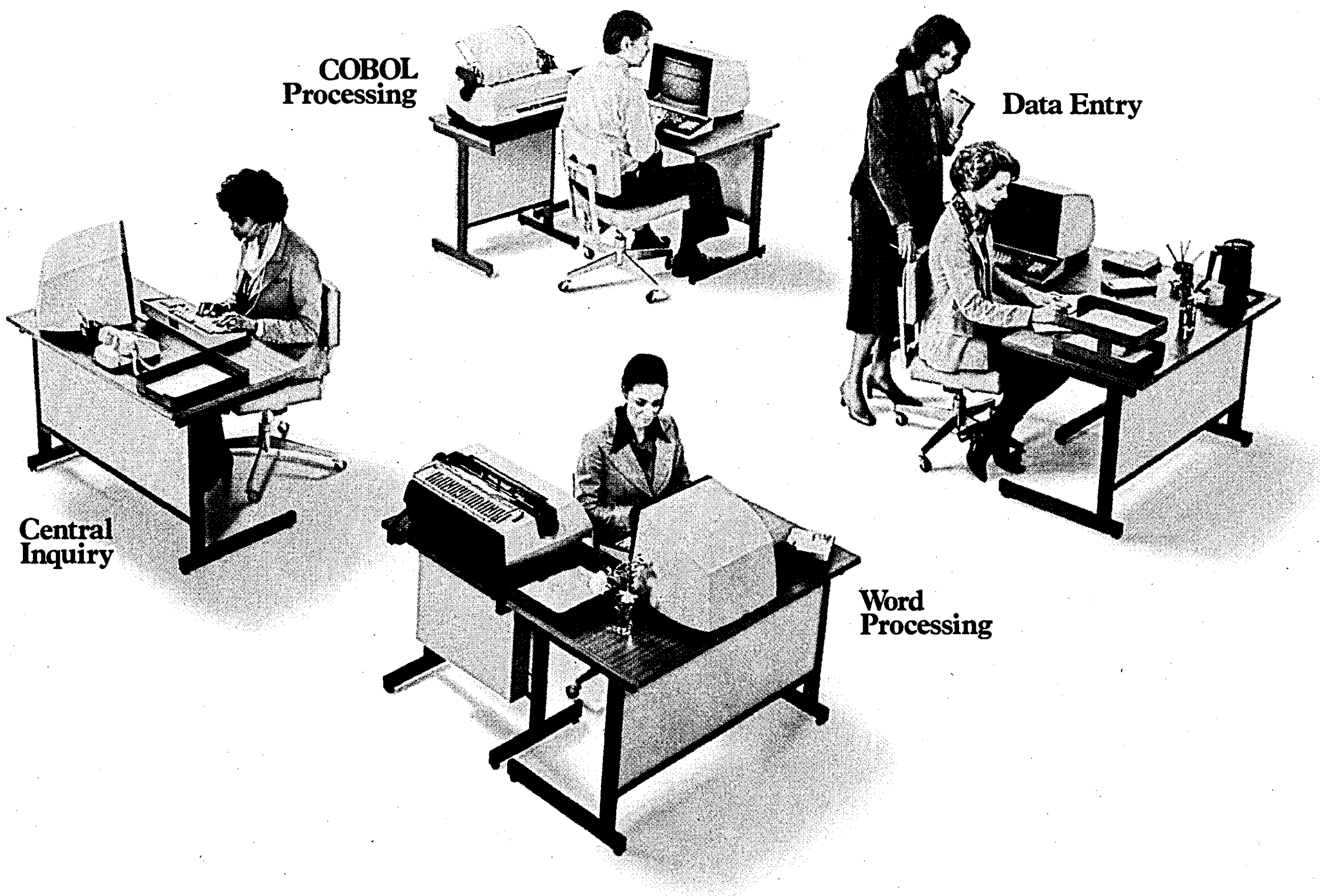
Commercial cryptography and step-by-step procedures for applying cryptographic technology to dp and datacommunications. Topics to be discussed include the data encryption standard algorithm and how to integrate cryptographic hardware into an information link. June 18-20 in Barcelona (just after the first World Computing Services Industry Conference) and July 24-26 in Denver. Price: $495. Multiple discounts offered. KETRON, INC., Valley Forge Executive Mall #10, Wayne, PA 19087.

Structured Methodology

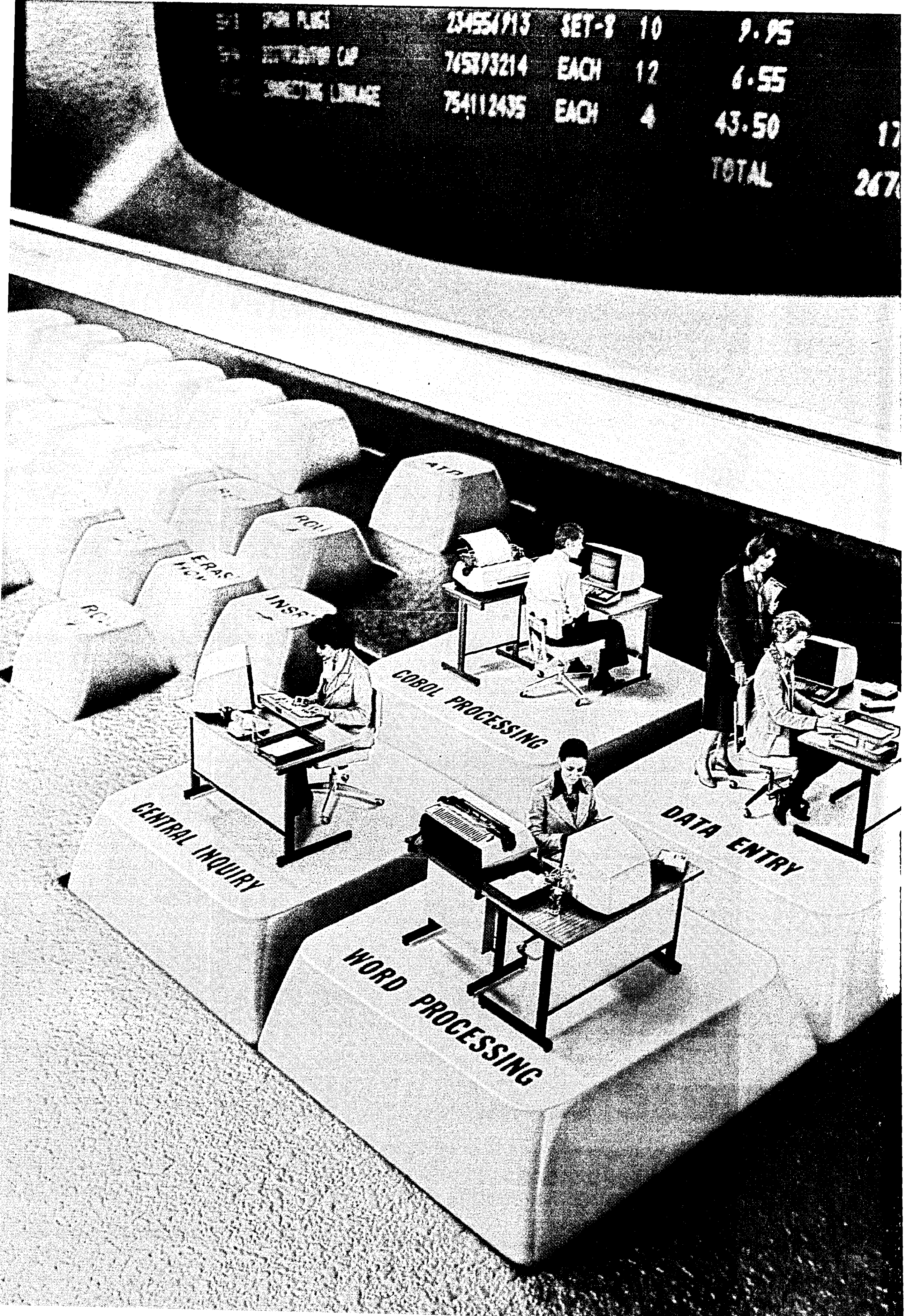
This course will explore structured design on the program, system, and module levels using a case study system with practical exercises designed to show the how, not just the why of structured design and programming. Techniques presented are based on the works of Dijkstra, Mills, Myers, Naur, Yourdon, and others. Both individual and team assignments are given, as well as class assignments in which the solution is found "interactively" with the instructor's guidance. June 19-23 in

(Continued on page 92)

You may need more than one computer function...



...but you don't need more than one computer system.


EACH 12 6.55
EACH 4 43.50
TOTAL
COBOL PROCESSING
CENTRAL INQUIRY
DATA ENTRY
WORD PROCESSING

source data

(Continued from page 88)

Washington, D.C. Fee: $695.

SDP (Structured Design and Programming Workshop) will also be offered in New York and Chicago in the fall, and is available in-house. BSI (Brandon Systems Institute, Inc.), 4720 Montgomery Lane, Bethesda, MD 20014 (301) 986-8611.

Simulation

Theory, case studies, and "hands-on" workshops in how to analyze a problem and apply the proper computer simulation technique. Basic techniques of discrete event modeling, the different classes of simulation languages and the interaction between simulation, analytic models, and measurement studies will be emphasized in the lectures. June 19-23. Contact: Mrs. Gerry Cohen, Carnegie-Mellon University, Carnegie Institute of Technology, Post College Professional Education, 405 MMCC, Pittsburgh, PA 15213 (412) 578-2207.

Material Flow

Control of material flow through management systems is the subject of this course which will emphasize the setting of criteria for choosing dp hardware and software, the definition of models and data structure, and systems project planning. Attendees are encouraged to present a major logistics question, accompanied, if possible, by supporting data. Topics of study will include: inventories, demand forecasting, replenishment rules, service levels, warehousing, and freight control. June 26-28 in New York. The course will also be offered in Toronto in late August and in Chicago in October, and is available in-house. Contact: William A. Kulok, Program Director, New York Management Center, 360 Lexington Ave., New York, NY (212) 953-7262.

Audit and Control

A two-day "executive management briefing" is being offered by SRI in Chicago June 26 and 27; June 28 and 29, July 17 and 18, September 13 and 14 in New York; July 19 and 20 in Houston, and August 21-22 in San Francisco. The course is an outgrowth of the study done for the Institute of Internal Auditors. EDP Systems: Security, Auditability and Control will attempt to provide management of audit or information systems with specific detailed information about available tools, techniques and technologies. Fee: $480. Contact: Katherine Mize, SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025, (415) 326-6200, ext. 3963.

Government Buying

Executives from government and industry will meet to review and discuss dp procurement and implementation policy. To be discussed are government reorganizations, internal government task forces, and assessments of the Brooks Bill. Parallel sessions will include hardware, software and timesharing procurement, and guidelines for benchmark tests. The conference will be held June 26-28 in Washington, D.C. Contact AIIE Seminars, P.O. Box 3727, Santa Monica, CA 90403 (213) 450-0500.

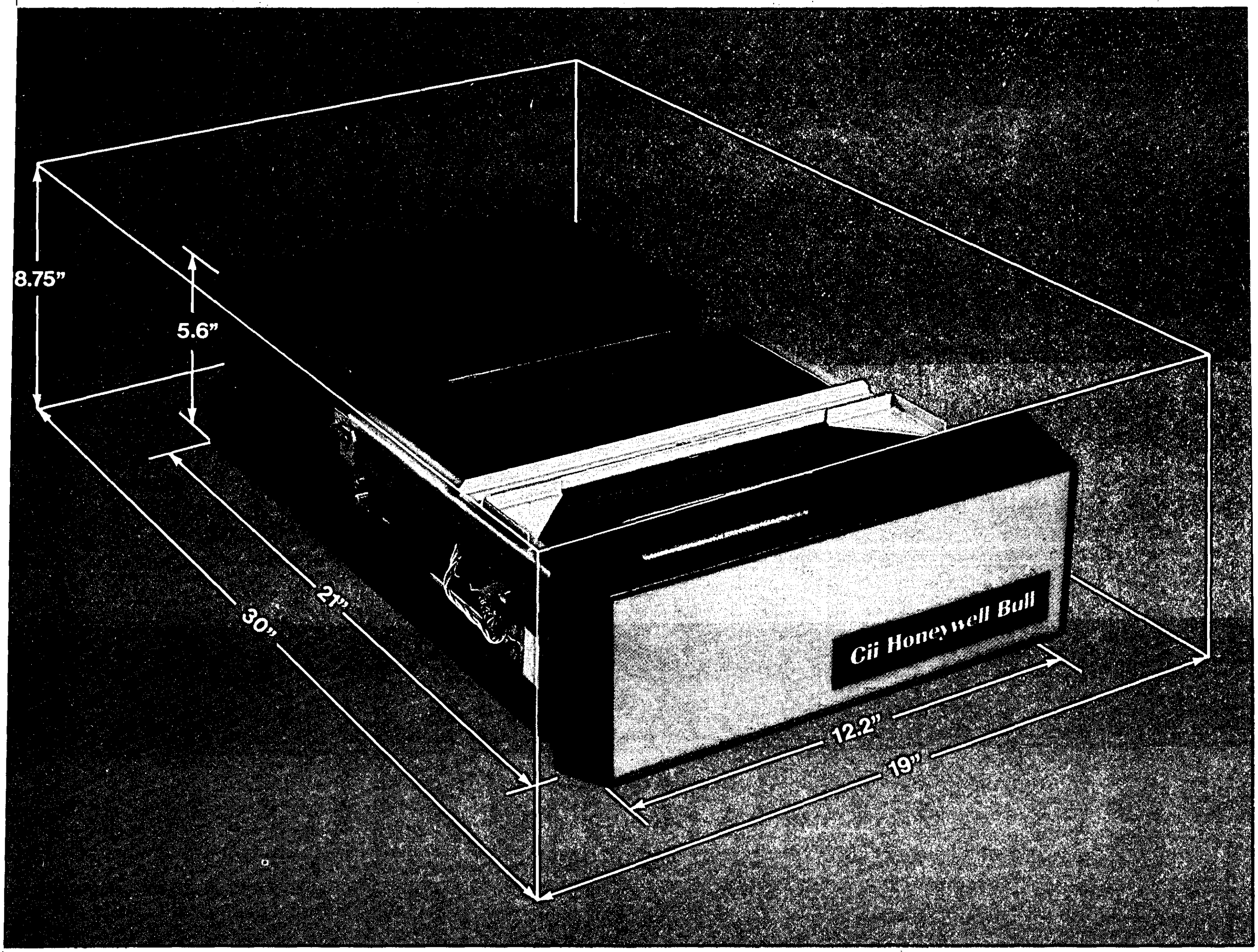
Data Entry Management

Management techniques for the data entry manager and supervisor including how to choose an up-to-date data entry system and how to deal with operators. Distributed data entry will be discussed, as will productivity and performance standards. June 26-29 in New York, August 21-24 in San Francisco. Fee: $630. AMERICAN MANAGEMENT ASSN., 135 West 50th St., New York, NY 10020. ✻

Crowed a bit-fiddler of Sault
  St. Marie,
"No coder's more cryptic than me.
    All the code that I make
    Is obtuse and opaque
And no one can patch it but me.

—Wm. J. Wilson

This disk drive packs 10 Megabytes in unit one-third the size of conventional drives.



OEMs and systems builders will want to take a hard look at this D120 MidiDisk drive (the first of a family) that combines large disk state-of-the-art technology in an unusually compact package.

Its performance advances include:

Operating Versatility. Three D120 units can be mounted vertically in a 19-inch rack. A table-top version is available also.

Midi-Cartridge. The D120 uses a flat, ultra-thin midi cartridge which measures only 11" square, is less than one inch thick, and weighs only 2.8 pounds.

Speed. A fast 920 kilobytes per second. (Densities of 4,750 B.P.I., and 500 T.P.I.)

Accuracy. Data-imbedded, servo-tracking techniques for head positioning eliminate the need for a transducer, thermal compensation, or head alignment techniques. This simplified mechanism rules out any need for preventive maintenance.

Power Savings. The midi cartridge is self-ventilated (operates at 3600 rpm). No air blower is required. (After startup, total power consumption is only 100 watts.)

Reliability. The spindle is an integral part of the brushless dc motor. There are no belts or pulleys, no electronic/mechanical adjustments to make. And head loading is controlled automatically to prevent damage in the event of a failure.

Available: Controllers for industry-standard microprocessors.

For price and delivery information, contact: **In North America**—Jean-Paul Garodel, Honeywell Information Systems, 200 Smith St. (MS 464), Waltham, Mass. 02154. 617/890-8400, x 2019. **In Europe**—Alain Kiffer, Cii Honeywell Bull, 6 Avenue des Usines, 90001 Belfort, France. (84) 228200.

CIRCLE 85 ON READER CARD

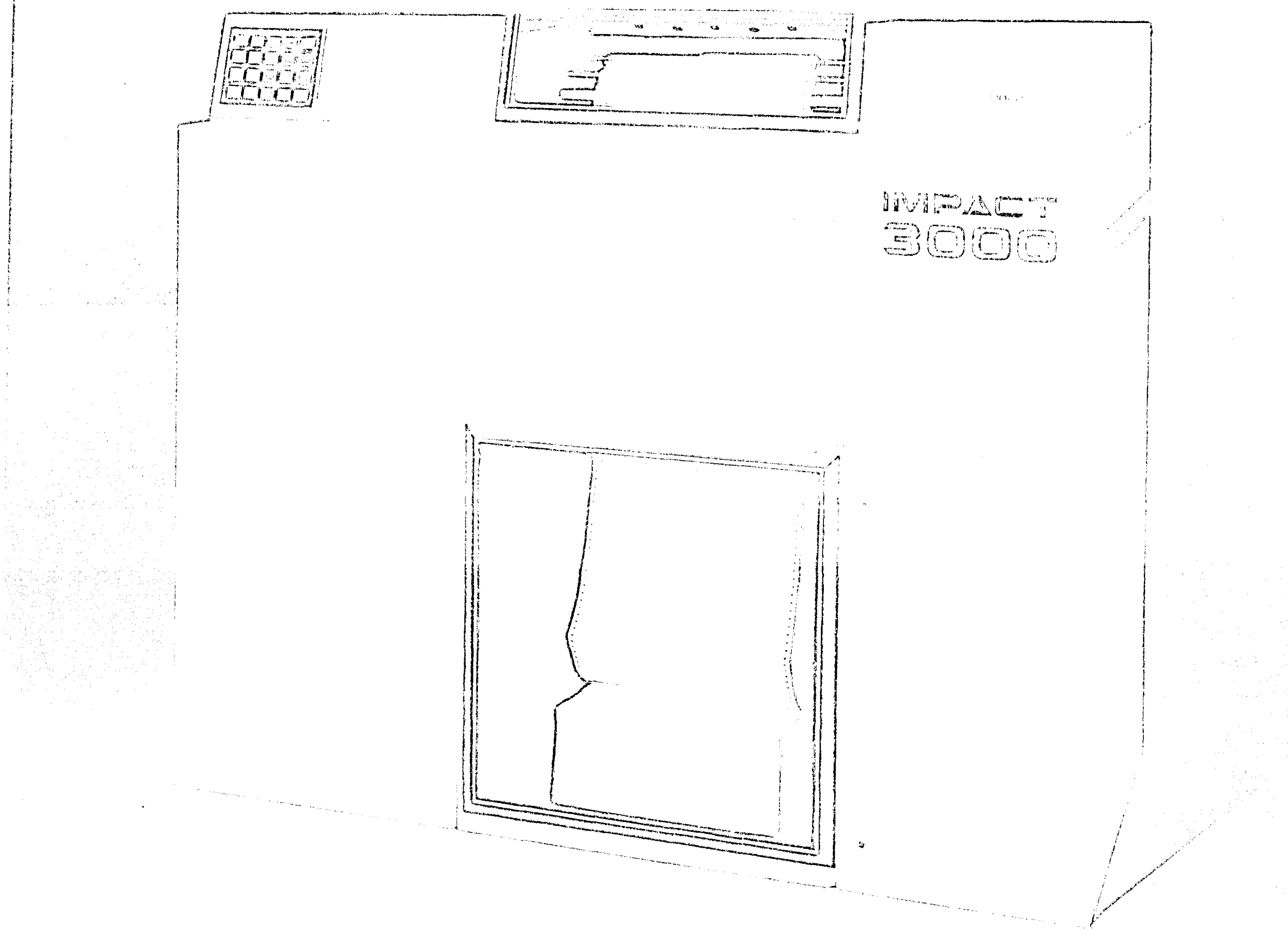
Cii Honeywell Bull

See us at the NCC, Booth 1758.

Documation's new breakthrough gives you all the advantages of impact printing

Call John Sterling (800) 327-6424 or (305) 724-1111 or your local Documation representative: **Atlanta, GA** 955-0309 **Boston, MA** 890-2650 □ **Chicago, IL** 782-0551 □ **Dallas, TX** 661-9902/750-6160 □ **Detroit, MI** 353-8181 □ **East Meadow, NY** 794-1186 **Greenwich, CT** 869-4123 □ **Hartford, CT** 278-2010 □ **Houston, TX** 780-1432 □ **Irvine, CA** 752-8782 □ **Long Beach, CA** 595-6775 **Miami, FL** 592-9655 □ **New York, NY** 695-4195 □ **Newark, NJ** 686-5223 □ **Oak Brook, IL** 920-0551 □ **Philadelphia, PA** 337-2850 **San Francisco, CA** 574-4060 □ **Washington, DC** 356-2050 □ International Offices: **London** — Staines 61124 □ **Paris** 686 8007 **Germany** 0611-762 055 □ **Spain** 416 87 60.

Introducing
IMPACT 3000



World's fastest Impact Line Printer
Documation's technology breakthroughs increase throughput to 3000 lines per minute. With 6 copy capability impact printing now yields throughput rates up to 18,000 lines per minute per printer.

More throughput per dollar invested
Cost of ownership of three IMPACT 3000 line printers is less than a single IBM 3800, providing you significantly lower cost redundant reliability. What's more, IMPACT 3000 productivity increases as the number of copies increases. Laser graphic productivity decreases.

Forms flexibility
IMPACT 3000 provides printing on any forms 3 to 18¾ inches wide and 3 to 24 inches deep. More than twice the form depth of laser graphic capability.

No additional programming required
Any 360/370 channel (or PCM mainframe channel) will support multiple IMPACT 3000 line printers. And, IMPACT 3000 requires no additional system or application programming.

Just four of the many reasons why you should investigate Documation's IMPACT 3000 as a viable alternative to laser graphic printing.

For more information on IMPACT 3000 write Documation Incorporated, P.O. Box 1240A, Melbourne, FL 32901 or call your local Documation representative for a detailed comparative analysis.

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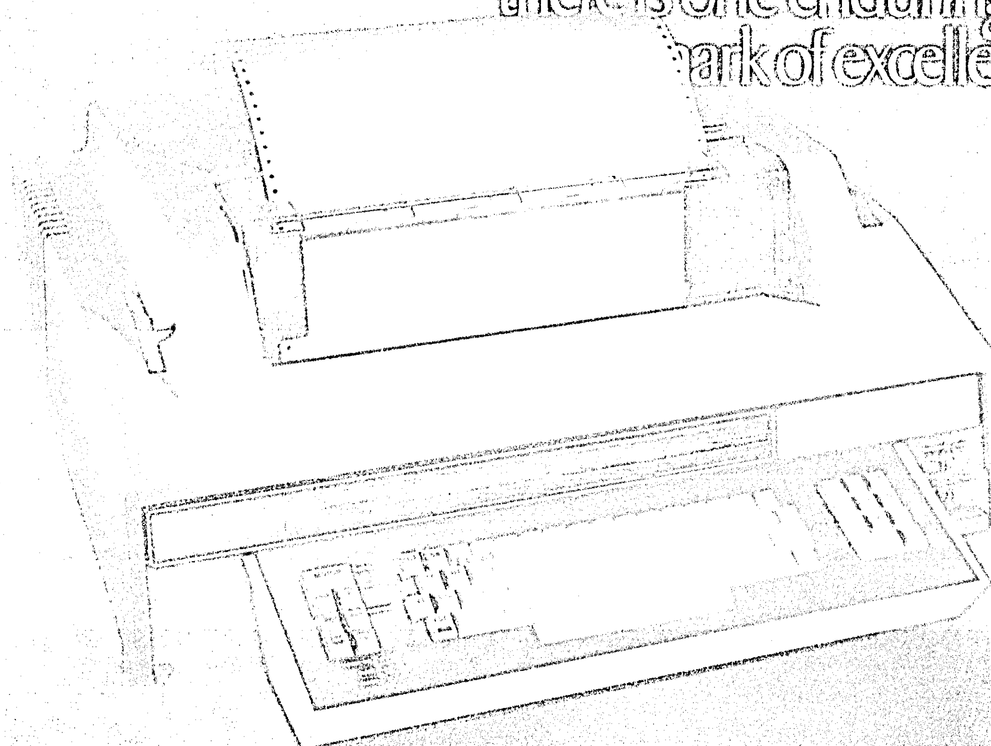
CIRCLE 45 ON READER CARD

In the harsh, demanding world of hardcopy printers, there is one enduring mark of excellence.



TermiNet

If you are in the market for a data terminal today, you are confronted with a bewildering array of choices—more than 250 different printers are available, manufactured by some 70 companies.

But if you demand uncompromised performance and durability in a hardcopy printer there is only one choice. General Electric TermiNet® printers. To learn why, write us at General Electric Company, TermiNet 749-30, Waynesboro, VA 22980. See the new TermiNet 200 matrix printer at the 1978 NCC Show in Anaheim, Booth 4309.

CIRCLE 62 ON READER CARD

GENERAL ELECTRIC

"My employees hated me until I got a $1,800 *CARD*ENTRY system for security."

"The employees always hated the security guards I had around. They told me it was like working in a prison. That's when I found out about the Rusco Electronic Systems MAC 520, a new low-cost CARDENTRY™ Security System. It's a state of the art system that's truly inexpensive with *sophisticated* features.

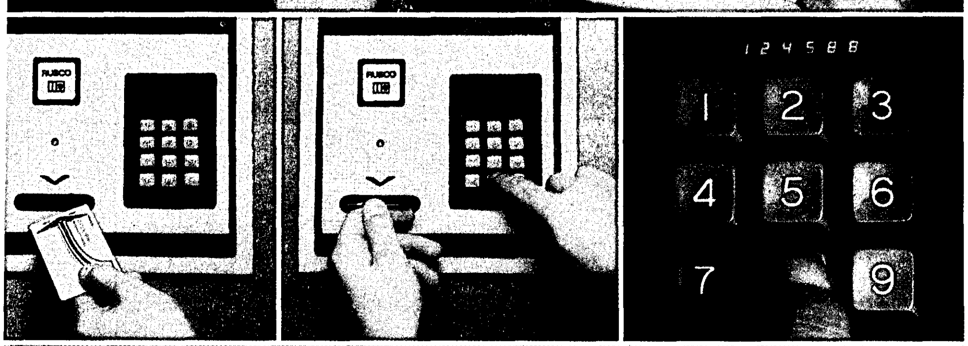
Listen to what it's got, and what it does.

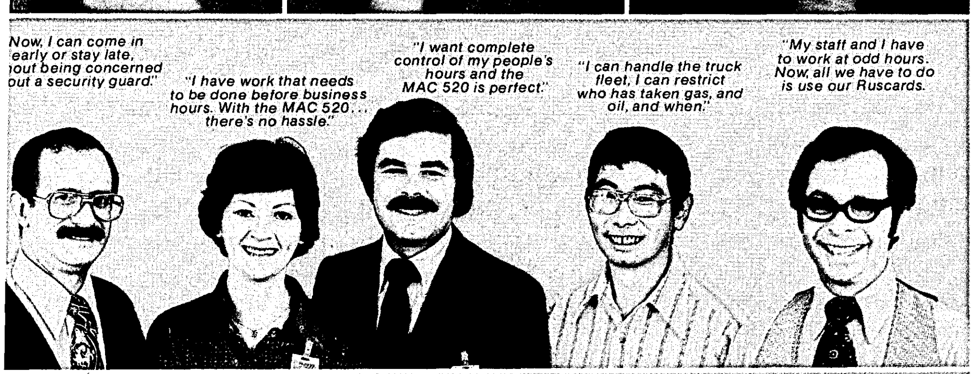
The Rusco System is a single compact unit with an ID card reader and a reusable solid state memory for storage of individual card data. I can have access control for many cardholders. I'm even thinking about purchasing the time zone option, so my cardholder's access privileges can be limited to certain hours during the day.

Rusco makes a great system. Now, I can protect my stock room, files, data processing center and personnel records with total security.

Also, there's no chance of my cardholders copying our personalized, cryptically encoded cards. As far as I'm concerned, someone should have thrown away the lock and key years ago. Rusco did, but I didn't know about it. All I can say is you should look into a Rusco CARDENTRY MAC 520 system. Have one of their systems consultants contact you. All you have to do is phone the 800 number below. You'll get service and knowledgeable advice on the MAC 520.

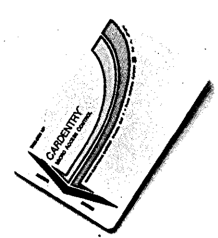
And you'll probably never have to worry about your employees hating you ever again."





Because of the memory in each MAC 520, everyone from the president of the company on down can have access to certain areas at certain times. Or all areas at all times. You assign the card data to each reader.

THE CARDENTRY COMPANY...



For a brochure detailing CARDENTRY's exciting capabilities, call toll-free **1-800-528-6050, Ext. 691** (in Arizona call 1-602-955-9714, Ext. 691) or write **Rusco Electronic Systems 1840 Victory Blvd., P.O. Box 5005 Glendale, Ca. 91201**

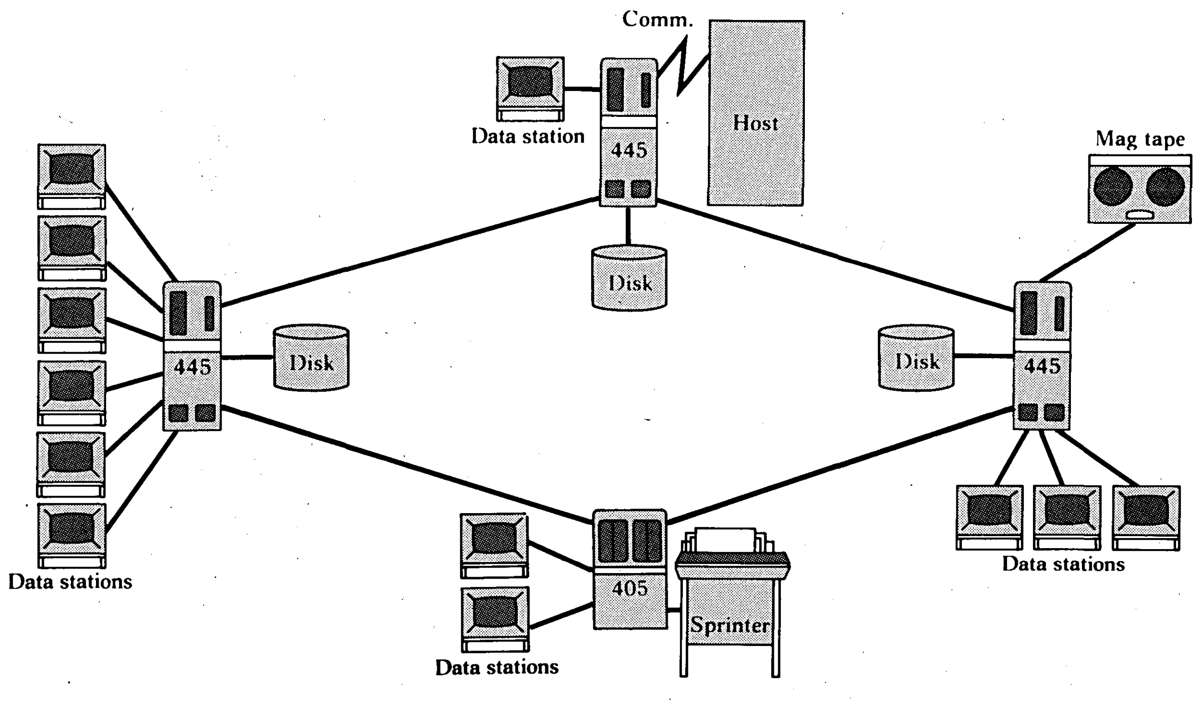
RUSCO ELECTRONIC SYSTEMS

A DIVISION OF ATO

CIRCLE 113 ON READER CARD

Now
can divide

A TYPICAL SYCORLINK NETWORK.



Sycorlink™ is a revolutionary resource sharing feature that lets you distribute the power and resources of computer systems throughout your organization. And conquer the problem of providing all your departments with the services they're looking for. At a price you're looking for.

In a nutshell, the Sycorlink networking feature is distributed processing the way it was meant to be.

Put the power of your network at every work station.

With Sycorlink, every system in the network can be tailored to handle the processing tasks of individual departments. And at the same time give authorized users in any department the power to access the files and peripherals of every other system in the network.

A user at any work station can access any file on any disk in the network. At the push of a key. Any file on any disk can be printed on any printer in the network. Any file can be transmitted to the host.

Any system in the network can process data from any file on any disk located at any other node in the network. And a system can be dropped out for maintenance or service

you and conquer.

without disrupting the flow of data to and from any other node.

Match the workhorse to the work load.

The Sycor 405 and 445 distributed processing systems can be mixed and matched in a Sycorlink network to create individual processing nodes with just the right amount of power for a specific department or location.

And while each node may be individually configured, it can access the files of another node just about as fast as its own files. Communicating this fast within the network allows nodes to share expensive peripherals, such as a line printer. So any way you put it together, your Sycorlink network has the performance capability that can get your job done. The way you want it done.

This means you never have to overequip any location, paying for power you don't need. Your first step in building your distributed processing network is the right one—with nothing to trip you up down the road.

Get started on a no-detour growth path.

The upward compatibility of the Sycor 400 series lets you grow your network without redesigning your system or replacing hardware. We call it planned nonobsolescence.

As your needs at a specific site grow, our compatible 405 and 445 systems let you upgrade without reprogramming or introducing unfamiliar hardware to your operators.

Install systems up to a half mile apart.

A Sycorlink network permits installation of systems up to a half mile away from each other. The systems are connected to each other by coaxial cables. This lets you increase your computer power simply by adding another system to the network. Without reprogramming.

Sycor's security-conscious software makes sure all disk files can be protected to prevent unauthorized access. You get peace of mind. And costs are kept to a minimum.

Link up your departments with Sycorlink. Call 800-521-2838 toll-free.

Sycor pioneered the concept of distributed data processing more than ten years ago. Since then we've been at the cutting edge of distributed processing technology. With over 100 service centers located within a half-hour drive of 1750 North American cities, and 40,000 systems installed, we're ready to help you bring your users state-of-the-art service in distributed processing. They deserve it.

To find out more about how Sycorlink can help you conquer distributed processing problems, call Tony Fazio, VP Sales, at the number above. Or write Sycor, Inc., Ann Arbor, Michigan 48104.

Better yet, contact a nearby sales office. We're in the Yellow Pages under Data Processing Equipment.

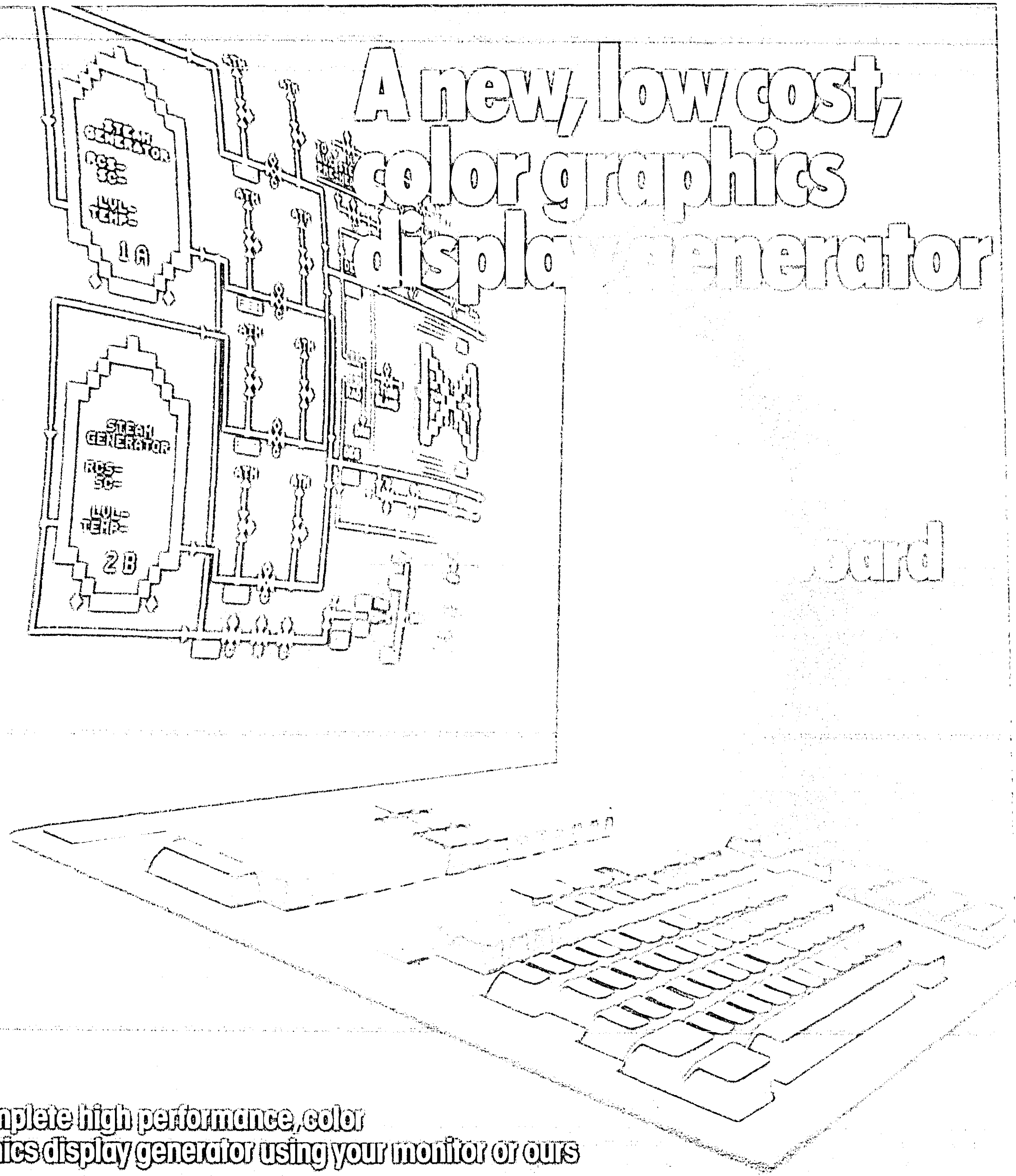
Sycor puts computer power where the work is.™

SYCOR®

CIRCLE 60 ON READER CARD

A new, low cost, color graphics display generator

oard



A complete high performance, color graphics display generator using your monitor or ours

AYDIN CONTROLS' new Model 5217 Keyboard Generator has it all in the case—dual asynchronous RS232C interface (to 25K Baud), power supply, a complete single channel display generator and of course the keyboard!

Outstanding user features incorporated into AYDIN'S new keyboard generator include:

- 55 user defined special function keys
- 256 different character/graphic symbols in two different sizes. All can be user defined
- 256 programmable computer only tabs
- Integral light pen requiring no software support
- Stores up to 4 separate display pages of 80 characters per line with 48 lines per page
- Complete edit capability
- Powerful communication codes
- Separate control by character of color (1 of 8 colors), blink, protect, intensity, size and normal or inverse video
- Red, blue and green video outputs for color, and separate video output for monochrome

The Model 5217 low cost keyboard generator, is software compatible with AYDIN CONTROLS high communications speed (up to 600K bytes/sec.) multi-channel Model 5215 color graphics display generator. Now you have a choice—the 5217 for small systems and remote applications or the 5215 for large system applications.

Interested in how we can pack all this performance into a keyboard case? Call or write us today —we'll let you in on it!

AYDIN CONTROLS

One source for all your CRT display requirements

414 Commerce Drive
Fort Washington, Pa. 19034
Phone (215) 542-7800
TWX (510) 661-0518

CIRCLE 19 ON READER CARD

Editor's Readout

John L. Kirkley, Editor

Great Expectations

Ah, spring!

The sound of booth construction is heard throughout the land. New four color brochures roll off the presses. Hardware and software salesmen ready three-piece suits, wing-tip cordovans and sincere smiles; it's almost National Computer Conference time again and they have great expectations.

The target of all this activity is the data processing professional: the NCC showgoer, the specifier, the buyer of dp hardware and software. He's there to be educated by his colleagues, wooed by the vendors, and maybe have a little fun in Anaheim's neon and plastic wonderland.

In addition to visiting the booths, he'll choose from a bewildering variety of sessions, ranging from personal computing to artificial intelligence and data base management. In the exhibit hall he'll see the broadest range of equipment and services ever shown at an NCC and find that just about every piece of hardware has a microprocessor stuffed in it somewhere.

And finally on Thursday, DATAMATION shopping bag stuffed with brochures and business cards, he'll wend his way home. Waiting for him back at the shop will be another set of great expectations. But they are not necessarily his own.

The range of the NCC conference program hints at the broad expectations held by his employers in addition to those he imposes on himself. Taken all at once, it's a bit staggering.

First of all he must have a broad technical base constantly updated to keep pace with an industry characterized by innovation. He must be a linguist: the master of an arcane and sometimes deliberately obfuscated language that seems to thrive on a steady diet of new and juicy buzz words.

At the same time, magazines like this one are cautioning him that a knowledge of the complexities of routine data processing is not enough. Other technologies are impinging on his fiefdom. Electronic mail, fax, word processing, digital PABX systems, in-plant printing . . . all tied together by another rapidly growing technical discipline, data communications.

And then there's planning. We all talk about it but few of us do it well. Particularly in an industry driven by IBM's marketing strategies. IBM plays its cards close to its white oxford-cloth chest; the dp professional as planner operates with a view of the future that is, at best, fuzzy.

He must be an expert purchasing agent and horse trader, one who understands the intricacies of leases and purchase plans, capitalization, and the whys and wherefores of investment tax credits.

Let's add security analyst to this composite person we're constructing: after all, purchasing equipment from a company that is undercapitalized or badly managed and then watch them file for Chapter XI two days after the the equipment is installed is not likely to endear him to the hearts of management.

He'd better know something about plumbing, carpentry, flooring, and he'd better be a damn good electrician.

The list could go on but let's wrap it up with the toughest job of all: managing people. Needed here is a high tolerance for ambiguity and the development of skills that all the management courses in the world can only hint at.

And another thing. Because of the importance of this activity to the corporation, because of the youth and vigor of the industry, because of the professional standards we have imposed on ourselves, he is expected to perform these many skills at a level of excellence found in few other fields. And he does.

Oh yes. There's one attribute that we forgot to mention, one that would make your average Dalmation green with envy—he's probably one of the best fire fighters around. ☼

NCC: Computers and Energy

Many special sessions at 6th National Computer Conference in Anaheim are focused on energy. Other subjects get attention on program of 107 sessions. Exhibit is a record with 351 companies in 1,396 booths.

The world's energy problems, so vigorously enunciated by President Jimmy Carter, will hold stage center at the 6th National Computer Conference in Anaheim, Calif. next June 5-8. The conference chairman, Stephen W. Miller of SRI International, says at least 14 sessions will address questions about energy.

Also on the four-day program are sessions devoted to databases, data networks, office automation, distributed processing, data processing management and administration, computer careers and a look at recent progress in Japan—to name a few of the 107 sessions put together by Miller and his program chairmen, Dr. Leonard Y. Liu and Dr. Sakti P. Ghosh, both of IBM, with a cast of some 700 speakers and organizers.

Two exhibits

There will be two exhibits, the usual huge exhibit of 351 vendors at the Anaheim Convention Center, where the technical program also will be presented, and a Personal Computing Fair for which, in late April, 77 companies had signed up to exhibit products in 112 booths.

At 1,396 booths, the NCC will set another record. Last year's exhibit in Dallas of 1,143 broke a record that had stood since the heyday of the computer business in 1969 when about 970 booths were crammed into two sites at Las Vegas.

Energy questions

Four program sessions will be directed specifically at the energy question—Energy Decision Analysis, Computer Modeling in Energy Technology, Computers in Oil Exploration, and Energy Modeling. But energy issues are to be discussed in many other sessions, such as panels on simulation and artificial intelligence. And in late April the American Federation of Information Processing Societies (AFIPS), which sponsors the NCC, was trying to have President Carter accept an invitation to address the NCC plenary session Monday morning on energy, but agreed it would settle for other top Administration officials.

Interestingly, Carter received third billing as a luncheon speaker when the NCC last was held in Anaheim in 1975 and he was a relatively unknown former governor of Georgia.

In addition to the plenary session, two luncheon keynoters will address the question. Harold J. Haynes, chairman of Standard Oil of California, will analyze the problem as seen by the oil industry and AFIPS president, Dr. Theodore J. Williams of Purdue, will discuss the question from the technical standpoint.

Haynes' talk will be given Tuesday June 6 at a luncheon in the Anaheim Room of the Convention Center. Dr. Williams, who is professor of engineering at Purdue Univ. and director of the Purdue laboratory for applied industrial control, in a luncheon address on Wednesday, will assess the importance of hierarchical and distributed computer systems in industrial process monitoring and control with special emphasis on their importance in conserving existing energy resources. "Such control systems," Williams says, "will be of major importance to industry in the near future as they will be of absolute necessity in coordinating plant operations in such a

NCC organizers and keynoters: Stephen Miller, conference chairman, organized the huge event. His program chairmen, Dr. Leonard Y. Liu and Dr. Sakti P. Ghosh, both of IBM, put together the huge program of 107 sessions. Dr. Cuthbert C. Hurd, a consultant and pioneer in the computer field who is president of Solar Energy Research Associates, has organized a symposium on Developing Energy and Computing Technology that will be held Tuesday evening at 6:30. Energy issues also will be emphasized in talks by three keynoters: Dr. Theodore J. Williams, AFIPS president, will discuss the energy question from the technical standpoint. He's also professor of engineering at Purdue Univ. Harold J. Haynes of Standard Oil of California will analyze the problem as seen by the oil industry. Ryal Poppa, chairman and chief executive officer of Pertec Computer Corp. of Los Angeles will discuss the role of personal computers in managing energy systems.

Illustrations by Mike Haasis

way as to permit maximum productivity with minimum energy usage."

And on Tuesday evening at 6:30 the subject will be given its most extensive airing at a Symposium on Developing Energy and Computing Technology of which the chairman is Dr. Cuthbert C. Hurd, a consultant and pioneer in the computer field who now is president of Solar Energy Research Associates.

Possibly the only shortcoming of that session is its length—only an hour and a half—but in that short time NCC attendees will have the chance to ponder the comments of Dr. Arthur G. Anderson, IBM vice president and president of the company's General Products Div.; Rep. "Pete" McCloskey (R-Calif.); Thomas J. Davis Jr., managing partner of Mayfield II, a venture capital firm; Dr. Marjorie W. Evans, an attorney and scientist who is an advisor to Bank of America; Dr. William F. Miller, a computer scientist who is provost at Stanford Univ.; Dr. John Stephens, president of Excel-Minerals Co.; and Henry D. Jacoby, professor of management and director of the Center for Energy Policy Research at MIT.

And it should be an interesting examination of the issue.

AFIPS says Rep. McCloskey will present Congress' views of energy and Prof. Jacoby will offer contrasting views that have been expressed by speakers during the first two days of the NCC conference. Dr. Anderson will discuss techniques for transforming research and development into meaningful production, while Davis will show how venture capitalists can help company startups in the energy industry. Dr. Evans will comment on environmental factors concerning energy problems. She's an advisor on matters such as land use, energy and environmental concerns. Stanford's Dr. Miller, who is a director of several corporations, will discuss the relationship of universities to industry in programs to alleviate the energy problem.

Dr. Stephens, a Ph.D. in mathematics from Univ. of Southern California, will comment on the growing need to involve scientists in the political process and Prof. Jacoby, in a summing up presentation, will pinpoint subjects where there seems to be a consensus view among the panelists. Prof. Jacoby has been successful in developing simulation models covering energy and the economy.

Personal computers

AFIPS even has found an energy angle in Ryal R. Poppa's keynote address Thursday on personal computing, in which he'll talk about ways for using small computers in the home and in industry to manage energy systems. Poppa, chairman and chief executive officer of Pertec Computer Corp., of Los Angeles, in recent years has moved into the personal computing market by acquiring MITS, Inc., a New Mexico manufacturer of microcomputers, and Icom, a manufacturer of microcomputer peripherals.

The personal computing festival, first held as part of the NCC last year in Dallas, should draw some 10,000 persons to the nearby Disneyland Hotel, says Miller who estimates that figure should boost the NCC attendance to about 45,000 when included with the 35,000 expected at the NCC exhibit and the NCC technical program.

The festival will include all of the way-out events to be expected, including this magazine's Klatu, a roving robot; a Micro-Mouse contest sponsored by the IEEE's two magazines, *Spectrum* and *Computer*, in which contestants have been invited to enter a robot mouse to run through a maze (some 6,000 entries had been received in April); and many discussions about the hobby computer

Klatu and thousands of rodent robots enliven festival of personal computing

market. Some papers also will be delivered at the Convention Center to draw visitors from the festival whose fees can be applied to NCC registration fees. And there's a Personal Computing Contest featuring 20 demonstrations including PCNET, an associative memory board, a computer to aid a person with cerebral palsy, a checker playing program, and a Pascal implementation. Contestants will be competing for prizes that include an oscilloscope, crt terminals and a floppy disc.

Miller says another feature of the Personal Computer Festival is that there's no age limit. For insurance reasons, last year's NCC limited the age to 14. This year, says Miller, anyone can go because personal computers don't discriminate against age. Asked if anyone at any age actually can walk in, Miller said, "they don't even have to be old enough to walk."

What you never thought of

Miller, who was the program chairman of the NCC held in Anaheim three years ago, first took the job as general conference chairman for this year's event two years ago and he's been working on it ever since. "You set up your ideas for a program, you select the top experts, such as Dr. Liu, to come up with topics and people and then you find that 42% of the papers that come in were unsolicited. You find out that there are topics you never thought of and they go on the program."

Miller says the program, for which there's an attendance of about 4,000 to 5,000 (low when compared to the total NCC attendance of 45,000 expected this year) consists of about 58% solicited papers. And he's been able to jam by the NCC board two papers which have been presented before in the artificial intelligence arena. "These are papers that have more relevance today than when last presented," Miller says.

"And I am not unaware that there are a lot of people who change two or three words in an old paper and present it over again," he says referring to other topics on the program.

But he says the NCC program basically is designed to bring forward what is relevant today for discussion before a huge forum.

Professional development

In addition to program topics (reviewed in the next article beginning on page 109) a Professional Development Series of subjects will be presented at the conference for a fee of $45 and limited to 100 persons per session. Among the topics: Word Processing; Women and Management Update; How to Get Started with Microcomputers; Developing Managerial Skills; Information System Architecture—a Management Perspective; Requirements Analysis and Definition; Computer System Capacity Planning and Performance Evaluation; An Overview of Distributed Processing; Managing and Motivating DP Professionals; Hows and Whys of Effective Computer Negotiations; Business Protection from Computer Crime and Accidental Loss; Cryptographic Protection in Computer Systems; Designing the Database System Project; Hands-on Microcomputer Software/Hardware Workshop; and Software Design Techniques/Structured Methodology—Truths and Fallacies.

And there'll be the usual Pioneer Day session on Wednesday, this year honoring the project team that developed SWAC, the National Bureau of Standards Western Automatic Computer. When dedicated in August 1950, it was the fastest in existence and the first to use crt's as its memory devices and the first parallel-stored program computer to become operational. Dr. Harry D. Huskey, then associate director of the NBS Institute for Numerical Analysis, will be chairman of the session. He's now professor of information sciences at Univ. of California in Santa Cruz.

Miller is frank about his thoughts on the huge undertaking of organizing an NCC—some have called it the computer happening. "Sometimes I think it's an opportunity to show a capability for organizing a large-scale something. I enjoy it and feel good about it. I haven't organized anything of this scale since the early '60s . . ."

"You meet very interesting people and make good friends.

"But mostly," says Miller, "I do feel a sense of accomplishment for making a contribution to the community."

Program Highlights

Although energy is a pervasive topic, many other issues occupy NCC speakers. What's new in database technology and in microprocessors? Are dp professionals becoming tired of their jobs? What about the woman's world?

Modeling and the Energy Problem

Papers in session on computer modeling in energy technology are designed to provide both hardware and software folks with a background on computer modeling and its application to the energy problem. They cover the entire cycle—from the recovery of oil, to its consumption, and even the extent to which the petroleum product is being used efficiently in an automotive engine.

Chairman, Dr. Julius Chang, said none of the papers gets heavily into the techniques of computer modeling at the Monday afternoon session. The first paper will dwell some on the model and its construction, although getting also into the results. The other two papers will look more at the results of the modeling activity, including the computer graphics dealing with the problems of combustion and structural aspects of engines. Graphics are an important element of a modeling system, Chang explains, for the researcher can easily become overwhelmed by data, and needs graphics for his analyses.

Those who are active in the modeling of large systems, such as energy systems, coal gasification projects, and oil recovery systems, are being hindered by a lack of off-the-shelf software packages that they can apply to their problems. Chang says they have packages for two-dimensional models and that there are three-dimensional packages as well, but researchers wishing to get into 3-D models must first go through the exercise of modifying existing software to fit their application or machine. And the same, he adds, is true with graphics software.

At this session, therefore, members of the audience will be encouraged to participate in the discussion. They might, after all, be able to tell of achievements using smaller machines or even know of graphics packages with capabilities beyond those described by the speakers. Besides, there are both detractors and supporters of computer modeling. "It's not totally clear whether we can really succeed," Chang admits, although the modeling activity appears to be becoming more widespread.

Models for Energy Policy Decisions

Computer models have been used in the past for some fairly important energy policy decisions. It is an applications helped along by the fact that energy issues tend to be complicated, and some people turn to models for help, others to support their own positions.

Chairman W. F. Rousseau, whose session on energy modeling is scheduled for Tuesday morning, explains that energy models tend to be for studies of long-range problems. "I don't think anyone pretends that they're really forecasting the future," he says. "What they're trying to get out of the models is insight." The models, he adds, are of the type that explain the effects of action taken: If all nuclear power generation were to stop, what would happen to the price of electricity? To oil imports? To coal production?

Have computer models been helpful? "I think computer models can help understand the problems, put them into perspective," he says.

Members of this panel are to discuss why the models were constructed, the questions they answer, the significant insights they have provided, how the models are being judged for credibility, and the extent to which these models are meaningful representations of the real world.

But the panelists will also be anxious to learn what members of the audience can do to help the energy modelers. "Some of the models get pretty large," says Rousseau. "One of the problems that has made modeling very difficult is that the computer codes become so large, so complicated, and so cumbersome that no one can understand what's going on inside any more. And at that point they aren't very useful." It should be a problem familiar to many in the audience.

Working in the Pressure Cooker

"The computer business has concentrated too much on introducing new productivity techniques, when we should have been introducing new motivational techniques," says Dr. J. Daniel Couger, professor of computer and management science at Univ. of Colorado. "Both are related to productivity," he says.

Couger who was named the Data Processing Management Assn.'s Man of the Year last year (December '77, p. 41) recently completed a study of how dp people in the federal, state, and local governments react to their jobs and how their reactions compare with dp people in nine private companies. His findings will be presented at an NCC session Monday, "Motivation of the DP Professional."

"I love my job so much and get such great satisfaction out of it, I thought it beneficial to study those of others," says Couger who has devoted the past 10 years to setting up curriculums in data processing for many of the nation's leading graduate business schools.

After 25 years, he says, the computer field is reaching a stage of maturity similar to other professions. The aura and excitement which attracted people are no longer factors for retention. Attrition and absenteeism—symptoms of job dissatisfaction—are on the increase, Couger says.

He says one key to the problem is that so many dp persons are "working in the pressure cooker," and finding it hard to cope with that situation. Having determined this, Couger now is attempting to identify factors that might motivate these persons to become excited about their work as first noted in the early days of the computer business.

His findings—which are based on a survey of more than 1,000 professionals and the identifying of 70 variables affecting motivation—so far are confined to programmers and analysts within the government, under a grant received by Couger from the Labor Dept. His studies of the nine companies within private industry were financed by Couger himself. Later he hopes to continue the study by type of industry and to include jobs at all levels of data processing, "from the programmer all the way to director of information systems."

He designed a questionnaire for the study, tested it for validity and then sent it out. Couger said it turned up a definite scarcity in motivational aids for dp people, but did not indicate a "crisis situation as yet." However, says Couger, the symptoms are appearing because of that pressure cooker environment in which the programmer and analyst finds himself. "What we've got to do is provide the correct motivational tools for them."

Kenneth T. Garrison of Pacific Mutual Life Insurance Co., Newport Beach, Calif.; Mayford L. Roark of Ford Motor Co.; and Howard B. Wilson of Reynolds Aluminum, Richmond, Va. will be part of the session, commenting on Couger's findings.


Anaheim Convention Center where NCC exhibit of 1,396 booths will be housed.

The NCC

Dates: June 5–8
Place: Anaheim Convention Center, Anaheim, Calif. Personal Computing Festival, Disneyland Hotel.
Conference Program: Monday, 2 p.m.–5.30 p.m. Tuesday, Wednesday and Thursday, 8:15 a.m.–5.30 p.m.
Exhibits: Monday, 11 a.m.–7 p.m. Tuesday, Wednesday and Thursday 10 a.m.–6 p.m.
Fees: Conference, exhibits, and proceedings for four days: $75. Exhibits one day, $10. Exhibits and conference for one day, $25. Four days of exhibits, $25. Students, $10 for entire conference and exhibits. NCC Personal Computing Festival: $9 for three days or $5 for one day, applicable to NCC registration.
Sponsor: American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N. J. 07645. Telephone: 201-391-9810.

Couger says they'll provide a perspective from the point of view of their own companies' experiences. All, he said, are with major companies and have long careers in the data processing industry. The session, originally scheduled for Wednesday, was moved up to Monday because of its current importance, Couger said.

Special Problems of Women in DP

Women are entering the computer industry in increasing numbers.

"They have no problems with entry and education," said Dr. Thelma Estrin of the UCLA Brain Research Institute, "but we sense problems in advancing and achieving important positions." Which is why she organized and will chair an NCC session on Thursday morning called, "Designing and Debugging Careers for Women in the Computer Industry."

A panel of five women will "talk about themselves and the special problems they have had as women," Estrin said. She said most of the session will apply to men as well as women. "We hope men will come. The only reason we have focused on women is that those who choose careers plus families must plan more critically and because societal attitudes make it necessary for women to be especially good and especially positive."

Marlys C. Hanson of Lawrence Livermore Laboratory will talk about stages of career development which she sees as being four—entry level or learning, creating, managing, and integrating management and guidance at the corporate management level. Naomi Guillen-Williams, Control Data Corp., Sunnyvale, Calif. feels this is the bottom-up approach. She will advocate a top-down approach which she likes both for software development and career planning. Planning, in her opinion, should involve knowing where you want to go and how to get there.

Carolyn Morris, Hewlett Packard, will cover careers in technical marketing and Donnamaie White, Advanced Micro Devices Inc., Sunnyvale, hardware oriented careers. Anita Cochran, Bell Labs, will take a case history approach to her own career, one she said had no debugging and was not designed. "Like Topsy, it just grew."

Estrin, who is chairperson for the IEEE's Committee on Professional Opportunities for Women, has organized a similar session for Electro to be held May 23–25 in Boston. For the NCC she'll go a step further.

"My committee and the IEEE Computer Society will co-host a hospitality suite for women at the Inn at The Park. Many women who attend conventions which are predominantly attended by men feel isolated and some of the sales techniques used on the convention floor are demeaning to women and that makes them feel alienated. At our suite they can meet and talk with other professional women and it's not for women only but for anyone interested in opportunities for professional women."

CCDs Seen Competing with Bubbles

A session entitled "What's Ahead in Computer Storage Technology" promises to provide lively debate among the session's participants. The speakers run the gamut as advocates of everything from bubble memories, semiconductor RAM's and charge-coupled device (CCD) memories and just as those technologies are clashing in the marketplace, the session participants can be expected to clash at Anaheim.

"I think that CCD's and bubbles will be in direct competition in some areas," says session chairman Lewis M. Terman, a research staff member at IBM's T. J. Watson Research Center in Yorktown Heights, New York. "CCD's are further along now and you can buy 64K CCD chips. I'm sure that bubbles will make it, too, mostly because of their potential in nonvolatile applications, but it's the cost of bubbles that I'm not sure of."

Terman said he expects at least one participant will maintain that bubbles will be cheaper than CCD's and Terman has some reservations on that argument.

J. Egil Juliussen of Texas Instruments will discuss bubbles and CCD's as "Solid State Mass Storage." Juliussen will examine those devices as they sit between RAM's and the more traditional types of computer hierarchical storage like discs and tapes.

Another speaker, Charles Beottcher of National Semiconductor, has prepared a breakdown of anticipated pricing of the various storage devices in 1980. Beottcher sees prices of storage devices dropping in 1980 with emitter-coupled logic (ECL) dropping to 3/10 cents a bit, MOS static to 1/10 cents, MOS dynamic to 40 to 50 millicents, CCD's to 20 millicents, and bubbles to 10 millicents. Cycle speeds of the devices will also vary and influence those prices.

"One interesting thing is that TTL and core memories seem to be vanishing in 1980," says Terman. "I think that is because much of the traditional roles of core and TTL will be taken over by MOS static."

Terman indicated that one of the most interesting questions of all regarding storage devices is what their prices will be in 1985. He expects there will be some discussion on that question during the session. Another speaker at the session, which is scheduled Wednesday morning, will be Steven Puthuff of the Memorex Corp. Puthuff will discuss "Dynamic Evolution of Large Storage Magnetic Technologies."

International Packet Switched Networks

Aimed at users with international communications or distributed data processing chores, Monday afternoon's session on "International Data Networks" will focus on some of the problems and solutions in interconnecting these new public packet switched data networks, which are being spawned worldwide. Chaired by Telenet Communications Corp. v.p. Barry Wessler, the session also will explore some of the technical interconnection issues, such as the new X.72 interface standard being hammered out by the CCITT (Consultative Committee on International Telephony and Telegraphy). The protocol, which is built around the now-familiar X.25 interface standard, will enable public data networks to communicate with each other.

Actual experience in data network interconnection will be discussed by several session speakers. Bell Canada's Tony Rybcznski will report on how his company interconnected its network with two U.S. packet switching systems—Telenet and Tymnet. An internetworking field trial will be detailed by John Goodman of the British Post Office. Reviewing the BPO's plans and specifications for an international packet gateway exchange setup, Goodman will explain how an overseas administration views its needs to transmit data into the U.S. through the ubiquitous international record carriers which in turn hand the data over to the domestic networks.

Another BPO representative, George Orchard, will discuss the Euronet experience. Unlike other independent packet setups, Euronet is a homogenous network shared by several European countries. Its operation and services are based on international agreements between foreign administrations. This can get sticky, as Telenet's Wessler notes. But independently developed systems can also have their problems when they decide to link up. One example he cites, which will be explored further in the session, is potential service limitations resulting from the hookup of individual networks.

Huge Public Sector Market for Satellites

Satellite communications could open a huge market for telecommunications carriers among the public service sector of the U.S. economy, one approaching $110 million by 1983, says James G. Potter, director of planning and analysis with the Public Service Satellite Consortium in San Diego. And that figure is only the tip of the iceberg when placed alongside the anticipated expenditures by libraries, hospitals, educational institutions, and local government agencies for telecommunications related equipment.

Wideband telecommunications facilities, says Potter, could open a vast market for sharing of data bases, terminals to access them, and for sharing of other software as well as computer power. That $110 million figure could represent only 15% of what they really could be spending in 1983.

Potter will present a paper Tuesday at the NCC during a session on "Satellite Data Communications for the Public Service Sector," in which he outlines the emerging markets for satellite data communications. Satellite Business Systems (the jointly owned company of IBM, Aetna Life, and Comsat Corp.) whose satellite is to be launched aboard the NASA Space Shuttle craft in July 1980, is targeting its satellite communications services at the Fortune 1,000 companies. "We believe it could also make money by modifying its services to take in the public sector as well," Potter says. His organization, formed less than three years ago with 21 charter members, today has close to 100 who pay $500 a year to be apprised of satellite-based communications trends. Eventually the consortium will become a manager of multipurpose private line services for members wishing to use satellite services of carriers. Among its members are the Corporation for Public Broadcasting, American Hospital Assn., American Bar Assn., American Medical Assn., Stanford University, and 26 other institutions of higher learning including the California State University and Colleges system.

The chairman of the session is John Witherspoon, president of the consortium and two of its directors, Frank W. Norwood of the joint council on educational telecommunications in Washington, D. C., and Norman Abramson of the Univ. of Hawaii, an advocate of packet broadcasting techniques, also will participate.

As for the NCC audience the session will attract, it's hard to say, Potter says. The consortium has made presentations before at IEEE sponsored meetings, but "we're not taken seriously at present." But Potter is sure of one group that will be in the audience: the carriers interested in that $110 million he's talking about.

Databases: The Fun and Games Are Over

Database sessions at the NCC will represent many decades of experience in research, design, implementation, and training. In four of the eight sessions, 12 experts from user organizations will share their experiences with consultants and with database veterans from the vendor side. As one session chairman put it, "The fun and games are over." An enormous body of knowledge and experience—pitfalls, pratfalls, and successes—now exists to be shared with the vast number of users who have not yet been able to make the database decision.

One chairman, George Dodd of General Motors Research Laboratories, noted, "Despite all that's written about database, the movement toward implementing these systems has not been as rapid as expected." His session on Wednesday afternoon, "Installing and Operating the Database," is one he hopes will tell users they can "jump in, do it right, do it well." Aimed at planners, managers and users of such systems, his speakers will discuss the expected and unexpected benefits and pitfalls they experienced in going the database route.

Each speaker operates in a totally different environment from the others. James Nolan will discuss the U.S. Air Force's installation, which has been converting from one database system to another while trying to operate a large terminal network without disruption. Operating a system using two different database packages and now implementing a third will be discussed by Joseph Orren, Armco Steel Corp. Theodore Ziehe and James Devlin of MRI Systems, Inc. will discuss customer experience using that company's System 2000.

A session Wednesday morning, "Making the Decision to Go Database," will provide the audience with multiple viewpoints on selecting a database system. They should hear about things that have bedeviled everyone: the cost of choosing various routes, the tradeoffs of redoing all or part of programming, distributed processing implications for database, and the big sociological and political stumbling block—departmental protectiveness about ownership of data.

Chairman James McKenney, professor of business administration at Harvard Business School, has worked with a number of organizations on database system planning. One speaker, Jon Kennedy, U. S. Forest Services, had a different design in mind, but took what he called a "cheap and dirty" route by selecting MRI's System 2000, which cannot handle all of the Services' information. Richard Schubert's company, B. F. Goodrich, chose the expensive route of rewriting the Honeywell/GE IDS system for its IBM equipment because of the company's long-term needs. James Welch, Chemical Bank, represents a user that took a long and detailed look at all systems. Uncertain about how its dp organization would evolve because of developments such as distributed processing, Welch says Chemical chose a slow, cautious approach to database implementation.

A session, also on Wednesday morning, on the important subject of "Training Company and EDP Personnel for Database," will suffer a bit because it's a combination of two sessions: training, and redesign considerations in database planning.

The training talks will be limited to educating technical staff, not the end users, says chairman John Lyon of Colonial Penn. But the cochairman, William Wilson of Univac's operation in Huntsville, Ala., notes that currently more emphasis is being placed on structuring the database to satisfy end user needs, and consultant Mark Ramm will discuss this issue, perhaps providing the bridge between design and education considerations.

If you're a user with some technical grounding in building a database system, don't cross off "Database Design Methodology" as a researcher's session on Monday. While the papers are highly technical, chairman Vincent Lum of IBM has charged the speakers with leaving the detail to the *Proceedings* and discussing the gap between researcher and practitioner in database design. "No particular method or technique in database design is widely accepted," says Lum, and the researcher is seeking answers from the user. Against the speakers, Lum will pit two panelists—M. Schkolnik from IBM Corp. in San Jose, and a user representative, R. R. Brown of Hughes Aircraft Co.

Should Your Database Be Distributed?

A sneak preview of a CODASYL Systems Committee report on the impact of distributed database technology will be offered Monday afternoon at a session on "Distributed Database Technology." It will be presented by William H. Stieger of Standard Oil of Ohio with comments later by Charles Bachman of Honeywell Information Systems.

The session chairman, Robert W. Taylor, a research staff member with IBM in San Jose, said the session will summarize the CODASYL committee's findings concerning technical and organizational considerations in the distribution of databases along with the current trend to distribute processing. It will suggest what portions of a database are suitable for distribution and what aren't. A much longer report is to be published within six months by the CODASYL committee.

Taylor said it is a very new art and according to his definition of distributed databases—that involving real-time situations—one that is not being implemented heavily by users, although he admits there must be some exceptions. Taylor said the session probably will disappoint a technical audience because it doesn't discuss technical breakthroughs. He's hoping the session will draw an audience of management-type persons.

Cobol 80: How the Standard Has Changed

"Very volatile" is the way Paul Oliver describes the COBOL language standard. Oliver, who heads the Navy Dept.'s Federal COBOL Compiling Testing Service, has organized an updating session on this very volatile and most widely used programming language. Entitled "COBOL—A Status Report," the Tuesday afternoon session will focus on the changes likely to result from the new COBOL standard, COBOL 80, now under development.

Pinpointing some of these "substantial" changes, session speaker George Baird, also part of the Navy's Federal COBOL Compiling Testing Service, will preview the 1980 COBOL standard. Other session participants will delve into what facilities, such as database, will be available to the new standard.

Session chairman Oliver sees the popular language as having "enormous economic and management impact" because of its heavy use by the dp community. Therefore it's very important for users, he points out, to understand the various mutations the COBOL standard has undergone in its evolution into the born-again COBOL 80. Central to the panel discussion, he adds, will be topics such as how the new COBOL standard "reflects current changes in programming methodology" and what "the overall impact of the changeover" from the current COBOL 74 standard will have on the dp world.

Conversion: A Dirty Word but Inevitable

"Conversion," laments Alan Merten, "is a dirty word." Merten, a professor at the Univ. of Michigan, will lead a session on the much-maligned subject of "Data and Program Conversion" Tuesday morning. Anxious to make users take a more rational and planned approach to conversion of application programs and data, Merten has tailored the session to address both management and technical issues.

Users, argues conversion reformer Merten, have to have a more pragmatic attitude about inevitable conversions. Conversion, he explains, is like "death or taxes. They are things which always occur. But historically, no one has been willing to talk about it (conversion), figuring that it will never happen again."

In order to better equip users to deal with this conversion reality, Merten has rounded up several panelists to provide different perspectives on the subject. Paul Oliver, director of the Navy Dept.'s Federal Cobol Compiling Testing Service in Washington, D.C., will discuss the federal government's attempts to try to coordinate conversion chores centrally. James Fry, from the Univ. of Michigan, will present a summary of the key findings of last year's workshop on "Database Directions—The Conversion Problem" sponsored by the National Bureau of Standards and the Association of Computing Machinery.

Architecture: from the Mark 1 to the Cray-1

Computer architecture buffs will get a chance to sit in on a comprehensive examination of that subject at a session entitled "Architecture Evolution" scheduled for double meetings Tuesday afternoon.

The session will span an era from the design of the Mark I at England's University of Manchester in 1946 to current developments with the CRAY-1 vector processor. In addition, an intriguing look at the development of IBM's 370 architecture will be presented.

In a paper prepared for the session by S. H. Lavington of the Univ. of Manchester, the author notes that the first goal of the Mark I was to construct a realistic test environment for a novel digital store—the electrostatic Williams Tube.

"The prototype Mark I simply consisted of a 32x32 bit Williams Tube store plus elementary computational facilities," Lavington states. "Nevertheless, when it successfully ran a 52-minute factoring program on June 21, 1948, it became the first general purpose stored-program computer to work."

Lavington also is slated to discuss another famous Univ. of Manchester computer—the Atlas. That machine, while not a commercial success since just three Atlas machines were sold, was nonetheless the architectural father of many later powerful computers. The MU5 Computer System, also developed at the Univ. of Manchester, also will be discussed at the session.

A team of Sperry Univac scientists will discuss the history of the 1100 Series and in the paper prepared for the session there is a hint that there may be some tips on the future of the computer mainframe series that is second only to IBM's 360/370 line in number of machines shipped. Well over 1,200 of the Univac cpu's have been delivered.

The Univac team emphasizes that the evolutionary nature of the 1100 Series, which began to be delivered in 1962, will continue in the future and that commitments have been made to make new versions of the line compatible with earlier models.

"We believe the 1100 Series has been at the forefront of a number of technical advances," the Univac designers say. "Among these are multiprogramming, symmetrical multiprocessing, virtual file control, database management, common compiler implementation techniques, and simultaneous demand, batch, and real-time operation.

"It is significant that these advances were made in such a way as to allow complete upward compatibility across a succession of computer models. This commitment to protect the user's software investment will continue to be a dominant factor in future extensions to the 1100 Series."

C. Gordon Bell of Digital Equipment Corp. leads a team that discusses the "Evolution of the DEC system 10." The DEC computer designers believe the key to the 10's long life—its basic design features first appeared in DEC's PDP-6 in 1963—can be largely attributed to "its basically simple, clean structure with adequately large (one megabyte) address space that allows users to get work done.

"An equally significant factor in its success is a single operating system environment enabling user program sharing among all machines. The machine has thus attracted users who have built significant languages and applications in a variety of environments."

The machine that is generally considered to be the most advanced large-scale computer on the market today—the CRAY-1—will be discussed. In a paper prepared by Richard M. Russell of Cray Research Inc., the CRAY-1 is claimed to be the equivalent of five IBM 370/195s. Russell believes that many of the features of the CRAY-1 will be incorporated into general purpose computers of the future.

Just three Atlas machines were sold but nonetheless it was the architectural father of many later powerful computers.

Two IBM designers make it clear that the 370 line—and that includes the 30XX machines—will take its place in computer history as merely an "extension" of the 360 series. In a paper prepared for the session, Richard P. Case and Andris Padegs of IBM review "the motivation for extending the System/360 architecture and . . . the design considerations associated with the extensions adopted for System/370." Prime motivation for extending the 360 line into the 370 were to take advantage of sharp reductions in computer hardware costs and to improve efficiency in the broad systems area.

The 370, of course, was not without technological achievement, too. The IBM designers state:

"The single item that most distinguishes the architecture of System/370 from its predecessor, System/360, is the availability of a dynamic-address-translation facility, which allows programming systems to efficiently implement a group of functions which are collectively known as virtual storage."

How Best to Apply Technology

If ever there was a time to get into the loop, the time is now. People in the semiconductor industry, who supply the building blocks for computers, can foresee a continuing ability to produce chips with increasingly complex structures on them. So the question becomes: What functions or devices should be incorporated into a single chip?

"We're getting to the point now where something beyond a simple processor certainly is possible," says Gordon Moore, chairman of a session on the Impact of Semiconductor Technology on Computer Architecture, "but it's not obvious that any good ideas have come along yet." It's been suggested, for example, that they should be using the technology to place a processor and some of its memory on a chip. Moore adds: "I'm not sure that's the most appropriate."

He suggests that it's just a matter of time before it becomes possible to place on one chip the processing power of a 370/158, "if one can come up with any justification for doing it. The usual justification of low cost is appropriate only if you can sell them by the hundreds of thousands. And it's not at all clear yet that machines of that performance can really be used that broadly."

But apparently there's no technical problem in putting that kind of complexity on a chip. "What we're able to do technologically keeps improving with time," says Moore. "So it's pretty much a question of trying to evolve the product ideas as fast as the technology evolves." And that's where the session attendee comes in. The capabilities and features desired in tomorrow's terminals and systems are the things that must be considered by today's designers. For the problem is not so much the technology as it is trying to figure out what to do with it, how best to apply it.

The participants in this panel discussion, scheduled for Tuesday morning, will examine the relationship between the semiconductor technology and computer architecture, but could just as easily extrapolate what's going to happen in the future.

How Does VSLI Impact the DP Community?

Very Large Scale Integration (VLSI): The New Semiconductor Revolution, will be discussed in terms of its impact on the dp community. Intended to explain the place of VLSI microprocessors and memory in the next five to 10 years, discussion will focus on the technology's impact on systems. The Wednesday morning session will offer projections into the future, and attendees may find some advance information on Zilog's next generation of microprocessors, the Z-8000, in the presentation of session chairman Frederico Faggin. Faggin, of Zilog, will address his comments to the impact of VLSI on microprocessors, while Ron Whittier, of Intel, will cover expected advances in semiconductor memories.

Privacy: A Lot of Implications for Users

The sticky issues spawned by the now-ongoing debate over privacy problems will get still another airing at a Tuesday afternoon session put together by Oliver Smoot, v.p. of the Computer & Business Equipment Manufacturers Assn. Concentrating on the White House's moves in this controversial area of individual rights in the computer age, the privacy session will feature an update on the key issues being looked into by the Executive Branch's newly formed privacy task force.

The session also will include talks on the technological and socio-political ramifications of the privacy problem. Leading off these talks will be panelist Robert Ellis Smith of the *Privacy Journal* and privacy potentate Willis Ware of The Rand Corp.

Session leader Smoot hopes the program will draw manager-types—"people who should be concerned about the broad questions of information system utilization in their companies or agencies." Smoot feels strongly that the real moving force in the privacy arena is the federal government. So the Administration's position, he points out, should be crucial.

"The direction the federal government (the Executive Branch) takes," he declares, "is going to determine in large measure the direction Congress takes, and to some extent, the action state legislatures take over the next year or so." And obviously, he maintains, these actions will have "a lot of implications for users of computers and software."

Auditors Shed the Green Eyeshade Image

"There's an old image of auditors as the guys with green eyeshades, digging till they get you."

Joe Antal, an edp auditor for General Telephone Co. of California, isn't sure such an auditor ever existed but is sure "there's no place for that in this day and age." Antal is chairman of a Thursday afternoon NCC session titled "EDP Auditing—Member of the DP Community."

"We're hoping to attract dp management. We plan to outline the need for professional dp managers to take a leadership role in using the expertise of both edp auditors and users in system development," said Antal. "As systems become more complex, the need for designing for auditability and control becomes vital. Simple programs lend themselves to quick analysis but with complex programs you have to build in the ability to audit and control."

Joining Antal in the session will be Sol Chooljian, Chooljian and Associates, Camarillo, Calif. consulting firm; Dick Hampikian, an edp specialist in the Western Regional Advisory Services Dept. of Alexander Grant & Co.; and Ken Pollock, Assistant Director, ADP Policy for the U. S. General Accounting Office.

They will cover such topics as how a dp shop can get started in designing for auditability and control, general versus application controls and the merging of the two, both batch and on-line control and auditability concepts, and control oriented advanced systems.

Antal said they also will talk about the impact of the recently released "Systems Auditability & Control" reports done by the Internal Auditors Assn. and Stanford Research Institute with a grant from IBM. He called this "a monumental work" and said session speakers would present key items from it.

Performance Modeling Emerges from the Lab

The emergence of computer performance modeling tools from the lab into real-world applications will be discussed Tuesday afternoon in a session chaired by Jeffrey P. Buzen of BGS Systems, Inc. The session is expected to attract capacity planners who must evaluate new systems or proposed upgrades as well as researchers involved in developing models. The field, according to Buzen, has suddenly crossed the boundary separating abstract research and real-world application. Today's researchers face the problems of making their models accurately reflect the dynamics of real systems, and of creating front-end interfaces that will allow non-specialists to use and benefit from system modeling.

Two papers are scheduled for presentation: A Hybrid Hierarchical Model of a Multiple Virtual Storage Operating System, by W. W. Chiu and We-Min Chow of the T. J. Watson Research Center, and Effects of Peripheral Wait List Positioning on System Performance, by Ronnie G. Ward, B. B. Turner, and G. J. Hubbard of the Univ. of Texas. Additionally, T. P. Giammo from the Social Security Administration and IBM's A. W. C. Shum will be on hand as discussants.

Office Automation: Skeptical Users Wanted

What's in a name?

David L. Holzman of The Rand Corp., chairman of a Wednesday morning session billed in the NCC program as "The Future of Office Automation," thinks there's quite a bit. "We initially called our session The Future of Office Automation Is in Doubt," said Holzman. "The program committee objected

> Manufacturers only aim is to speed up what already is an awkward and clumsy situation.

and we agreed that perhaps it was too declarative. We agreed to make it a question–Is the Future of Office Automation in Doubt? They changed it." He said he heard "IBM and Xerox members of the program committee objected."

Holzman feels the session title as printed in the program will tend to attract "more pro-office automation manufacturers than skeptical users." He expressed concern about what he termed "this kind of domination of so-called public forums." Holzman has worked for both IBM and Xerox and said he quit because "I was always interested in the users' side and I was censored and cut off. Now I'm off their payrolls but I'm still cut off."

He contends manufacturers of office automation products are ignoring problems inherent in existing manual systems and are only aiming "to speed up what already is an awkward and clumsy situation." He feels manufacturers must address the problems of today's poor allocation of resources and minimum accountability and build "a conceptual structure."

Richard O. Mason, Univ. of California at Los Angeles, will talk about productivity measurement, something else Holzman feels manufacturers should provide for their users and don't.

Rounding out the session will be Robert Kling, Univ. of California, Irvine, who will cover the social and human considerations of office automation. Manufacturers have ignored these, Holzman said. "Oh they've considered them on a button basis. They want users to be able to press the right buttons and not get blind looking at the screen."

He feels manufacturers have ignored such things as monotony and lack of job progression. "In manufacturing, most progressive companies today are doing job restructuring and job enhancement. In the computer industry it's job restriction and job control. The industry is a whole generation behind what users of equipment want. There is no concern for the quality of work."

How High Technology Companies Succeeded

"Very few new companies fail for technical reasons," says Dr. Vir A. Dhaka, director of the Xerox microelectronics center in El Segundo, who is chairman of a session Wednesday on "Opportunity for New Technology Companies." He's assembled a panel of persons who've achieved the distinction of successfully building high technology companies and overcoming the financing, personnel and other problems that confront such startups.

There'll be no forecasts on the outlook for small startups, says Dhaka. "We'll merely give our speakers time to speak from their own personal experiences" in forming high technology companies and hopefully the audience will be interested in learning from their experiences. The speakers are Robert H. F. Lloyd, who founded Advanced Memory Systems, Inc., in Sunnyvale, Calif., in 1968 and later left to form Conver Corp. in nearby Cupertino, a maker of switching power supplies; Jessie Aweida, a founder of Storage Technology Corp., Louisville, Colo.; Renn Zaphiropoulos, president of Versatec, Santa Clara, Calif.; and Richard Petritz, a former vice-president of Texas Instruments, Dallas, who now heads New Business Resources, a venture capital firm.

Dhaka says technological innovations create unique opportunities for developing new markets. He adds, "New enterprises which are not encumbered with an inventory of equipment representing the older technology quite often become the vehicle to bring the new technology to the marketplace."

As for Dhaka, who says he's a scientist not an entrepreneur, he's chairing the session as "an academic exercise" in which he says his main function will be to insure the speakers don't become too verbose. He says he wants a brief statement from each panelist and then hopes these will be followed by questions and answers from the audience.

Performance Measurement: Different to Some

The vast quantity of performance statistics which can be gathered with current hardware and software system monitors, and what to do with the data after it's been captured, will be the topic of a Monday afternoon session entitled Computer Performance Management. Session chairman Philip J. Kiviat expects both dp managers and the developers of measurement tools to attend the session. David F. Stevens of the Univ. of California, will present a paper, appropriately called "How to Improve Your Performance Through Obfuscatory Measurement." Stevens will discuss the problem of confusing reports. The dp staff may define availability as the ratio of observed production time compared to scheduled production time. On the other hand, a user will perceive maintenance time as unavailable time. Thus management may come up with a figure of 98% availability, while the user may feel 60% is closer to the truth. Likewise, averages can mislead; in some cases the median will be much more significant than the mean. ✲

Product Preview

Not all of the excitement is at Disneyland this month . . . there's magic, too, at the Convention Center where a record number of vendors are displaying their latest electronic marvels. And you don't even need an E coupon.

ANN ARBOR TERMINALS, INC.
Ann Arbor, Mich. Booth 4007

Crt Terminal

The model 530 is a batch transmission crt terminal with editing capabilities. Standard editing functions include insert line or character, delete line or character, and erase to end of line or screen. Protected fields, character accents, and a printer output port are standard. The terminal displays 24 lines of 80 ASCII characters on its 15-inch screen. Upper/lower case and double-size characters are offered as options. The 530 has an RS232 interface; current loop interfaces are available as options. A single 530 sells for $1,500.
FOR DATA CIRCLE 346 ON READER CARD

BDT GMBH
Rottweil, W. Germany Booth 4246

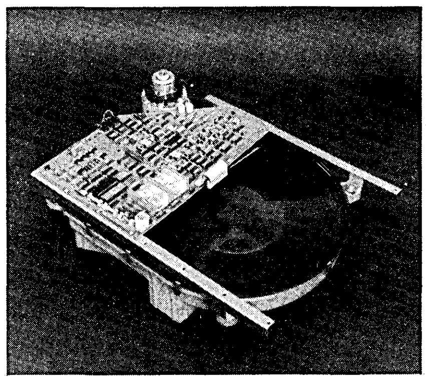
Forms Handling

From Germany come two paper handling devices for use with printers from Qume and Diablo. The FT 210 forms tractor assembly can be disengaged while still mounted on the printer. It handles forms from 4 to 14 inches wide, and it allows reverse line feed. The FT 210 retails for $240. An automatic sheet feeder, the ASF 150, can feed as many as 250 single part pieces of paper without operator intervention. It handles both correspondence and legal size paper, taking a bit over half a second to insert a page (plus time to roll the platten to the first print line) and 0.2 second to eject a finished page. The ASF 150 retails for $1,495. MQI Computer Products of Santa Ana, Calif., represents BDT in the U.S.
FOR DATA CIRCLE 347 ON READER CARD

CALIFORNIA COMPUTER PRODUCTS, INC.
Anaheim, Calif. Booth 2408

Disc Drive and Graphics

A 16.9MB Winchester-technology disc drive, aimed at the floppy disc market,



and an interactive graphics system will highlight this booth. The Marksman disc drive is priced to give oem's an alternative to floppy discs. A systems integrator willing to contract for 300 to 400 drives per year can get the higher performance and greater capacity of a rigid disc for less than $1,300 per drive. He'll still need to add a power supply and controller, but chances are he's doing that with his floppies already. Salient specs include an average access time of 80msec, an average latency of 12.5msec, and a transfer rate of 806KBps. Evaluation units should be available in the third quarter, with production shipments starting in October.

A minicomputer-based interactive graphics system, the IGS-5000, supports multiple workstations, and provides dynamic video graphics. Each workstation includes its own picture processor with 64KB of memory, reducing the burden on the central mini. An IGS-500 system with 64KB mini, 50MB disc, operator's console, user workstation with separate alphanumeric and graphic crt screens, ASCII keyboard, 11-inch-square digitizer tablet, and joystick picture controller will sell for $71,700, including system software. First deliveries are scheduled for June of next year.
FOR DATA CIRCLE 348 ON READER CARD

CENTIGRAM CORP.
Sunnyvale, Calif. Booth 1566

Voice Recognition

Mike recognizes 16 words or phrases in a user-defined vocabulary, generating an ASCII output to a cpu (or other device) and a vocal acknowledgement of input received. Mike operates in two modes. In the learn mode, the user trains it to recognize isolated words or utterances; the vendor says three or four repetitions usually suffice when training the system. In the recognize mode, Mike continuously listens. When it recognizes a discrete utterance (one with a pause at both beginning and end) it sends out the appropriate ASCII message over its RS232 interface; it also gives an appropriate vocal acknowledgement. A stand-alone, end-user Mike sells for $5,500. For oem's, Mike's electronics are offered for $3,080 in quantities of 25.
FOR DATA CIRCLE 349 ON READER CARD

Getting there is half the fun. . .

Booths with numbers less than 1000 are located in the personal computing exhibition, held at the Disneyland Hotel. Exhibit areas at the convention center are split into four sections: 1000-series numbers will be found in the North Hall; 2000-series in the South Hall; 3000-series in the Arena; and the 4000-series will be found in the newly built West Hall Annex.

When an exhibitor is occupying more than one booth and it's obvious that the several numbers represent adjacent booths, we give only one booth number.

PRODUCT PREVIEW

CENTRONICS DATA COMPUTER CORP.
Hudson, N.H. **Booths 1447, 1442**

Printers

Among the printers highlighted by this vendor will be the 6000 series, a family of four impact printers. The four use an operator-changeable print band to print fully formed characters. The units, which feature microprocessor-based electronics, will be offered in 75 lpm,

150 lpm, 300 lpm, and 600 lpm versions; single unit end user prices range from $4,050 to $7,600.
FOR DATA CIRCLE 350 ON READER CARD

CII HONEYWELL BULL
Waltham, Mass. **Booth 1758**

Disc Drives

This French manufacturer will show a pair of cartridge disc drives targeted for the oem market. The D120 is a 10MB removable cartridge unit, the D140 is a 20MB fixed/removable drive. Both use "mididiscs," 10½-inch diameter platters packed in 11-inch-square cartridges. Both drives have average head positioning times of 75msec, latencies of 8.3msec, and transfer rates of 920KBps. All I/O and control lines operate at TTL levels. Available now, the D120 sells for $3,000. The D140 will be available next year for $3,640. These prices are for quantities of one to nine, fob France; discounts are offered on larger orders.
FOR DATA CIRCLE 351 ON READER CARD

COMPUTER AUTOMATION, INC.
Irvine, Calif. **Booth 2438**

Small Systems

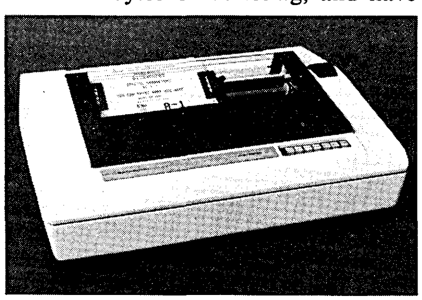
After years of selling to oem's with both hardware and software expertise, this vendor is now after the oem customer who's value-added contribution to a system consists solely of software. To this end, the vendor has put together the BASIC Desk. Built around one of the vendor's 16-bit minicomputers, the BASIC language systems range from a single user, dual-floppy configuration up to one supporting four users, multiple floppies and 10MB discs, line printer and additional peripherals. The standard version of the BASIC Desk, built around a 64KB mini, and including operator's console, crt terminal, the vendor's distributed I/O system, desk, and BASIC software system, sells for

$11,700 in quantities of 25, dropping to $9,750 in lots of 100. A larger configuration with rigid disc controller, and swapping support in the software, sells for $13,200 (25 units) or $11,000 (100 units).
FOR DATA CIRCLE 352 ON READER CARD

DATAROYAL INC.
Nashua, N.H. **Booth 2243**

Printers

Two additional impact printers will join this vendor's IPS-7000 series at the show. Both are microprocessor-controlled, offer 500 bytes of buffering, and have

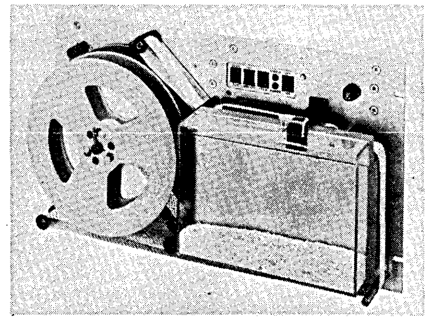


RS232 interfaces as standard equipment. The models 7201 and 7208 both print at 160cps. The 7201 prints 64 ASCII characters formed as 5x7-dot matrices; the 7208 prints 96 ASCII characters formed on 9x7-dot matrices. In lots of 100, the 7201 sells for $1,595, the 7208 for $1,645.
FOR DATA CIRCLE 353 ON READER CARD

DATA SPECIALTIES, INC.
Northbrook, Ill. **Booth 1663**

Tape Punch

A rack panel mounted punch system, the RP-75 runs at up to 75cps. The unit's punch mechanism is guaranteed to perforate at least a million feet of paper



tape. Two interfaces are offered: TTL parallel, and RS232. The serial RS232 interface can accept data at standard rates of 300bps or 600bps, or for full speed operation at 750bps. A TTL parallel unit, with supply and take-up reels, sells for $1,785; with an RS232 interface, the same unit goes for $2,010. An optional tape sensor package, which provides tape out, low tape, and tight tape indicators, is priced at $75.
FOR DATA CIRCLE 354 ON READER CARD

DIGI-DATA CORP.
Jessup, Maryland **Booth 4323**

Tape Transport and Formatter

The Maxidek 75 is a 75ips, tension-arm tape transport; the Micro-Formatter is a microprocessor-based tape formatter. Put the two together, add some interface logic, and you've got a tape subsystem. The Maxidek 75 comes in two versions, an NRZI model for $2,570, and an NRZI/PE model for $2,920. The add-in formatter also comes in two varieties, one for NRZI recording ($560), the other for NRZI and PE ($1,120). Prices given are for 100 unit orders.
FOR DATA CIRCLE 355 ON READER CARD

DIGI-LOG SYSTEMS, INC.
Horsham, Penn. **Booth 1465**

Intelligent Terminal OS

A multitasking, multijobbing operating system allows users of the Microterm II intelligent terminal to concurrently execute applications programs, communications emulators, and spooling software. The system supports ISAM files, 2780 RJE emulation, and applications written in business BASIC and assembly language. The software is bundled in the intelligent terminal's purchase price of $4,950 in oem quantities of 100. That price applies to a 32KB system with dual mini-diskette drives, communications and parallel printer interfaces, and auto dial/auto answer.
FOR DATA CIRCLE 356 ON READER CARD

DYNUS INC.
Costa Mesa, Calif. **Booth 3211**

Disc Controller

The DI-CO5 moving head disc controller, an add-in quad-size printed circuit module for PDP-11s, handles drives up to 20MB. Microprocessor-based, the controller emulates DEC's RK-11 disc system providing diagnostic and software

compatibility with existing systems. The board plugs directly into the PDP-11 backplane. It provides automatic retry on seek errors and overlapped seek capabilities. Single units sell for $3,000; the price drops to $2,425 in lots of 25 to 49.
FOR DATA CIRCLE 357 ON READER CARD

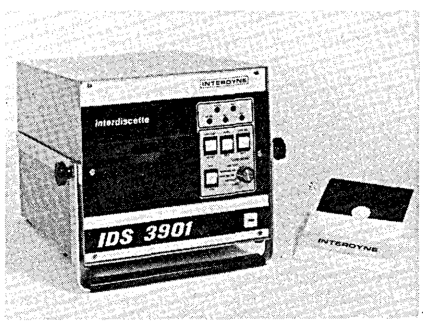
E & L INSTRUMENTS INC.
Derby, Conn. Booth 3114
Video Terminal
Video display electronics (the vendor's phrase) pretty well describes the VTE-80. It's not a pretty, single-unit, office decor coordinated crt terminal; rather it's a triad consisting of video monitor, keyboard, and the electronics to tie the two together into a 1,024-character video terminal. And, at a packaged price of $650 (for one), it probably will be fairly popular among the budget minded. Users already owning a video monitor or keyboard get off even cheaper by buying only what they lack. The uppercase ASCII terminal displays 16 lines of 64 characters. If desired, the PROM which controls character generation can be reprogrammed (for graphics characters or foreign character sets). The terminal can handle RS232 or 20mA current loop data transfers at speeds ranging from 110bps to 9600bps. Characters can contain 5, 6, 7, or 8 data bits (one or two stop bits) and parity can be selected as even, odd, or none. Video output conforms to the RS170 standard used with standard television monitors and projection television systems.
FOR DATA CIRCLE 358 ON READER CARD

EXTEL CORP.
Northbrook, Ill. Booth 1349
TWX Data/Phone ASR
The B318 automatic send/receive terminal has a built in dual ported TWX/DDD modem; it's certified for direct connection to the phone system, without adding a data access arrangement (DAA). The 30cps dot-matrix impact printer terminal has 8,000 bytes of memory for messages; its editing capabilities include insert character, find a given string, backspace, and justify. Its memory can be printed off-line, or transmitted on-line. An automatic dialing feature allows the user to store, and automatically call, any 10 TWX and any 10 direct dial phone numbers. The single unit price of the B318 is $3,500.
FOR DATA CIRCLE 359 ON READER CARD

FACCIT-ADDO INC.
Greenwich, Conn. Booth 2145
Punched Tape Reader
The 4030 series can read five to eight-level perforated tape at 120cps; it can spool tape at up to 800cps. It can be had with fanfold take-up bins or any of several systems for handling rolled tape. Interfaces include the vendor's universal parallel interface and RS232 serial interfaces. A 4030 reader, including power supply and purchaser's choice of one interface, sells for $625 in singles, dropping to $494 in lots of 100.
FOR DATA CIRCLE 360 ON READER CARD

GOULD INC., Instruments Div.
Cleveland, Ohio Booth 1107
Plotting Equipment
An electrostatic plotter and a microprocessor-based interface will debut in this vendor's booth. The model 5400 plotter handles 36-inch wide paper and provides resolution of 0.01-inch. It sells for $25,900. Multiple microprocessors convert vectors into raster scan patterns in the Vector Plotter interface. This raster data is formatted for input to the electrostatic plotter. Off-line versions with 9-track, 800bpi tape input go for $22,350; with 1600bpi tape input the price is $25,030.
FOR DATA CIRCLE 361 ON READER CARD

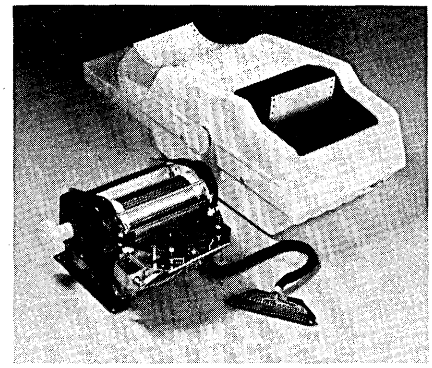
INTERDYNE CO.
Van Nuys, Calif. Booth 2561
Intelligent Floppy Drive
The Interdiscette combines an intelligent controller with a mini floppy drive, providing both editing capabilities and 143KB of storage. The unit interfaces to



terminals or computers through an RS-232 interface; asynchronous data rates are switch-selectable from 110bps up to 19,200bps. Thirty ASCII commands control the Interdiscette, allowing the user to enter, list, or edit data in lines of as many as 128 characters. There is also a transparent binary mode. The Interdiscette sells for $2,095.
FOR DATA CIRCLE 362 ON READER CARD

KYBE CORP.
Waltham, Mass. Booth 2151
Cassette Tape
The K Series Accutrack cassettes are this vendor's top-of-the-line premium tapes for word processing and computer applications. The cassettes are said to comply with ANSI, ECMA, and ISO requirements. Features include the use of premium grade tape, certified error-free, low friction slip sheets, machined Delrin tape rollers, and a dual write-lockout system, consisting of removable plugs and permanently attached slides. Cassette prices range from $4.30 to $6.95 in quantities of 10.
FOR DATA CIRCLE 363 ON READER CARD

KYODO PRINTING CO., LTD.
Tokyo, Japan Booth 1665
40-Column Line Printer
The RO-101P is a 40-column drum impact line printer, printing in the line-per-second speed range. Standard fonts include OCR A and B; character sets may contain 48 or 64 characters. Special



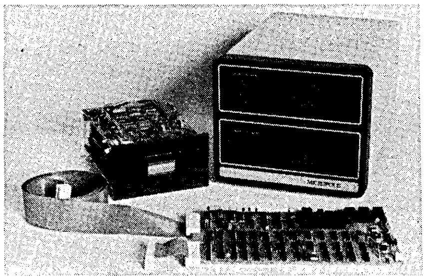
symbols are available at a nominal charge, according to the vendor. The unit includes a microprocessor-based controller, and offers a variety of interfaces: eight-bit ASCII parallel (standard), RS232, 20mA current loop, and IEEE-488-B. An S-100 bus interface also is offered. In singles, the printer, controller, and parallel interface sell for $1,295; in lots of 100, the price drops to $1,025. Prices for the printer mechanism only are $745, and $575, in the same quantities. All prices are fob Los Angeles.
FOR DATA CIRCLE 364 ON READER CARD

LICON, Div. ITW
Chicago, Ill. Booth 2509
Lighted Pushbutton Switch
Building something? Building lots of somethings? Maybe the 05-6 miniature, lighted push-button switch would look good on your something's front panel. Available in a variety of configurations, and with many display options, the 05-6 series should become available in June or July. A momentary action switch from the series will sell for roughly $2.30 in orders of 500.
FOR DATA CIRCLE 365 ON READER CARD

MICROPOLIS CORP.
Canoga Park, Calif. Booth 4443
Megabyte Minifloppies
It's been rumored since last year's NCC that this firm would bring out a floppy drive capable of storing a megabyte or more on a single diskette. They've done it, and on a minifloppy to boot. The double-sided model 1055 drive packs a whopping 1,892KB (or, if you prefer, 1.892MB) onto a 5¼-inch diskette; a single-sided version of the 1055 provides half that capacity, 946KB. The 1055 uses soft-sectoring. It uses Group Code Recording (GCR), the same recording method used on 6250bpi tape drives; the 1055's recording density is 6,380bpi. A single-sided 1055 with mircoproces-

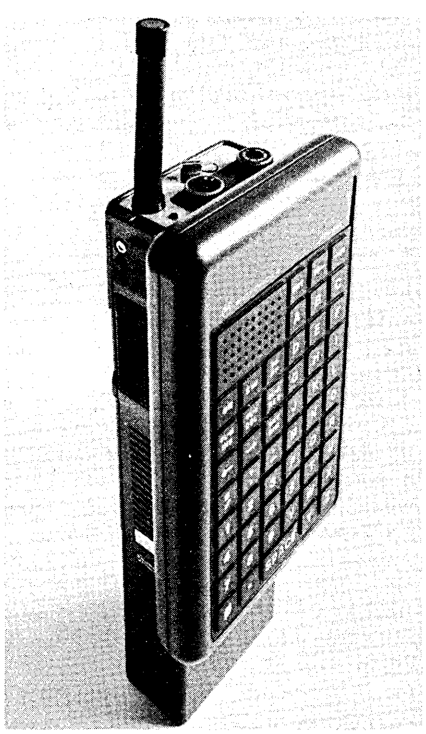
sor-based controller sells for $1,336 in lots of 50; the dual-sided version is $1,796 in similar quantities.

The vendor also has gone double-sided on its 1015 series of minifloppy



drives, expanding hard-sectored storage capacities to 630KB; optional use of the vendor's controller and GCR lets users store 946KB per diskette. The 1015 series is intended for large oem's; prices range from $223 to $396 per drive in quantities of 500.
FOR DATA CIRCLE 366 ON READER CARD

MOTOROLA, INC.
Schaumburg, Ill. — Booth 4329
Portable Handheld Terminal
When this vendor says portable it means portable. The RDX system comprises RDX 1000 portable data terminals, a duplex FM radio base station, and an RDX 1100 control unit. Portable terminals communicate with the base station over an FM UHF-band radio link; a bisync land-line links the base station, via the RDX 1100 control unit, to the user's IBM mainframe. Land-line communications are 3270-compatible. The RDX 1100 control unit supports as many as 32 portable terminals. A typi-



cal system, consisting of control unit, FM base station, and 10 portable terminals, sells for roughly $60,000. Customer shipments are scheduled to begin this fall.
FOR DATA CIRCLE 367 ON READER CARD

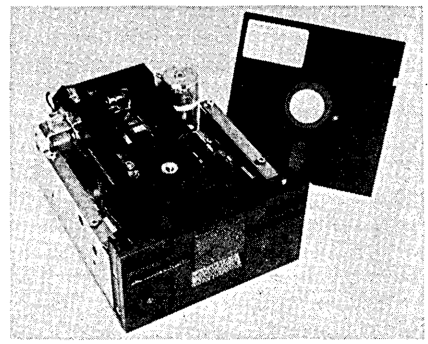
MUPRO INC.
Sunnyvale, Calif. — Booth 4038
Memory Boards
Compatible with the bus structure used in Intel's SBC line of microcomputer modules, this vendor's line of memory boards ranges from 4KB to 64KB. The dynamic boards include refresh circuitry. Boards from 4KB to 16KB use 4K chips; a second version of the 16KB board, and those larger, use 16K chips. And the boards are available with three varieties of error detection: none, parity (for detecting single-bit errors), and error correcting (capable of fixing single-bit errors, and detecting double-bit errors). The 64KB board, with error correction, will star in the vendor's booth. It sells for $2,595 for one, dropping to $2,335 in lots of 10.
FOR DATA CIRCLE 368 ON READER CARD

NOVA ELECTRIC MANUFACTURING CO.
Nutley, N.J. — Booth 1165
Voltage Regulating Transformer
The model T120/2K stabilizes line voltages, providing fixed output voltages with load variation. Rated at 2KVA, the solid state device is said to be maintenance free and short circuit protected. It sells for $600.
FOR DATA CIRCLE 369 ON READER CARD

PERSCI, INC.
West Los Angeles, Calif. — Booth 1239
Intelligent Floppy Controller
Designed for compatibility with IBM diskette 2D, 3740, and the microcomputer S-100 bus, this vendor's model 1170 intelligent controller can handle as many as 32 diskette sides (single or double density) providing a maximum subsystem capacity of 32MB, formatted. Based on a Z-80 microprocessor, the 1170 off-loads much of the cpu's file-oriented software burden, communicating by file name and performing housekeeping functions. The controller's file management capabilities include initialization, allocation and deallocation of diskette space, and creating, deleting, renaming, and copying files. The 1170 works with the vendor's model 277 and 299 diskette drives. In oem quantities of 500, the 1170 sells for $800.
FOR DATA CIRCLE 370 ON READER CARD

PERTEC COMPUTER CORP., Pertec Div.
Chatsworth, Calif. — Booth 2103
Floppy Drives
A pair of double-headed floppy drives—an 8-inch unit and one for 5¼-inch diskettes—will grace this vendor's booth. The standard size (8-inch) FD650 can read or write in double density on both sides of an IBM Diskette 2 or 2D (or equivalent media). It provides an unformatted capacity of 1.6MB per diskette. The drive's electronics are said to be compatible with the proposed ANSI standard for floppies. In singles, the FD650 sells for $755; oem discounts are available.

For those looking for minifloppies, the vendor will show its FD250 Microfloppy disc drive, which can store

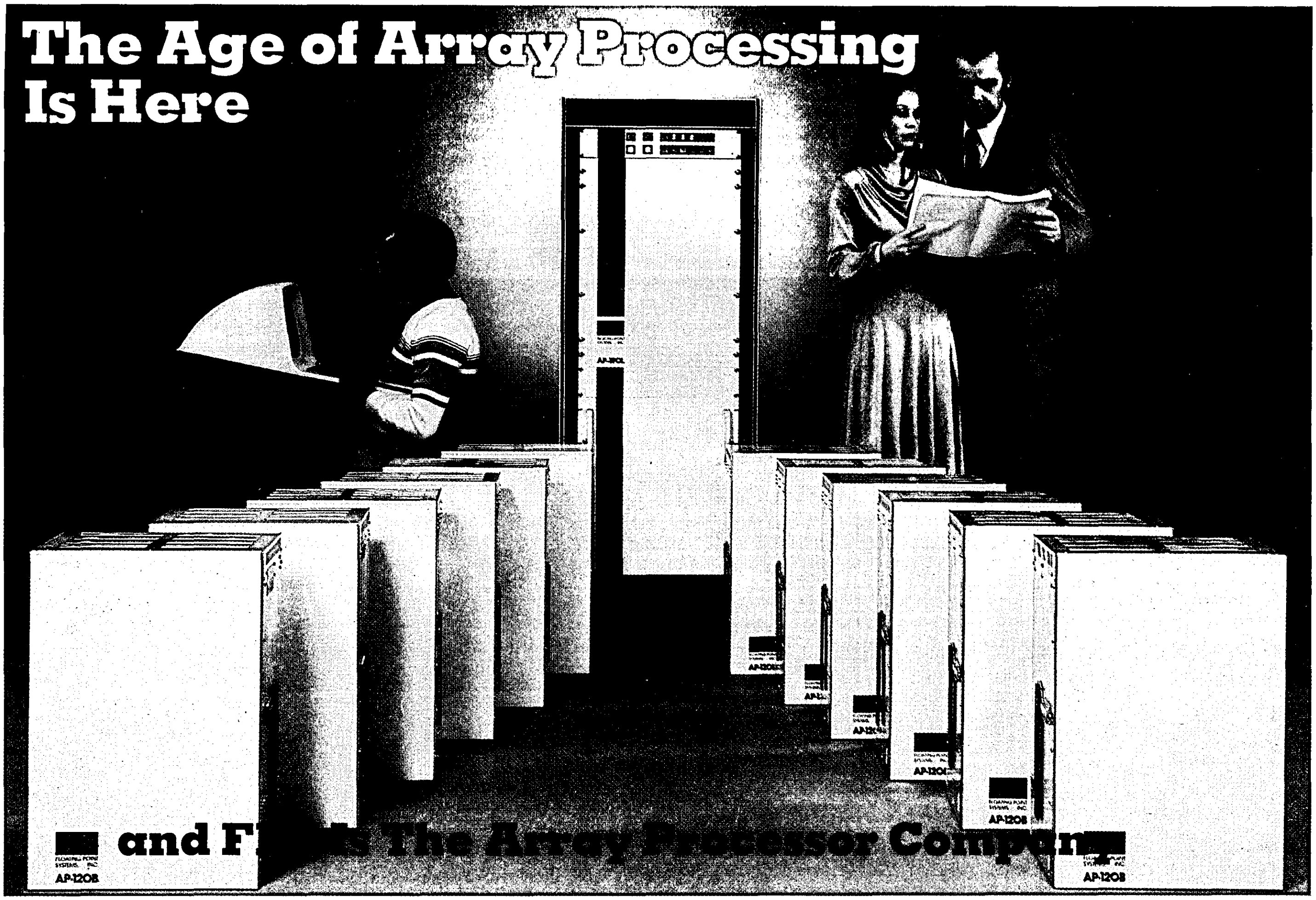


437,500 bytes on a 5¼-inch diskette. The double-headed drive has standard features including double density, hard or soft sectoring, and write protect. In oem lots of 100, the FD250 sells for $325 per unit.
FOR DATA CIRCLE 371 ON READER CARD

PRACTICAL AUTOMATION, INC.
Shelton, Conn. — Booth 1345
Printer
This vendor will show a couple of new tricks it's taught its DMTP-6 series of dot matrix impact printers. A new member of the family, the 2527, uses a stepper motor paper advance mechanism which gives the printer some graphics capabilities. The paper now can be moved forward or backward; six- or nine-lines-per-inch spacing can be dynamically selected. At nine lines per inch, the printer can draw a continuous vertical line anywhere on the page. An 8½-inch-paper-width printer, with the stepper motor option, sells for $425; quantity discounts are offered.

An additional interface option, the uP-9, accepts ASCII data at up to 300bps. The interface may be 20mA current loop, RS232, or TTL levels. The unit allows a DMTP printer to function as a receive-only teletypewriter. The uP-9 sells for $190; again, quantity discounts are available.
FOR DATA CIRCLE 372 ON READER CARD

PRECISION HANDLING DEVICES, INC.
Assonet, Mass. — Booth 4016
Low Profile Tractor
Few people give much thought to form



The AP-120B
ARRAY PROCESSOR COMPUTER
Interfaces to all popular minicomputers . . . a typical AP-120B complete is less than $50K.

The AP-190L
ARRAY PROCESSOR COMPUTER
Interfaces to IBM 360/370, UNIVAC 1100, Sigma 5-9, and DEC System 10 . . . a typical AP-190L System is less than $97K.

Simulation: Mechanical Systems, Flight, Theoretical Physics & Chemistry, Electric Power Distribution • Image Processing: Satellite Imagery, X-Ray Tomography & Ultrasonics • Graphic Research • Finite Element Analysis • Meteorology • Signal Processing: Speech, Vibration Analysis, Geophysical and Seismological.

More than 500 FPS Array Processor computers are in use worldwide, providing their users with the computational power of large, mega-dollar scientific computers at **greater reliability, greater applicability, easier programmability,** and **at a small fraction of the cost.**

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A large computer/FPS Array Processor system allows heavy data processing, which would severely load the host CPU, to be **off-loaded to the AP-190L for efficient processing** while the host CPU is utilized for tasks more appropriate to its architecture and operating system.

The unique, efficient instruction set and complementary architecture of FPS Array Processor computers are **specifically designed to accommodate the vector and matrix algorithms** for scientific data processing. High processing speeds result from the **seven independent data paths** that move operands synchronously to and from the **38-bit floating-point arithmetic units,** accumulators, and **multiple memories.** This inherent simplicity allows FPS Array Processors to be readily simulated on the host or front-end computers for program development. It allows FPS to provide you with a large volume **Scientific Math Library** (more than 200 functions) and additional volumes for **Signal Processing** and **other special operations.** And it allows **you** to **program** FPS Array Processors so you can create your own special, unique, or proprietary functions.

FPS Array Processor computers offer high reliability (much more than your present computer) and compactness (only slightly larger than minicomputers). They are found in research, shipboard, airborne, and mobile installations, as well as computer rooms throughout the world.

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167 nanosecond multiply/add
The following algorithms are memory to memory
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26.1ms 8192 pt real FFT
1.55s 512 x 512 real 2D FFT
10.2ms 20 x 20 matrix inverse

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HIGH CAPACITY
Data memory to 512K words (2-million bytes)

PRECISION
38-bit floating point arithmetic

FPS can bring new power to your computer system. Find out how FPS Array Processor technology can benefit your application. For more information and an FPS Array Processor brochure, **use the reader response number or coupon below.** For immediate consultation, **contact Floating Point Systems directly.**

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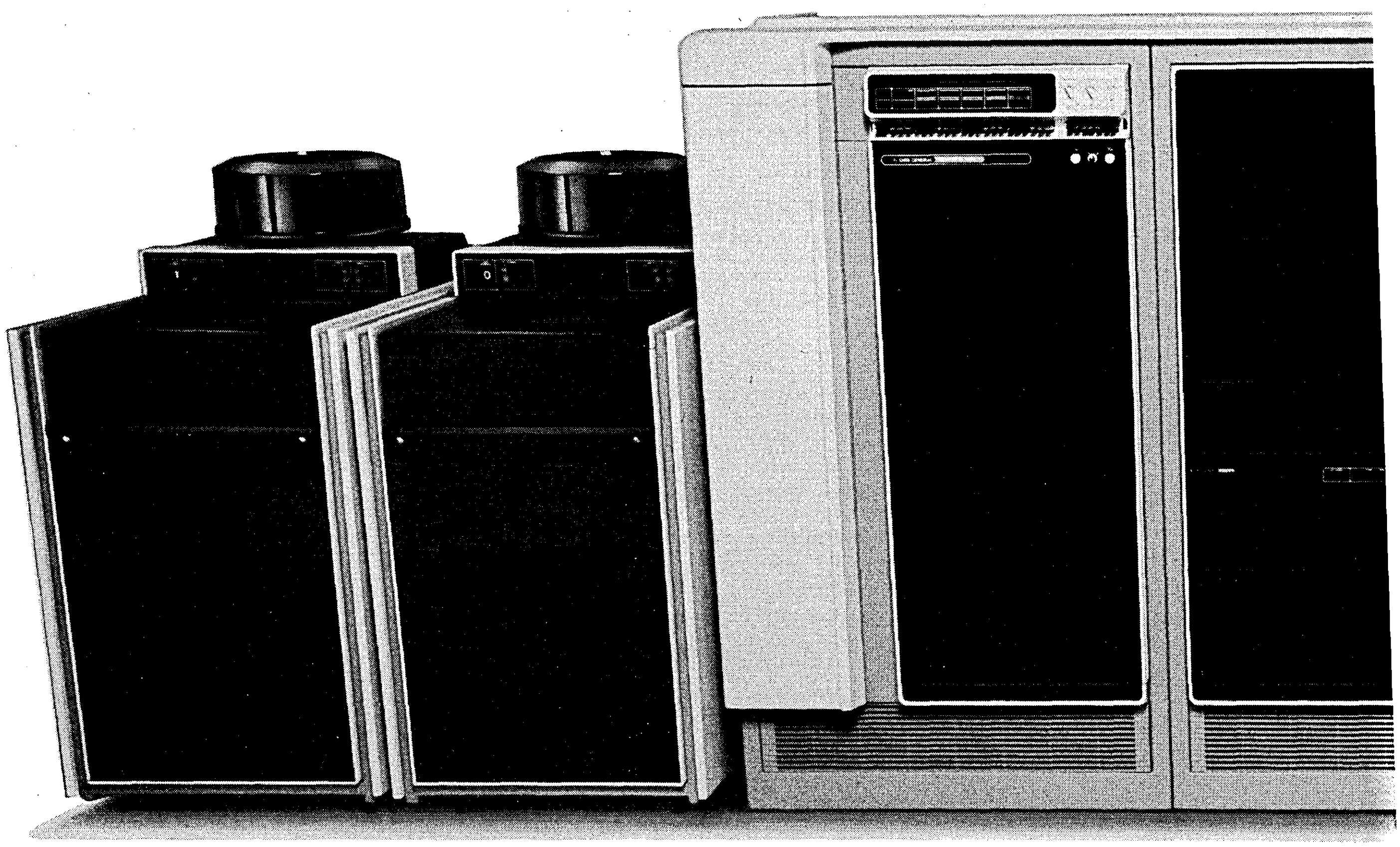
DATAMATION 5/78

CIRCLE 61 ON READER CARD

INTRODUCING THE MINI-MAINFRAME. $195,000.



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Until now, either you opted for the capability of a mainframe or you went with the flexibility and economy of a mini. Until now.

Introducing the Data General ECLIPSE M/600 computer system. It combines the workload capability of a mainframe with the traditional advantages of a mini, such as interactive computing, distributed processing and economy.

One thing that makes the ECLIPSE M/600 like no other existing computer is an incomparable three level I/O Management System, which prohibits I/O bottlenecks. Another is an incredibly efficient Demand-Paged Memory Management, which allows you to run more jobs faster. And its new Job Processor is unmatched for speed and flexibility. Then our supremely intelligent Advanced Operating System (AOS) keeps everything speeding along for a minimal terminal response time and a maximum concurrent batch stream throughput.

Once again Data General raises the world's expectations for computers, while lowering the cost. To find out more about what you can expect from the new ECLIPSE M/600, write for our brochure. Or call (617) 366-8911, Ext. 4735.

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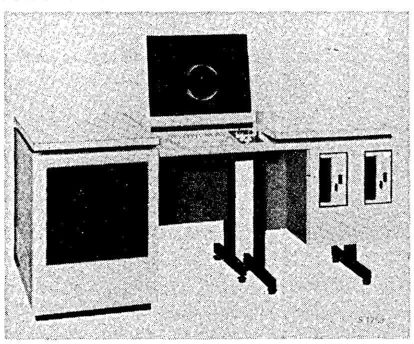
feed tractors, but someone has to make them. This vendor makes them, and will show a new tractor, the 1040-90, designed for use with low-profile printers. The tractor feeds forms along a 90° path. Slated for availability early in the third quarter, the tractors will sell for less than $10 apiece in oem quantities of 5,000.
FOR DATA CIRCLE 373 ON READER CARD

PRINCETON ELECTRONIC PRODUCTS, INC.
North Brunswick, N.J. Booth 4439

Graphics Terminal

An $18,000 price tag might lead one to suspect that there's something out of the ordinary in this 20-inch raster-scan graphics terminal. It has the capability of mixing alphanumerics, vector graphics, and television—still or live—input. It also can store a video frame. And then it has the graphics capabilities you'd expect in a fancy tube—256 text sizes, 360° rotation, hardware conic curve generation, scaling and windowing, and zoom. Known as the 8500M, the terminal is built around an M6800 microprocessor. A joystick performs those functions ASCII or APL keyboards can't. As for interfacing, the unit communicates digitally over an RS232 interface at speeds of up to 9600bps; for video signals, both as input and output, it uses the RS170 composite video output standard interface. Availability is slated for mid-June.
FOR DATA CIRCLE 374 ON READER CARD



QUME CORP.
Hayward, Calif. Booth 2513

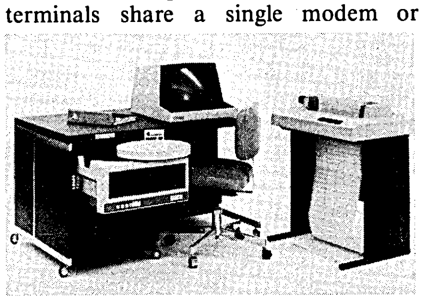
Daisywheel Terminal

Last summer this vendor announced a RS232 interfaced version of its daisywheel printer, making it fit the bill as an RO printer. Now they've gone and added a keyboard to make the Sprint 5 a KSR terminal. The buffered, upper/lower case ASCII terminal can be had in either 45cps or 55cps versions. An integral microprocessor controls the printer mechanism and provides a wide variety of functions including diagnostics and forms handling. And, since the print mechanism can step horizontally in increments of 1/120-inch, and vertically in 1/48-inch increments, the Sprint 5 can print plots. In addition to RS232, current loop and parallel interfaces are offered. Quantity 50 price for the 45cps KSR is $2,480.
FOR DATA CIRCLE 375 ON READER CARD

RACAL-MILGO, INC.
Miami, Fla. Booth 1611

Communications Products

Already a big gun in the modem market, this manufacturer will increase its offerings in that market and in the terminal market it's now pursuing. New members of the microprocessor-based series of modems (appropriately dubbed the MPS line) will be on hand at the show. Synchronous transmission speeds available are 4800bps, 7200bps, and 9600bps. Multiple-port models allow several terminals to share a communications channel; this feature lets four 2400bps devices, connected to a 9600bps modem, share the same line. For even more flexibility, optional built-in sharing devices let multiple terminals share a single modem or



modem port. These modems will carry price tags ranging from $5,000 to $10,000, depending on speed and options.

The System 4000, an intelligent clustered terminal system, will debut at the show. Consisting of a cluster controller/processor, up to 1MB of floppy disc storage, display stations, and line printers, the System 4000 can emulate IBM's 3270 and 2260 communications protocols. The system can be programmed in COBOL and a proprietary, ALGOL-like language, ESAL. System prices start in the $20,000 range.
FOR DATA CIRCLE 376 ON READER CARD

RANDAL DATA SYSTEMS, INC.
Torrance, Calif. Booth 1070

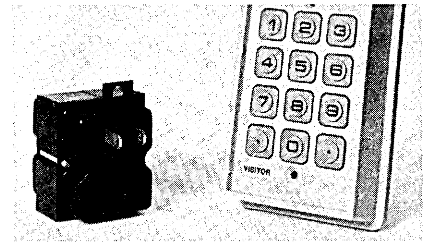
Business Computers

The Link 240 and Link 250 have joined this vendor's line of compatible, minicomputer-based business systems. The vendor says both systems offer a 60% throughput improvement over earlier Link 200 systems; this increase is attributed primarily to a faster disc. The systems, which operate in a time-sharing mode, can support five (240) or 10 (250) users. A Link 240, with 32KB of memory, 10MB of rigid disc, one crt, and a 110cps printer, sells for $22,900. A 64KB Link 250, with 10MB of disc, three crt's, and a 110cps printer, goes for $29,900.
FOR DATA CIRCLE 377 ON READER CARD

SARGENT & GREENLEAF, INC.
Nicholasville, Ky. Booth 2644

Access Control

The Digitrol is a digital combination lock, providing in excess of 5,000 possible access codes. The unit can be used

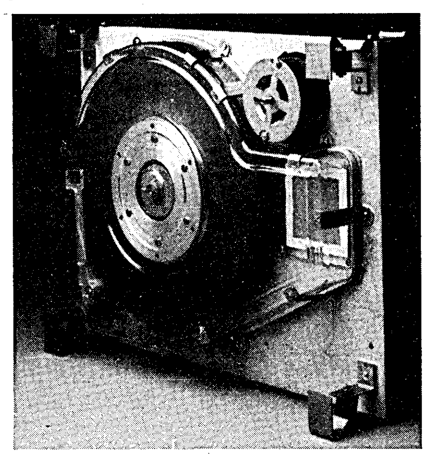


with most electromechanical door strikes, locks, or relay switches; it can sound an alarm if tampered with. Access codes are changed by plugging in a different code-key module. Single units list at $146.
FOR DATA CIRCLE 378 ON READER CARD

SHUGART ASSOCIATES
Sunnyvale Calif. Booth 2445

Disc Drive

Winchester technology, 14.5MB or 29MB unformatted capacities, optional head-per-track storage for an additional 144KB, and prices starting at $1,450 in lots of 100 14.5MB drives—just a few of the comments attendees are likely to be jotting in their notebooks as they talk to



this vendor about the SA4000 line of fixed disc drives. The 4000 series marks this established floppy-maker's first entry into the world of rigid disc drives. Considering its background in floppies, it's not surprising that the 4000 series is designed with the same power requirements as a floppy, nor is it surprising that the vendor has a controller—for IBM's Systems/32 and /34, and Series/1—in the works, a controller that will handle four 4000 series rigid discs and four floppies. We'll let the vendor fill you in on nuts and bolts specs, such as average access time (87msec) and transfer rate (889KBps). A single 14.5MB SA4004 drive sells for $2,550; 29MB versions (the SA4008) go for $3,500, quantity one, and $2,000 in lots of 100. Deliveries are quoted at 120 days ARO.
FOR DATA CIRCLE 379 ON READER CARD

THE TRACK STAR

To keep track of all your property data, you can't beat our Fixed Assets System.

Before you can manage your assets, you've got to have the right data. The data you need for accounting, taxes, insurance, engineering, leases, and replacement cost.

To keep track of all that data, nothing shines like the McCormack and Dodge Fixed Assets Analysis and Accounting System. This star performer can really help you beat your various property control and depreciation problems.

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Among its many outstanding features are a single path input stream, top-down structured design and programming, and a powerful, user-oriented report writer. A simple and efficient file structure lets you carry only the data required for each asset; no master file sorts are required for normal processing.

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In short, our Fixed Assets Analysis and Accounting System is a real star when it comes to tracking asset data.

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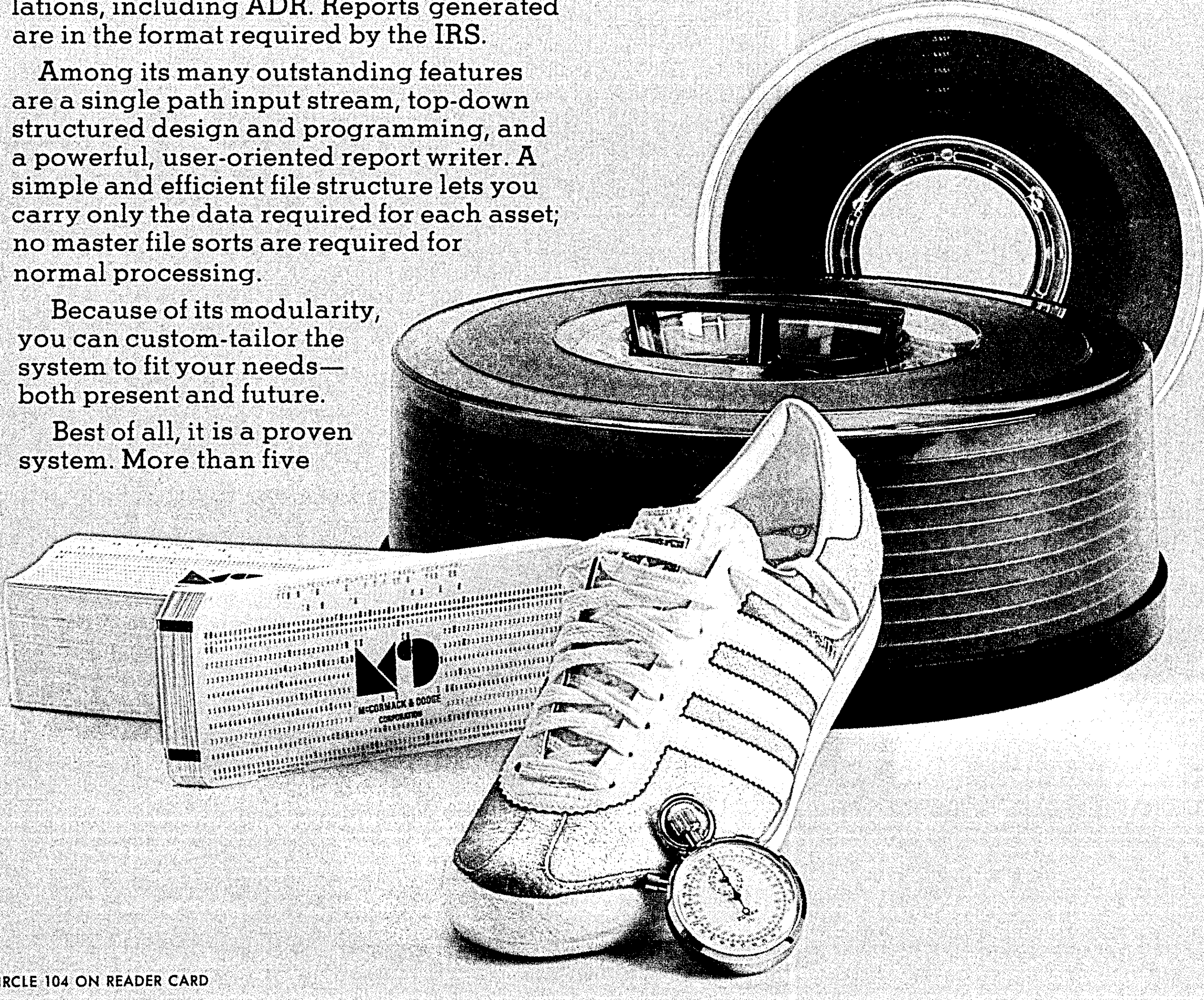


CIRCLE 104 ON READER CARD

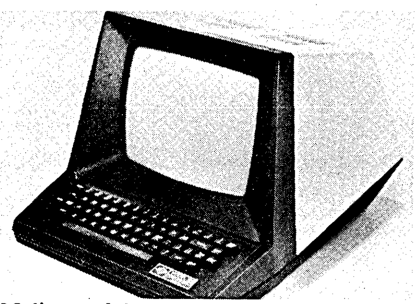
PRODUCT PREVIEW

TEAC CORP.
Tokyo, Japan **Booth 1665**

Cassette Tape System
The Datapack MT-2 combines a 15ips cassette deck with an LSI controller, providing a secondary storage device for personal computer users and those building small systems. The tape format is 800bpi PE, said to be compatible with ANSI, ECMA, and ISO standards. The unit's data transfer rate is 1.5KBps; when searching for a file mark, the unit runs at 45ips. Connection to eight bit microprocessors (8080, 6800, Z-80, etc.) as well as to minicomputer buses, is said to be facilitated by the unit's LSI controller. A single unit, including controller, sells for $695, fob Los Angeles.
FOR DATA CIRCLE 380 ON READER CARD

TEC, INC.
Tucson, Ariz. **Booth 4237**

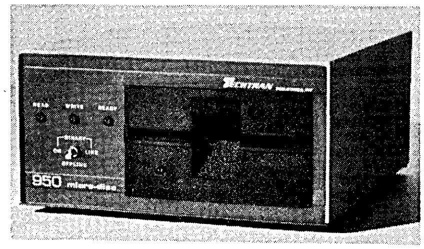
Crt Terminal
Series 500 terminals offer teletypewriter compatibility, cursor positioning, inverse video characters, and an RS232 interface. The terminals, which display



25 lines of 80 ASCII characters, operate in either roll up or page mode. Data may be entered at the top or bottom of the screen. A monitor mode allows display of control characters, aiding in debugging. Data transmission rates range from 50bps to 9600bps. The upper/lower cast terminal sells for $995 to domestic end-users; a European version, with international keybaord and power supply designed for foreign use, sells for $1,095.
FOR DATA CIRCLE 381 ON READER CARD

TECHTRAN INDUSTRIES, INC.
Rochester, N.Y. **Booth 2751**

Minidiskette System
The microprocessor-controlled model 950 micro-disc stores 200KB on one side of a 5¼-inch diskette. The unit's micro maintains a file directory on each diskette. Interfaces include RS232 and 20mA current loop. The desk-top unit operates at switch-selectable transmission rates ranging from 110bps to



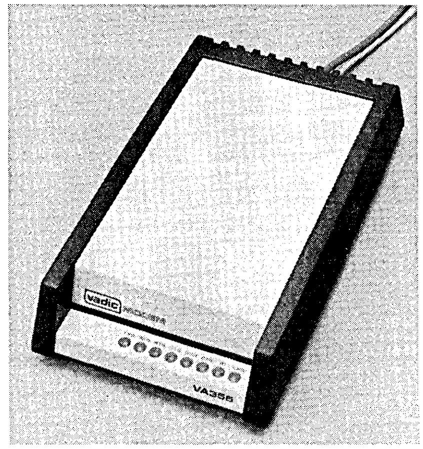
9600bps. In addition to an ASCII mode with editing capabilities, the micro supports a transparent binary mode. The 950 lists at $1,395.
FOR DATA CIRCLE 382 ON READER CARD

TIMPLEX, INC.
Hackensack, N.J. **Booth 4031**

Data Concentrator
The Microplexors M4 and M8 concentrate four or eight asynchronous terminals, respectively, onto one synchronous communications line. The microprocessor-based units use statistical multiplexing techniques, and support transmissions at a maximum aggregate data rate of 9600bps. RS232 interfaces are standard, with the newer RS423 interface available as an option. The four terminal M4 sells for $1,500; the eight terminal M8 goes for $2,500.
FOR DATA CIRCLE 383 ON READER CARD

VADIC CORP.
Sunnyvale, Calif. **Booth 2141**

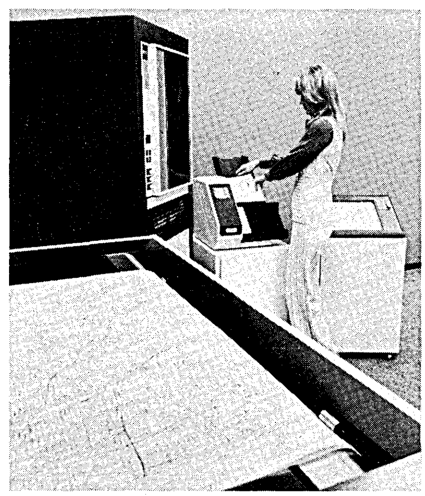
Modem
The VA355 offers compatibility with Bell's 103 data set, and it's certified for direct connection to the telephone system, without adding a DAA (data access arrangement). The modem, which operates at up to 300bps, can function in originate or answer mode. It includes

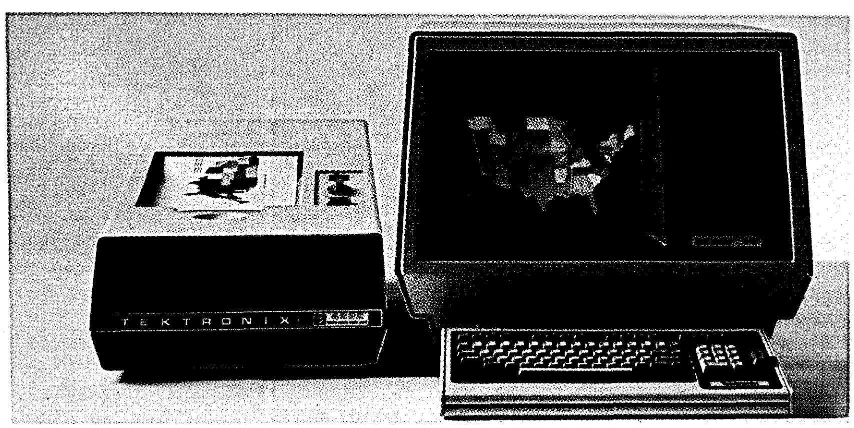


diagnostic capabilities, with both analog and digital loop-back. To reduce cost and increase reliability, the unit uses a wall-mounted power supply. The VA355 sells for $350.
FOR DATA CIRCLE 384 ON READER CARD

VERSATEC
Santa Clara, Calif. **Booth 1463**

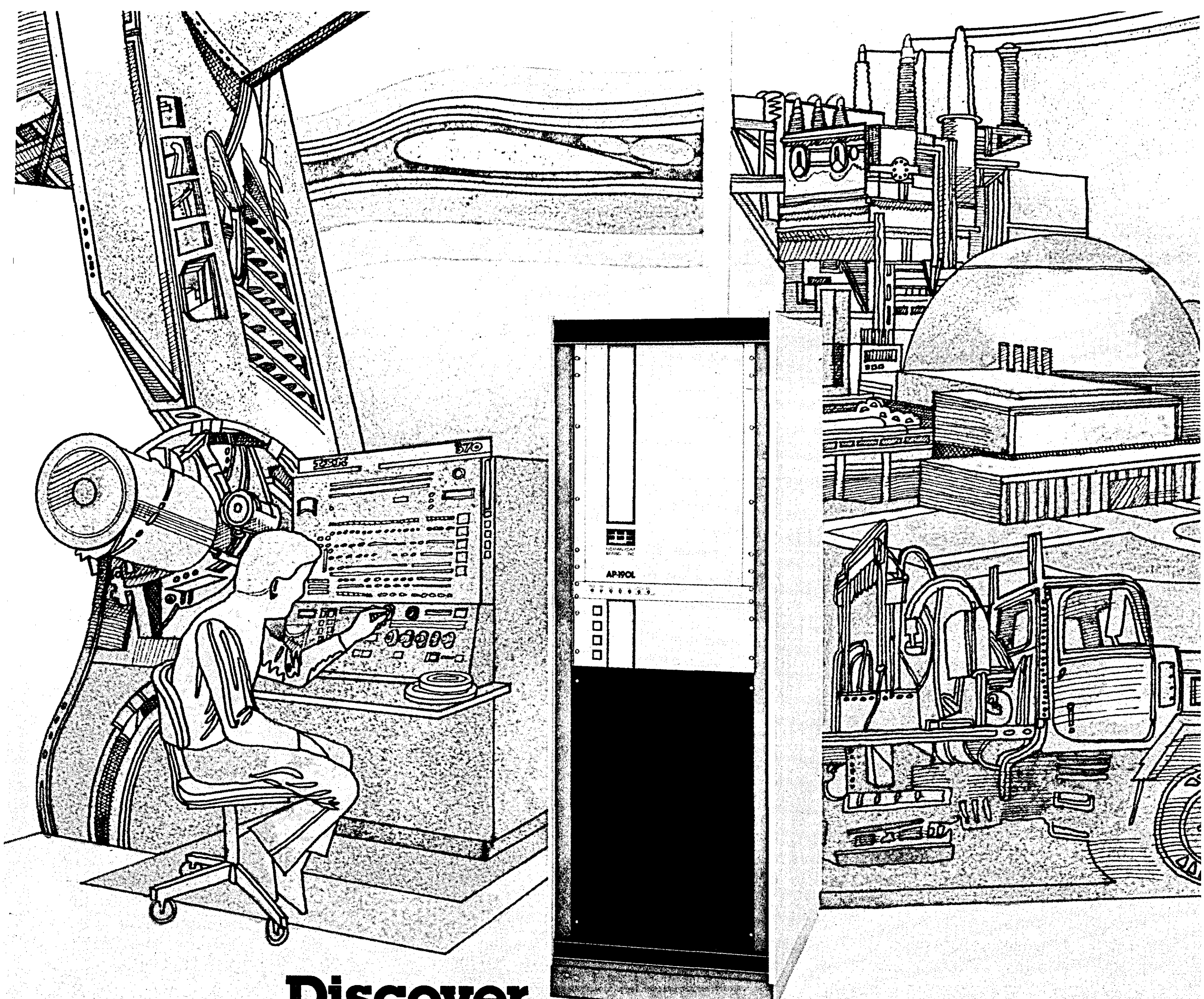
Remote Batch Printer/Plotter
The Remote Spooling Vector Processor—RSVP—emulates the communications features and functions of IBM 2780/3780 terminals, giving 360 and 370 users remote batch electrostatic printing and plotting. Communicating in bisync protocol using EBCDIC characters, RSVP accepts vector form plot data, converts the vectors to rasters, and





TEKTRONIX INC.
Beaverton, Ore. **Booth 2309**

Color Graphics
The 4027 marks this leading graphics terminal manufacturer's first entry into the world of color graphics. Details will be found in this month's Hardware section (p. 292).
FOR DATA CIRCLE 345 ON READER CARD

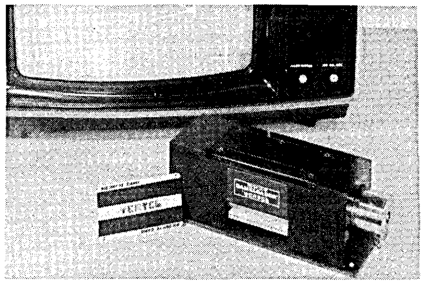

370

routes jobs to multiple electrostatic printer/plotters or mag tape. Dial up or leased line communications, at speeds ranging from 2400bps to 9600bps, are supported. RSVP can support up to four printers, plotters, or printer/plotters chosen from this vendor's product line. RSVP systems, including vector processor and card reader, start at $39,500. Electrostatic output units range from $6,200 for an 8½-inch wide printer to $54,500 for a 72-inch wide plotter with character generator. Deliveries are quoted at 120 days.
FOR DATA CIRCLE 385 ON READER CARD

VERTEL, INC.
Clifton, N.J. **Booth 1856**

Magnetic Card Reader

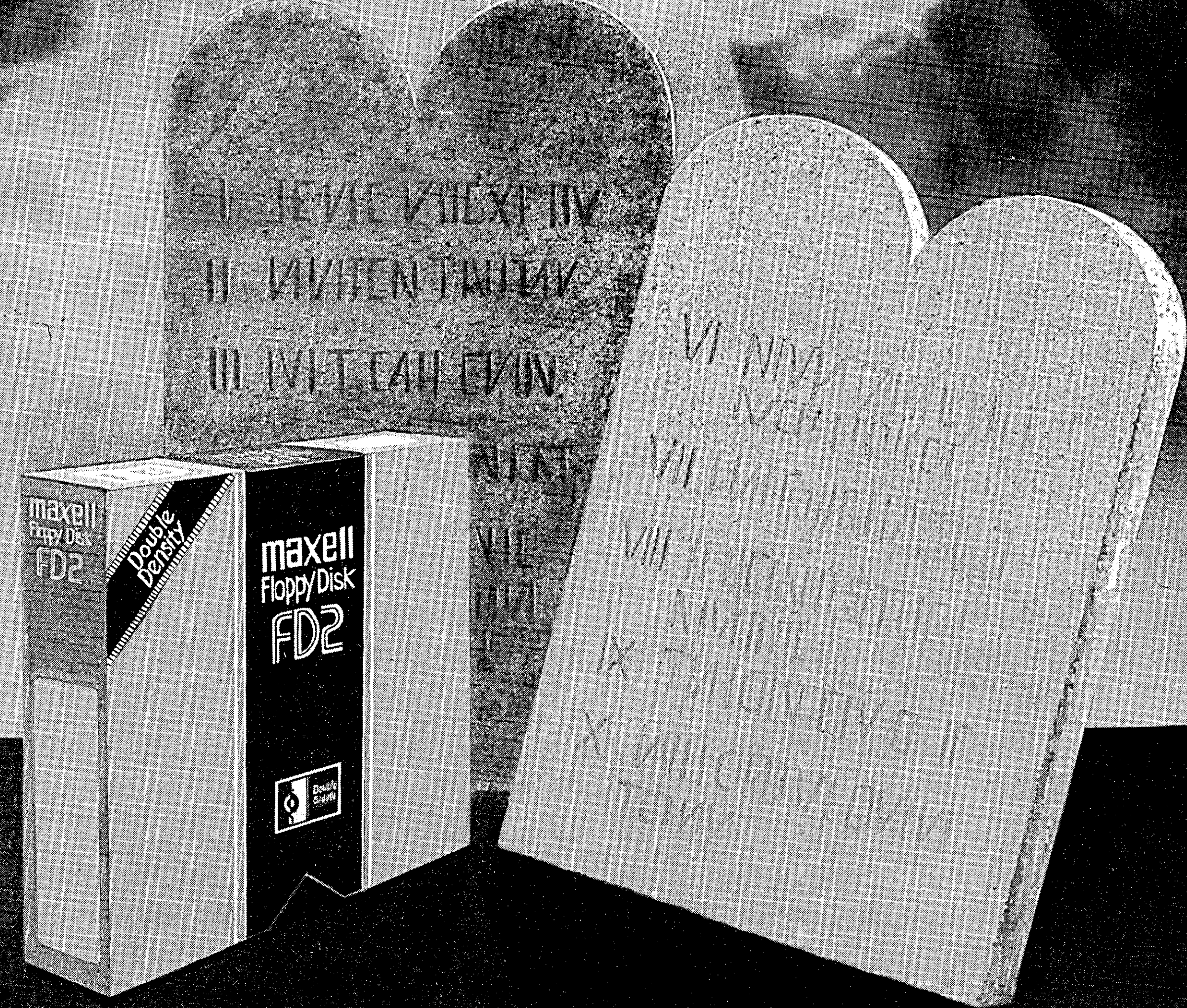
The LC-31 Gameloader, a product for the OEM market, is aimed at manufacturers of microcomputer-based products.



The vendor wants to sell in large quantities, making the product attractive to companies that make electronic games and, perhaps, the largest personal computer vendors. The magnetic card read by the LC-31 resembles a credit card with four strips of half-inch mag tape—two per side—affixed. The cards are known as Kilobyte Cards, a name borrowed from their capacity. The Gameloader, with an F8 microprocessor-based controller, is available with RS232, 20mA current loop, or byte parallel interfaces. The going price is $40 apiece, in quantities of 100,000. No shoving, please; the line forms to the right.
FOR DATA CIRCLE 386 ON READER CARD

ADDRESSOGRAPH-MULTIGRAPH CORP., Cleveland, Ohio (Booth 1621), plans to show its model 1830 plain paper microfiche enlarger-printer, which can print 8½ by 11-inch copies of microfiche frames. Leases begin at $745 per month . . . AI ELECTRONICS CORP., Tokyo, Japan (Booth 1665), will demonstrate its FDPS-20 microcomputer development system. The systems include two or four 8-inch floppy drives, a Z-80 microcomputer with 32KB to 64KB of memory, and development software. Interfaces available include RS232, 20mA current loop, IEEE-488, and S-100. The units are capable of in-circuit-emulation in Z-80, 8080A, and 8085 environments. Prices start around $7,500 . . . COMPUCORP, Los Angeles, Calif. (Booth 10), plans to bring its Series 625 desktop computer to the Disneyland Hotel. Crt display, 64KB of memory, 630KB of diskette storage, ASCII keyboard, and 40-column alphanumeric printer are features of the unit. A basic system sells for $6,950 . . . COMPUTER PATHWAYS UNLIMITED, INC., Salem, Ore. (Booth 175), will show personalized microprocessor-based business systems for law offices, pharmacies, contractors' offices, and CPA offices. The basic law office system goes for $5,500 . . . DATA 100 CORP., Minnetonka, Minn. (Booth 2337), will bring its model 85-based remote information system to Anaheim. We wrote more on the model 85 last month (April p. 214) . . . DATAPRODUCTS CORP., Woodland Hills, Calif. (Booth 1562), will show the newest addition to its B-Series of character-band line printers. The B-600, rated at 600 lpm, includes a microprogrammed controller built with bit-slice architecture . . . DATAWARE, INC., Tonawanda, N.Y. (Booth 2749), will explain its source language conversion capabilities, including RPG II to COBOL, AUTOCODER to COBOL, and assembly language to COBOL translation by computer . . . DELTA DATA SYSTEMS CORP., Cornwells Heights, Penn. (Booth 2549), will have on hand its Delta 7000 intelligent terminal. Based on a 16-bit Texas Instruments 990/4 microprocessor, the terminal's operating characteristics are selectable from the keyboard. In lots of 10, the 7000 sells for $3,500 . . . DIGITAL COMPUTER CONTROLS, Fairfield, N.J. (Booth 3027), will demonstrate the business systems it markets through a network of distributors. Among the interactive systems on hand will be the entry level Synergist 1500, based on Data General's MicroNova, and the Synergist 3700, a 17-user system built around a Nova 3/D. Prices range from $15,000 to $75,000 . . . DIVA, INC. Eatontown, N.J. (Booth 1163), will spotlight its DD 70 series of disc subsystems, which use a controller that interfaces to a PDP-11/70's cache bus controller. A functional replacement for DEC's RPO4 and RPO6 drives, the system can have as many as eight 80MB to 300MB drives . . . INFODETICS CORP., Anaheim, Calif. (Booth 3222), can't bring its automated document storage and retrieval equipment to the show (too big and too little time to install it), so it's doing the next best thing: it's going to take interested parties about a mile or so across town to its plant. While there, visitors can see the models 410/45 and 410/50 systems put through the paces. The model 45 can automatically store and retrieve aperture cards (up to 200,000); the model does the same thing with as many as 150,000 microfiche. Pricing starts at $275,000; delivery takes nine months . . . LEAR SIEGLER, INC./ELECTRONIC INSTRUMENT DIV., Anaheim, Calif. (Booth 1519), will debut a handful of products at the show. These include the ADM-31 and ADM-42 smart editing terminals, the 300 series 180cps, bidirectional impact printer, the VDP-410 terminal controller, and the VDP-1000 intelligent terminal system. From what we can learn the VDP-1000 will have a 200nsec, 16-bit processor, and it will be programmable in BASIC, COBOL, and an ALGOL-like proprietary language known as ASGOL . . . MAGNAVOX DISPLAY SYSTEMS, Fort Wayne, Ind. (Booth 3410), will show a plasma display graphics terminal. The Orion-60/53 is programmable in BASIC, has floppy disc storage and, by virtue of the plasma display screen, supports rear projection of 35mm slides on a random access basis. The price tag reads $14,000 . . . NATIONAL SEMICONDUCTOR CORP., Santa Clara, Calif. (Booth 4135) will show a low-profile packaged 8080A-based microcomputer which sells for $1,345. The unit requires only 3½-inches of panel space, and mounts in a standard 19-inch rack. A 2KB monitor ($200) is available in ROM. Other micro-related products will fill out the display . . . NIPPON PERIPHERALS LTD., Kanagwa, Japan (Booth 4337), plans to introduce its NP25 317.5MB disc drives to the U.S. market. A dual spindle configuration doubles the capacity to 635MB. Additional specs and pricing weren't available at press time . . . TELERAY, Div. of Research Inc., Minneapolis, Minn. (Booth 1743), will introduce a smart crt, the model 1061, sporting full cursor control (including x-y positioning), a variety of display attributes, and a keyboard with numeric pad and eight function keys. The microprocessor-based terminal has editing capabilities: clear page, to end of line, to end of page; insert character or line; and delete character or line . . . SWEDA INTERNATIONAL, INC., Pine Brook, N.J. (Booth 1768), will show its model 1560AS reader/punch. The unit perforates tape at 60cps, and can read at up to 240cps. It supports RS232 communications at up to 4800bps. The unit sells for $2,250, with quantity discounts available . . . THE SPACE BYTE COMPUTER CORP., Los Angeles, Calif. (Booth 7), will show its 8085-based modular business computers. System hardware includes processor with 16KB of static memory, Hazeltine 1500 crt terminal, iCOM 3712 dual floppy drives, and a floor stand. A floppy disc operating system is included, as is accounting software. Optional software includes disc-extended BASIC, CP/M, and FORTRAN-80. A typical system sells for $5,900; marketing is through computer retailers.

Maxell double density floppys. When the data is too important to lose.



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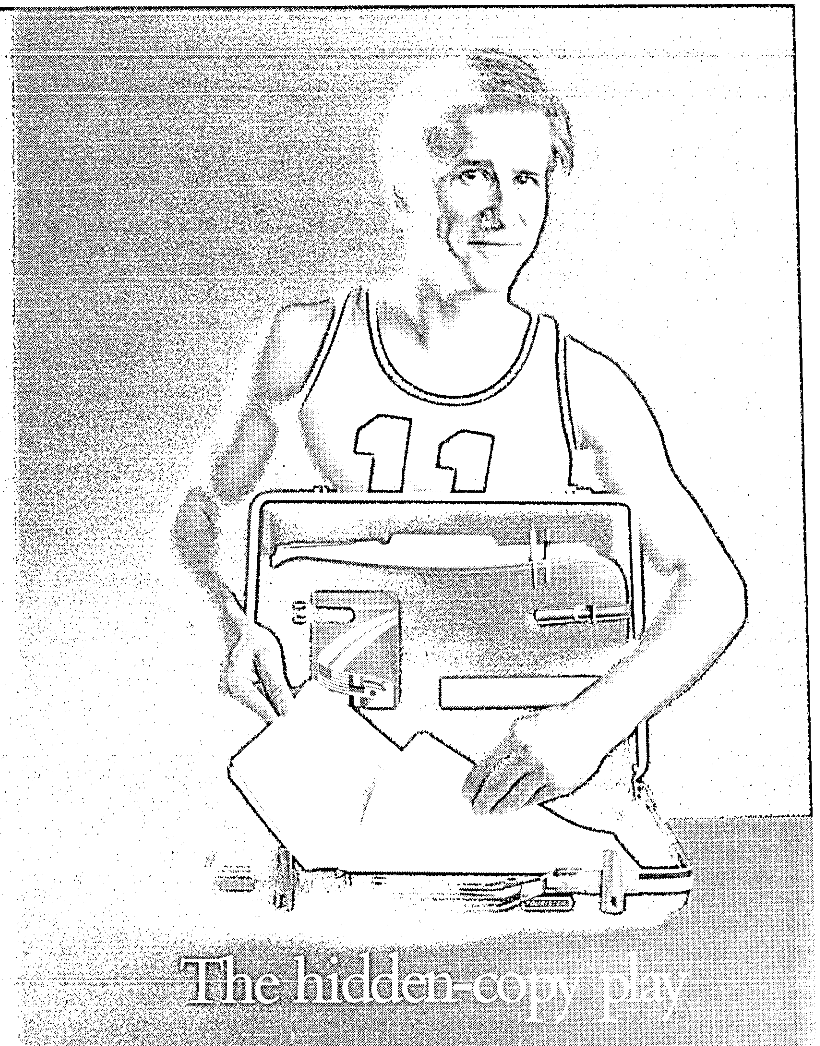
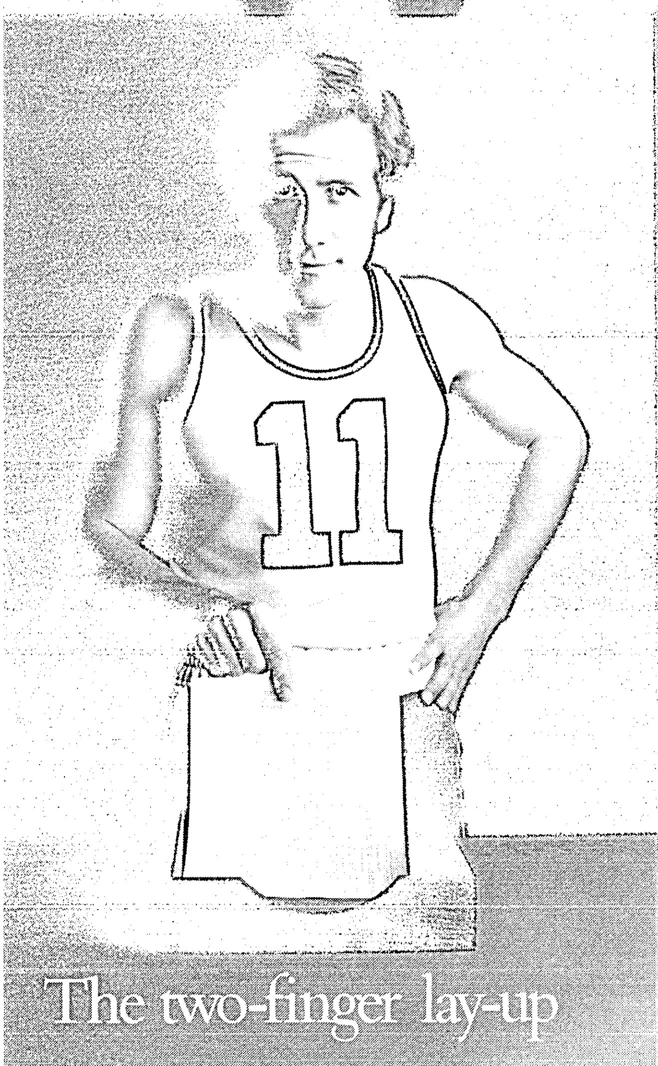
CIRCLE 51 ON READER CARD

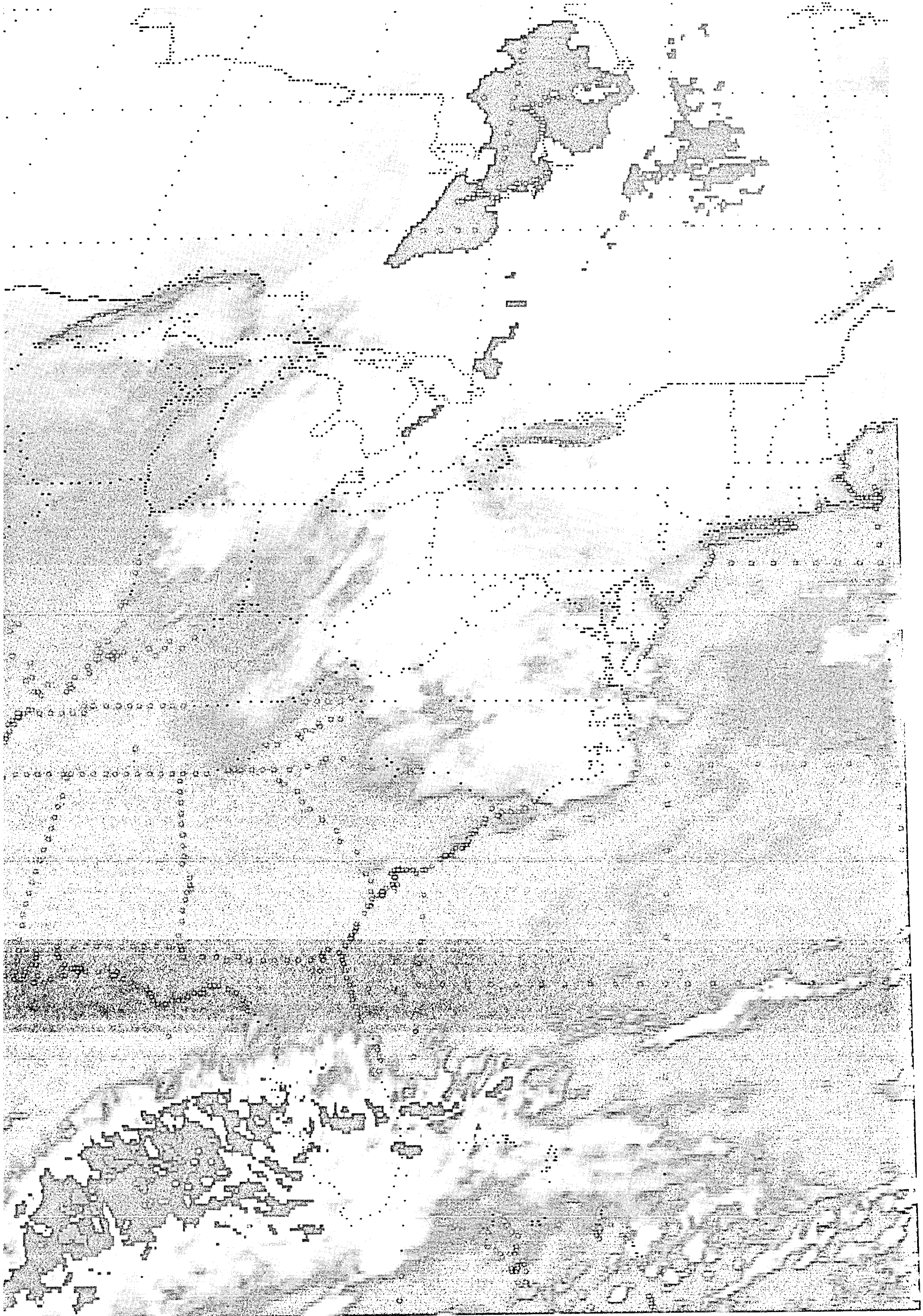

The fast break

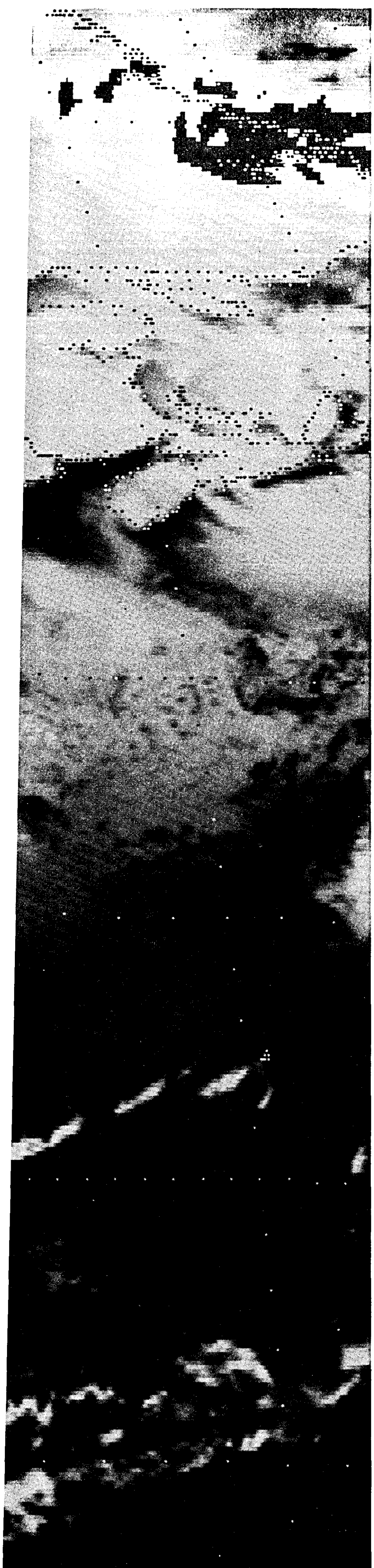

The hidden-copy play


The two-finger lay-up


The one-handed pass

CIRCLE 7 ON READER CARD





When computers were new, one of the first applications tried on them was weather modeling. But early machines weren't big enough. Now "fifth generation" supercomputers are available. They're still not big enough.

Modeling the Weather

by Francis J. Balint

Tucked away in a federal building at Suitland, Maryland, a suburb of Washington, D.C., is one of the largest computer centers in the United States. While the existence of the center is known to very few, almost everyone is aware of its products, the daily weather forecast and satellite movies.

The center, which uses three IBM 360/195s for its major computer power source and some two dozen smaller mini- and midicomputer systems for pre- and post-processing of weather data, is one of two major computer centers operated by the National Oceanic and Atmospheric Admin. (NOAA) for meteorological modeling. The other is located at the NOAA Geophysical Fluid Dynamic Laboratory (GFDL), Princeton, New Jersey, and is primarily concerned with research dealing in global, general circulation models of the atmosphere.

The basic approach used for both day-to-day operational and research weather forecasting is the solution of a set of finite difference equations which attempt to simulate the activity of a fluid medium—in this case, the atmosphere. This mathematical modeling is similar to that used for petroleum reservoir analysis, wind tunnel analysis, and nuclear modeling, making very large computer systems equally important in all these areas.

Dividing the world

The simulation scheme used for meteorology divides the atmosphere into three-dimensional units resembling rectangular blocks which cover the globe in two dimensions and extend vertically over 50,000 feet from sea level. Each of these blocks has data describing atmospheric conditions at its center which were derived from data for each of its corners. The size of these blocks determines, for the most part, the speed of the computer necessary to solve the system of equations which make up the model.

The two-dimensional horizontal coordinates of the blocks form a grid network which covers the area of interest to the modeler. For many of NOAA's operational models this grid covers only the Northern Hemisphere, while for other research and operational models it covers the entire globe. Thus, if we were to look down upon the earth from space, and if the sides of the grid were visible, the surface of the earth would appear to be covered with a two-dimensional screen-like mesh.

One center has three IBM 360/195s and two dozen smaller machines.

The size of the mesh may be described, according to a convention suggested by the GFDL, as a number of concentric circles dividing the area between the poles of the earth and the equator, or in terms of kilometers at a given latitude in the Northern Hemisphere—for example, as having a grid size of 300 kilometers at 60° North latitude.

When using this latter method of size description, it is necessary to state both the distance between the grid points and the specific latitude since the grid size will vary for a given latitude; this is a result of distortion introduced by the use of the polar stereographic projection used for Northern Hemisphere modeling.

The third dimension of our imaginary blocks is the vertical levels or layers into which the modeler divides the atmosphere. While the definition of the number of layers of a model may vary from one modeler to another (for example, some modelers count the earth's surface as the first layer; others do not), we will define a one-dimensional system as one having only one layer of imaginary blocks. Thus, a 12-layer model would be one such that at any one point there would be 12 imaginary blocks stacked on each other.

Increasing the number of levels or decreasing the mesh size causes a significant increase in the size and power

Doubling the resolution of the models would lead to a fourfold increase in memory, an eightfold increase in auxiliary storage, and a sixteenfold increase in computer power required.

of the computer required to solve the model. There is also the time factor to be considered when sizing a computer system. In fact, time is involved twice. First, the computer system must be powerful enough to produce a useful forecast well in advance of the actual weather occurrence. Second, operational forecasts must be made within a rigid time schedule so that users will get it on a predictable basis. Mesh size, the number of levels, the forecast range (in days or hours), and the schedule all must be balanced against the size of the available computer system.

Supercomputers not super enough

To give some idea of the impact on the size of the computer, of changing just one of these dimensions, scientists have estimated that doubling the resolution of a model without changing the time elements involved would require a fourfold increase in central memory, an eightfold increase in auxiliary storage, and a sixteenfold increase in computer power!

But more important, meteorological modelers are also convinced that doubling the resolution of current models would improve the usefulness and accuracy of the information produced by the model. Scientists see a significant gain possible using current modeling strategies, but cannot achieve it with today's computers.

This requirement for supercomputers to solve weather models is well known in the industry. Each time a new supercomputer is announced, the manufacturer suggests that among its many intended uses is meteorological modeling. This is a reasonable marketing strategy not only because the utilization of the very largest computers has led to significant forecasting advances, but also because even the most powerful of today's computers is far too small for projected requirements—such as for making accurate 14-day weather forecasts.

Parallel array processors and vector pipeline computers do appear to hold great potential to meet NOAA scientists' need for more computer power. Indeed, at first glance the repetitive mathematical operations dealing with long strings of data seem to be tailor-made for multiple-pipeline processors. However, mathematically describing the physical attributes of our environment by including oceans, mountains, radiation, etc.—all of which are needed for an improved simulation—introduces more *scalar* operations.

A supercomputer which has extremely fast vector operations but slow scalar speeds may not be able to meet the execution speeds required by the modeler. Such a machine forces the modeler to make an arbitrary reduction in mathematical descriptions since the better the real life situation is described mathematically, the slower the model will execute on computer systems designed for high speed vector operations. This is true even if the grid size and number of vertical levels are kept constant.

Meteorologists have always been waiting for bigger machines, and for some time have related their models to the available computer power. For example, first generation atmospheric models were executed on first generation computer systems. It should be pointed out, however, that computer generations have a somewhat different meaning to NOAA scientists than to computer manufacturers' marketing departments.

In our system, a new generation of computers begins with the delivery of a computer which is about five times more powerful than the most powerful system previously available. Table 1 shows that this has happened about every five years, beginning about 1955. The cost of the newer top-of-the-line system as compared to the cost of the previous system usually has not significantly increased (ignoring inflation), particularly since 1965.

Table 1 is based on the computing systems that NOAA has used or is using today and represents a history of large scale computing in NOAA.

Starting with von Neumann

The organization responsible for operational forecasting in NOAA is the National Meteorological Center (NMC) of the National Weather Service. Using an IBM 701, NMC began with very primitive weather models first programmed for an electronic computer at the Institute for Advanced Study in Princeton by John von Neumann, Jule G. Charney and others in 1950. The center has progressed to using a very sophisticated set of operational models.

Fig. 1, which was developed by Dr. Frederick G. Shuman, Director of NMC, relates various operational models, the computer systems in use, and the "skill" of the model in predicting the weather. A score of 100 is given for a near perfect forecast while a score of 0 is for a worthless one.

Two aspects which are not clear from the chart should be pointed out. First, in relating Fig. 1 to Table 1, it can be seen that model implementation lags the installation of a new computer system by a couple of years. Second, while only one physical computer is used for operational modeling, Suitland's workloads have resulted in the installation of three CDC 6600s during the years 1965 to 1968, and three IBM 360/195 systems beginning in 1973. It is not the lack of hardware but the reliability and backup arrangements necessary to meet schedules that restrict models to operation on single systems.

NOAA's strategy for introducing new computers into the operation is to attempt to provide the maximum capability possible with an assurance of excellent reliability. Since reliability generally increases in proportion to the time the computer system has been in use, new, low serial-numbered systems are avoided at Suitland. While this does prevent us from taking immediate advantage of the latest equipment, it

Generations of Computer Systems

System	Generation	Announced	Power
IBM 704	1	1955	1
IBM 7090	2	1960	5
CDC 6600	3	1965	25
IBM 360/195	4	1970	125
TI ASC	5	1975	625
?	6	?	3125

Table 1. New generations of supercomputers (where a "generation" is defined as having a machine five times as powerful as the most powerful previously available) have come out at about five year intervals. It now seems clear that the sixth generation will come on schedule.

also assures our ability to meet commitments.

In research, the requirement for reliability is somewhat less. Thus NOAA is able to consider using equipment with low serial numbers when determining the trade-off between power and reliability. And so NOAA's Geophysical Fluid Dynamic Laboratory (GFDL) at Princeton historically has been one of the pioneers in the use of new supercomputers.

The history of GFDL computers extends from IBM's Stretch in the '60s to the installation of a Texas Instruments

The effective speed of the Texas Instruments ASC 4X is "only" about four times that of an IBM 360/195.

4X (four-pipeline) Advanced Scientific Computer system in the early '70s.

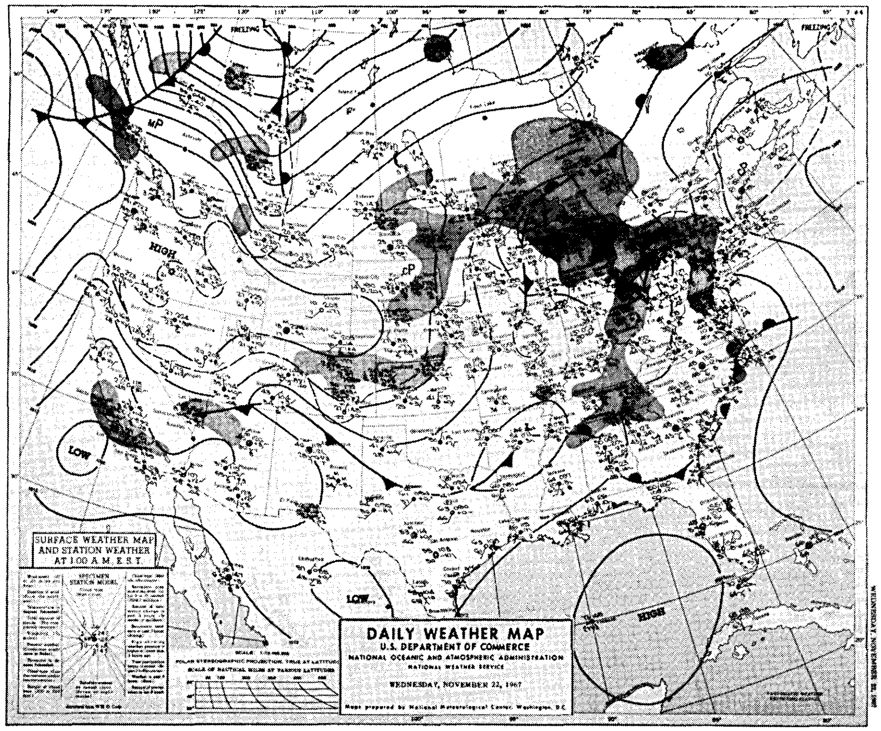
The TI ASC 4X is a complex computing system developed around pipeline logic implemented in integrated circuitry and bipolar central memory. This fifth generation system has demonstrated speeds up to 20 times faster than an IBM 360/195 on certain vectorized code; but the lack of a special processing unit for scalars slows the effective execution speed to "only" about four times that of an IBM 360/195—which is close to our projections for a fifth generation system as shown in Table 1.

The ASC 4X was a significant advancement not only in hardware, but also in software. The system's FORTRAN compiler (FORTRAN is the language used by all NOAA modelers) has sophisticated vector handling capabilities which permit us to program in a high level language and still be assured that the inherent speed of the system will be realized.

The ASC 4X is an outstanding example of combining computer architecture and electronic componentry to meet our requirement for more computing power. Part of its power derives from its design rather than from its circuit speeds. Improved strategies of architecture and configuration can increase our effective execution speeds and thus are as important as raw cpu speeds. We are interested in the number of answers per second produced by a computer system, not solely in the number of operations per second.

In summary, NOAA has essentially stayed on its plan, as expressed in Table 1, for installing and using computer equipment, particularly for research. The single-purpose orientation of the researchers has enabled NOAA to meet its goals for a fifth generation system and to begin looking for a sixth.

We have not been as fortunate in the operational side of the organization, even though the need of the modelers in



Much of the output of NOAA's National Weather Service branch goes out on telecommunications lines from Suitland in the form of digitized weather maps. TV stations, among others, pick up the broadcasts.

this area is as great as that in research. The requirement for a real-time, general purpose system, and the lack of generally available and proven fifth generation systems have slowed our replacement cycle.

To better understand those complexities, let's examine in greater detail the computer requirements placed on the Suitland Center by one of its larger users, the National Meteorological Center (NMC) mentioned earlier. NMC is

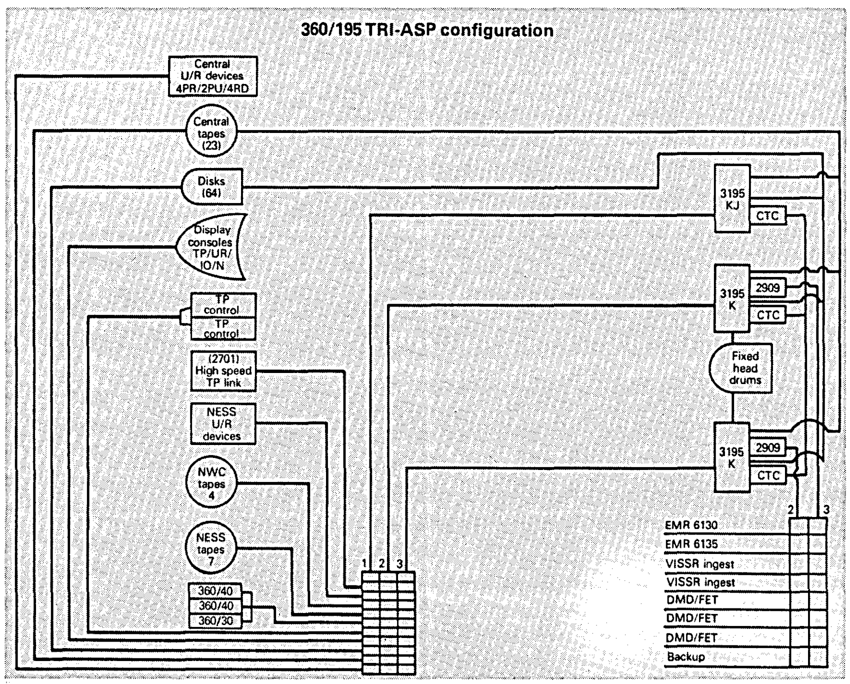


Fig. 1. The NOAA center at Suitland runs three IBM 360/195s—each good for some 12-15 million instructions per second—and two dozen smaller computers. Since it is responsible for reliable and timely weather forecasts, this installation is somewhat conservative in its hardware choice. NOAA's research lab in Princeton is more willing to take chances on low-serial number machines; it runs a Texas Instruments ASC four-pipeline machine with an internal processing rate greater than that of the three 195s together.

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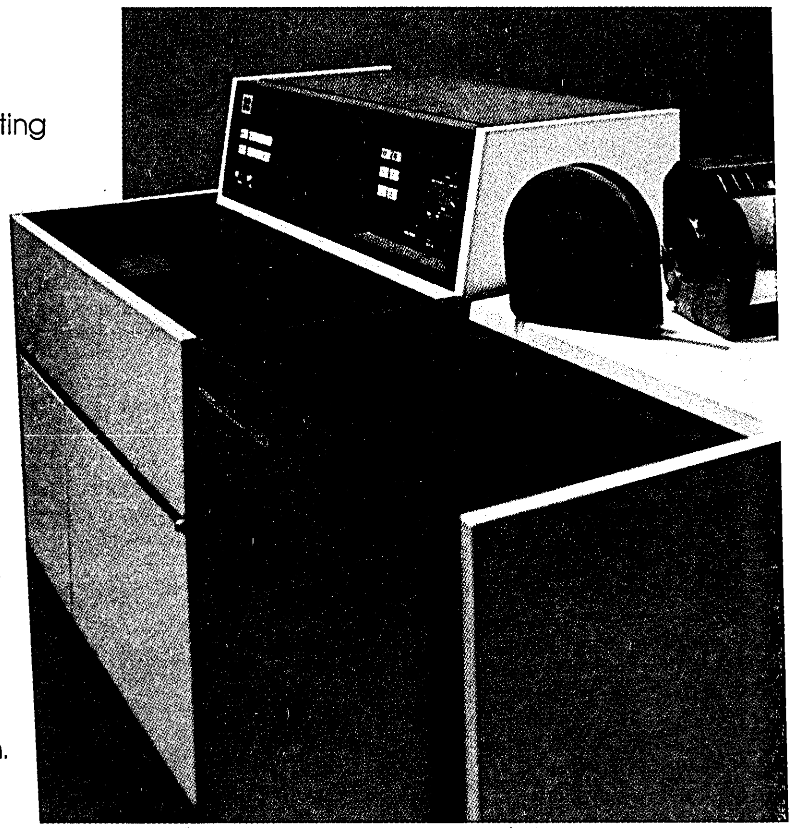

Consider the operating cost of the Kodak laser printer versus the operating cost of a paper-impact printer.

Consider, for example, the cost of generating a 1000-page, 3-copy report.

Three-part stock paper costs about \$22.30* per 1000 pages. But you can put the same report on microfiche for around \$1.50.

So, from the standpoint of materials alone, paper is about 15 times more expensive than microfilm.

Time and labor costs are important factors, too. Especially in a DP department. Which is why you should know that it would take almost 50 minutes to decollate, burst, bind and package a 1000-page report. It would take only 9 minutes to print, duplicate and package the same report on just 4 microfiche.

A Kodak laser printer can save you money in other ways, too. With a paper printer, you'd have to load at least 12 boxes of paper to print the equivalent of one cartridge of 16-mm film. Compared with fiche, the margin of difference is even wider. You'd need 31 boxes of paper to print the equivalent of one fiche cartridge.

87% cheaper.

In fact, when you add up the savings in materials and labor, you'll find that printing with a Kodak Komstar laser printer is about 87% cheaper overall than printing with a paper-impact printer.

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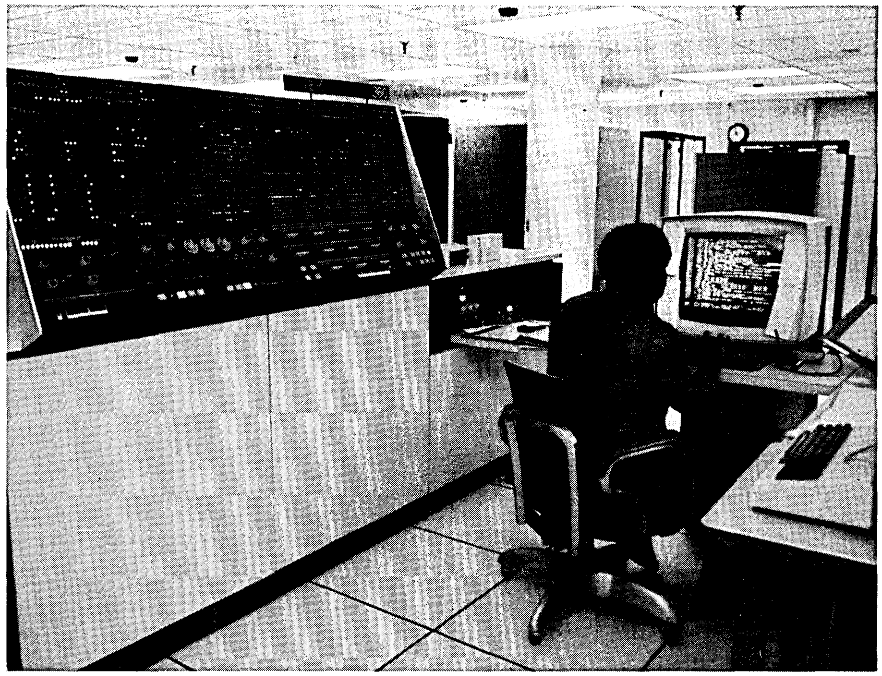
responsible not only for forecast modeling, but also for collecting weather data and distributing weather forecast information. To put operational modeling in proper perspective, we should first understand how the daily weather forecast cycle functions.

Herculean data collection

Twice daily, 365 days per year, worldwide weather data is collected by airplanes, ships, satellites, and ground stations and communicated to Suitland begining at 00:00 and 12:00 Greenwich Mean Time. These are referred to as "synoptic" times since at these times 800 to 900 weather stations throughout the world take temperature, humidity, wind direction, wind speed, and air pressure measurements from the earth's surface to above 100,000 feet and then begin to transmit these readings to NMC.

In addition to these fundamental and key data, NMC receives data from over 5,000 world weather stations four times per day; ocean data from the Coast Guard, ocean bouys, and over 2,500 ships; and over 1,200 observations from worldwide aircraft every six hours.

Data is also received about every two hours from polar orbiting, sun-synchronous satellites, and every half hour from two geostationary satellites. The satellites are managed by the National Environmental Satellite Service, a NOAA component which is also a very large user of the Suitland center. This is the group which provides the digitized satellite photos, like the one on p. 130.



NOAA's three IBM 360/195s are run from a single console under the control of the ASP operating system.

From each weather forecast cycle, about 500 weather charts and 2,000 frames of digital facsimiles are distributed to 52 regional forecast offices and 250 smaller service offices, where they are used for guidance for local forecasting.

Other weather information is distributed on both domestic and international transmission circuits which vary in capacity from 60 baud start/stop asynchronous speeds up to 4800bps dedicated synchronous systems. These circuits provide weather data to the Associated Press, United Press and airlines such as TWA, United, Japan Air, Braniff, and Air France—and stretch from Melbourne in the west, Moscow in the east, Helsinki in the north, and Buenos Aires in the south.

Hardware to match

The collection of this data on a near real-time basis is a herculean task requiring a widespread and reliable international telecommunication network. Directing both the collection and distribution communication tasks are

OPERATIONAL WEATHER FORECAST MODELS

STARTING TIME AFTER 00:00 AND 12:00 GMT	MODEL NAME	AREA COVERED	ATMOSPHERIC LEVELS	GRID SIZE	FORECAST PERIOD	APPROXIMATE WALL CLOCK TIME ON 195
01:15	BAROTROPIC-MESH	NORTHERN HEMISPHERE	2	381km AT 60°N	48 HOURS	20 MINUTES
01:30	LIMITED FINE MESH (LFM)	NORTH AMERICA	6	190.5km AT 60°N	48 HOURS	2 HOURS
04:00	7 LAYER PRIMITIVE EQUATION (7LPE)	NORTHERN HEMISPHERE	7	190.5km AT 60°N	84 HOURS AT 06:00GMT 48 HOURS AT 12:00GMT	4 HOURS 2½ HOURS
07:30*	MOVABLE FINE MESH (MFM)	3,000kmX 3,000km	10	60km	48 HOURS	1 HOUR
10:00	9 LAYER GLOBAL (9LGLOBAL)	GLOBAL	9	2.5° LATITUDE	6 HOURS 18 HOURS AT 18GMT	20 MINUTES

*run only when special weather problems exist

Table 2. Model sizes are held down so that each operates in a single cpu. This means that more than 10 hours of processing *must* be turned around in each 12 hour cycle; and since three of the models take over 2 hours each, there's little room for a failure.

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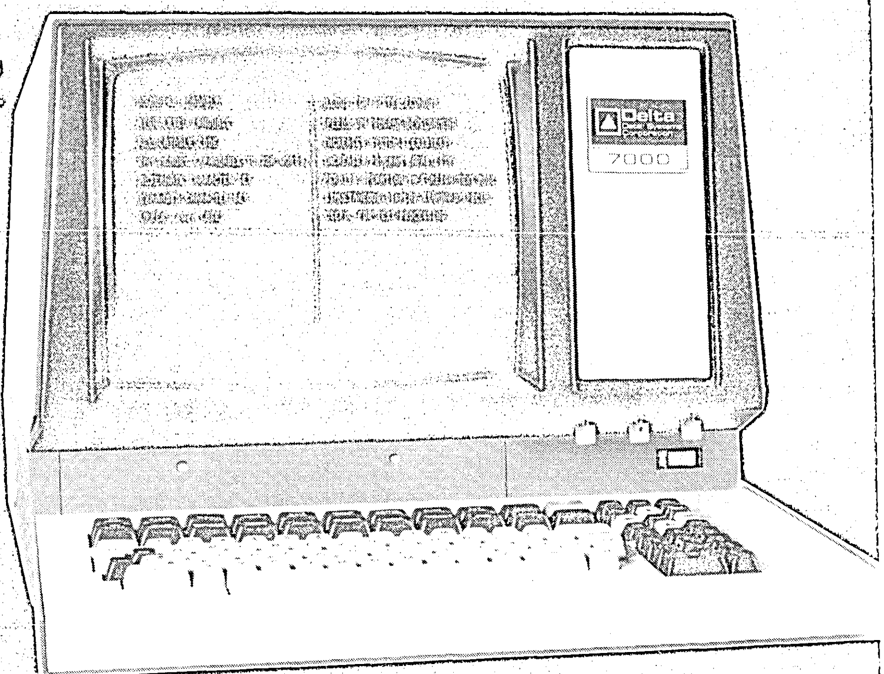

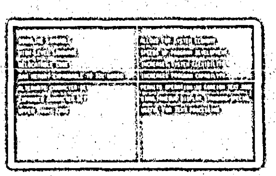

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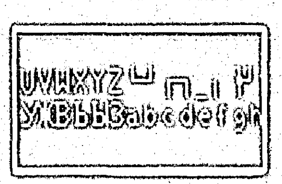

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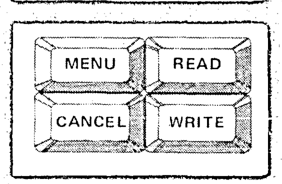

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three IBM 360/40s, which are channel-connected to the 195s.

Information received by the 40s is decoded and checked in preparation for entry into the operational models. As with any model, the better the input data, the better the simulation. However, schedules often prevent NMC from waiting until all data is in before executing the model. Missing input can be simulated by combining the output from a previously executed model and the data received up to start time.

Three IBM 360/40s act as front-ends for the 195s.

The 195 uses ASP and OS/MVT Version 21.8 control software (not VS). One of the 195s acts as the master machine, scheduling the work load for the other two support systems. All work is entered into the system in a single input queue. All of the peripheral devices, including 10.9 billion bytes of removable disc storage, are accessible by all three 195s.

Of the 12,000 jobs which are entered into the system each day, 95% come from remote terminals. In fact, the daily weather forecast cycle is initiated from a terminal located some five miles from the computer center. (The 195 software also includes TSO which is used by the modelers for new development and testing modular changes to operational models.)

The forecast models are not individual single purpose programs, but rather sets including programs for input analysis and graphical output as well as for model calculations.

For example, the seven-level "primitive equation" model is actually made up of over 400 FORTRAN programs which are run as 30-some jobs using the network feature of OS/MVT. Each of the 30 jobs can contain up to 20 job steps or programs.

The 30 jobs are functionally related so that the result is a structured system easily understood and managed. This method of netting the job together not only adds a measure of control by permitting conditional execution of a job, it also greatly reduces the OS and ASP job handling overhead as we sequence through the system.

Still, each model depends upon the timely and successful completion of the preceding model, and one cycle requires about ten hours to complete, so there is little room for error.

And massive models

Table 2 provides an overview of the features of the operational models now used in one cycle and indicates how they are scheduled.

The Barotropic-mesh model, the most elementary of the operational models, is the first one run. It includes very little simulation of physical effects, like those related to topography, and is used primarily to provide a crude, early prediction. It is started about 1½ hours after synoptic time, and provides the forecaster with considerable understanding as to developing situations in the atmosphere.

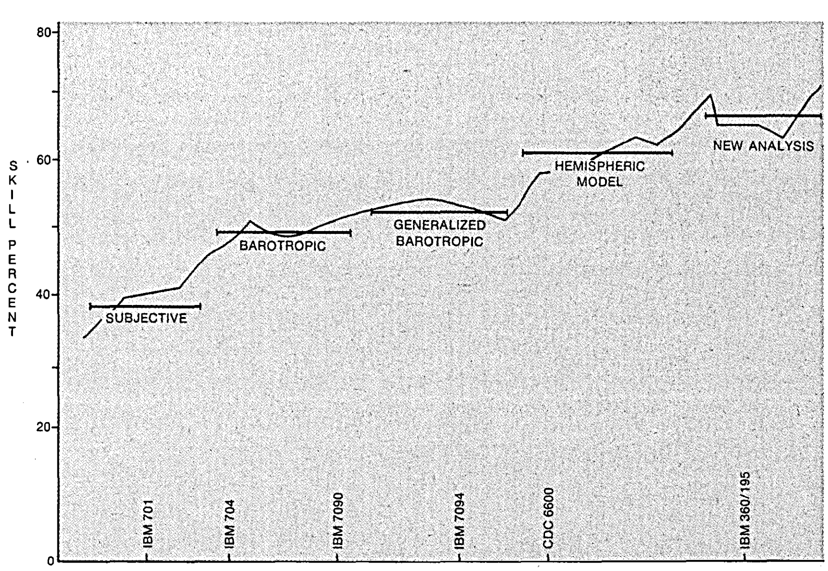

Fig. 2. New meteorological models lag the introduction of new computers by several years, but the trend is clear: bigger models on bigger machines are more accurate at predicting the weather. (The skill percentage shown is based on a scoring system devised by Teweles and Wabus in 1954 as a measure of normalized error in predicting high and low pressure areas.)

The next model run is the Limited-area, Fine-mesh Model (LFM) which provides most of the guidance for domestic weather forecasting. This model is particularly important for forecasters along the east coast of the United States since its results can be made available so early. Unlike the quick and dirty Barotropic-mesh model, this one includes simulation of several physical effects including those of topographical features like mountains and oceans.

Until January 19 of this year, the Six-Layer Primitive Equation Model (6LPE) was the primary forecasting model for the entire Northern Hemisphere. That was where most of our radio and tv weather forecasts came from. On that date, this important and long-standing model was replaced by a refined seven-layer version, 7LPE. In addition to adding another layer in the stratosphere, the new model has a horizontal spatial resolution equal to one-half of the grid increment of the older six-layer model.

But while the new model has demonstrated consistent improvement in the atmospheric flow-pattern predictions, such as who's going to get the rain next, it has shown only small improvements in precipitation reports—the "how much" part. Nevertheless, the atmospheric modelers and operational forecasters are very impressed with it.

The results of this model are particularly important to commercial aviation, maritime interests, and international users. Output from the 84-hour run is used as input to the Barotropic-mesh model which provides prediction information up to 168 hours in advance.

Its biggest problem for us is that it takes longer to run, which makes squeezing it into our already tight schedule very difficult.

The fourth operational model is the Movable Fine-Mesh Model (MFM) which was originally developed to predict the paths of hurricanes. It is the most highly resolved model run on the 195s with 10 layers and a mesh size of 60 km. It covers an area about the size of the 48 contiguous states and is only run when made necessary by some unusual weather activity—hurricanes, flash floods, etc.

The beauty of this model is that the mesh may be moved to that area which is experiencing the unusual weather. For example, it can be executed so that its center coincides and moves with the center of a hurricane.

The last operational model, the Nine-Layer Global model (9LGLOBAL) is the only global model that is run operationally. It is mathematically similar to the 6LPE but its grid points are separated by a uniform latitude and longitude interval of 2.5° (roughly 166 miles by 166 miles). The 18-hour forecast produced by this model provides backup for the 6-hour run made during the first

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forecast cycle.

While not part of the regular operational string, another new operational model must be mentioned. Until recently, NMC did not use models to forecast beyond five days. Now, however, NMC has gained enough confidence in a new model developed by Lloyd Vanderman to run a mid-range forecast three times per week (extending the forecast from the sixth through the tenth day). The model produces 6-10 day maps which are transmitted along with other maps over the NWS facsimile circuits.

An extra minute gets an extra hour

One of the more interesting new models under development is the Nested Grid Model (NGM). Not only are the mathematical techniques used in this model different from the other operational models, but it also can use three different sizes of nested grids, 448 km at 60°N covering the hemisphere, a double resolution of 224 km at 60°N covering a smaller area, and a very fine resolution of 112 km at 60°N for an even smaller area. Both of the smaller grids are movable so that they could be concentrated on the "problem of the day."

This model, when fully operational, will perform the functions of the LFM and the 7LPE. Its three different grids are fully interactive, too; calculations from the finer grids are fed back into the coarser grid calculations and vice versa. Finally, it handles 8 to 10 vertical levels.

The constraints placed on the development of this model are that, when operational, it must not add more than 48 minutes of wall clock running time for each 48 hours of forecast, and must cover the Northern Hemisphere. This will be difficult to achieve using the 195 or any other fourth-generation computer.

Other facilities are being developed to improve the accuracy of weather models, too. For example, there is mounting evidence that the improvements in weather prediction can be achieved through a reduction of truncation error. This purely mathematical error occurs when finite-difference equations are used to replace derivations in the basic modeling equations. It is introduced because we replace the continuous analog of reality of the world with discrete digital approximations.

One way to reduce truncation error is by reducing the grid space; but, as mentioned before, this is expensive in terms of computer resources since dividing the grid interval in two increases the computing power requirement by eight, other factors being unchanged. Two other ways now being pursued are making more accurate estimates of the derivations and using spherical harmonics.

Numerical analysis, improved performance measurement techniques, and increases gained from modular hardware and software upgrades do help us in overcoming current schedule problems, but they cannot provide the significant increases in power that we need for future models. It has been estimated, for example, that a global model which has a one-half degree of longitude resolution and 18 layers would require three full days of calculation for a 21 day forecast—even if we were using a sixth generation computer system!

Already looking at models which will require three full days of processing on sixth generation computers—when we get them.

Such a model could not even *influence* operational models before being used in years of study and repeated executions to help us understand climatic evolution and stability.

Even longer experiments must be run before we begin to understand whether the meteorological phenomena we see are a natural variance from the norm or whether they signal a new trend. A good example of this is in the current speculation about a coming "ice age." Much of this speculation is based on our last two winters. Both were unusually severe; but it is possible that they were just unusual deviations from average and not harbingers of something worse to follow. The point is that without some very long experiments using very large models on very large machines, we can't say.

Never enough machine

Experimental models now appear to have considerable skill in forecasting the weather when compared with actual surface temperature and precipitation. NOAA scientists are sufficiently encouraged to expand their previous limit of five days for useful predictability. Without reliable and proven fifth and sixth generations of computer systems, however, they will be unable to put these newer models into operation. Can we expect such systems to be marketed in the future?

Willis Ware pointed out several years ago ("The Ultimate Computer," *Computers and Automation,* April 1973) that we are a long way from the ultimate computer, which, by the way, he indicates may be capable of handling $2x10^{47}$ bits per second per gram of its mass. While a computer of this power is well beyond our present conception, I agree with Dr. Ware's opinion that we can proceed a long way before we reach a serious limit if we are willing to make the resource investment required. Computers ten thousand times faster than are available today are, as Ware points out, "neither impossible nor unreasonable" to build.

In his book, Kenneth Thurber likewise is optimistic about the future possibilities of computing (*Large Scale Computer Architecture,* Hayden Book Co. Inc., Rochelle Park, N.J., 1976). He suggests that we will be able to achieve considerable power increases by greater utilization of Single Instruction Stream, Multiple Data Stream (SIMD) architectures. He feels that much of today's pessimism about the use of SIMD systems results from "the three-stage mathematical / algorithmic / programming filter through which our preception of nature has been strained."

New real-time requirements, effective use of very large scale circuit integration, and new architectures offer some fascinating possibilities for very large and powerful computers. The responses to a recent NOAA request for information concerning the development of sixth generation computing systems for the early '80s indicate that industry is developing systems which will meet our sixth generation needs. Further, we remain optimistic about the future availability of seventh and later generations of systems.

And when those super systems are announced, you can bet their vendors will include in their claims that one of the intended uses of Computer X is meteorological modeling. Now you know why. ⁂

Mr. Balint is the deputy director of the Office of Management and Computer Systems within the National Oceanic and Atmospheric Admin. (NOAA). In that position he is responsible for the overall management of computing and teleprocessing within the agency, including the operation of the two huge computer centers mentioned in the article.

Starting as a customer engineer for IBM in 1954, he came up through the ranks as a programmer, systems programmer, and later head of computer operations at Gulf Research and Development, joining civil service as chief of programming and systems for the U.S. Weather Bureau in 1965.

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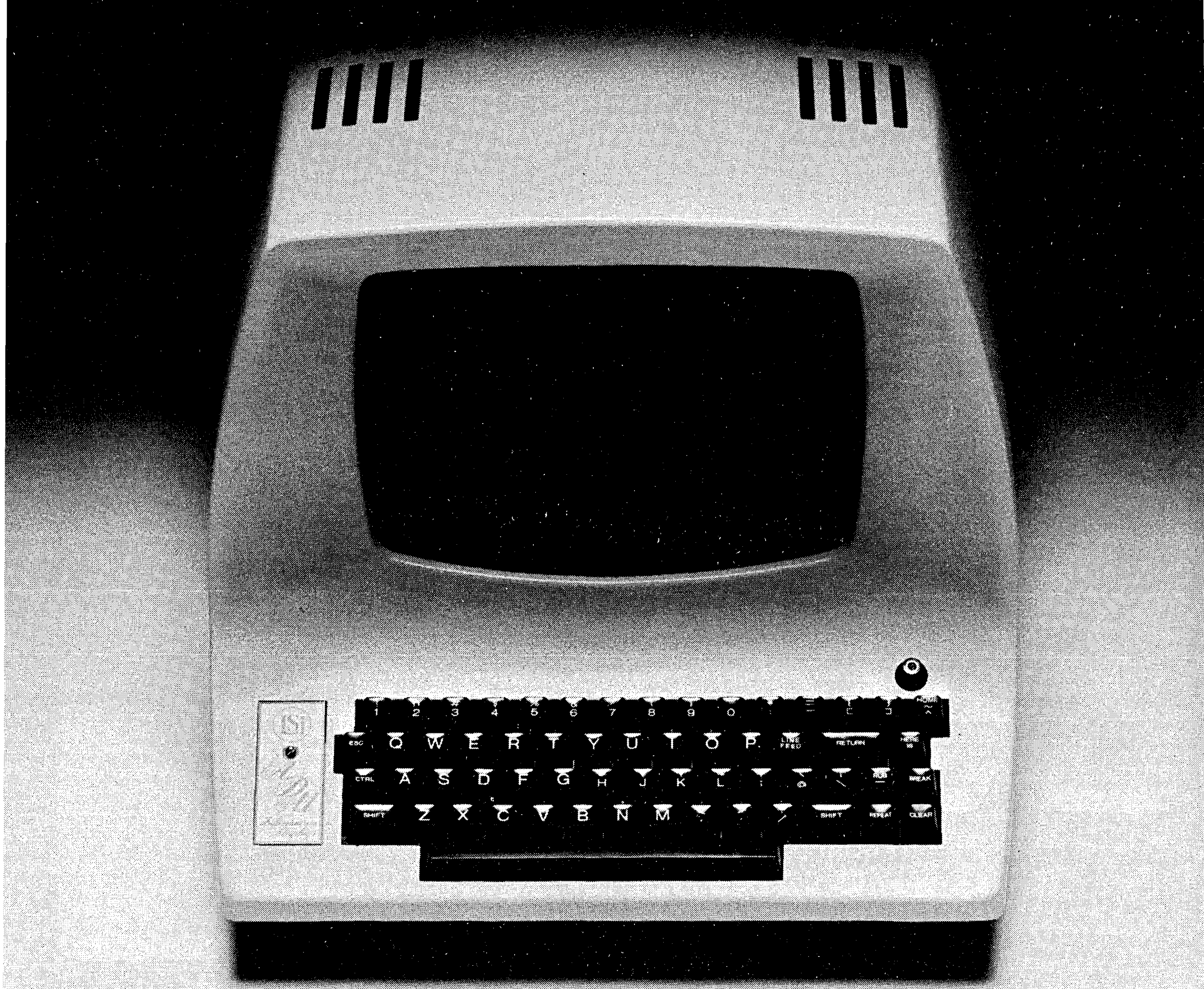

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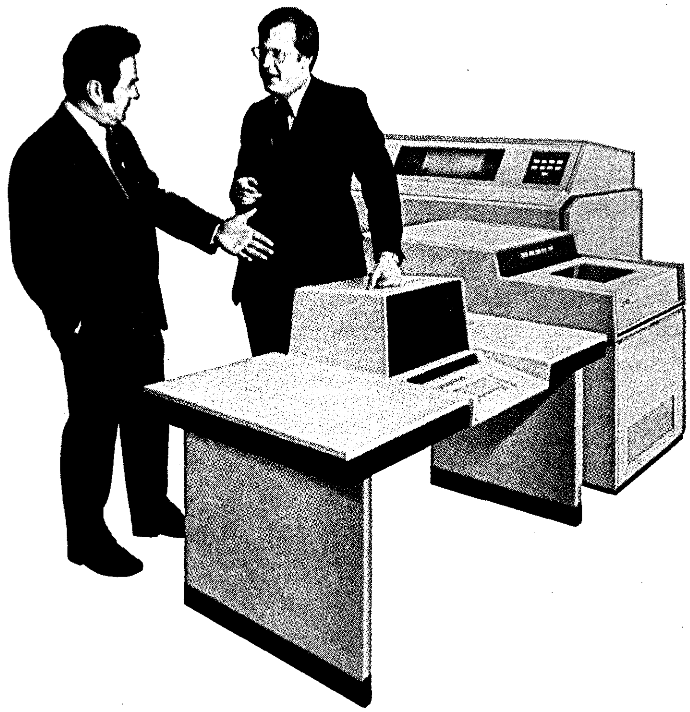

"NCR eased us through a period of exploding volume," says Joe Vitolo of fast-growing Bank Leumi Trust.

NCR's HANSON: Joe, how can you grow through four NCR computers in just three years?

VITOLO: Well, it's a great story, Tom. The answer is rapidly increasing volume. During those three years, Bank Leumi Trust enjoyed extraordinary growth. We went from just 6,000 to almost 100,000 accounts–from $250 million to $1.28 billion in assets.

HANSON: Did changing computers hurt your operations in any way?

VITOLO: Absolutely not. In fact, our operations actually increased in sophistication. During that same time frame, we became the first major New York commercial bank to go into full online operation.

HANSON: If I need an example of NCR's Migration Path Engineering, Bank Leumi may just be the best there is.

VITOLO: You're talking about the relatively easy transition from system to system?

HANSON: Yes. NCR builds more continuity into its systems than any other full-line mainframe supplier. We ease those painful conversions from our entry-level systems step-by-step all the way up to the biggest 8000 series systems, the Criterions. That's "Migration Path Engineering".

VITOLO: That's what helped make our speedy growth possible. We've gone from the NCR Century 101 to the Century 251 to the Century 300 to our present NCR Criterion–the 8570. Each time, we seemed to have capacity to burn. But our growth continued to surprise us.

HANSON: And what happened to your software as you changed systems?

VITOLO: Our basic software system didn't change. It just ran faster. We didn't have to rewrite it for the new system.

HANSON: But you did rewrite, eventually.

VITOLO: That's precisely the point, Tom, as you well know. We rewrote only when the application software was at the end of its normal life cycle – when we would have rewritten even if the hardware had not changed. The software was not obsoleted by the change in systems. And when we rewrote, we used the enhanced command structure of the larger system.

HANSON: And how does that experience compare with the jump from Century to Criterion, from generation to generation?

VITOLO: Exactly the same. The Criterion 8570 is a virtual machine, which means that it can function as a Century–it runs our old programs somewhat faster, and without modification. But when we rewrite our software, we will do it in NCR COBOL 74 to gain top efficiency in programming and operations both. Because the Criterion can operate as a COBOL 74 virtual machine, too.

HANSON: And you are still protected in case you continue to grow. There are two larger Criterions available.

VITOLO: And an even bigger family waiting in the wings, I understand.

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On the left is Joseph D. Vitolo, Executive Vice President, **Bank Leumi Trust Company,** New York, N.Y.; on the right, Thomas Hanson, NCR District Manager and Financial Systems Specialist.

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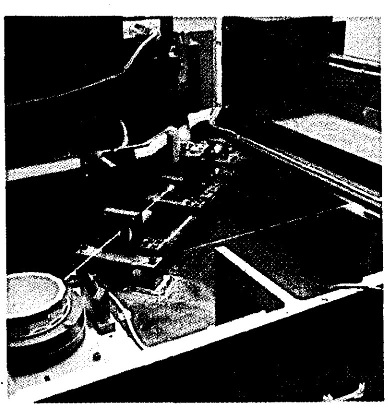

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When Digital Processing Meets Weather Imagery

by Robert Wallis

It's come a long way, but the image processing part of weather forecasting still has a long way to go. It will be the next revolution in meteorology.

Weather forecasting has certainly benefited from the introduction of larger and larger computers, but satellite technology is what has really revolutionized the practice. Not only meteorology and climatology, but agricultural planning, optimization of aircraft routes, and even commercial fishing have felt the impact of this new data collection tool.

And yet the part of the science that lags strangely behind is the analysis of weather imagery. This is because the entire system of image collection and distribution was developed before the advent of low cost minicomputers and digital displays, and because the production of forecasts could not tolerate the disruption which could result from continually following the latest technology. However, the advantages of an all digital approach to image analysis have now become so compelling that investigations into how to make the transition are underway.

Currently, line-scan image data received from weather satellites are transmitted from a central facility in Camp Springs, Maryland, to each of the six individual Satellite Field Service Stations over dedicated phone lines. The field stations are equipped with rotating drum recorders which are used to generate hard copies from the analog signals on the phone lines in a manner similar to that for facsimile transmitters. But in this case the copies are conventional, wet process, photographic prints like the one on page 000, and are used to make a variety of products. Among these are the popular "time lapse" movie loops from the stationary satellites, which have proved to be so useful in the study of weather pattern development.

The present analog film system is quite dependable, but it is slow, expensive, inflexible, and completely qualitative in that any interpretation of the photographs is done visually. But the weaknesses of the photographic system are precisely the strengths of the digital approach. Improved speed is important since meteorological data becomes obsolete quite quickly, and since minutes may make a difference in storm warnings. Then, too, due to the large volume of imagery, the cost of photographic processing is quite high—about $400,000 annually just for expendable photographic materials.

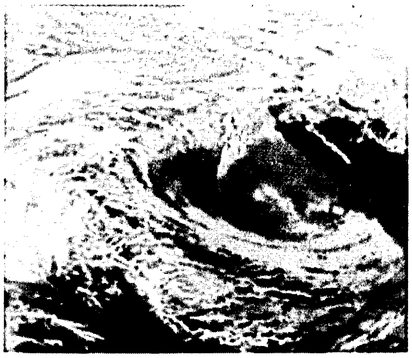
The present analog film system is quite dependable, but slow, expensive, inflexible, and completely qualitative.

Although an all electronic system would still require some conventional hardcopy, the photographic printing volume could be drastically reduced. The flexibility of interactive, minicomputer based analyst stations would be clearly superior. New analysis techniques could be implemented as soon as they were developed, and software could be easily shared among the Field Service Stations or other potential users.

While many digital image processing procedures may be implemented photographically, the digital implementation is considerably less tedious, and absolutely repeatable. Perhaps more important, an analyst may *interactively* manipulate imagery, using a wide variety of techniques, to extract a more meaningful representation of some feature. For instance, consider Figs. 1 and 2. Fig. 1 represents an infrared image from the Synchronous Meterological Satellite above the west coast of the U.S. Fig. 2 is the counterpart of Fig. 1 representing the visual (as opposed to infrared) segment of the spectrum.

The infrared (IR) image is a map of temperatures, with the whitest parts associated with the coldest areas, while the visible image represents the light reflectivity of the surface features, just as any other conventional photograph. Note that in the visible image, all of the clouds are a uniform white, while in the IR image, many shades of gray are represented. This is because the different cloud formations possess different temperatures, and hence different gray levels in the IR image. This, of course, allows an analyst to discriminate between the various types of clouds in Fig. 2.

Using the visible counterpart of the IR image, a "false color" composite may be made which provides more information than the sum of its parts. Fig. 3 was constructed by using the IR image for the green component, and the visible image for the red and blue components. A binary map of the geopolitical boundaries was also overlayed in the



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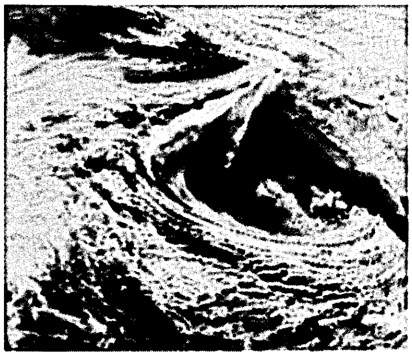

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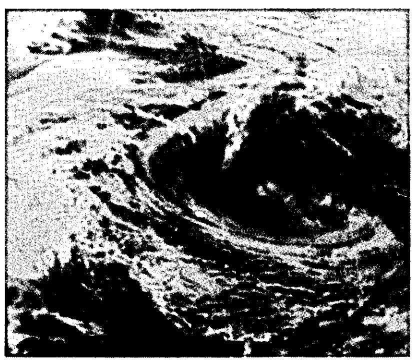

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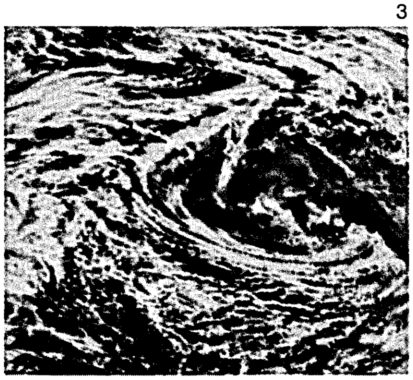

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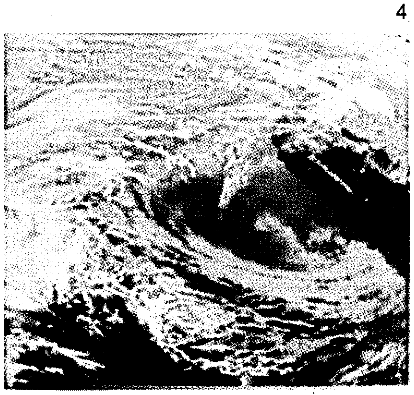

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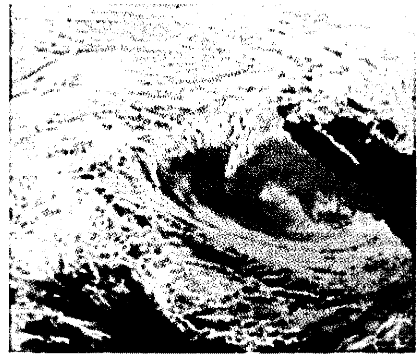

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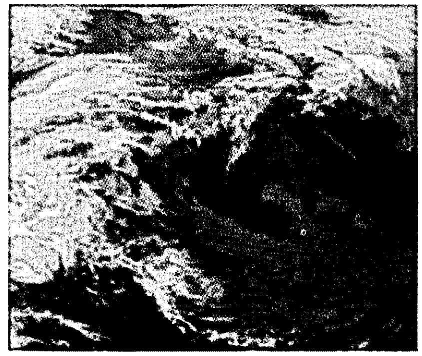

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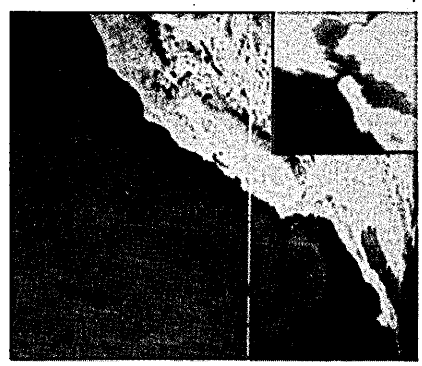

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color yellow. Note that the cloud types are more easily discriminated than in either image singly.

Fig. 4 shows the result of applying a digital enhancement technique to the image of Fig. 3. The technique consists of an adaptive "contrast stretch" (where the contrast between tiny adjacent parts of the image is exaggerated), which varies continually over the entire image. Note that subtle details are enhanced.

Figs. 5 and 6 depict an interactive technique which allows an analyst to identify areas of a given temperature, by displaying all picture cells (pixels) of certain gray levels in red. In the case of a thermal IR image (as shown), this procedure provides a graphic display of all the areas of an image which possess a given temperature (or temperature range). Thus, the user may easily determine the location of the coldest cloud tops, the warmest ocean currents, etc. The analyst may indicate the desired temperature range by designating a particular gray level on a gray scale inserted in the image. This may be done interactively by moving a cursor to the appropriate gray shade in the scale.

Pseudocolor

Instead of mapping a specific range of gray levels to a single color, all the gray levels may be simultaneously mapped into a spectrum of colors. This technique is known as "pseudocolor" enhancement, and provides an excellent method for visualizing regions of the same gray level. Figs. 7 and 8 show some examples of pseudocolor transforms applied to weather images.

The image of Fig. 8 was derived from a lower altitude orbiting (as opposed to

An analyst may interactively manipulate the imagery, to extract a more meaningful representation of some feature.

stationary) satellite which gives considerably higher spatial resolution than the Synchronous Meteorological Satellite mentioned earlier. The insert in the upper right hand corner represents a 200 by 200 pixel area near San Francisco from the larger picture, showing the excellent resolution of the image. A rather remarkable attribute of the image in Fig. 8 is the large expanse of cloud-free ocean. This renders the temperature gradients in the ocean (which appear as multicolored clouds in this enhancement) quite visible. The characteristics of these currents and their relative temperatures may be exploited to facilitate the routing of shipping and even the location of potentially rich fishing grounds.

Figs. 9 and 10 depict a type of digital

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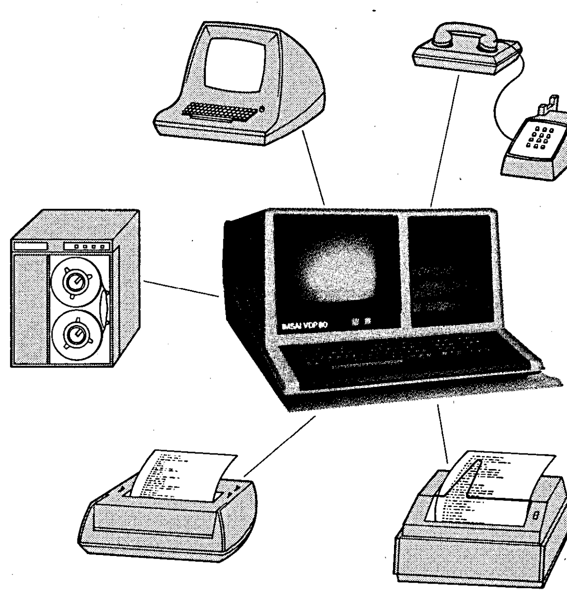

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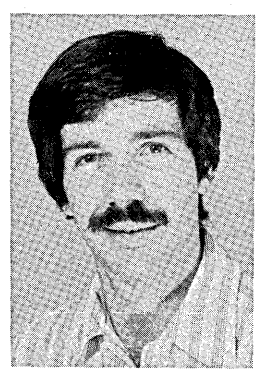
processing which would be nearly impossible to implement by purely analog techniques. Fig. 9 shows a conventional weather map (in the red overlay) which indicates the locations of fronts, high or low pressure areas, etc. The underlying image represents a satellite image of the same area. Note that the two images are geometrically incompatible because the cartographic projection used in the weather map is quite different from the effective projection of the associated gray level image.

Fig. 10 shows the result of geometrically "warping" the satellite image to force it to conform with the weather map (shown again as a red overlay). Note that the parallels and meridians of the two images are in much better registration in Fig. 10.

The above examples represent but a few of the possible techniques which may be applied to assist a weather analyst in his work. The most significant advantage of the computer based approach is its flexibility and its potential for interaction with the user. As digital techniques begin to replace the old analog approaches, greater automation will lead to improved accuracy and a more quantitative approach to weather forecasting. The exploitation of digital image processing will doubtless be the next revolution in meteorology.

The exploitation of digital image processing will doubtless be the next revolution in meteorology.



Dr. Wallis is a software engineer at Stanford Technology Corp. in Sunnyvale Calif., where his responsibilities have been in the development of applications software for computer-based image processing systems. His present interests are digital image enhancement techniques, numerical analysis, colorimetry, and the design of digital signal processing equipment.

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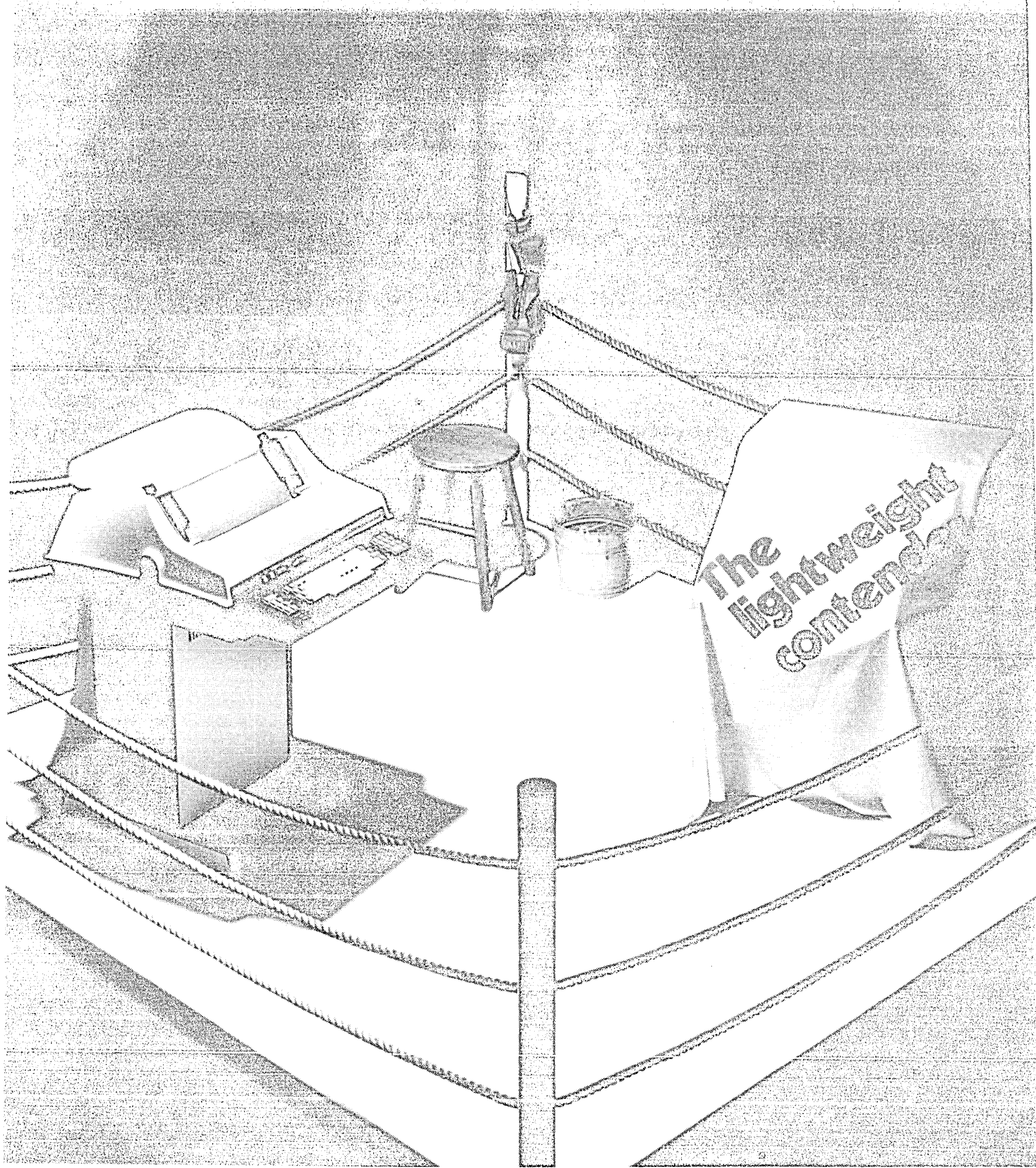

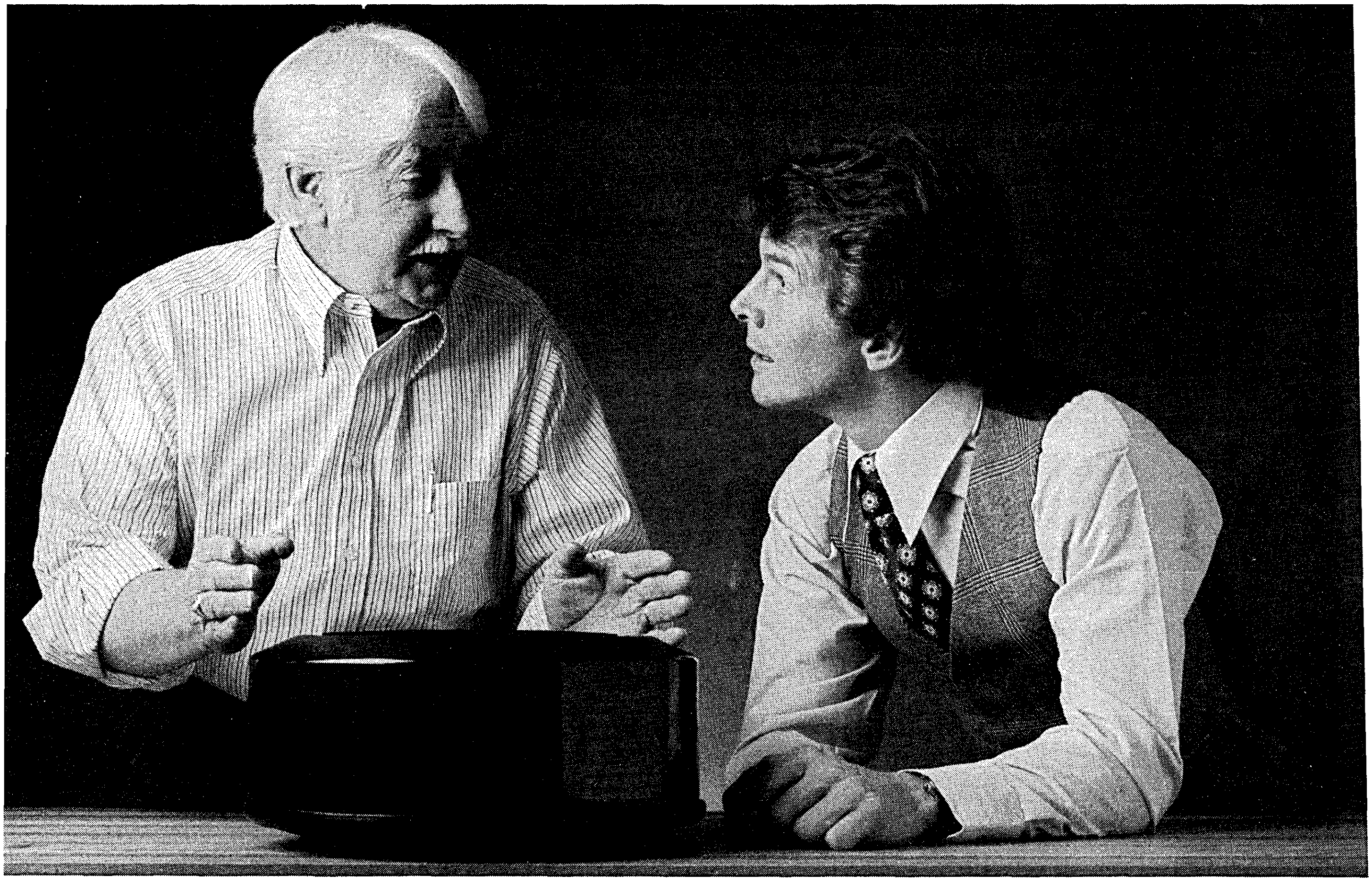

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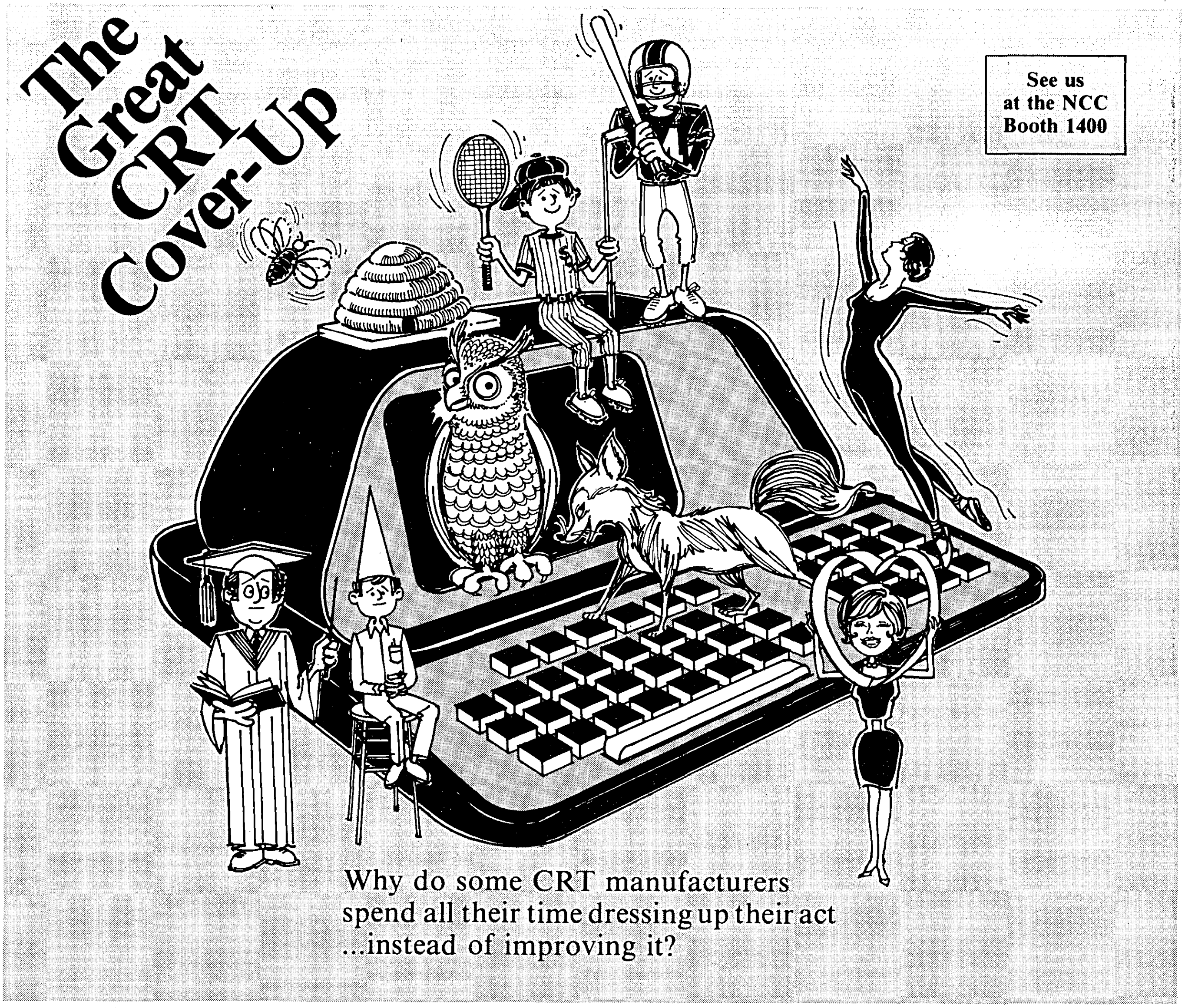

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Computer Aided Design and Manufacturing at GM

Computers are well established in design and data processing functions in General Motors plants. The big future growth will be in manufacturing applications.

by Robert W. Decker

Computer aided design and computer aided manufacturing really came into prominence at GM after the late-1973 oil embargo, according to the author, who is a vice president of General Motors Corporation. Presently in charge of GM's Mechanical Components Group, he has also headed the company's Manufacturing Staff and been general manager of the Fisher Body Div. Thus he knows both sides of the CAD/CAM picture.

In 1973 the U.S. auto industry was enjoying its best year in history. It was General Motors' third consecutive year of record worldwide sales, and the company posted its highest earnings in history.

This glowing picture was suddenly dimmed when the oil embargo was imposed on most of the world late that year. The consumer's mood changed overnight. Confidence gave way to concern and uncertainty about the availability of fuel. Many potential car buyers deferred their purchase plans. Others switched to smaller cars. Sales of imports flourished and their market penetration increased.

Fortunately, GM already had been laying orderly plans for more fuel-efficient automotive products. These plans, begun in January 1973, involved the redesign of the 1977 full-size cars. They were scheduled to be about a foot shorter than the then-current full size cars and a little lighter.

However the program became stalled as GM and the U.S. auto industry watched public sentiment switch quickly and dramatically to small cars. GM agonized over whether to drop its biggest cars completely and concentrate on small cars.

Finally, in the fall of 1974 the decision was made to go ahead with the 1977 resizing program. In the meantime, of course, several deadlines of a normal program schedule had already passed. At this stage body designs should have been completed, and the dies and tooling in the works.

Nine months behind schedule and undergoing a major shift in specifications, GM called on computer aided design and computer aided manufacturing to help put the best component combinations together for the specifications required—a new generation of smaller, lighter, more fuel-efficient vehicles involving a "from-the-ground-up" approach to engineering and design. These designs were conceived, tested, and proved by CAD/CAM techniques. Where the 1976 full size cars had weighed, in most instances, well over 5,000 pounds, 1977 versions weighed in at least 700 pounds lighter.

The 1977 program was just the beginning. GM's 1978 intermediate size cars also went through a complete redesign. Our full size luxury vehicles will be redesigned in the same manner this year, and the compacts next year.

Then, if we are to meet the government's fuel economy requirements of an average of 27.5mpg by 1985, and still offer five- and six-passenger cars, we'll have to redesign our full size cars once more, reducing their weight at least as much as was done for the 1977 models. This second weight reduction design will be harder to accomplish because the emphasis will have to be on the substitution of more lightweight materials (light metals, plastics and the like), wider use of electronics, and new powerplants.

Accelerating the design

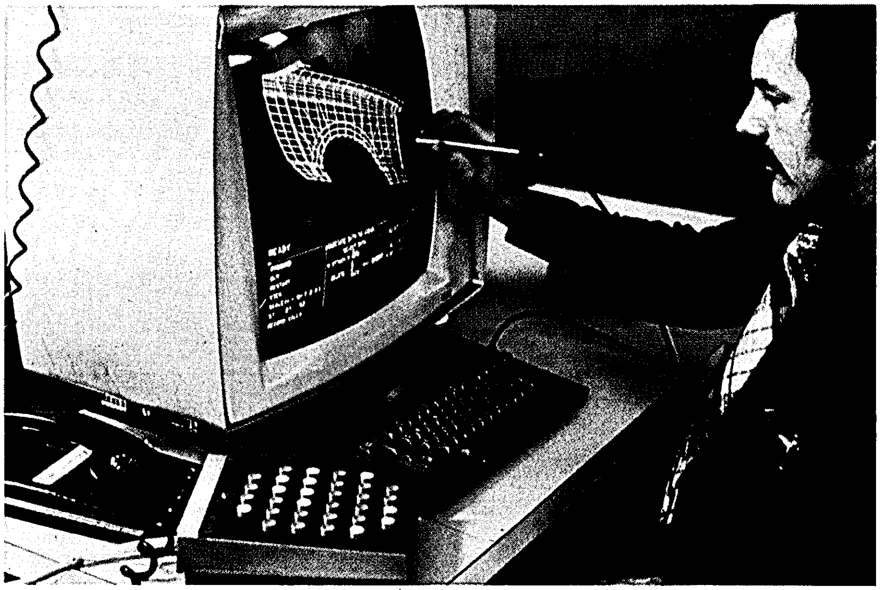
Once again, General Motors will call on its experience with computer aided design and manufacturing. That experience goes back over 15 years and has culminated in the GM Design Console system. This system utilizes computers and crt displays to perform design, engineering, and manufacturing functions. The concept has become sophisticated enough so that measurements taken from clay models can be used to produce dies to stamp out sheet metal.

Crt consoles are used to evaluate the structural characteristics of designs in a technique called Vehicle Structural Analysis Program (VSAP). With VSAP, engineers can "assemble" mathematical models of the components in a car and then "road test" the car on a simulated drive route. The design console system was first used in the design of the Cadillac Seville, which was put on the market in record time *during* the oil embargo.

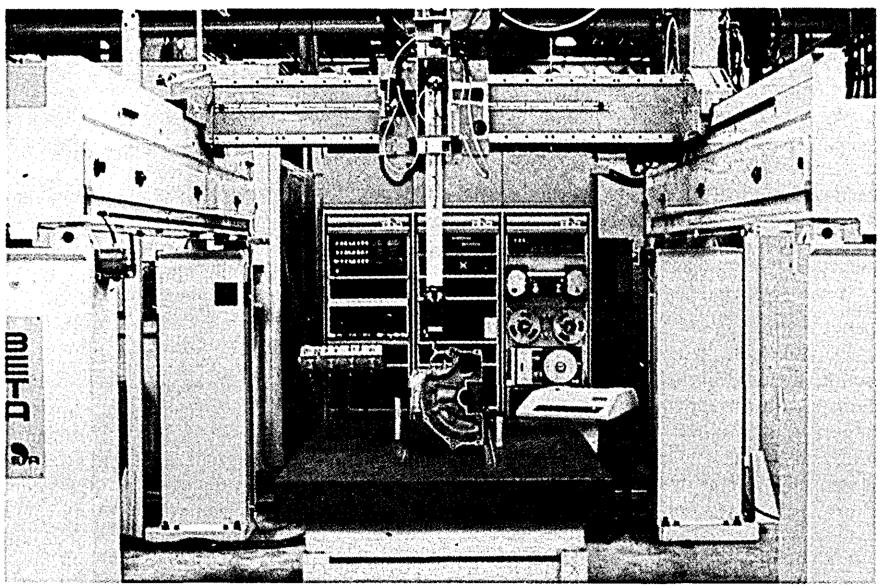
Because design changes can be made with minimal risk, since they have already been "proved" by the console system, a lot of the trial and error has been taken out of the design process. For example, a common design activity, such as reducing the weight of a chassis cross member, used to involve a long and anxious wait while a prototype was constructed and tested. Then, if the design didn't prove feasible in the prototype, the process had to be repeated—sometimes two or three or more times.

Today such change can be proved in the computer before the prototype is built. That not only cuts down on development time, but greatly reduces prototype expense as well. Applying CAD/CAM accelerates the logical progression of automotive design—identifying the problem, correcting the design, rendering the model, and analyzing the result. From there it is a relatively easy step to determine the right tooling to build the designed product—and it has the additional advantage of gaining the accuracy of a single reference data base.

In the automobile business, the potential of CAD/CAM technology is great. Possible future uses include computer modeling from drawings, making scale plastic models, ⅜-scale crash testing, crash simulating, and the prototype testing.



GM has been involved in computer aided design and manufacturing techniques for more than 15 years. Its current system employs about 100 design consoles, like the one above, based on IBM 2250 or DEC GT62 interactive displays. In use since 1968, the consoles came to real prominence after the 1973 oil embargo, in redesigning GM's full size cars.



Finished parts, tools, and dies are inspected by this numerically controlled device to determine whether the object meets its design specifications. Eventually GM hopes to make parts inspection highly automated, and to do the inspection during the manufacturing process so that unacceptable parts won't get to the finished product stage.

Making tools intelligent

But an area offering perhaps even

Within 10 years computers will control about 90% of all the new machines in GM's manufacturing and assembly plants.

greater potential is that of increasing productivity in the production process. As material prices increase, labor costs go up, and the overall cost of doing business rises, it is imperative to find new ways for productivity to keep pace. Efficient use of CAD/CAM in plant operations can help improve productivity and generate profits.

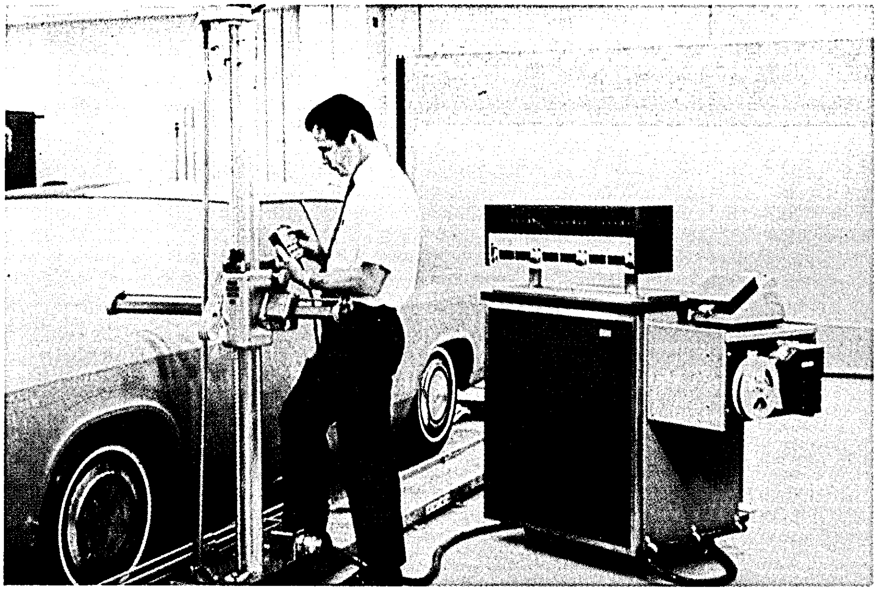
One of GM's goals is to provide more flexibility in its manufacturing operations. In the past few years we have invested a large sum of money in basic machines that carry out the traditional tasks of turning, boring, drilling, or grinding metal parts. The basic designs of these machines have not changed for many years. The result is that productivity in relation to costs has *declined.* Consequently GM is undertaking a development program to improve the productivity of these basic units.

Deterioration in the cost-effectiveness of basic machines is a serious problem. New designs which would take full advantage of the newest technology are therefore being considered, and many of these designs include computer controls of one form or another. Once the advanced basic machines are developed, accepted, and put into use, an improvement in cost-effectiveness should result. Such technology relates to feeds and speeds of cutting tools, improvements in their dynamic stability, feedback controls for precision machining, and tool ruggedness.

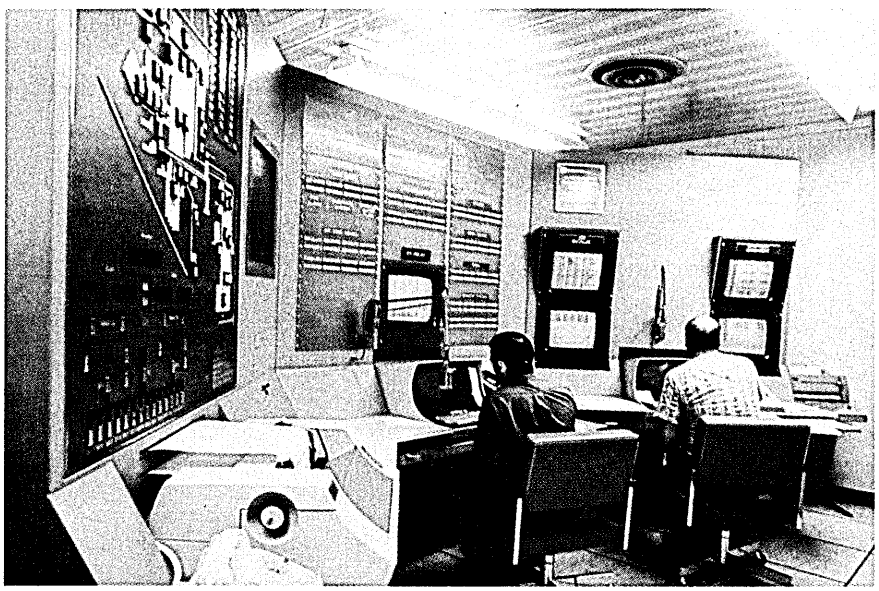
GM President E. M. Estes not long ago told a group of manufacturing engineers, "An internal study recently found that the use of computers in manufacturing now lags behind both design and data processing uses in GM. But the study concluded that the use of computers in manufacturing would increase by as much as 400% in the five year period ending in 1982, compared to just a 40% increase for design functions and 9% growth in data processing.

"I think it is fairly safe to say that within 10 years computers will control about 90% of all the new machines in GM's manufacturing and assembly plants. This doesn't mean computers will be replacing men nearly as much as it means they will be helping our employees do a better job."

Presently, our manufacturing development personnel are studying and con-



This GM-designed digitizer produces a paper or mylar tape of measurements taken from a clay model. The device doesn't actually touch the surface, but transmits and picks up an optical pulse from it. The output may be used for further contour milling of the clay, or stored for access by other designers and engineers—including those using graphics consoles.



Another operation in which computer power has been successfully applied is in facilities monitoring. Here, in a GM truck plant, displays show the status of machines on the shop floor; the man at the left dispatches maintenance personnel where needed. Such control rooms are also used to monitor labor allocation and materials distribution.

structing mock-ups of two advanced basic metal cutting machines. One is a computer controlled high speed bar machine which has the potential to replace hundreds of multispindle bar machines currently used to machine tubular parts such as bearing races and various transmission parts. In addition to high speed operation, the machine features programmable tool positioning and simultaneous cutting of the inside diameter and outside diameter.

Another machine under development is a computer controlled high speed multiple chucking machine which has the potential of replacing many conventional machines used to turn cylindrical iron and steel castings and forgings. The initial proposed developmental machine is single station; however, features tested in this mock-up apply to multiple station production machines as well.

Neither of these machines would be practical, of course, if it were not for the availability of well-developed computer hardware, software, and firmware.

Making new processes possible

As previously noted, the direction of the automobile industry is toward smaller, lighter, and more fuel-efficient cars. The potential of structural plastics in helping to achieve these goals is significant. And there again computers play a role. Plastics are already widely used in today's automobiles. There is an average of about 200 pounds in a typical 1978 GM car. By 1985 it appears possible that this could reach 350 to 500 pounds per car.

These materials will appear as new types of sheet molding compounds, reaction injection molding compounds, and conventional injection type materials. Materials for military use have already been produced in which ratios of strength-to-weight exceed those of conventional metals. If similar materials can be produced at commercially competitive costs, significant productivity inroads will result.

New machines will be required to compound these materials and to manufacture parts. Further, computerized techniques will have to be devised to measure and mix the materials and to control the press machinery.

Metal founding on the other hand, is almost an archaic art; it has undergone very little change over the years. Bonded sand cores are still used, requiring large capital investments for sand preparation, handling, and molding equipment. For generations tolerance variations in the process have been accepted, along with the costly finishing steps.

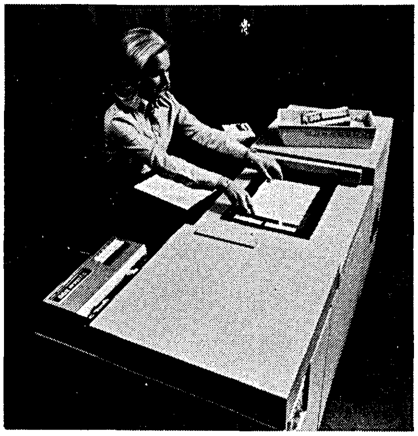
For precise, finely detailed castings,

Productivity in relation to costs has declined. One reason is that the basic designs of machines haven't changed.

such as turbine vanes and supercharger impellers, the lost-wax casting process—which remains essentially unchanged since the days of the Phoenicians—has been used. Now a new process has been developed which is similar to lost-wax casting except that Styrofoam is substituted for the wax. The Styrofoam pattern is buried in casting sand and hot metal poured into it. The Styrofoam vaporizes, leaving a metal casting with thinner structure walls and more precise dimensions than was possible with the lost-wax technique. It also alleviates the ecology problems inherent in the processing of foundry sand.

In the case of both structural plastics and founding, CAD/CAM techniques are required to achieve the necessary efficiency of structure and accuracy of manufacture. Also, ways are being sought to automate inspection of manufactured pieces as work on them proceeds. This involves the employment of process computers and appropriate sensing devices which can measure posi-

Over 43 million records are now under new management.



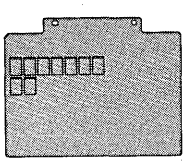
System 200™ by A.B. Dick/Scott is bringing efficient, cost-effective information management to massive volumes of government, banking, law enforcement, insurance and personnel records.

The record speaks for itself. As a highly flexible and completely updatable micrographic record processing system, System 200 has rolled up an impressive string of application success stories.

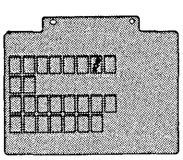
The key to its growing reputation and enthusiastic acceptance among administrative and record processing personnel is the overall accuracy, immediacy, durability, and completeness of information that can be stored on System 200 File Film.

The following on-the-job profiles demonstrate the flexibility of System 200 and its capacity to meet a wide range of record management requirements.

The durability and quality of System 200 File Film images and a built-in audit trail help assure file integrity.



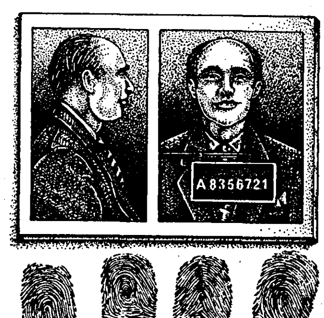
A single piece of 4" x 6" File Film accommodates 60 legal size or 98 letter-size documents. Images can be recorded or updated in just seconds.



File Film has an add-on capability and can be updated. Prior recorded documents can be readily annotated for record control purposes.

Rapid updating and confidentiality ideal for Colorado police records.

When the Colorado Springs, Colorado, police department looked for ways to replace its outmoded paper arrest and identification files, System 200 joined the force.



File Film containing some 40,000 criminal records has been structured to provide a complete unit record containing everything from fingerprints and mug shots to written court depositions.

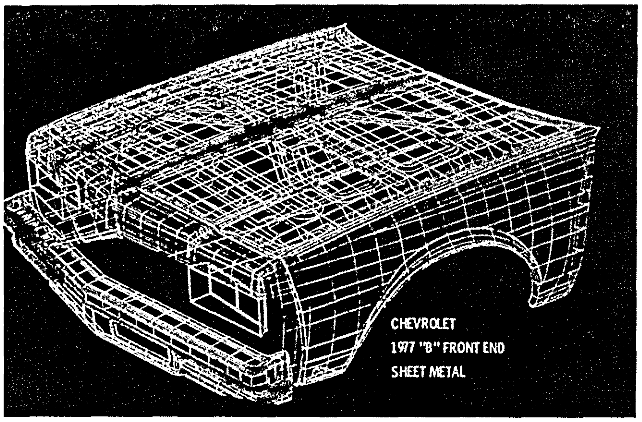
Lt. Ernest Adams, the department records manager, recently noted that System 200 "provides better access and distribution of file information for those who have a legitimate right to the information and better control against intrusion from those who do not."

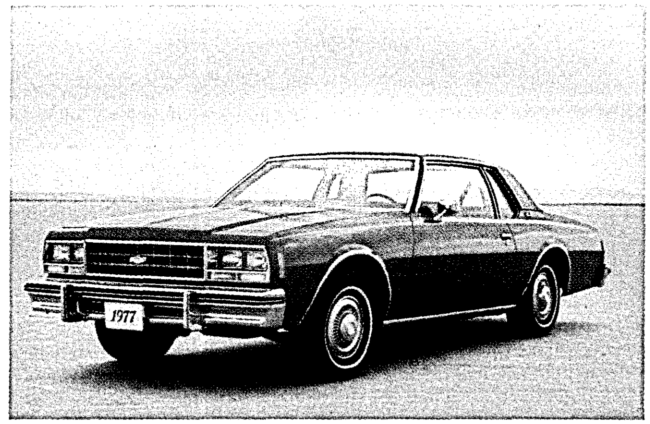
A tactical weapon in the U.S. Army's war on paperwork.

With over 785,000 individual files containing 52 million document pages, the daily battle to maintain U.S. Army service records was a formidable task.

Each day, about 1000 records must be created or retired, 30,000 new pages added to existing files, and 2500 user requests fulfilled.

By linking System 200 with a minicomputer and automated retrieval techniques, the Army Personnel Center has dramatically reduced response and retrieval time while tightening file control and integrity. The System is expected to do away with a paper mass that once occupied 4700 filing cabinets and 35,000 square feet of floor space. It also will reduce operating costs significantly.





Body designers have shown a preference for using crt's and light pens to produce their drawings; their design time is cut by 40% to 50%. What might have taken weeks before, now takes days, and the resulting work product is automatically accessible by other engineers. GM-produced software for the system includes the Vehicle Structural Analysis Program, which allows the engineers to "road test" vehicles before they're built. (The "after" version is on the right.)

tion, motion, and shape. With appropriate feedback methods this could result in machines that refuse to make bad or unacceptable pieces.

Pushing up productivity

CAD/CAM technology is extending rapidly in many directions throughout the automotive industry. It is no secret, for example, that for a great deal of the time that material is in a manufacturing plant, nothing is happening to it. Only a small portion of time—perhaps as little as 5%—is time when value is added by spot welding, cutting, shaping, or assembly. The cost of in-process inventory to sustain such a system is prodigious. Application of automated process engineering, group technology, and improved materials handling systems—all with computer based support—could result in making great strides in this factor of productivity.

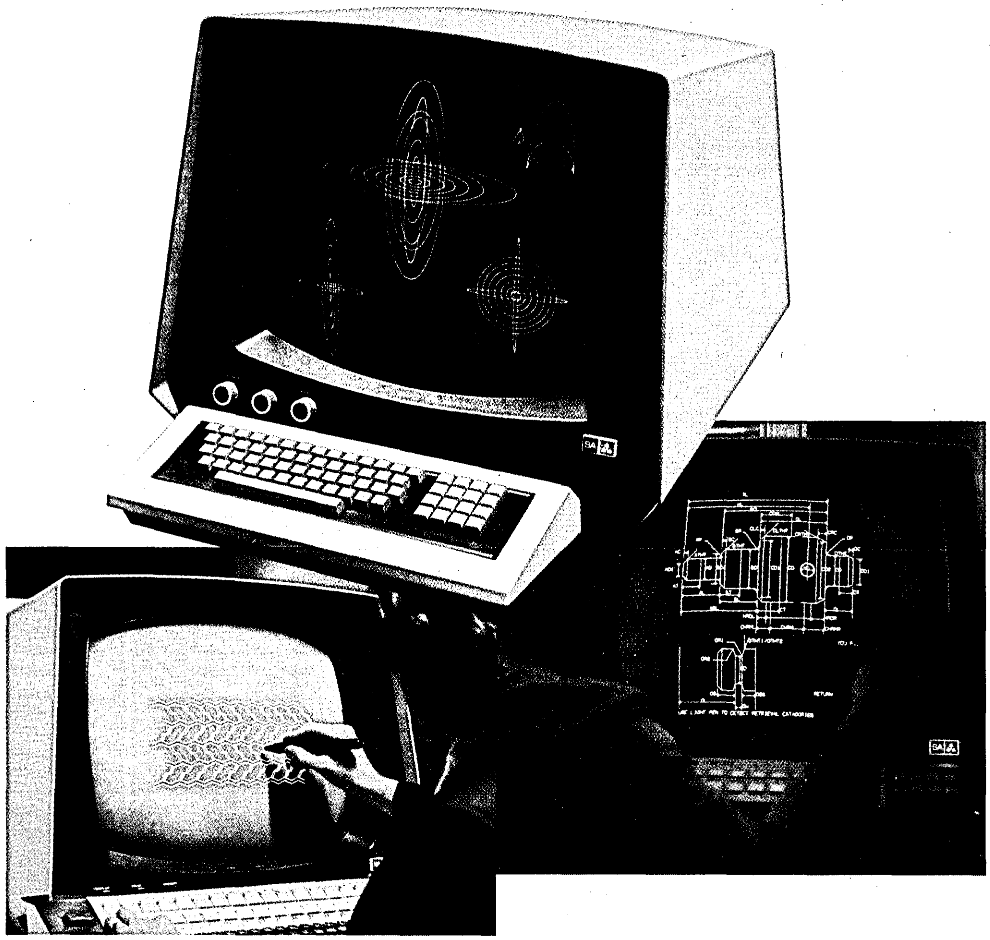
New areas of computer assisted engineering, which would extend the scope of the industrial engineer and permit designers of plants and facilities to better integrate production, also must be explored.

In the last 40 years productive labor has continually decreased as a share of the total labor output. Expense labor—labor not directly associated with manufacturing, such as janitorial work, maintenance, and material handling—has increased. In heavy industry it has nearly tripled, and it is not uncommon to see work situations in which 50% of the hourly employees are expense labor. Computer based facilities have been used to monitor the allocation of labor and to program improvements in material handling which would reflect directly in the more efficient use of plant space and other primary facilities, again boosting productivity.

In short, CAD/CAM technology used in a total systems approach to the entire manufacturing process can contribute significantly to management decisions required for improving productivity. Its usefulness ranges through planning to production, and, of course, encompasses design, testing and development phases prior to the actual start of production.

CAD/CAM already has contributed significantly to these efforts at General Motors and we look for even greater contributions in the future as we face increasing cost pressures, shortages in energy and materials, and increased government involvement in regulatory activity. ❊

Compare the new Sanders Graphic 7 with other interactive terminals.



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The Evolution of the Page Printer

by Paul A. Strassmann and Charles F. Willard

Modern page printers are far more than just replacements for impact printers. By bringing electronic intelligence to the output point in computer processing, they open up a new realm of demand publishing.

The development of high speed printers has not moved in step with advances in computers. In the beginning there was rapid evolution. The progression from tabulating bar printers, like the old IBM 402, and from early drum and wheel printers to chains took less than a decade. But from about 1960 until the '70s, little development activity was evident.

Now, although the impact printer still dominates the high speed market, within a very few years a variety of large nonimpact page printers have become available from Honeywell, IBM, Xerox, and Siemens. Similar equipment is also expected from Uppster and Canon. In addition, direct electrostatic printers that were first developed as graphic plotters, such as those from Honeywell, Versatec, and Gould, have some of the same attributes. General purpose graphic printers and general purpose character devices appear to be beginning to converge.

The evolution

We think there are four identifiable phases in the development of high speed computer printing:

Stage 1. *Rudimentary impact printing.* During the early '50s, only modified bar and wheel tab printers were available. The user accepted low quality printing, wavy print lines, almost illegible carbon copies, and restricted page layout. The low speed of on-line printing encumbered computer operations and led to off-line techniques.

Stage 2. *Quality impact printing.* Newly developed units, especially the IBM 1403 with interchangeable print trains, brought a fourfold increase in speed, improved quality of the original, and less restricted format. This equipment worked so well for so long that it shaped the structure of computer operations and users' quality standards.

> "Demand printing," where we can put anything we want on paper electronically, requires a whole rethinking of computer output.

Stage 3. *First-generation electronic printing.* This is the stage we are in now. Speeds are from two to ten times as high as the latest impact printers. This stage is characterized by optical forms overlays, limited font selection, and improved page layout. However, batched print runs are still necessary for efficiency.

Stage 4. *Second-generation electronic printing.* This is the stage we are now entering. It is characterized by "software" forms, complete font flexibility, and complete freedom in page layout. Batch sequencing is not necessary, since forms are stored digitally and are changeable from page to page without affecting printing rates. Users can program the information wanted, and define its appearance, *while* it's printed. When users fully understand the implications of this, the dp manager will find himself in the publishing and forms management business for the whole organization.

During the first and second stages, there was some interest in alternatives to standard computer printing. Unit cost of printout was low but not all the copies were used or needed. Conversely, it wasn't easy to get a few more copies of *part* of a batched print run. On-line techniques were developed, using cathode ray displays, but hardcopy remained the most common way to extract output from a computer. When demand-printing terminals appeared, their speed was limited and unit costs rose; they were not a substitute for conventional batch printing.

Xerox side of history

Early in the first stage, during the '50s, Xerox had the Copyflo, a continuous printer that reproduced from roll microfilm or original documents onto plain paper. And we had also built one or two machines called the Xeronic about the same time, using a cathode ray tube to provide imaging onto a selenium drum, with the same kind of paper-moving mechanism as on the Copyflo.

We also had a choice of xerographic processors by then, and we used one of them—from a 2400 copier—to make the Computer Forms Printer. It was introduced in 1967 and hundreds are still in use. It accepted the standard 14⅞x11 computer fanfold paper as input, reduced it to 8½x11, projected special forms, designs and made as many copies as you wanted.

We also had a successor in the labs that we wanted to call the Computer Forms Duplicator. It was really just a higher speed copier that would take computer fanfold output, overlay a forms designs, and made as many copies the platen automatically, and make page-size copies.

Both the Computer Forms Printer and the Computer Forms Duplicator were only copiers of paper output produced by impact printers. But about 1967 our labs got the idea that we could create the images directly from magnetic tape, just as the impact printers did. We set up a couple of really huge machines with lots of electronics, using a cathode ray tube to create the images by stroke generation onto the "photoreceptor"—the drum or belt surface used in xerography.

The progression from tab machine printers to chain printers took about a decade; but from 1960 to the '70s, not much happened.

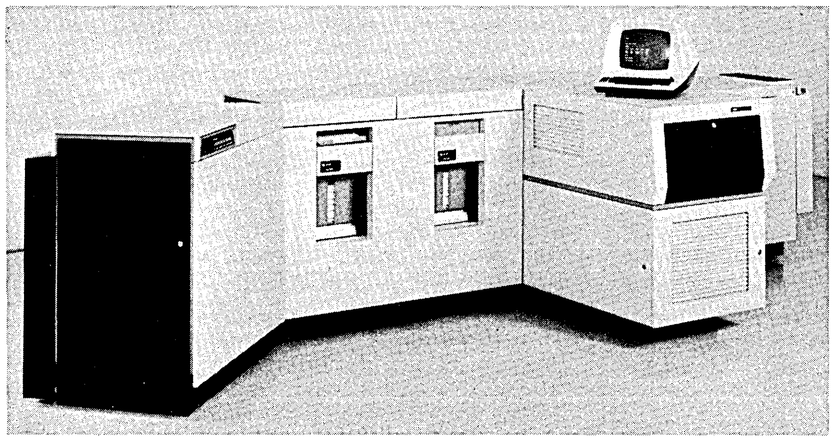
The direct image generation on photoreceptors never reached the marketing stage but the program survived until we started development of the Xerox 1200 computer printing system in 1970. By that time, we had more choice among technologies to use for flash exposure imaging and we decided to go with an optical character generator and a rotating drum. The forms overlay function would be handled at another station on the paper path. Introduced in 1973, the 1200 was the world's first xerographic page printer. The Xerox 9700 electronic printing system, now in production, is descended from that machine, but forms its image by laser scanning and adds a host of other Stage 4-like features.

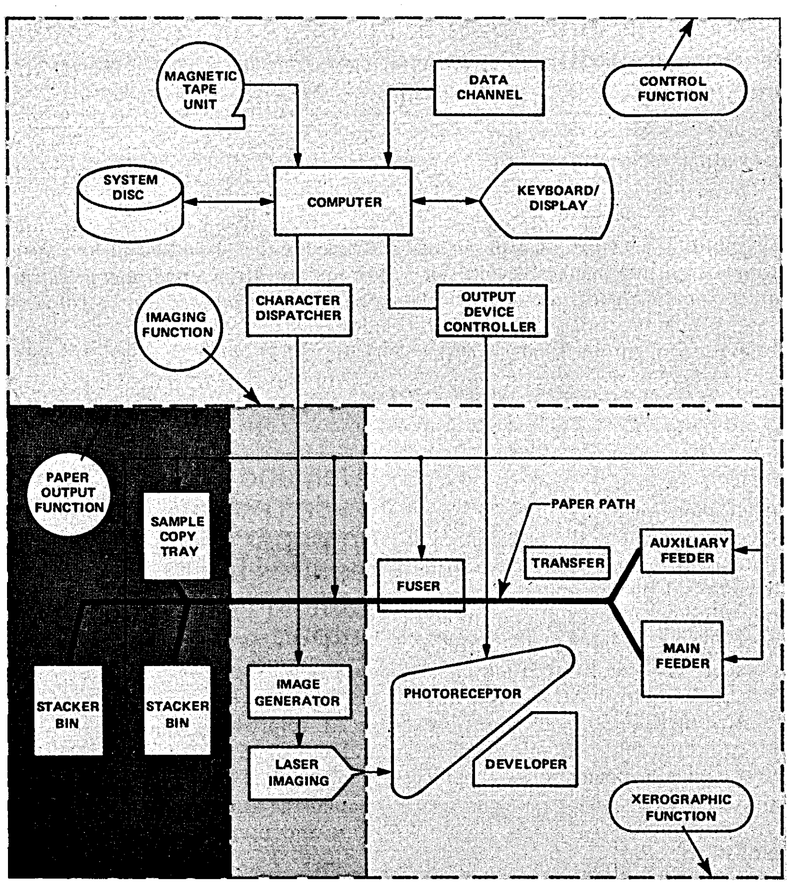
Not just replacements

Users have now learned a lot about nonimpact page printing—not only as an alternative for impact printing, but also for value added features such as better quality printing, less dependence on preprinted forms, and more flexibility in both computer operations and dissemination of information throughout the user organization.

As we contemplate replacement of Stage 2 impact printers by Stage 4 nonimpact page printing technologies, we need to consider even more dimensions of the question of how to make computer output processes more effective and productive. We must get used to thinking about what we're calling "demand publishing," where we can put anything we want on paper electronically.

We are really dealing with a different concept—even though the available machines like the 9700 are combinations of existing technologies.





Computer printers have come a long way since the first modified tab machines were pressed into service. In those not so distant days, the printer would show up as a single box in a configuration diagram like the one above; but this particular diagram is required to show the *components of* a contemporary page printer (in this case, the Xerox 9700).

First, the quality of the printing is exceptional. All of the information on a page, whether alphanumeric or graphic, is constructed from "pixels," short for picture elements. These very small dots can be put anywhere on the page, using a laser scanner for imaging, in any combination. Letters, numbers, pictures, and signatures can be placed on paper without any limitation other than the size of font memory.

Television is a good analogy, in the sense that you can get any picture you want. But there is a big difference in resolution. There are 525 scan lines from the top of the tv tube to the bottom, whatever size is used, so let's assume a screen the size of a standard page, 8½x11. While the tv would be spreading the image 525 scan lines down the 8½ dimension of that picture tube, current page printers spread five times as many. So the resolution of the picture on that page is much better than that on a tv picture tube.

We could, of course, have even higher resolution. The limiting factors are storage size and bandwidth. If you double the resolution, you square the amount of buffer space needed to store one element of the picture. And the same applies to bandwidth, when you transmit the picture. Even though costs have steadily come down for both, these costs are still a limitation on what can be done.

Departing from tradition

The main point, though, is that once you have a printer with this kind of flexibility—putting the picture element wherever you want it on the page with very high resolution—you have something far different from traditional computer printing.

It may not be obvious why this ability to produce everything on the page at the same time is such an important change. But consider the following example.

Government tax collectors, diligent in their efforts to provide structure to support increasingly complex tax laws, are constantly adding and changing forms. The IRS alone has hundreds of forms and many of them are revised every year. This complexity has led to computerized preparation of tax returns for both businesses and individuals, a fairly common application for banks, insurance companies, and specialized service groups.

The actual computation is simple in this application but the printing problems are horrendous. A bank might have 10,000 clients using this service and deadlines for tax payments are always tight. The computer system must first print information on 1004W forms for *each* of the clients who needs it, then other information on a 1004E, then on a capital gains form, then on attachment D, and so on. After all these print runs, which can be in the hundreds when you add state forms as well, there is an immense collating job, most of which has to be done by hand. At the same time, there must be elaborate quality control procedures to make sure that the bundle of forms for each client is complete and that each form really has the right information for that client.

Now, what happens with electronic printing? The forms are stored digitally. Each client's complete tax return is printed in final collated sequence. And the printer need not be stopped until the job is done for the whole client list. In addition, the bank can't run short of forms and doesn't have any wastage when the forms are revised.

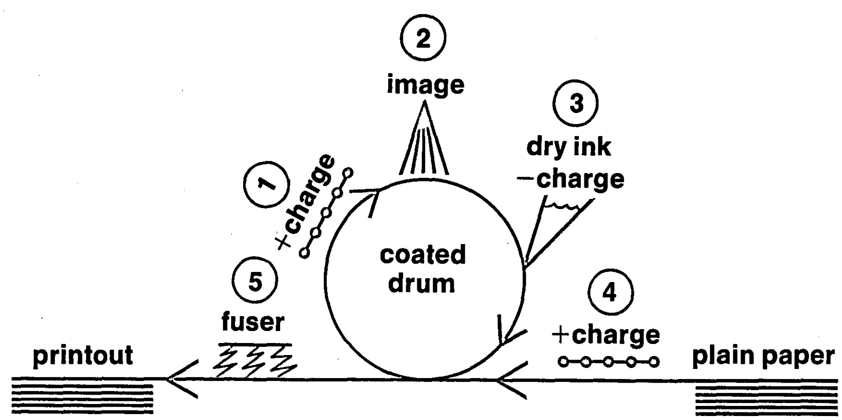
What is happening here, of course, is the substitution of software functions for printing, stocking, inserting, collating, and controlling forms. Money, time, and trouble are always saved by eliminating steps in any process. But something more subtle is also happening: a kind of electronic intelligence has been introduced at the output point in the computer processing. We're used to the computer itself controlling the computing process—but not the reproduction and distribution stage.

Software is being substituted for functions like printing, stocking, inserting, collating, and controlling forms.

Another way to look at electronic printing is that it is a solution to a basic problem common to highly industrialized societies: too much data is being produced. The sensible way to reduce that data to information is by selectively applying electronic intelligence.

Conventional printing devices are not intelligent; they cannot be discriminating, so everything has to be done sequentially. This is true of both Stage 2 and Stage 3 batch output printing that

The Xerographic Process



Xerographic page printers work through an electrostatic process similar to that first used in Xerox office copiers.

The technique relies upon the photoconductive properties of some materials like selenium. These materials are able to hold an electrical charge for some time, but lose it when exposed to light.

The first step in the process of putting an image on plain paper with xerography is to electrically charge the selenium-coated surface of a plate or belt or drum by passing it under electrically charged wires. This leaves it with an all-over positive charge.

Next the image to be printed is either projected through a lens onto the coated surface, as in an office copier, or electronically transferred to the surface by laser scanning, as in modern page printers.

The light received by either process removes the charge everywhere *except* where the image is to appear. (In office copiers, little or no light is reflected from the black part of a black and white page. In laser scanning, the beam skips over portions which are intended to remain black.) Then negatively charged powder (dry ink or "toner") is applied to the surface, where it adheres only to the positively charged areas.

Next the paper or other material to be printed on is placed over the surface and given a positive charge. The charge attracts the dry ink from the plate or drum, forming an image on the paper.

Finally, the dry ink is fused by heat onto the paper to make the image permanent. ❊

is dependent either on printed or fixed overlay forms. But once the original material is changed from optical to digital form, it becomes possible to manipulate the original. And it should also be noted that the original material need not ever be in optical form. Nor must it necessarily come on-line from a computer; it can come remotely from a telecommunications network.

Ahead, in Stage 4

For example, in the future it will be relatively simple to have word processors in other parts of the user's organization—or at sites in other parts of the world—sending information that would be recorded, then reproduced selectively on demand. This could be done without interfering with the printer's use for computer output. Once again, keep in mind that no forms or letterheads need be involved; the unit generates and prints everything that is commanded to appear on the page.

This is only one example of the kinds of things to expect during the development of Stage 4. There are a lot of things we could do—but they're going to be shaped by user experience with existing equipment.

Some obvious characteristics of Stage 4 equipment could be duplex xerographic printing, adaptation to microfilm output, generalized graphic output capability, text generation upon request, and incorporation of "electronic mail" receiving capabilities. We also expect

Stage 4 equipment will handle duplex printing, microfilm output, graphics, and even electronic mail.

that further cost reductions will be made in the printing process itself in the future, through simplifying present techniques or through new methods. These new technologies may use liquid or solid ink or they may be electrostatic, chemical, or transfer processes.

As an example of the future direction of Stage 4, Xerox now has a system installed that has some of the characteristics we have been describing. It is called ARCS (Automated Reproduction and Collating System), and is a custom-built project for the U.S. State Department.

The system began operation in December 1976, and uses the same combination of technologies—small computers, laser scanners, and xerographic reproduction equipment—as the 9700. Its function is to print messages arriving by communications lines from all over the world for distribution to government agencies. It does this by storing incoming electronic signals digitally, printing them electronically, and sorting the hard copies by destination.

Here again, conventional methods were displaced by software, eliminating the need for teleprinters, as well as line printers that produced offset masters, and the offset presses that used them.

Since the text is produced electronically, the type size can be altered from

The State Department found that 99.3% of its messages now can be produced on a single page each.

page to page, according to the length of the message. The State Department reports than 99.3% of their messages now can be produced on a single page each, which has made the previous collating and assembling steps unnecessary. Special headings, generated electronically, flag high-priority messages, which were previously handstamped.

The differences between ARCS and existing page printers are not in technology and technique but in system architecture, configuration, and application. The front end of the system is a master controller with two minicomputers, each with a separate disc drive. Both receive the same messages; the second is for backup.

The master controller directs a slave subsystem, including a character generator, which controls two print stations. When a page image is created electronically, it is transmitted to one of these laser-scanned xerographic printers. The hard copies are sent to a 50-bin sorter for transfer to address-designated destination bins.

Since each page is created electronically under computer control, the software can produce special symbols and titles for each message that make it easier for people to read. For example, before ARCS was installed, each designation for distribution of messages was checked against the required number of copies, then underlined by hand. Now the computer checks the distribution designations and copies and the appropriate designation indicators are underlined by the laser printer.

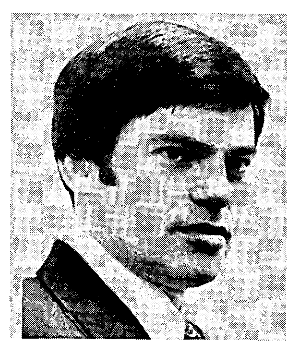
Thus, in the ARCS system, we see one of the main elements that will characterize the fourth stage of printer development—the insertion of electronic intelligence during the imaging and printing process.

In summary, Stage 3 has shown what the first generation of nonimpact printers can do—they're fast, they eliminate some steps in the process, and they have alerted the final user to some new possibilities in convenience and effectiveness. Stage 4 will increase these benefits, eliminate more steps, and—most important—introduce electronic intelligence where it will have the greatest effect on the legibility of the information, thus materially increasing the comprehension of messages by people.

Stage 4 will also bring these advantages to a vastly larger number of organizations; just how many depends on the success of the manufacturers in reducing costs and how fast the information systems profession grasps the opportunity to extend the scope of information systems into new areas.

The day of user-designed and user-customized output has finally dawned. Demand publishing by means of an "intelligent" printing device has now arrived, thus giving people much greater freedom to receive the benefits of computer automation in a form that suits them best, individually. The custodians of computerized information handling technology will have acquired a new means for serving the needs of their clients in a more acceptable way. ❊

Mr. Strassmann is vice president of Xerox Corp.'s Information Products Group, which is responsible for all Xerox products and services other than conventional copying and duplicating. Prior to this, Mr. Strassmann worked for 20 years as the top computer executive in a number of large computer user organizations.



Mr. Willard is manager of printer technology and design at Xerox Corp., responsible for technical management of the Xerox 1200 and 9700 projects. Since joining the company in 1965, he has held various engineering management positions directing mechanical, optical, and xerographic programs.

Figuring the Economics of the New Page Printers

by Edward Webster

High volume, nonimpact page printers usher in a new economics and a new pragmatics. Neither costs nor page sizes are the only considerations. Here's one evaluation method.

It has taken awhile, but relatively recent developments in computer output methodology are forcing dp managements to take a closer look at the economics of this tail-end function. In contrast to the pace of innovation elsewhere, computer printer technology until recently has been remarkably stable. But significant change is underway.

It was back in 1952, a full quarter-century ago, that Sperry Univac delivered its first 600 lpm, on-the-fly drum printer. During the '50s Sperry, along with Potter, Shepard, and Anelex, pioneered this new genre of printers, which could pump out 600 to 1200 lpm. In those early days, such printers were typically configured as off-line print stations sold at prices approaching $100,000 for the complete system, the printers alone valued in the range of $50,000 to $75,000. Today you can buy a 2,000 lpm IBM 3211 at around $63,000 and various 1,000 lpm printers for less than half that amount.

This tripling of speed with a modest cost reduction amounts, perhaps, to a 4- or 5-to-1 gain in cost effectiveness. Nice, but pretty ho-hum compared with what's been happening in circuitry and elsewhere. Print quality has been improved by moving the type horizontally with trains and bands instead of vertically on a drum, and this has been the main mechanical innovation.

We're told one reason for this dearth of innovation is that printers are heavily mechanical rather than electronic. But another reason may be the unprecedented success of the IBM 1403. Leapfrogging the drum printer stage, IBM in 1959 jumped from its lamentable 150 lpm modified tab printers to the 600 lpm chain printer in a single bound, and some of the others have only recently caught up. The success of this printer may be one reason why much further innovation has proven difficult: everyone else was too busy emulating the 1403, and IBM was too busy counting its money as the printers paid for themselves over and over.

This stability in the technology may be one reason why relatively scant attention is devoted to the printout function. Yet this is strange, since the printed report or document continues to be the major tangible product of the whole sophisticated and expensive dp function. Most internal users see little else. And to vendors, customers, and others in the outside world, the organization's dp-printed documents are a reflection of the organization itself.

In economic terms, with the cost of computers plummeting, paper prices increasing, and printout hardware achieving only modest price reduction, the printout function assumes new prominence as a cost element in the total system budget.

> The material in this article is derived from a larger study the author is preparing on the costs of operating the IBM 3800, and on the future of large volume nonimpact page printers. This feature is intended as a model for evaluating the costs of those devices; users are encouraged to plug their own assumptions about costs and volumes into the model.
>
> A 100-page report detailing the results of the larger study project will soon be available from Datek of New England, 150 Main St., Fitchbury, MA 01420 for $200.

Underwhelming response

Electronic printing was around in the '50s and early '60s, with the Burroughs "Whippet" teleprinter, the Xeronic page printer, and Radiation "Superspeed" printer. But it has taken Xerox, IBM, and Honeywell to introduce practical nonimpact page printers (NIP's) as a realistic option for dp users in the monthly volume range of a half-million or more pages.

Now it's the Xerox 1200, IBM 3800, and Honwywell Page Printing System. Waiting in the wings is similar technology from firms such as Siemens, Uppster, and Canon. And Xerox has already announced its second generation 9700.

The numbers installed to date are not overwhelming. There is consensus that by year-end 1977, around 800 to 900 of the systems had been shipped (500 to 600 Xerox 1200s, 100 Honeywell Page Printing Systems and 200 IBM 3800s). But many times that number of users have seriously evaluated one or more of the products. And certainly over the next few years most medium to large scale users will have to take the time to look at the new high volume NIP's, and this is a chore not to be undertaken lightly.

Experience of the early users can certainly be instructive, and over the past year or so we have been talking to them as well as to the vendors. The basic message—and some good questions—come through loud and clear:

- For high volume report printing,

the new systems seem to be proving their worth as cost-effective alternatives.

• Analyzing printout costs in response to the availability of these new page printers is very complex. It's a whole new ball game. In effect, users are substituting hardware costs for forms and forms-related costs, a trade-off that has quite a few ramifications.

• Whether the user achieves a net gain depends, in part, on how costs are applied to the printout function. Here "specsmanship" can come into play, depending upon who is trying to prove what. A marketing proposal from a page printer vendor will show one picture. People in the supplies area, who may see the NIP as a threat, can build quite a different case.

Yet the economics may not be pivotal in the decision, since user motivation for moving to the electronic page printers is often a revealing blend of tangible and subjective considerations.

• Sorting these out may involve reexamining overall system efficiency on the assumption that a major innovation of this type may cause the critical points to move. It has not been uncommon to view the system traditionally as print-bound. Might the higher performance nonimpact page printers become cpu-bound?

• And, finally, this innovation is reopening the ancient on-line versus off-line controversy. Off-line print stations, popular in the early days, lost ground in the '60s. Now the pendulum may be swinging back. The first of the high volume NIP's was the Xerox 1200, initially available only as an off-line system. Honeywell, too, came out off-line with its Page Printing System. And recently IBM announced an off-line option for its 3800—bowing, some say, to arguments long ignored by the dyed-in-the-wool IBM user.

Comparing the Costs of Printing Methods
(including equipment, supplies, paper and labor)

Volume (pages/month)	Impact Printer (continuous forms)	Nonimpact Printer (continuous forms)	Nonimpact Printer (cut sheets)
1 million	$11,810	$15,610	$18,150
2¾ million	$33,880	$36,586	$50,128

Table 1. Not so surprisingly, when the One-Time Carbon Paper Council does the math, continuous forms with interleaved carbons have a clear cost advantage.

Comparing the Costs of Using Current Printing Systems
(including equipment, supplies, and paper but not labor)

Volume (pages/month)	IBM 3800	Xerox 1200	Honeywell	IBM 1403N1
1 million	$13,276 (1)	$12,694 (2)	$13,248 (1)	$10,800 (3)
2 million	$18,552 (1)	$24,328 (3)	$26,497 (2)	$20,000 (5)
3 million	$30,928 (2)	$34,842 (4)	$34,670 (2)	$28,100 (8)

(Note: figures in parentheses indicate number of printers)

Table 2. Impact printers come out as least costly in two of the three volume ranges reported on by International Data Corp., but somewhat less decisively than the paper manufacturers declare.

Cost comparisons

In contrast to these relatively pithy issues, most reports of new page printer applications dwell on purported savings.

The First National Bank of Kansas City is reported as saving $40,000 a year by using the 3800 to print the logos of customer banks on stock paper, and $15,000 a year by using small, 11x8½ inch, "people-size" forms for reports.

With its two Xerox 1200s, Xerox says, the First National Bank of Chicago reports "upper management actually documented an annual savings of more than $40,000" on a monthly volume of 1 million pages.

"We were spending about $3,600 a month on paper forms previously and we're down to less than a third of this with the nonimpact unit," Xerox quotes another user of its 1200 system, the operations manager at an F. W. Woolworth Co. computer site.

This is pretty heady stuff, especially when you consider that direct savings in forms costs can be considered the gravy. Vendors and users more often than not agree the meat is speed (for quick turnaround) and capability (such as format flexibility), plus a host of peripheral savings.

But regardless of whether savings in direct costs are considered the meat or the gravy, they have to be considered part of the equation. Maybe quick turnaround is the big thing. But you still have to know the price—*if any*—you pay for that capability.

There is a price, and it's significant, say the skeptics. The One-Time Carbon Paper Council, representing paper manufacturers, did some research into comparative printing costs. Costs at two volume levels were totaled, including equipment, supplies (ribbons, or toner and developer), paper, and labor for three types of printers: an impact printer using continuous forms (a mix of singles and carbon interleaved), a nonimpact printer using continuous forms, and a nonimpact printer using sheets. At both volume levels, the impact printer using conventional carbon-interleaved forms was least expensive—according to their math. (See Table 1.)

The bottom line, of course, depends on the detailed data selected and this, in turn, may depend upon the angle being pursued. To corroborate such findings, one might turn to the consultants who (in theory) pursue no angle. In a study performed late in 1977 by Joan Ross, who directs the Output Program of International Data Corp., the comparison in Table 2 was included. This version of "total monthly output cost" includes equipment, labor, toner and developer (or ribbons), and paper (14⅞x11 for the 1403N1, 11x8½ for the NIP's).

These figures also show the impact printer as least costly in two out of three volume ranges, but somewhat less decisively. Both analyses are no doubt correct in terms of the data selected. Obviously critical elements are the mix of applications in terms of number of copies needed, page sizes and formats and, especially, the number of printers.

But even with this additional detail, the full picture is still not given. A more complete listing of the elements of printout cost might look something like this:

direct hardware cost
cost of maintenance and preventive maintenance
productivity ratios (reliability, set-up time, etc.)
print speed, related to:
- lines per page
- page length
- character selection
- density per page
- etc.

ribbons, or toner/developer
cpu input-output cost (cycles devoted to printing)
environmental cost and floor space for printer and forms inventory
forms costs:
- custom or stock
- single or multipart
- wastage

direct labor cost
handling costs (bursting, decollating, binding, etc., equipment and labor)
software conversion costs
"use costs" (mailing and filing costs, etc.)

Forms Costs

Paper Grade: For the IBM 3800, IBM specifies paper should be formulated primarily from chemical wood pulp, that is, it should be conventional "forms bond." Economy papers containing varying percentages of groundwood or recycled fiber have also come into vogue and some 3800 users report such papers are being processed without problems. However, since these papers are not recommended by IBM, and are no doubt the exception rather than the rule, the prices given here are for forms made of conventional forms bonds.

One-time carbon interleaved forms using economy, groundwood papers have proven satisfactory with conventional impact printers, and these are often priced lower than the 2- and 3-part forms shown here. Use of these papers would tilt the comparison somewhat more in favor of the impact printers in multipart applications.

Paper Weight: 15#, 16#, and 20# papers are commonly used with the IBM 3800 and with impact printers. In researching forms prices, the 16# weight was assumed.

Custom/stock composition: Since by far the most common applications are reports on stock forms, this product ("stock tab") has been used in this comparison. Some analyses place much weight upon savings achieved by use of the 3800's overlay capability ("form flash") in place of custom printed forms. However, it can be argued that in large quantity orders the extra cost of custom-printed forms will normally be more than offset by increased toner cost incurred in using the form flash.

Stock continuous forms, 16# paper: representative price per thousand

	single	2-part	3-part
14⅞ x 11	\$4.60	\$13.00	\$21.00
14⅞ x 8½	\$4.10	\$10.50	\$17.00
12 x 8½*	\$3.80	(not used with impact)	

*This is considered more representative in the case of the IBM 3800 than 11 x 8½, since full 132 character lines can be printed at 12 per inch, avoiding reprogramming; also, the 3800 with the burster-trimmer-stacker option must trim off margins, creating a finished 11 x 8½ inch sheet.

Looking at this more complete list, overall printout cost may be deemed unknowable. Talks with early users of the big NIP's generally confirm this. But here, in the final analysis, is where the answer lies—not in tabulations of direct costs but, rather, are they happy?

Among those we have talked with, quite a few seem to have complaints but the overall level of satisfaction is generally high. This may mean the honeymoon isn't over quite yet. Or that they have to rationalize the decision. Or even that they really are happy.

Some minimize the importance of direct cost savings. Or that savings may depend upon the equipment being replaced.

An early user of the IBM 3800 in New England has a volume of only about a million pages a month. Yet there had been an earlier management decision to adopt the 11x8½ inch report size, and a Xerox reduction duplicator was installed. Matched against this approach, the IBM 3800 was found to be cost-effective even at that modest volume level, according to the user. What's more, "It's lived up to IBM's billing and our expectations . . . it's a godsend!" the dp manager maintains.

"We had a lot of mechanical problems with the printer at first and a real disaster with ink bleed on preprinted forms," another user said. "But that's behind us now, and it's lived up to its billing. For volume printing, page printers are the way to go. It's definitely the wave of the future." This user, like several others interviewed, managed a multiple 3800 site.

Apples and oranges

Detailed cost comparisons developed by users and prospective users were harder to come by.

"All we can say is that this is a complex question . . . very, complex," we were told again and again. IBM uses a computer program to analyze printout options, and its proposal to install a 3800 may run 30 pages.

Others maintain you can't compare impact line printing with nonimpact page printing. It's apples and oranges. The technology is different. The hardware pricing is different.

A few things are known. For example, the NIP moves paper at a fixed speed: regardless of format, the IBM 3800 at 31.8 inches/sec, the Xerox 1200 at a page a second. The volume of paper used is metered, and becomes a significant component of hardware cost (in the case of the 3800, it's a "use charge" on leased gear, and a "maintenance charge" when the system is owned).

"Lines per minute" rates will vary widely depending upon their density. At 6 lines/inch the 3800 can go 10,020 lpm. At 12 lines/inch, the speed can be 20,040 lpm. In terms of pages per minute, the speed of the 3800 can also vary somewhat, depending upon page length and their fit on the 77-inch available circumference of the image transfer cylinder. In the case of Xerox, the page speed is constant because it handles only a single page size.

The speed of an impact line printer in terms of lpm can vary somewhat; in terms of pages per minute, it will vary significantly. With a two or three-part carbon interleaved form, speed will effectively double or triple with only a modest increase in paper cost. There is also high speed skipping over blank space, so format will play a role. And pricing does not depend on the volume of paper processed.

The cost-effectiveness of the nonimpact printer is relatively volume-sensitive, the impact printer relatively format-sensitive (line printing-to-skipping ratio, and number of parts).

Comparing them anyway

Apples and oranges. You can't compare them. But unfortunately, users will have to, and they of course should not rely exclusively upon data supplied either by the NIP vendors or the skeptics.

First, cut through the "specsmanship." The IBM 3800 can print up to 20,040 lpm—but it rarely will. The IBM 1403N1 prints up to 1,100 lpm, and it often will. But it, of course, also skips over blank vertical space at 33 or 75 inches/sec—equivalent to 11,880 lpm or 27,000 lpm at 6 lines/inch (15,850 or 36,000 lpm at 8 lines/inch). In volume report applications, the density of lines per page is often surprisingly low—30 or 40 not uncommon. Skipping over the blank space at the equivalent of 36,000 lpm might result in performance equivalent to 10,000 to 20,000 lpm for pages with skipping over 50% or more of the vertical area.

Then take the carbon interleaved form, and you can multiply this 10,000 to 20,000 lpm by the number of parts which can be printed—6, or sometimes 8 parts with premium materials—to arrive at an effective speed equivalent to 80,000 lpm or more.

In short, in almost any application, the impact printer will usually produce a good bit more than its specified performance in lines per minute, particularly in multipart applications.

Of course, the name of the game is to get data, not paper, out of the system. So it would seem the best measure is characters per second. But the numbers become unwieldy, and, regardless of our druthers, the new measure is pages per minute. So, going with pages per minute, the following approach to comparing apples to oranges seems to make some sense: (1) First, a look at the relative effective speeds of representative printers, to come up with performance equivalency ratios, which are then mixed with (2) some basic cost data, to get an admittedly somewhat gross comparison of relative cost effectiveness (at least in terms of the direct costs), with the main intent being *not* to compare the given printers, but rather (3) to highlight the major variables and how they influence the cost effectiveness equation.

For this comparison, we've pitted the IBM 1403N1 against the IBM 3800.

It might be suggested that we use the 3211, since at 2000 lpm this represents the latest state-of-the art on the impact side. Also, it is easier to cost since there is a controller for each printer, while 1403s can be clustered three to a controller. And indeed, among users interviewed, 3211s often outnumbered the 1403s. But on the other hand, there is a much larger population of 1403 printers; they are more familiar and actually a bit more cost effective (in terms of lpm per hardware dollar).

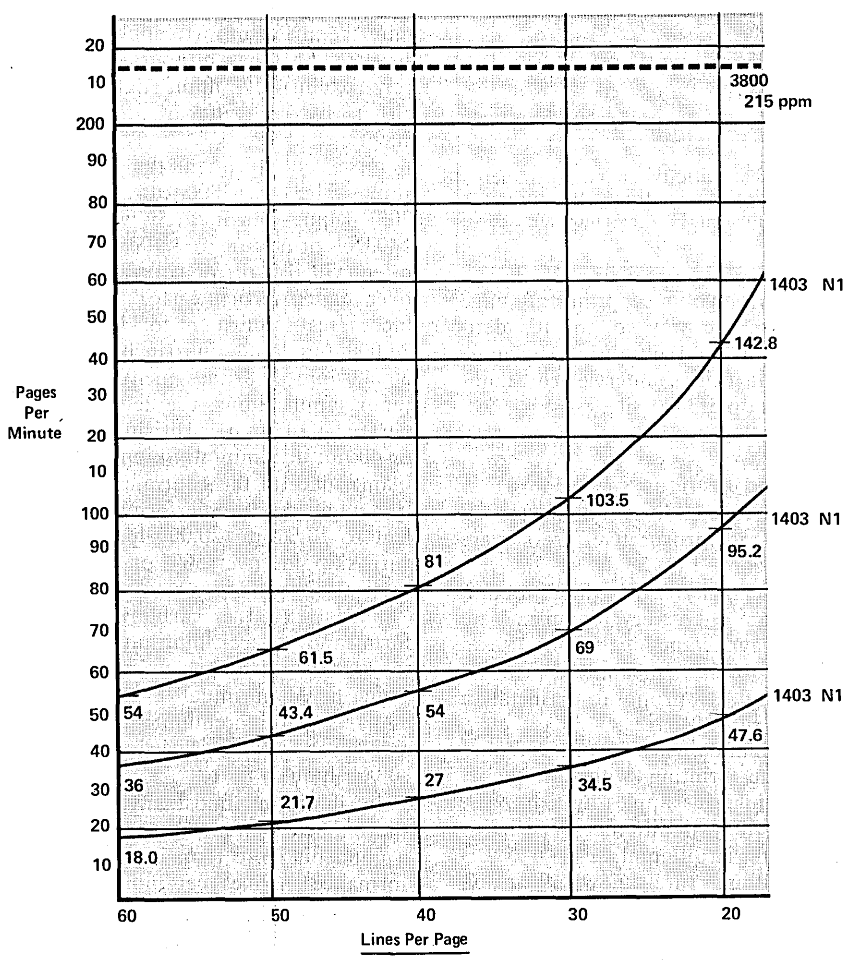
In Fig. 1, the 1403N1 and 3800 are compared in terms of pages per minute, both printing 8 lines/inch on an 8½-inch deep form, at various numbers of lines per page. This shows the IBM impact printer becomes more effective compared with the IBM nonimpact printer when the lines per page fall into the 30 to 40 range. The 3800, on the other hand, maintains a constant printout speed regardless of the number of lines per page.

This exercise yields a rough "performance equivalency ratio," although still a few assumptions remain. The 1403 skips at 33 inches/sec and (with dual feed carriage) 75 inches/sec after 8 lines. With normal top and bottom margins, there would surely be some 75ips skipping on all forms. Although as the line density goes down there would tend to be more, we have used a constant average skipping speed of 40ips.

Below the chart are a set of "performance equivalency ratios." These are simply the results of dividing the 215 pages/minute produced by the 3800 by the pages per minute produced by the 1403. For example, printing 40 lines/page in a single-part application, it would theoretically take eight 1403N1s to keep up with a single 3800 (215/27=7.963).

One 3800 user reports keeping his 5- and 6-part reports on impact printers. Using carbon interleaved forms and impact printing in this case was considered more cost effective, and there was also a small saving in cpu time (more on this below). In fact, charting the performance of an IBM 3211 printer using a 3-part carbon interleaved form would show the impact printer actually outperforming the NIP when the lines per page density falls below 30.

Figure 1: IBM 3800 and 1403 N1 @ 8½ inch page depth



4.0:1	3.3:1	2.65:1	2.09:1	1.50:1
6.0:1	5.0:1	4.0:1	3.12:1	2.26:1
11.9:1	9.9:1	8.0:1	6.23:1	4.51:1

Performancy Equivalency Ratios

Fig. 1. Since it is so familiar, and also slightly more cost effective than the IBM 3211, the venerable 1403 is used as a benchmark for printing performance. The equivalency ratios for each lines/page measure are determined simply by dividing the page/minute figure by the 3800's fixed number of 215.

Form size: mix and match?

User interviews confirmed that the 8½-inch form depth is virtually a standard, apparently representing at least 80% or 90% of the volume of the 3800 users contacted. Form size figures in a trade-off that faces users of the new page printers: (a) the desire to put to work the format flexibility and ability to compress data to fit smaller, cost-saving, "people size" page sizes, versus (b) concern with backup.

One early user of the 3800 continued with the same 14⅞x11 page size so that report users were barely aware whether printing was by impact or NIP. This permitted jobs to be shifted from printer to printer without complication.

Maximum paper savings are achieved with the 11x8½ page size (as well as the oft-mentioned mailing and filing savings). Yet this size is used by a *minority* of the 3800 users interviewed to date. Those who do use it have generally replaced a Xerox 1200 or a reduction duplicator with an IBM 3800.

Compressed format has its advantages, but it also can evoke complaints about its readability and lack of space for subsequent notations. To get 132 characters on an 11-inch wide sheet with the 3800, 15 characters/inch printing must be used. (This explains the selection of off-beat 12.5 or 13cpi by Honeywell and Xerox.)

Users—particularly the large volume ones—often seem to stay with the 14⅞x8½ form size. The switch away from 14⅞x11 had been made earlier, with the impact printers, in response to rising paper prices and the encouragement of some of the forms suppliers. Sticking with this size offers painless transition to the 3800, with no format reprogramming, transparency among all printers, and simplified forms stocking with the ability to mix and match forms in stock with various printers. Such considerations, especially backup, may prompt many users to select this form size during their first few years of experience with the page printers. But it may be only an interim size.

Replacement ratio

Now, getting dollars into the picture, monthly volume and, especially, replacement ratio become critical factors. Replacement ratio can in fact loom as the main controlling ingredient in almost any calculation of relative costs. *And whatever ratio is used, it can almost always be shown to be arbitrary.* For this reason, in our calculations here our raw performance equivalency ratio has been used, rounded to the nearest whole printer.

In practice, our user interviews provide some evidence that these theoretical ratios may not be too far off base if it can be assumed that the applications typically require two-part forms with 40 or 50 lines/page on the average. These (see Fig. 1) would warrant a 5-to-1 or a 4-to-1 replacement ratio. In some cases it appeared redundant impact printer capacity had been retained.

Some representative "before and after" printer inventories are shown in Table 3. In theory, a printer like the 3800 could replace up to 18 1403s. In practice, however, the 3800 replaces only a relatively small number of impact printers—between 3.6 and 7.2.

Complicating the picture is the fact that in some cases, admittedly rare, the IBM 3800 replaced another NIP (like the Xerox 1200). To relate these cases to our theoretical performance equivalency ratios, the faster printers (IBM 3211 at 2,000 lpm and Xerox 1200 at 4,000 lpm) are translated into IBM 1403N1 equivalents simply according to their relative speeds in lpm (one Xerox 1200 translates to 3.6 1403s, and one 3211 translates to 1.8 1403s).

A number of factors may explain low replacement ratios. Most users report plans for added applications. Also, in some cases the line printers are owned, which weakens the motivation to remove them. Some may want flexibility and backup during the initial stages, and also anticipate future volume increase. Then there are the jobs that can be run only on impact printers (specialized forms, heavyweight papers, continuous cards, etc.). More important may be the variable demand that characterizes many sites. The NIP is justified to meet peak load demands; when total printout capability is measured against overall monthly volume, it only appears excessive. And finally, the low replacement ratio could indicate a gap in productivity.

Production and production problems

Adequate treatment of productivity exhibited to date by the big NIP's makes a good study in itself, but is somewhat tangential to the main question at hand. We might note that users interviewed emphasize that the IBM 3800 is viewed primarily as a high volume, production machine. It seems as though much of the flexibility is not being used at this time. "It's a production machine," we

The 3800 can eat up a carton of paper in 10 to 15 minutes.

hear again and again, "we avoid changing paper size; we use the cheapest paper that works, keep splicing, and keep it going." Stock "tab" forms, 40 to 50 lines/page, with page depths 8½ or 11 inch continue to be the dominant application.

With hardware cost five to six times that of an impact printer, each second of unproductive time is that many times more expensive. The 3800 can eat up a carton of paper in 10 to 15 minutes. The form threading path is long (we're told it takes sixteen 11-inch pages to thread when refolding, 20 with the burster-trimmer-stacker option). And although IBM says an experienced operator can negotiate it within three minutes, the process is certainly more time consuming than loading a 1403. As long as forms of similar width are used, the built-in splicing station can be employed, reducing the form change time to around one minute.

While some users claim to be using the cheapest available stock forms without running problems, others have mentioned significant time lost due to forms problems, or a combination of forms problems and the early learning or shakedown period. Continuing intermittent ink problems are reported. There are breaks. And recovery, reports one user, can take a half-hour. Much hinges on the skill of the operator.

The big cost items

On labor costs, some users report no change in operating staff with the installation of a high volume NIP. Several report a reduction of one person. So far, it seems the labor rate for NIP operators is the same as for any other printer operator. But because skills and experience are said to be so important, it is possible this cost may tend to rise. For this reason, we have considered labor costs a wash out and they are not included in our comparison in Table 3.

Toner and developer, the nonimpact counterpart to the inked ribbon, are not an incidental cost, and users agree these are turning out to be quite a bit more expensive than printer ribbons. Most seem satisfied with IBM's original statement on these costs, which are therefore the ones we have used in this example.

How Many Can One IBM 3800 Displace?

"Before" Printers	"Before" 1403 equivalents	"After" Printers	"After" 1403 equivalents		Replacement Ratio (1403N1 equivalents: 3800)
5 3211s	9	2 3800s	2 × 5.4	10.8	5.4 : 1
1 X1200	3.6	1 3211		1.8	
10 3211s	18	4 3800s	4 × 3.6	14.4	3.6 : 1
2 1403s	2	2 3211s	2 × 1.8	3.6	
		2 1403s	2 × 1.0	2	
4 3211s	7.2	1 3800	1 × 6.4	6.4	6.4 : 1
4 1403s	4	1 3211	1 × 1.8	1.8	
		3 1403s	3 × 1.0	3.0	
4 X1200s	14.4	2 3800s	2 × 7.2	14.4	7.2 : 1

Table 3. The "before" and "after" hardware mixes of four sites suggest that the IBM 3800 will come nowhere near its theoretical limit on how many line printers it can replace. Instead of 18, it actually displaced from 3.6 to 7.2.

Developer is the carrier that transfers toner particles to the paper. Consumption is related to the volume of paper moving through the printer. A 20lb box costing around $200 is considered good for about 1.1 million feet of paper.

Toner is related to the density of the copy. In Table 5 we use the example of 40 lines/page and, to calculate toner, assume an average of 50 characters/line for 2,000 characters/page. Toner cost is believed to run about 40¢ per million characters. It will, of course, be substantially higher if the forms flash is used. Also, we assume that with closer spacing, smaller characters consume a bit less toner. All this considered, we have used the following: $.0009/page with 10 char/inch spacing; $.0008/page with 12 char/inch spacing.

Forms costs, as shown in Tables 4 and 5 are significant factors. They can run a lot higher than the cost of the printout hardware. Because of the wide variations reported, analysts can pick a number to prove a point, and probably back it up. Seeing figures ranging from \$3 per thousand to \$8 per thousand for IBM 3800 forms prompted us to do some extra digging on this specific question.

It immediately became clear why forms pricing is something of a mystery among the hardware vendors; among the forms vendors, it's something of a mystery, too. Call a forms industry insider, and your conversation is likely to run something like this:

"Forms prices? No problem, I'll send you our latest price list. But it's going to be revised in about a month; the mills are going to be raising their paper prices. Also, the price list doesn't mean much. Volume orders, contract buying may be 30% to 40% below list."

"How about forms for the IBM 3800?"

"Well, that's a specially priced item. We have to take some extra care with the inks and perforation strength. . ."

"So it is priced higher?"

"Well, in theory it should . . . but it depends. . ."

Actually the users, and some vendors, were somewhat more specific. Tempering such reports with various price lists including the *GPO Contract for Marginal Punched Forms* give us confidence that real world pricing for

It is unlikely that an application program can drive a 3800 at full speed.

large volume forms users at this point will usually be at least in the general range shown in the boxed item, "Forms Costs."

Hardware cost, in contrast, is relatively cut and dried, although there is a choice of purchase or leasing plans, and also the problem of up to three 1403s working off a single 2821 control unit. We've simply divided the shared units by three to get the single 1403 printer cost. Fixed Term Plan pricing is used since we're told this is the most common with the 1403, and also handiest, since there are no additional use charges for operation beyond one shift. Table 6 compares the hardware cost of the IBM 3800 and the 1403N1.

Combining all the data, as illustrated in Table 7, indicates the 3800 will often have obvious superiority in the one-part case, at least when the smaller page sizes are used. In the cases indicated by light shading, the cost difference is nominal, and we are sure they could swing either way depending upon minor changes in the circumstances. In the cases highlighted in darker gray, the impact alternatives appear to offer clear cost advantages (\$,000 to almost \$4,000/month).

Typically "average number of parts" is now said to fall between 1.3 and 2, although some users of the high volume NIP's claim the requirement of 8 parts or more made the justification of their new systems elementary. The "2-part average" column in Table 7 is certainly not far afield from reality in many cases, and we are sure that variation in forms costs and toner/developer costs could swing it either way.

The picture brought into focus by Table 3 is, of course, not unexpected; the major value of the process, we feel, is in documenting the costs upon which it is based, and the influence of the variables. It is only a model, but a useful one, we hope, since others can easily plug in their own costs.

But what about . . . ?

We have dissected, of course, only the most basic and direct elements of printout cost. Vendors of the big NIP's can reel off a barrage of other considera-

Total Printout Cost Using IBM 3800

Volume of 2.5 million pages per month, 40 lines per page average, 50 characters per line average

Form Size	3800 (ETP)	Monthly Use \$	Toner & Developer	Paper	Total
14⅞ × 11 (10cpi/6 lpi) 2.3 million ft.	\$6,250	\$5,290	\$2,250	\$11,500	\$25,290
14⅞ × 8½ (10 cpi/8 lpi) 1.75 million ft.	\$6,250	\$4,025	\$2,250	\$10,250	\$22,775
12 × 8½	\$6,250	\$4,025	\$2,000	\$9,500	\$21,775

Table 4. The cost of forms is a significant factor in total costs, running almost the same amount as the combined hardware lease and use cost for the page printers.

Total Printout Cost Using IBM 1403N1s

Volume of 2.5 million pages per month, 40 lines per page average, 50 characters per line average

Form Size	No. Parts	No. Printers	1403 (FTP)	Ribbons	Paper	Total
14⅞ × 8½	1	8	\$13,864	\$996	\$10,250	\$25,110
	2	4	6,932	498	13,125	20,555
	3	3	5,199	375	14,166	19,740
14⅞ × 11	1	6	\$10,398	\$996	\$11,500	\$22,894
	2	3	5,199	498	16,250	21,947
	3	2	3,466	332	17,500	21,298

Table 5. The number of printers required to equal the IBM 3800 were determined in Fig. 1 for the 14⅞×8½ inch form. Fewer printers can equal the output of the non-impact device when 11 inch forms are used; the longer form handicaps the 3800 more than the line printer.

Comparing Hardware Costs

IBM 3800	Basic Monthly Charge (ETP)	\$6,250.00
	Monthly Use Charge	\$ .0023 per foot

IBM 1403N1 (FTP)			for 3	for 1
Printer	\$ 826	1 each	\$2,478	\$ 826
1416 cartridge	101	1 each	303	303
2821 controller	1,130	share up to 3 printers	1,130	377
1,100 lpm adapter	70	1 each	210	70
Third printer adapter	472	one needed with 3 1403s	472	157
	Total, each 1403:			\$1,733

Table 6. For ease in computation, the total cost for a cluster of 1403s is divided by three for purposes of comparing the cost of the line printer with the page printer.

	one part 1403	one part 3800	two-part average 1403	two-part average 3800	three-part average 1403	three-part average 3800
both 14-7/8 x 11 10 cpi/6 lpi	$22,894	$25,290	$21,947	$25,290	$21,298	$25,290
replacement ratio	6 : 1		3 : 1		2 : 1	
performance equivalency	6.35 : 1		3.17 : 1		2.1 : 1	
both 14-7/8 x 8½ 10 cpi/8 lpi	$25,110	$22,775	$20,555	$22,775	$19,740	$22,775
replacement ratio	8 : 1		4 : 1		3 : 1	
performance equivalency	8 : 1		4 : 1		2.65 : 1	
1403 : 14-7/8 x 8½ 10 cpi/8 lpi 3800 : 12 x 8½ 12 cpi/8 lpi	$25,110	$21,775	$20,555	$21,775	$19,740	$21,775
replacement ratio	8 : 1		4 : 1		3 : 1	
performance equivalency	8 : 1		4 : 1		2.65 : 1	

Table 7. Combining all the assumptions and data, the cost effectiveness of the IBM 3800 compared to that of the IBM 1403N1 comes out like this. Unshaded areas are where the 3800 has the cost advantage. In the lightly shaded parts, impact printers with carbon interleaved forms have a moderate advantage. The heavily shaded areas show where the 1403 performs best in comparison—multiple-part, 14⅞×11 forms being its very best case.

tions, as can the users. Yet the analysis of the rest is much more difficult; complexity is greater and indirect costs and intangibles come into play.

Among those mentioned earlier are the ancillary considerations related to the forms. With the nonimpact printer using forms flash to overlay what would otherwise be custom printed in the forms plant, more toner is used, and this is more expensive than printer's ink. But avoided are the extra cost of custom forms and also a good portion of the expense associated with stocking a wide variety of custom forms.

What about cpu efficiency with the big NIP's? Can there be situations where the system is cpu-bound because of the high data rate of the page printer?

Off-line proponents claim there are, asserting that's why IBM recently added an off-line option to its 3800 menu. One of the IBM 3800 manuals cautions that direct output to the 3800 is not recommended, since it is unlikely that a problem program can drive the 3800 at full speed. Instead, data to be printed should be spooled to storage with special care taken to ensure sufficient volume is reserved for that purpose when page format is dense, and to make sure the channel will support the data rate of the 3800. And if multiple copies of output documents are being printed from disc or tape, there is at least some additional load on the system as each page of data is moved back through the cpu to the 3800.

An IBMer replies that such considerations are not the reason for the off-line option; the move simply acknowledged that some users are off-line oriented, and also that there are non-IBM accounts which are prospects for the 3800. Current users also, judging from our interviews, are strongly committed to on-line processing for maximum control and minimal operator intervention. Some had replaced off-line Xerox 1200 printers, and they were pleased to be rid of what they felt was considerable inefficiency in the form of manual handling and storage of tapes. They further profess to be skeptical that the 3800 operating on-line robs the cpu of cycles any more than impact printers do; in fact several asserted more efficient use of the cpu was possible.

Watching the pioneers

The new high volume, nonimpact page printers then, in the process of drawing attention to the oft-neglected printout function, also help bring into focus some of the broader issues of significance to equipment vendors, users, and the suppliers of forms and other expendables. Trends in paper prices will be having a significant impact on the cost effectiveness of the new page printers. Sharp increases would hasten movement toward the NIP's; however paper capacity is currently felt to be underutilized, and no sharp escalation in prices is expected for the next few years. But the paper mills and forms suppliers, conversely, are watching user reaction to these systems very closely in the belief that the pace of conversion to the new printers signals important new directions for their markets.

The printout function is finally responding to the inexorable evolution of technology from the mechanical to the electronic. Users are faced with important new options. React they must, sooner or later. The desire to be first on the block with a new toy, and numerous other subjective considerations can obviously shape user response. Even though it's apples and oranges, hopefully the wherewithal will be mustered for intelligent quantitative analysis. ⁂

Mr. Webster was a programmer and analyst before joining the IBFI, the international association of forms manufacturers, where for 15 years he directed a technical information program for the industry. Now with Datek of New England, he edits the monthly newsletter *Printout*.

NON IMPACT

Converting to the IBM 3800

by Richard Groppa and Linda C. Jones

After adjusting to the new operating environment, adding more hardware, improving operator training, demanding better maintenance, and upgrading everything—it all turned out to be worthwhile.

In 1976, the Con Edison data center in New York City was producing 240 million lines of print from 4,000 tapes every month. Seventeen printers, nine tape drives, and as many as ten operators per shift were needed to print that large a volume. Today, with even more print load, three IBM 3800s have replaced most of the printers and tapes that once filled the center. The peripheral operations staff has been reduced by 50%, and the annual dp budget by $360,000.

Although there was a relatively straight road from the 1976 operation to today's, it wasn't without its detours and potholes. When the 3800s were first offered, they didn't have features we needed. When those features were added, some of our applications weren't compatible with nonimpact printing. When the applications were made compatible, other problems came up. Still, our printing production is crucial to our business' operation—especially the printing of meter reading slips and customer bills—and our present ability to put out higher quality printout more quickly made the conversion worthwhile. And the savings are an awfully nice side benefit.

Due to the nature of its business, the Consolidated Edison Company has always had a tremendous data processing and printing workload. The company provides electricity, gas, and steam service to nine million people in the five boroughs of New York City and in parts of Westchester County, for a total service area of 660 square miles. Its corporate headquarters, located in lower Manhattan, houses two data centers which are 13 floors apart.

Between them, the data centers have five cpu's. These include a two-megabyte IBM 370/148 and a five-megabyte 370/168 which together support a corporate IMS/VS system, stock transfer, general accounting, TSO, and other non-customer service applications. Two five-meg 370/168s and another two-meg 370/158 support the customer services system and its 2,000-terminal CICS/VS network. All systems operate under MVS, and the four large systems are linked in a JES2 shared spool environment.

The current printer complement consists of two 3800 printing subsystems and four 3211 printers located in Data Center I, where most production output is processed, plus one 3800 and one 3211 in Data Center II, used primarily for test and development output and as backup for the other center's production machines. (See Table 1.)

With 660 square miles of some of the world's most densely populated territory, Con Ed needs three 168s, a 158, and a 148 to keep up.

The configuration has been designed to present a single data center image. The JES2 shared spool function provides maximum flexibility in directing output from the mainframes to the printers. Since the 370/148 cannot be linked into the shared spool environment, the company plans to replace it and the 370/158 with a new 3032 system next month.

Starting with dedicated 1401s

This isn't the first time the company has upgraded to keep up with the printing load. In 1962, 1403 printers were driven from tape by dedicated 1401 computers. By 1965 they had been replaced with dedicated 360/30s in the same tape-to-print environment. In 1970, 360/65s were installed to support budding on-line applications, and Data Products printers were installed. All these operated in an independent standalone environment, thus unloading the mainframes to improve on-line performance.

By 1973, however, the IBM 3211 printer proved to be more economical than the Data Products printer; its wide carriage made it possible to print customer bills and meter reading documents two-across. So 3211s were run on-line under OS/MVT.

The 3800s aren't even the first nonimpact page printers at Con Edison. In 1975, three Xerox 1200 page printers were installed. The Xerox was revolutionary in one respect: since its output was 8½x11 inch plain paper, it offered substantial savings in paper costs. Its other attractive features included forms overlay, which replaced many expensive tailored forms, and ready to be bound output, which completely eliminated bursting and decollating and also simplified binding. In addition, the Xerox printer operated in a standalone mode, and was thus well suited to the tape-to-print environment.

With all its advantages, however, the Xerox printer's days were numbered. In September 1975, Con Edison conducted its first feasibility study of the IBM 3800 printing subsystem as a replacement for the Xerox 1200 and the

3211 printers. Fifteen months later, in January 1977, the first 3800 was installed.

The 3800 hinged on a form

Ironically, the 1975 study decided *against* the 3800. Since more than half the print workload was already produced on the Xerox page printers, no saving on forms was expected. At that time, the 3800 did not include the Burster-Trimmer-Stacker (BTS) feature, which meant that the bursting operation, which the Xerox printer had eliminated, would again be required. The 3800 could not operate as a standalone.

On top of that, customer bills at that time were printed on card stock, which the 3800 could not accommodate. Its maximum paper weight is 24 pounds. Size and weight restrictions made it impossible to convert most of the specialized forms printed on the 3211 directly to the 3800.

And after the specific objections came a general drawback: the 3800 represented an unproven technology and appeared to be an electromechanical monster. Why be a pioneer?

The subject seemed to be closed. Then in February 1976, a new development made the company reconsider. Con Edison abandoned its 51-column card customer bill in favor of an optically scannable paper document. The card bill had too little room for the customer information mandated by the Public Service Commission. It also presented operational problems, since it required both printing and punching; and it was clumsy in remittance processing since partial payments were mark-sensed on the reverse side.

Studies showed that if the paper bill were introduced print volume would double, possibly triple, adding approximately 165,000 documents/day to our load. The installed hardware wouldn't be able to handle it all.

Once the company had committed itself to the paper bill, the 3800 looked more attractive. Although adequate OCR quality had been achieved with the 3211, stringent quality control procedures were required to assure consistency. And Xerox output wasn't scannable. The 3800, on the other hand, offered OCR excellence.

Then, too, Con Edison's overall hardware/software plan included implementation of shared-spool I/O processing. This made the 3800 cost-competitive with the 3211/Xerox configuration, and turned its on-line capability into a plus. Although the 3800 could not immediately support many specialized 3211 applications, it could take on 80% of the workload.

By 1976, IBM had given its 3800 a BTS capability, which of course solved the bursting problem. And one final advantage made the 3800 particularly attractive: consistently high quality output.

When plotters were first added to computer rooms, they drew onlookers and productivity plummeted. The same can be true of the 3800 unless appropriate precautions are taken.

Controlled migration

On the basis of the second study, implementation was approved. To get things started a task force was appointed. On it were representatives of all areas of our systems and information processing groups plus IBM representatives from Data Processing, Field Engineering, and Information Records divisions. The primary objective of the task force was the implementation of the new paper bill.

When output can be printed two-across, printout time is cut in half.

The group also looked into the conversion of high volume applications which could be migrated to the 3800 with the least redesign and application programming effort. These applications included the meter reading document—produced at a rate of 175,000/day—which required redesign to allow for the half-inch upper margin restriction; the 3211 plain paper output, which could be directly migrated; the Xerox plain paper output, which required minor JCL modifications; and the Xerox forms overlay applications, which required major graphic design for conversion to 3800 overlay flashes.

By September the task force had drawn up a timetable for the conversion. The first 3800 (without BTS) was due in early January 1977. The newly designed paper bill would be implemented almost immediately thereafter. The operational pilot for the paper bill had been conducted during November and December, using 3211s and the IBM

RESOURCE/COST COMPARISON

	Resource	Lines/Month (Millions)	Cost/Month
"Before"	3 Xerox 1200s	467	$15,000
	2 1403s	95	3,000
	12 3211s	1,037	36,000
	9 tapes		4,000
	30 operators		50,000
	Total	1,599	$108,000
"After"	5 3211s	432	$15,000
	3 3800s	1,296	35,000
	2 tapes		1,000
	15 operators		25,000
	Total	1,728	$72,000

Table 1. The conversion provided 8% more capacity at 33% less cost, using 50% fewer people. (In fact, the additional costs for the more expensive page printers were more than made up for in reduced personnel expenses alone.)

Data Center's 3800 printers. By March, the first BTS would be installed. This would permit migration of standard Xerox output and conversion of the 3211 output.

In April, the second 3800 would be installed, including a BTS. The new system could then take over all the remaining Xerox work, and the newly designed meter reading document could go live. All overlap equipment was to be eliminated by May 1977.

Controlling the conversion was no small task

In November 1976, representatives of Con Edison and IBM began to plan, coordinate, and assign responsibility for the next year's hardware migration and MVS conversion. A broad range of Con Edison personnel took part, including the managers of the computer technology group, the two data centers, the systems assurance group, the two major on-line applications (IMS and CICS), and members of their staffs.

Detailed schedules and tasklists were developed to achieve the following goals:

Install 370/168	4Q 1976
Convert to 6250bpi tape	1Q 1977
Convert to 3705 Mod II TCU	1Q 1977
Install 3800 Printing Subsystems	1Q 1977-2Q 1977
Convert to 3350 DASD	2Q 1977-4Q 1977
Convert to MVS/JES2	3Q 1977-4Q 1977
Install 370/148	4Q 1977
Install 3850 MSS	4Q 1977-2Q 1978

This detailed tasklist was maintained on-line, and has been used as a checklist in weekly task force meetings. It is updated after each meeting. A completed task is so marked and kept on the list for one more week. The tasklist is still growing. By now, we've worked on or identified 871 tasks, of which 749 have been completed. Fig. 1 shows a sample tasklist, containing key 3800 tasks extracted from the original tasklist.

Following the hardware migration planning session, a larger group of people became involved in implementing the 3800. Initial operator education had begun in November 1976. The first 3800 printer was installed in January 1977.

Converting the data sets

Conversion of print data sets began that month with the printing of the customer bill. Between January and August two more 3800s were installed, the conversion from SVS and HASP and JES2 was completed, and several software modifications were made to JES2 to better support the 3800.

The major conversions which were undertaken are listed in Table 2, along with the lines per month represented by each.

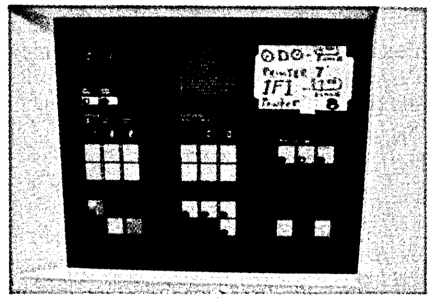
Needless to say, the production of customer bills is a very important data processing job at Con Edison. The company prints bills on a 21-day cycle, producing an average of 165,000 each working day. Before the 3800 was installed, bills were printed on 3211 printers, burst, and punched on IBM 2540 card punches. This was a tedious, labor intensive job.

With the 3800, bills are printed in a total of eight hours of printer time, using one or two printers. Before the 3800 installation, bill printing was finished at about noon each day. Now the bills are out by 7:00 a.m.

The new paper bill itself is largely responsible for this improvement. Con Edison designed it not only to meet Public Service Commission requirements, but also to make the most of the 3800's capabilities. Bills are printed two-across, thereby cutting printing time in half! They are printed in OCR font, and after being returned are scanned using a new Cummins/Allison 4400 system which was installed for this application.

Detours and potholes

Of course the transition was not perfectly smooth. Con Edison had some operational problems with its first 3800 application. Since the data sets for billing are large, printer problems often interrupted the process, especially in the early days of the transition. Backspacing the printer file was difficult because HASP/JES2 does not specify the correct

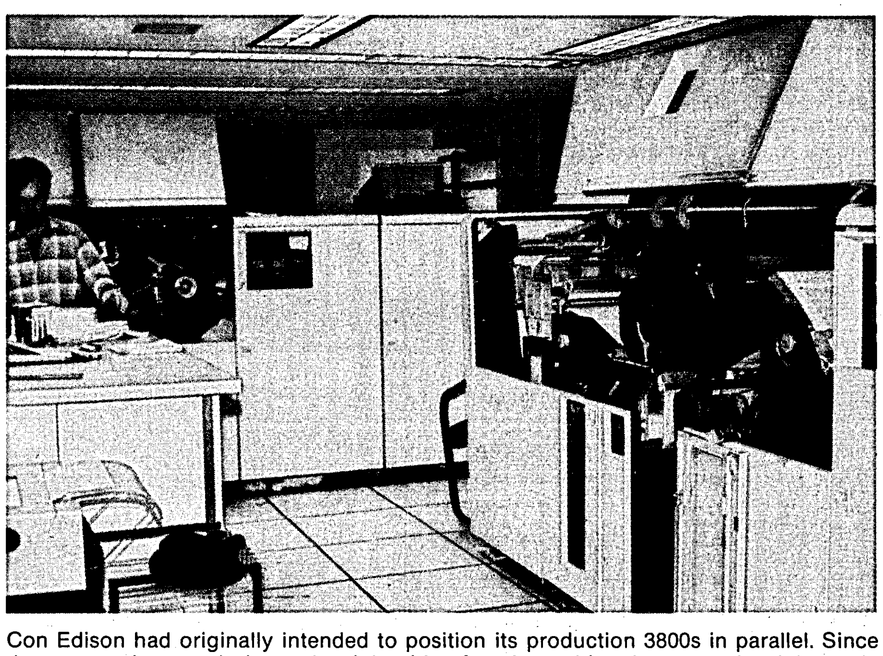


Displays on the operator panel are too small to be seen from a distance—an obvious place for improvement.

CONVERSION OF PRINT DATASETS TO IBM 3800

	Lines/Month (Millions)
Customer bills	31
Xerox output without overlays	142
Meter reading documents	14
Xerox output with overlays	8
Millions of lines/month	195

Table 2. Although they represented a relatively small portion of the total output, the customer bills and meter reading documents largely decided whether the conversion would be made.



Con Edison had originally intended to position its production 3800s in parallel. Since the operator's console is on the right side of each machine, however, the right-angle arrangement proved less clumsy.

number of pages to backspace. As a result, occasionally bills were duplicated or not printed at all. Eventually a special program was written to control bill printing. It has the ability to restart at any account number.

Because the bills are printed two-up, they must be sliced. Slicing accuracy remains a problem, because it depends on careful work by the operations staff. Since the page for the two-across bill printing is wider than standard plain paper, smears and streaks appeared on the right outside edges of the bills. This was corrected by running the "clear print" routine just before printing bills. All 3800 printers have since been upgraded to automatically run this routine between data sets.

Shortly after the 3800 was installed, an extended 3800 outage forced Con Edison to revert to printing bills on the 3211 printers. Unfortunately, the new messages on the bills contained characters available in the 3800 character arrangement table but not on the 3211 print trains. (Worse yet, one of the 3211 print trains periodically printed a wrong number.) Since there are now three 3800s, it is extremely unlikely that fallback would again be necessary. However, if it is, a special print program will translate unprintable characters to something printable.

We calculated that one 3800 could handle the entire print volume—we actually needed three.

The latest step in bill printing at Con Edison has been the use of upper and lower case characters for all but the one OCR-scannable line of the bill. This was adopted to make the numbers more easily readable for the customers, and to highlight the special messages. To make sure that we can fall back to the 3211s, which are not set up to print lower case, the print program has been modified once again. The 3800 table reference character is removed and lower case translated to upper.

Standard plain paper output was previously printed on the three Xerox printers. Most of these jobs were easily converted to the 3800. Two tasks had to be performed by operations and software systems personnel before this conversion could take place. One was to convert the Xerox versions of Forms Control Buffer modules (FCB's) to 3800 FCB's. The second was to write two utilities. Whereas the Xerox printers had been operated off-line, the 3800s are driven by HASP.

As an interim measure, a special set of programs was written to spool the data sets from tape to HASP. One utility functions through the console, allowing the operator to specify the characteristics of the tape and the 3800 parameters to be included in the JCL. The JCL generated by that utility invokes another which reads the various tape formats and produces the required print output. Most production JCL has now been converted to direct output to the JES2 spool. When this conversion is complete, the utility programs will no longer be required.

Meter reading documents, like the customer bills, are printed on a 21-day cycle. On each working day approximately 175,000 of them are produced. They also are printed two-across, and are OCR-scannable. They had been printed on 3211 printers, and the only

APPENDIX A

CON EDISON S & IP / IBM   OCTOBER 6, 1977
SAMPLE TASK LIST BY PROJECT AND TARGET DATE

PROJECT	TARGET-DT	TASK	ACTIVITY -- *DEPENDENCY	SHIP-DT	STATUS	ASSIGNED
3800	12/23/76	95	PROVIDE SUPERVISOR TRAINING AT 909-3RD AVE		COMPL	WARREN
	12/29/76	14	DETERMINE MAXIMUM BOX SIZE		COMPL	LYNCH SMURRO WHITE E
	12/30/76	13	INSTALL FIRST 3800		COMPL	LIPINSKI
	01/08/77	12	PROVIDE BASIC HASP 3800 SUPPORT		COMPL	NESTEL
	01/24/77	5	WRITTEN PROCEDURE FOR DRIVING DC 1 3800 FROM DC 2		COMPL	BERGER
	02/14/77	36	IMPLEMENT HARDWARE PLAN FOR DRIVING FROM DC2		COMPL	BERGER MURPHY KOSEK
	02/27/77	43	DETERMINE STANDARD FORM SIZE AND STYLE		COMPL	MAC LEAN OGILVIE PRIORE
	03/16/77	38	INSTALL SECOND 3800	03/11/77	COMPL	LIPINSKI KOSEK
	04/04/77	73	INSTALL FIRST BURSTER TRIMMER STACKER	03/18/77	COMPL	GROPPA
	04/18/77	25	CONVERT METER READING DOCUMENT SYSTEM WIDE		COMPL	LYNCH RYAN SMURRO
	04/25/77	2	MODIFY HASP TO ARCHIVE SYSOUTS		COMPL	NESTEL SCANNELLO
	05/26/77	17	COMPLETE XEROX OVERLAY CONVERSION		COMPL	LYNCH MURRAY SHEA SMURRO
	06/01/77	74	INSTALL SECOND BURSTER TRIMMER STACKER	05/27/77	COMPL	SULTAN
	06/03/77	58	DELETE THIRD XEROX (DC 1) *3800 17		COMPL	VANVALKENBURG
	08/01/77	52	INSTALL THIRD 3800 (DC 2)	07/22/77	COMPL	KOSEK

Fig. 1. A conversion of this magnitude is too tough to play by ear. Goals, milestones, and action items were posted to a data base, updated and printed weekly. This particular printout is from the 3800.

modification necessary to use the 3800 was an increase in length from 3½ to 4 inches. (The 3800 is capable of printing a four-inch form when modified by standard RPQ.) As with the bill, a continuing problem was accurate center slicing. Since these scannable documents have been printed on both the 3211s and 3800s, error rates for scanning the documents can be compared. Here the 3800 clearly shows its superiority; less than 1% of its documents are unscannable as opposed to 3% for the 3211.

Last to be converted was the overlay output. In addition to converting about two dozen Xerox overlays, we designed a "bar" overlay to print lines every half-inch on standard plain paper. This provides readability for reports, program listings, and dumps, which had been printed on green bar paper, or by the Xerox printers, which provided lines automatically. After several tries, a bar overlay was selected which has slightly broken lines.

Software modifications

Before the installation of the 3800 Printing Subsystems, all production print datasets were written to tape and transported to peripheral operations staff in Data Center I, where they were printed either off-line on Xerox printers or on-line on 3211 printers using an in-house utility. As a result, peripheral operations personnel had no experience with HASP. After the 3800 installation, all printing was done from the HASP spool. Conversion to HASP was aided by the two in-house utilities mentioned above, which allowed operators to handle the tapes in a familiar way, and provided time for the conversion of production JCL.

The procedures that were followed before the 3800 was installed had two advantages. They permitted identification of each print data set by index number and "trip" (which indicates position in the cycle of working days); and they offered the ability to reprint a data set from several days back, using the retained tape.

When the first 3800 was installed, it was supported by the SVS operating system and a modified shared-spool HASP. By August 1977, MVS was operational and the HASP modifications were carried forward into the JES2 output subsystem.

One of the first modifications made was to provide separator pages between multiple copies of a data set. These resemble standard JES2 separator pages, except that they contain copy identification in place of the standard START JOB and END JOB designation. This modification allowed quicker breakdown of output and provided assurance that the proper number of copies had been produced, but was to cause big problems later.

Standard JES2 code tests to see if the BTS is threaded. If not, and bursting has been requested in the JCL, JES2 will not schedule the print job. We have bypassed the test. This allows the operator to control use of the BTS, which in turn permits printing to continue when the BTS is down and eliminates both set up messages and time-consuming operator responses for each data set.

The $DW command we've added enhances JES2 to provide a list of jobs awaiting output by class and print priority, along with 3800 related information such as form requirements, FCB data, character set, and overlay information. This information enables the peripheral operations supervisor to control the printing of priority jobs.

The $W command lists the number of lines awaiting output, and the amount of time on the output queue, by job.

A major enhancement made to JES2 provides for automatic tape archiving of selected print data sets. These data sets may be recovered and reprinted, if necessary. Data sets are identified on the output queue by index number. Still another new command, $DX, is used to list these spooled data sets by index. (This whole system is presently being converted to archive to the 3850 Mass Storage Subsystem instead of to tape.)

Throughput falls off

In June, after spooling of print data sets had begun and the third Xerox printer was removed, the HASP spool filled up and suddenly we fell behind on production work. Representatives of the data centers, computer technology department, and IBM quickly developed four hypotheses to explain the backlog: (1) the 3800s were operating below rated speed; (2) the operation was inefficient, with too much time being wasted on paper changing and error recovery; (3) too many errors were occurring; or (4) downtime on the 3800s was excessive.

Three people, one for each shift, were assigned to monitor the operation of the 3800s, noting each time a printer stopped, the reason for the pause, and the duration. Tables 3 and 4 summarize the results of three days of observation. On each of the three days, there had been a continuous outage of two or more hours on at least one 3800, and the backup 3800 had been pressed into service.

In light of these observations, we reconsidered our hypotheses. The original estimate of productive use of the 3800 had been based on the assumption that after downtime and paper changing time, approximately 70% of the rated speed of 9,000 feet/hour could be realized. The study showed that we actually were experiencing 13% downtime. Had we not used the backup 3800, downtime would have been 29%! Clearly, this was excessive. Since then, careful maintenance has considerably reduced those percentages.

IBM 3800 AVAILABILITY

A. Total time	100%
B. Cpu down	3%
C. 3800 down	13%
D. 3800 up but stopped	32%
E. 3800 available A - (B + C)	84%
F. 3800 effective A - (B + C + D)	52%

Table 3. Throughput fell after the conversion, largely because the 3800 was not printing much more than half the time. The downtime was even worse than item C makes it appear, since the 13% figure represents time when the production machine was down *and* the backup unavailable. Downtime on the production printer actually ran 29% in the beginning.

IBM 3800 THROUGHPUT

A. Rated feet/hour	9,000
B. Target feet/hour (70 % of A)	6,300
C. Actual feet/hour	3,800
D. Actual feet/available hour	4,100
E. Actual feet/effective hour	6,500

Table 4. Before the bugs were worked out, effective throughput was only about 70% of rated hourly speed—but not because the machine wasn't printing fast enough when it was productive.

The detailed logs kept by the observors gave the reason for the 32% printer-stopped time. Most of the stoppages were due to 3800 errors, and most of these were associated with BTS problems. Once one of these errors occurred, the operators had great difficulty resolving it, and the error would usually recur several times. The third hypothesis—too many error conditions—was also correct. IBM devoted intensive effort over the next two weeks to BTS problems.

Most of the remainder of the idle time was for paper changing and other normal operator activities. However, there were also problems with HASP, particularly with the backspace command. Target times were set for the most frequent 3800 operator activities: 3 to 5 minutes for loading and threading paper, 1 to 1½ minutes for splicing, 1 to 2 minutes for unloading. Additional training was provided for the operators to help them meet the targets and to familiarize them with basic HASP commands. Too much time was, in fact, being spent on paper changing and error recovery, but the amount of time thus lost was less significant than we had supposed.

The study also showed that even

during the 52% of the time that the printer was running, only 6,500 print feet/hour were processed, even though the rated speed of the 3800 printer is approximately 9,000 feet/hour. It seemed that the 3800s might be running below rated speed. Closer examination revealed that when a large data set was being printed (one requiring a box or more of paper), the printer did indeed run at full speed. What had not been taken into account was the large amount of time between data sets—something between 10 and 40 seconds. Thus, when many small data sets were being printed, the idle time between them could easily be longer than the time to actually print them.

The delay between data sets at that time was composed of the following:

Edgemarking	7 seconds
Loading a character set	23-28 seconds
Issuing clear print macro	3 seconds

Character set loading was not usually taking place, since most data sets were printed using the installation standard character table. However, edgemarking (printing solid bars over the perforations to identify where data sets should be separated) was routine. In addition, the delay problem had been inadvertantly exacerbated by the HASP modification which provided separator pages between copies. Since the BTS indicates the separation between copies by offsetting the stacked output, edgemarking could be eliminated. Once it was, throughput for standard output improved dramatically.

The printer did run at full speed when printing, but idled away 10 to 40 seconds between data sets.

Since this efficiency study was made, IBM has made several improvements to the 3800 which reduce the delay times considerably. The new times are approximately as follows:

Edgemarking	7 seconds
Loading a character set	3 seconds
Issuing clear print macro	0.3 seconds

A new "mark copy" function can cut this delay even further. It replaces the edgemark function completely, providing data set separation with no delay.

Real-world problems: operations, forms, hardware

The original estimates for print production had indicated that one 3800 printer could handle the entire print volume. Thus, the second printer was installed only for backup. However, the estimates had not considered that almost all printing is done during third shift and that most printed output must be completed before 8:00 a.m. The two printers together could barely handle this peak load if there were no outages. We requested an earlier ship date on the third 3800 and got it. Although this machine is not used for production work, it is available to back up the production 3800s during third shift and any other period of extraordinary print production.

The study also uncovered several additional operational problems. When the designated cpu for the 3800 was down, the switch to Data Center II backup took much too long. This problem was solved by providing better labels on switches and detailed procedures for the operators. Another problem, which affected the day shift, was the multitude of data control personnel, users, and systems programmers entering the area to inquire about or to demand output. All such persons are now restricted from the area. Finally, the observers found that often a new box of paper was not ready when needed; operators were instructed to keep ahead of the printer.

After adjusting the operating environment, acquiring an additional printer to meet peak requirements, improving operator training, receiving improved maintenance from IBM, and upgrading all 3800 printers with hardware and software improvements offered by IBM, we can easily complete our production work on time. Bills are out earlier than ever before, and user satisfaction with the quality of print output is very high.

Experience has shown that the forms designer must study the 3800 forms design manual carefully. Both obvious and obscure restrictions abound, and most of them cannot be violated. The more obvious include the half-inch clear space at top and bottom, discrete form sizes, and the supported range of paper weights. The subtle restrictions can be tricky. Perforation placement and strength, binding holes, corner cuts, paper quality, and ink quality have all presented problems.

At first, forms vendors did not have an adequate understanding of these requirements. IBM has since offered education for forms vendors, and some improvement has been noted. The restrictions are not as unreasonable as they might at first appear; and they have generally led to the development and enforcement of standards which were lacking in the past.

Con Edison did encounter several hardware problems with the 3800, all of which are now under control. Static electricity caused a great deal of trouble before the BTS was installed. A satisfactory method has not yet been found for bursting 3800 output off-line when paper weight is less than 24 pounds. Bursters from three vendors, exotic static elimination devices, and increased relative humidity have all been tried, to no avail. Clearly, BTS is the solution. This device has been carefully designed to handle the output, and when it is working properly, it works well.

In the beginning, delays in shipping spare parts resulted in long outages. Now that three 3800 printers have been installed, spare parts are generally available on-site.

The additional Writable Character Generation Memory (WCGM) has been installed on all machines. This feature permits four character sets to be resident concurrently, saving initialization time when fonts are changed, and allowing more character sets to be used on one printout.

New users generally feel a strong urge to take advantage of the 3800's special features right away. But the changeover should not be too quick or too drastic. A data processing center with only one 3800 should always be ready to fall back to 3211. It may also be possible to arrange mutual backup with another nearby 3800 user. A related point is that because preventive and remedial maintenance will govern the operational performance of the 3800; it does not pay to skip PM.

Experience has shown Con Edison how to live comfortably with the 3800. The best physical arrangement for two 3800 printers seems to be at 90 degree angles to one another. Our original plan called for a face-to-face parallel layout. However, since the 3800 printer is offered in only one configuration (with the control panel on the right), parallel placement would be operationally clumsy; operator panels and forms stackers would be at opposite ends of a tunnel.

The 3800 Printing Subsystem is a fascinating machine to watch, especially in the beginning, and it may draw crowds. Traffic should be routed around rather than through the printer area. Among other things, this will keep the operator from being distracted; and operator attention is an essential ingredient for good throughput.

The 3800 is a fascinating machine to watch, and it may draw crowds.

The weight of the 3800 required reenforcement of the raised floor in the area, while its sensitivity to relative humidity (greater than that of most devices, especially since forms are "baked" as they pass through the fuser) made some changes in the environment necessary. Output will be easier to handle if environmental conditions are right.

Worth all the effort

Overall, the 3800 has performed very well at Con Edison. However, there is still room for improvements, including:

Since the speed of the 3800 printer can be effectively doubled by printing documents two-across, the system should be reworked to produce a finished product. This could be done by adding a center-slice knife to the BTS.

The operator panel could be redesigned to improve operator productivity. The digital condition code readouts should be enlarged so that the operator can see them from a greater distance. Also, some system console functions could be built into the 3800 operator panel. At the moment, operators spend too much time moving back and forth between the system console and the printer itself.

Availability of both left- and right-hand models would provide more choices for the physical arrangement of 3800 printers for operational convenience.

Many character sets should be offered as standard or extra-cost features. Although the user can design character sets, this has proven to be a time-consuming, error-prone chore. Some standard character sets that might be developed are italics, script, business graphics, and APL. Existing character sets, such as upper and lower case text, should be available in more than one pitch.

Finally, the currently available batch facility for the development of new character sets is unwieldy and should be replaced by an interactive on-line facility.

Given these relatively minor changes, the machine will be a real workhorse for years to come, and many more users will find, as we did, that converting to its use pays off. ✲

Mr. Groppa joined Consolidated Edison as systems manager, EDP Equipment Planning, in 1976. He has responsibility for evaluation, selection, and implementation of data processing and teleprocessing hardware throughout the company.

Prior to joining Con Ed, he spent eight years at RCA Corp. where his assignments included management of the corporate data center, operation of the NBC News election analysis system, and administration of the corporate time-sharing system.

Linda Jones joined Consolidated Edison in 1975 and is now manager of Computer Technology. She is project manager of the GUIDE IMS Performance Project and chairperson of the New York IMS Users Group.

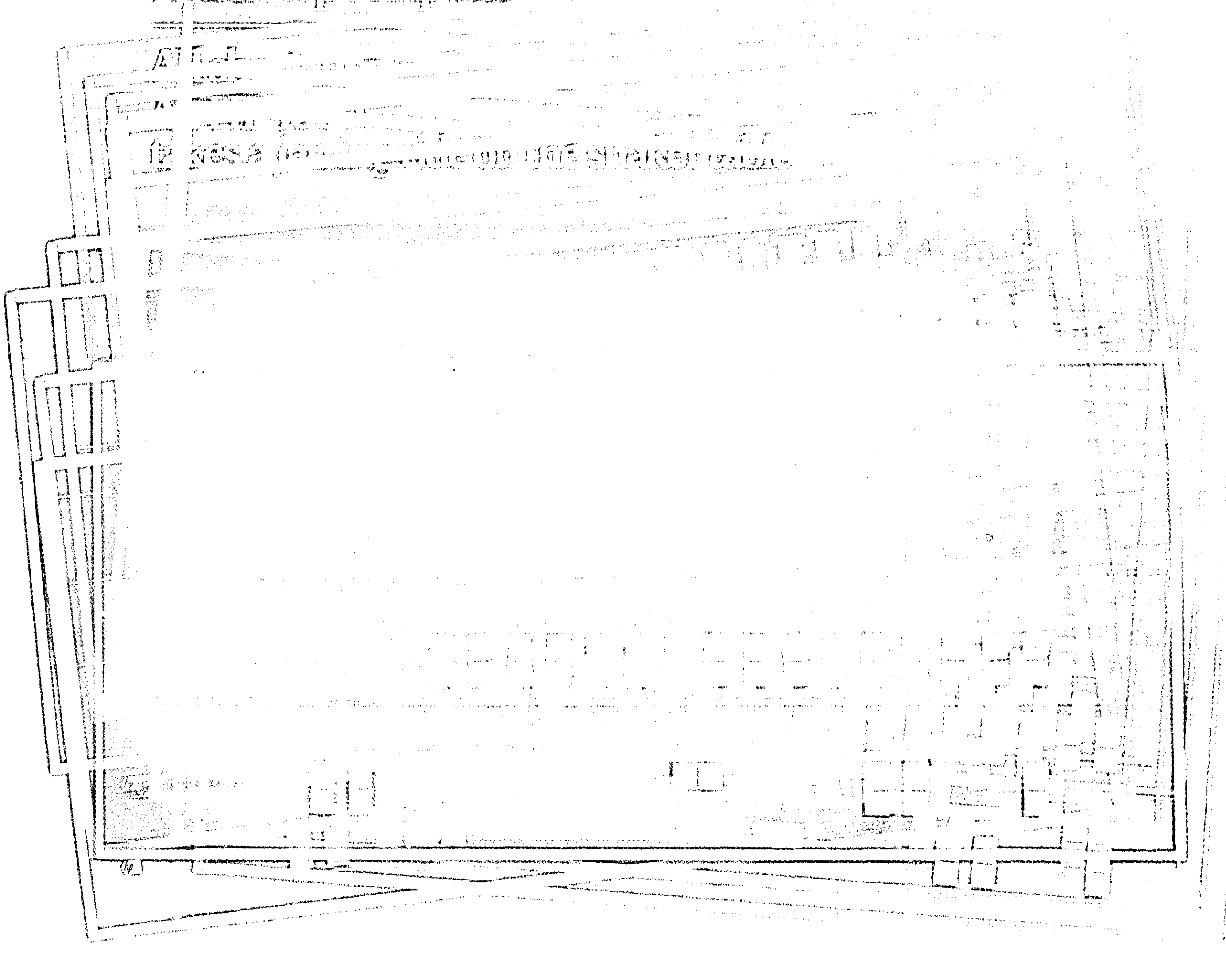
Prior to joining Con Ed, she was with Loeb, Rhoades & Co. as Manager of Standards and PL/1 Support, and with New York Telephone Co. as a programmer/analyst.

Hewlett-Packard

Computer Advances

Vol. 3 No. 3 May/June 1978

System 45: A desk-top computer



You won't stand in line for these two...

CIS/3000: On-line means no line

With HP's new College Information System, students can register for classes and be on their way in a matter of minutes. CIS/3000 handles all student records, registration, and grade reports. Written in Cobol, it uses the IMAGE data base management system, and operates in batch or interactive mode with formatted screens to aid user input. CIS/3000 can serve the student information needs of diverse educational customers. For example:

Seattle University is a four-year undergraduate and graduate school founded by the Jesuits in 1891. The neatly landscaped campus, just blocks from downtown, draws 3,600 students—from 50 states and 40 foreign countries.

Mira Costa Community College overlooks the spectacular California coastline. A variety of day, evening, and even weekend courses serve a mobile community of some 7,500 students ranging in age from eleven to more than ninety.

Mary Alice Lee has been registrar of S. U. through the transition from pen and ink posting of grades, to keypunching, and now to a totally interactive HP 3000. Mary Alice comments on...

Bob Crabtree is Mira Costa's one-man data processing department. The HP 3000 is their one computer system. Bob talks about...

CIS and the 3000...

"If you told me this time last year that we'd be getting on-line student information at the drop of a hat, with literally no DP support, I'd probably have laughed out loud."

"The 3000 is almost an operatorless system. Nobody sits at our console 8 hours a day. Instead, my secretary handles more and more of the operational tasks. Before the 3000 came, she'd never seen a computer... except on TV."

the conversion...

"People typically underestimate the complexity of conversions — I know, I've been through four! Our HP systems analyst came in on August 18 to begin reformatting our data. The 3000 was plugged in on September 8; terminals arrived on the 13th. On the 20th and 21st, we were registering students on-line."

"I've been in DP since 1967 and have had experience with five conversions. This one has been, by far, the easiest. We fired up our 3000 Series II on July 25 and started registering students ten days later. Now, I focus my attention on the users and their needs and not on the software problems."

the interactive environment...

"The greatest advantage we see with our interactive system is the potential for accuracy. Before, our batch system had around a 5% error rate at the end of a ten week quarter. This absolutely plagued our staff and students. Now corrections are immediate."

"Basically, we get the same information, but now we get it when we need it. Before, we could have two week delays in census reports. They were outdated when we got them. With CIS/3000, the information is current."

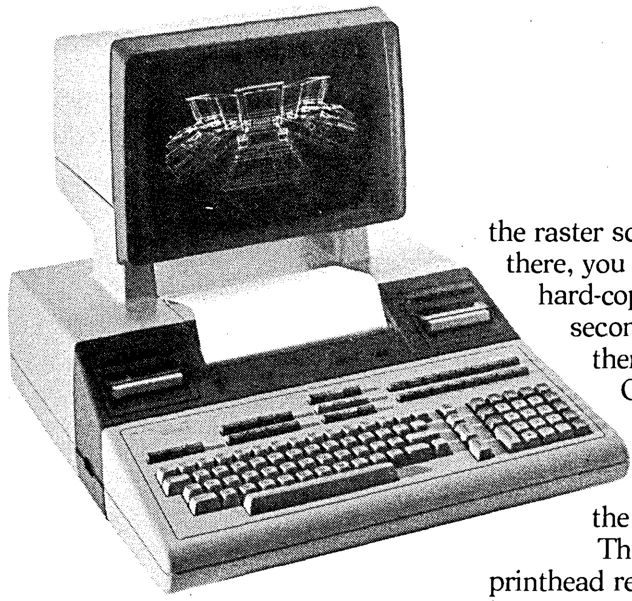
the data base...

"A university is a dynamic place; there's always a new report needed. What we saw in CIS/3000 was a data base of enormous scope — 200 data items* that cover any student info item that we might ever have."

"The IMAGE data base provides 200 predefined items of information — more than we'll ever need!"

CIS/3000's initial cost is $5000. More information? Indicate A.**

*Most items are suggested by NCHEMS — the National Center for Higher Education Management Systems.



System 45: You're always first

The System 45 is a 16-bit computer system that is so compact it fits right on top of your desk. All the peripherals are neatly integrated for easy accessibility — keyboard, CRT display, printer/plotter, and two tape cartridges. High performance results from state-of-the-art technology — six LSI microcomputers, plus two CPUs which occupy only 5.36 cubic inches each.

Dual processor architecture

One secret to the System 45's responsiveness is its two processors — one for I/O, the other for program execution. By operating concurrently on the user's program and I/O (in an overlapped approach) these processors can, in some cases, double system throughput. The System 45 is the first desktop computer to use dual processors.

The System 45 closely couples powerful computational capability with graphics options. A high-level interactive graphics language simplifies developing an image on the raster scan screen. From there, you can get a dot-for-dot, hard-copy replica in just 15 seconds on the high-speed thermal line printer.

Other HP plotting devices can be connected and then controlled by the same commands.

The printer/plotter's printhead represents an interesting break-through in thin-film technology. Multiple layers of conductive and resistive surfaces are deposited on three sides of the printhead.*

Because of this difficult-to-do conductor wraparound, the 560 print elements (resistors) can be evenly spaced across the printhead for continuous plotting and alphanumeric output. But why power up for all 560 dots when analysis revealed that 90% of typical printouts have rows with fewer than 56 dots? To avoid this inefficiency, we implemented a microprocessor-controlled, "variable pass" method. In those cases where more than 56 dots per row are needed, the printhead takes another 5 millisecond pass. The result: a typical speed of 480 lines per minute, and power consumption in most cases of no more than 30 watts.

Cool as a breeze

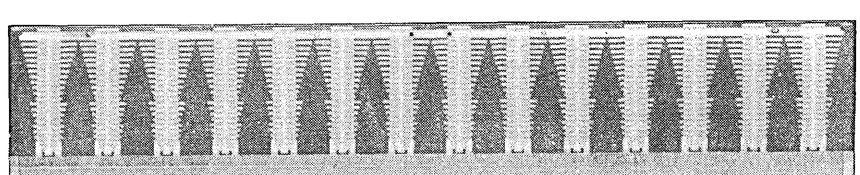
Integrating peripherals into one unit presents a real challenge in cooling. The solution was an innovative parallel/pull air circulation system. The air flows up through the entire system, first passing those components most sensitive to heat and then those less sensitive.

BASIC, an obvious language choice, is a superset of the new proposed ANSI standard (X3J2/77-26). It has some features not usually found in desktop computers — for example, the use of variable names up to 15 characters, and FORTRAN or ALGOL-like subroutines.

Standard with each System 45 is a library of generally useful utility software packages (statistical and numerical analysis, etc.). Ten other packs are available now. Of particular interest, is a waveform analysis library which uses graphics and fast Fourier Transforms, and a project management library for network analysis.

If you would like more information on the System 45, which starts at $11,500, indicate B on the reply card.**

*Patent pending
**U. S. prices only



*The System 45 desk-top computer's innovative, thin-film printhead.**

Shake and bake, drop and shock

Assuring product quality is more than a saying at Hewlett-Packard — it's a way of life. Since the company's beginning as an instrumentation firm, quality assurance has been an integral part of a product's lifecycle.

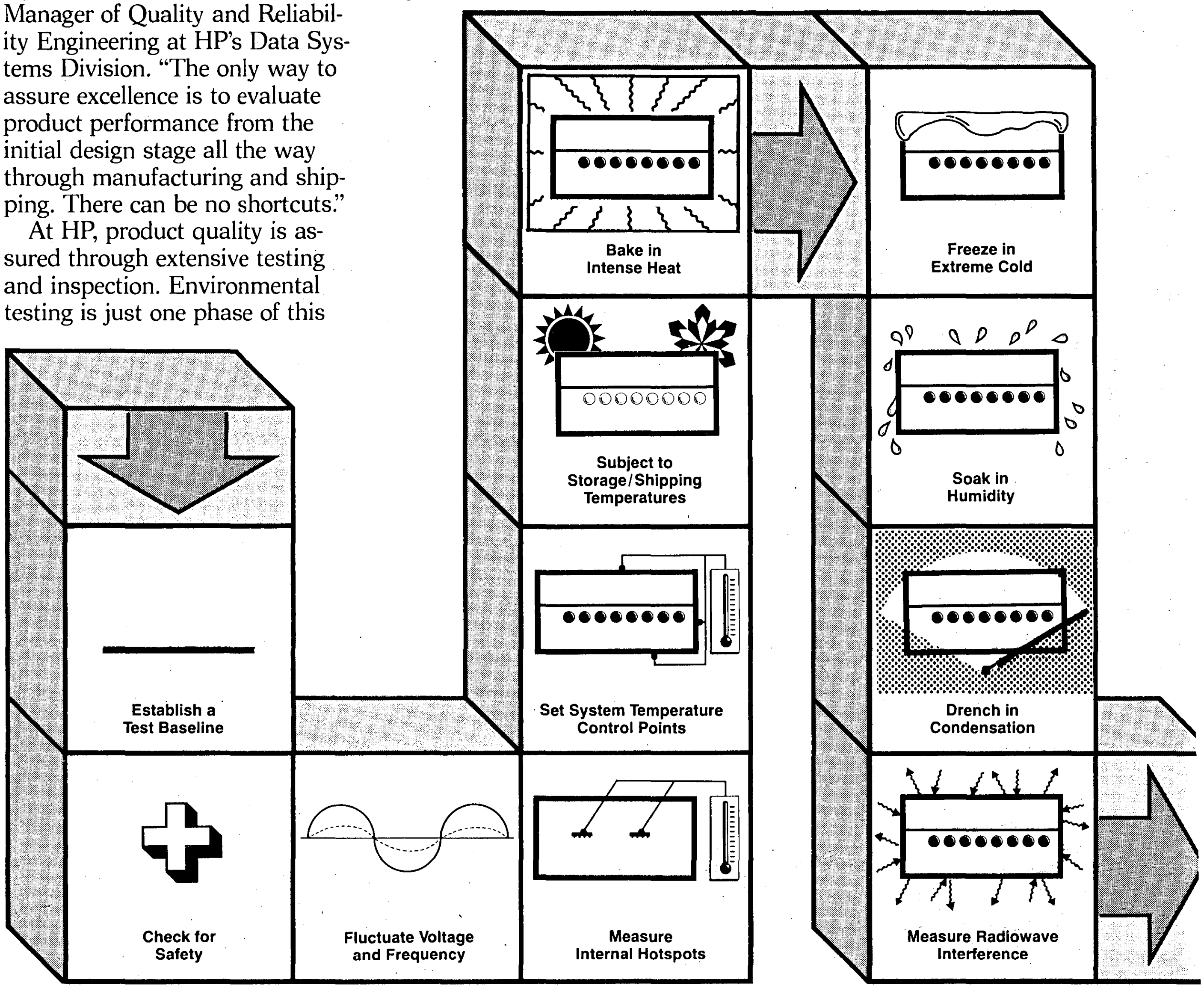
"Quality must be designed into a product", states Jim Gillette, Manager of Quality and Reliability Engineering at HP's Data Systems Division. "The only way to assure excellence is to evaluate product performance from the initial design stage all the way through manufacturing and shipping. There can be no shortcuts."

At HP, product quality is assured through extensive testing and inspection. Environmental testing is just one phase of this process and is performed at several points in the product's developmental cycle. Sixteen grueling, environmental tests are conducted, ranging from severe temperature extremes to massive extended vibrations.

"HP has one of the most dynamic and dramatic environmental testing programs in the industry," says Jim Ehrhardt, Reliability Engineer at Disc Memory Division. "It's been good design practice here for years."

A product's rigorous life

In the design phase, the product is defined, and its desired



working parameters outlined. A breadboard or preliminary prototype is made, and environmental testing occurs for the first time to evaluate product design.

Based upon the knowledge gained from the breadboard testing, a final or production prototype is constructed. The most rigorous testing in a product's developmental lifecycle occurs during this critical period.

At this point, changes and adjustments are made to the design to assure reliable performance. Should a failure occur here, or at any other point in time, it may be necessary to revise the product design and restart the testing.

Next, there is a pilot production run. Once again the exhaustive environmental tests are performed. If the product passes them, it is ready for production and shipment to the customer.

"Because some products may never be used in certain environments, some tests may be waived," says Stan McCarthy, Product Assurance Manager at Data Systems Division. "Card readers, for example, may never be used in a high condensation environment."

Besides this standard series of tests, periodic random checks are made on products ready for shipment to make sure they live up to designed survival parameters. Even the product assurance and environmental testing procedures themselves are periodically evaluated.

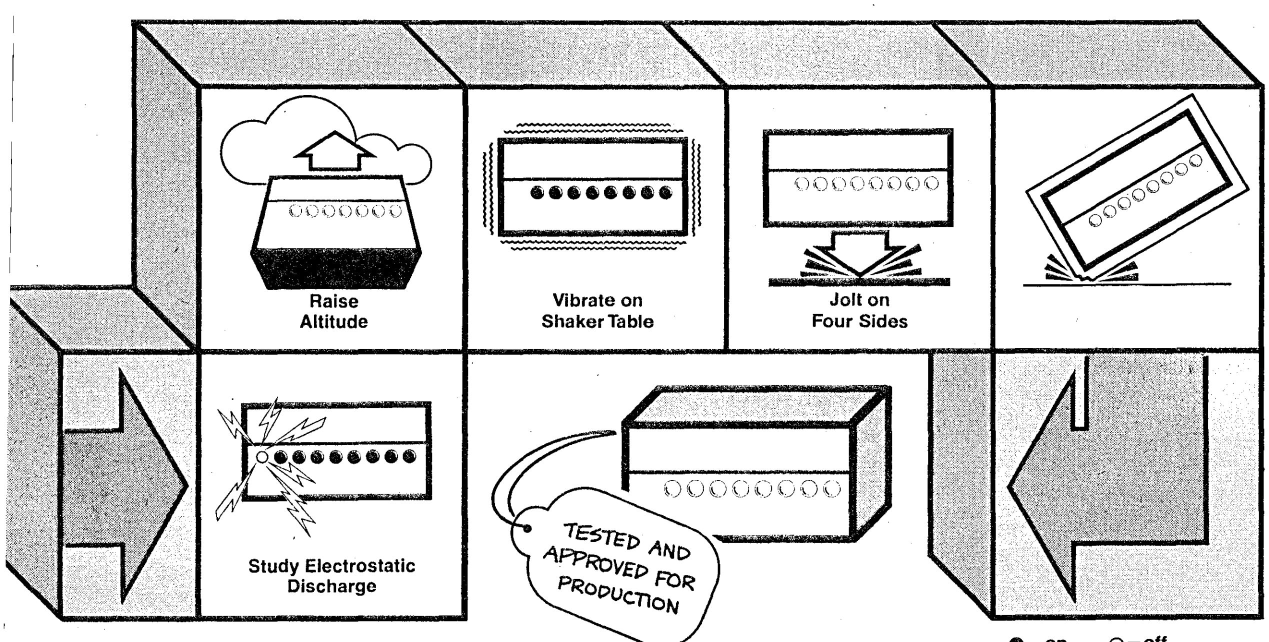
Evolving Tests

Test parameters change and new tests evolve as we move into markets where different customer environments exist. For example, noise detection is one environmental test now being developed, refined, and conducted at General Systems Division. Jim Bobroff, Hardware Reliability Manager, explains that GSD's new products will be used primarily in the commercial business market. "Our customers and computers will be in an office environment with low ceilings. We must make our products quieter."

Gillette adds, "We give the customer a product which can stand up under varied and extreme environments even beyond those found on the customer's manufacturing floor."

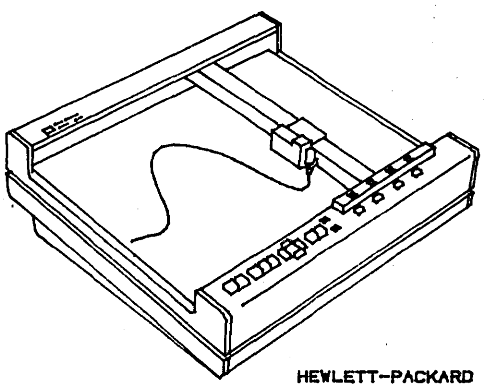
Customers describe our environmental tests as "rugged", "rigid", "exhaustive", and even "sadistic". "They are," claims McCarthy. "But, thorough testing helps us to ensure that we have a quality product."

More information? Indicate C.



New & Noteworthy

The four-color plot



HEWLETT-PACKARD MULTICOLOR GRAPHIC PLOTTER

The crisp, clean lines shown here are an untouched sample of publication-quality drawings produced by HP's new graphic plotters. These microprocessor-controlled, programmable plotters produce low-cost, multi-color graphs, charts and drawings — all with alphanumeric labeling from remote processing facilities.

Traditionally, the pens of plotters move in visible steps. HP's advanced microstep control system moves the pen in much smaller increments — 1024 per inch, to eliminate the visible stair-step effect. A 16-bit microprocessor does the necessary high speed calculations.

Further smoothness is gained by an electronic compensation which linearizes the motor's performance even more. Motor perturbations are reduced to a negligible level by proper adjustment of the waveform of the motor phase currents — we add a third harmonic component to the normal sinusoidal motor phase currents.*

The plotters provide multiple colors in a dramatic new way. Rather than carrying the weight of four pens on the plotter arm, these pens are neatly capped and stored along the lower right edge in a "stable". Pen changing, either under manual or programmatic control, occurs during the natural motions of the X & Y axes. No additional motors or solenoids are used.

There are two versions of the new graphic plotter. The HP 9872 ($4200**) is HP-IB compatible. The HP 7221 ($4600**) is RS232/CCITT compatible. The microprocessor used in the HP 7221 has been optimized for data communication efficiency. Dashed-lines, arcs, and circles are quickly drawn by a single command.

More information? Indicate D and E on the reply card.

*Patent pending
**U. S. prices only

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HEWLETT hp PACKARD

Faster, faster

Fast disc drives don't keep you or your CPU waiting. Several features make the new HP 7906 one of the highest performance 20 megabyte disc drives in the industry:

- start-up time=60 seconds
- track-to-track seek=5 ms
- data transfer rate=937 KB/S
- average data access=33.3 ms

Outstanding start-up time is achieved through sophisticated temperature compensation circuitry. The head positioner automatically compensates for thermal expansion. At power-on, thermal sensors measure the temperature difference between platters and, within 60 seconds, the circuitry compensates for the difference by offsetting the heads.

Besides environmental tests (see page 4), extensive manufacturing tests are performed on each disc to increase reliability. IC and PCA burn-ins at 75°C for 48 hours are examples of the rigorous tests conducted.

In addition, a new pre-filter assembly is included with every HP 7906 for reducing particulate contamination, providing more efficient cooling, extending life of the absolute filter, and reducing noise.

The HP 7906, compatible with HP 1000 and 21MX-based computer systems, starts at $9500.**

For additional details, check F on your reply card.

DP Sales Ploys and Counterploys

by Phillip Crabtree and Rob Kling

Case histories documenting vendors' tactics come complete with suggestions for turning chicanery to the advantage of the end user.

End users working with their first or second computer systems may well profit from these anecdotes; the old and wise should read them for fun.

Difficulties experienced by organizations in getting their information processing needs properly met are often the result of a particular sales or account development strategy of a computer vendor. While some common sales practices used by businesses that market computing equipment and services jointly benefit buyer and seller, some—as might be expected—primarily benefit the seller.

Computer manufacturers have learned from their industrial colleagues that "sound sales strategy" is the difference between profit and loss. Computer sales strategy has, indeed, become something of a pop art form, calling upon the marketing traditions of other American manufacturers. From the automakers, for example, computer vendors have picked up the concept of the add-on accessories: air-conditioning, digital clocks, and performance packages have their counterparts in minicomputers for front-end processing, graphics packages, and voice recognition input devices.

Much computer sales strategy also involves ongoing service and supply operations that generate income for the manufacturer long after the initial hardware sale has been consummated. This continuing supplier relationship keeps the customer's door open for the manufacturer's representative, who can suggest equipment upgrades or additions from within a service and consulting environment.

All of the following examples of sales strategies are factual. While the temptation was strong to add concreteness to the illustrations by naming specific organizations, vendors, and equipment, the urge was resisted in the interest of preventing possible embarrassment. In addition, although the experiences recounted all occurred in governmental user organizations at the local level, similar experiences could be documented at every level of government—and in private enterprise, for that matter.

Strategies aimed at the local government market, for example, often reflect a keen understanding of local government politics and all other elements that influence local government decision makers. Clearly, the computer sales reps have done their homework. It is time that the end users do a similar job of research on the computer reps.

When a public agency makes a poor choice of computer equipment or services, it pays some costs, but it rarely encounters life or death crises as a consequence. For example, if the agency purchases too much hardware, it may spend $200,000 that could have been better used for other purposes; if it chooses an inappropriate software package, it may waste two to six man-years of skilled staff time and the dp staff may lose credibility with the user department. But these are not the kind of events by which governments rise or fall.

They are, however, sufficient to create occasional embarrassing news stories, encourage general mistrust of dp, and produce a noticeable loss of efficiency and effectiveness.

One of the most common and pervasive strategies is for a vendor to focus on the potential his product has for providing solutions to user department problems. This seems to make good sense for both buyer and seller alike, until the buyer realizes that computing is indeed a complex package. A "good" computer system includes good hardware, properly designed software, and a skilled staff to maintain and make use of both.

Often public agencies and others can easily afford good quality hardware, but have trouble attracting and keeping a skilled technical staff. And herein lies the rub: many of the possible "potentials" may never be realized because of the limitations of a given agency's staff.

The following vendor strategies are formatted with an introductory scenario, followed by some analyses and suggested user counterstrategies.

Strategy No. 1: *Be the first kid on the block or the application development syndrome.*

A county welfare agency had established a reputation for being an information systems innovator. Wishing to keep this reputation, the data processing department decided to develop a sophisticated system for reporting state requirements. The hardware vendor, seeing the publicity value and additional hardware requirements generated by the innovative application, cooperated fully to help the user implement the system.

Because it appeared other agencies might be developing similar systems, timing, rather than cost, became the prime motivation for the project. While development of the system was being pushed, little time was spent on analyzing the anticipated costs and benefits. Consequently, when the state was slow in responding to questions about the requirements, any coordination between county and state was cut short.

Ultimately, the agency achieved its share of publicity for developing a leading-edge application. The vendor, riding on the same wave of publicity, received many inquiries for similar systems. However, the welfare agency discovered its new system was rendered obsolete shortly after it became operational due to changing state requirements. The agency found that it had to give top priority to the task of redeveloping the new and innovative—but unworkable—system.

This true story illustrates how dominant the motivation of establishing a reputation for innovation can become. It also illustrates problems that can develop when design and implementation schedules are rushed.

Frequently, the push for the rapid development of innovative applications is characterized by a lack of analysis of the anticipated costs and benefits. In the scenario cited, the vendor representative did not need to demonstrate concrete benefits for the application since the order for additional equipment was determined by time constraints.

Not just any cost justification is useful, either. Historically, justification of data processing costs has evolved through the cycle of "justification by the elimination of personnel" to "justification by the avoidance of future costs" and, finally, to "justification by providing a better way." Under normal circumstances, this last rationale confounds the user who has to pay and support data processing services and who is really more interested in gaining *increased* benefits.

The agency had to give top priority to redeveloping the new and innovative—but unworkable—system.

Whenever a new application development is proposed, the best strategy for the department head is to be certain that a thorough cost/benefit analysis is prepared and is analyzed by an independent team. This team may be comprised of the user department management and dp specialists, or may be from an outside consulting firm. Such an independent review of the cost/benefit analysis would have unearthed the self-serving motivations illustrated in the scenario.

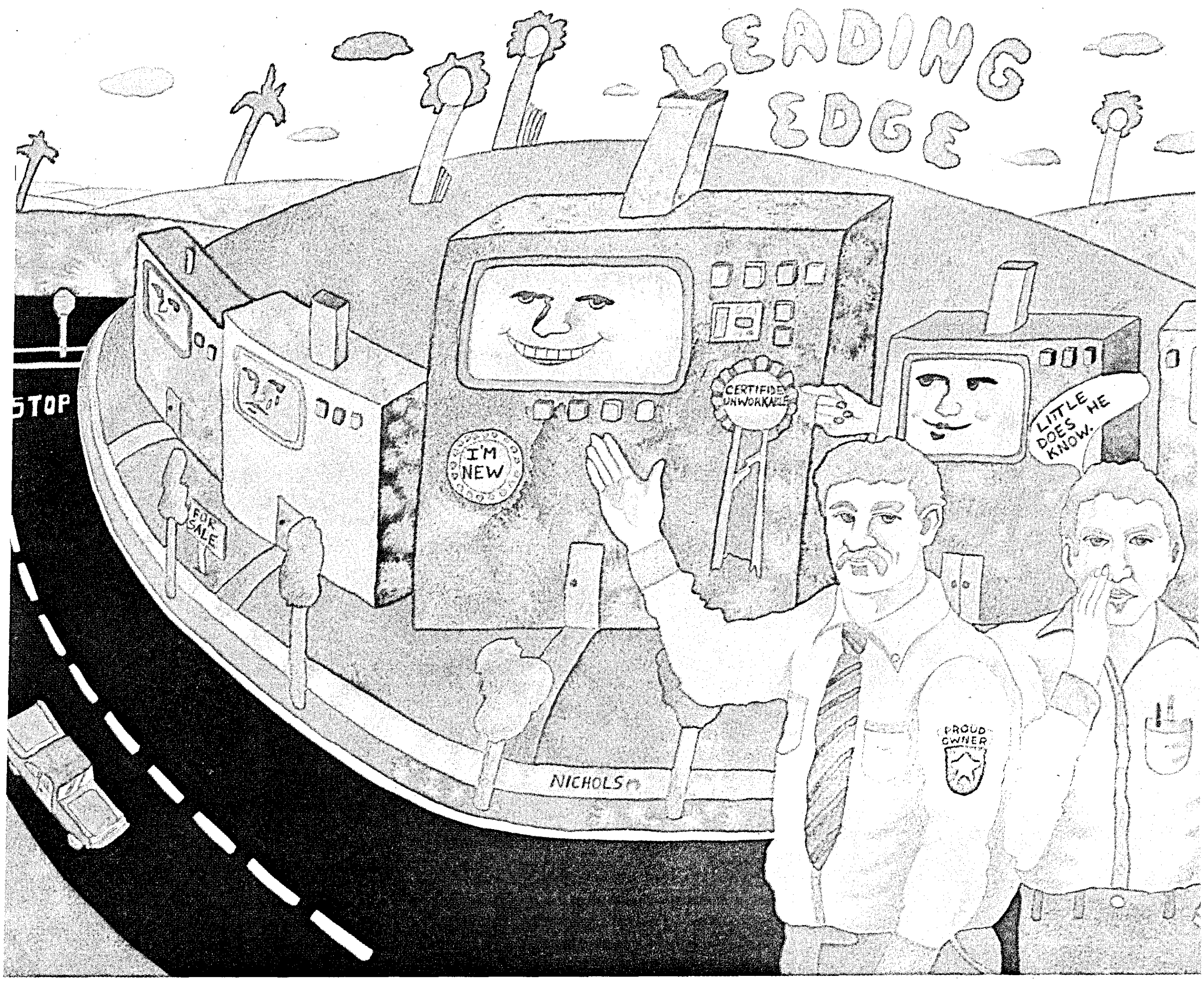
The cost/benefit analysis review should include:

1. *Were benefits investigated independently of cost considerations?*

Since many long range and even immediate benefits are intangible, there is a tendency for those responsible for cost/benefit analysis to analyze costs first and then stretch the intangible benefits dollars to meet the costs involved. When benefits are examined independently, it may be that some are of such little consequence that no expenditure is justified.

2. *Were all costs investigated?*

Typically, most analysis includes the costs of hardware, software and programming, but ignores many costs that are indirect, but nevertheless significant. These indirect "costs" involve vari-



ous inefficiencies in the use of personnel and equipment, including loss of user staff during training sessions in system use and establishment of backup procedures, disruption of the department in which the changes are introduced, downtime occurring during the transition stage, delays caused by slow response from other agencies, and the like.

3. *Are the projected benefits realistic?*

In local governments, particularly in the law enforcement sector, many benefits tend to be measured in terms other than dollar savings. These benefits, such as the saving of human lives, can be easily manipulated depending on relevant statistics used. Even in these cases, quantitative parameters would be helpful.

4. *Have alternative approaches been investigated thoroughly?*

Often this seemingly obvious step is overlooked entirely. Perhaps the problem solved or the service provided by the new application is quantitatively small and easily controlled, or could be provided manually, or could be handled by another less costly method. Automation does not provide cost effective answers for all uses.

5. *Have underlying motivations promoting development of the new application been examined thoroughly?*

This question, which involves healthy cynicism, ferrets out such motivation as a desire to sell more hardware, a com-

The push for the rapid development of innovative applications is characterized by a lack of analysis of costs.

pulsion to build a data processing empire, or a desire to control operations for political reasons. Even when some of these motivations do exist, the application may still stand up to scrutiny if its overall benefit to the local government is substantial. Ways to check include:

• Talk to other vendors. Discover their approaches to the same problem.

• Read periodicals that discuss application development relative to the user department involved. However, be aware that often these articles present only the positive aspects of any development.

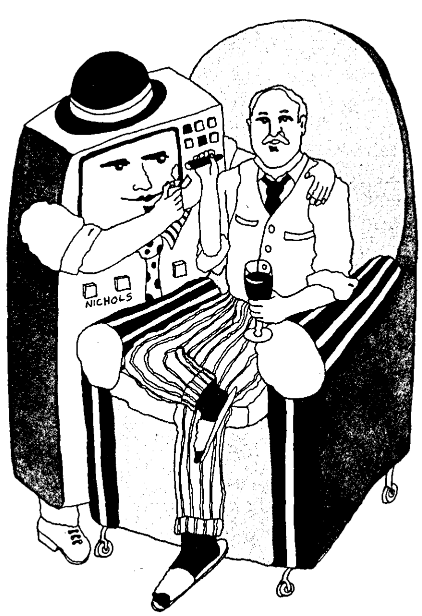
• Ask other users at professional association meetings what approaches they are using.

• Visit other organizations. Talk to user department personnel and data processing department personnel to test their reactions to the new application to be developed.

Establishing a cost/benefit review team or hiring an outside consultant requires time and money. The user should allocate such expenditures in relation to the cost of the application being undertaken and should include the costs of such review processes as part of the total cost of the application.

Strategy No. 2 *Tennis anyone? The care and feeding of decision makers.*

A county sheriff's department required a particular type of software package for its information system. Not



knowing exactly who would make the decision for the package, the various interested vendors bestowed their attentions on different prospective decision makers within the organization.

One vendor representative concluded that the project leader would make the final decision and spent considerable time cultivating his fancy. Another vendor correctly guessed that the assistant administrative officer would make the final decision. As might be expected, the vendor who identified and courted the key decision maker won the order for the required software package. Although it was later proven that the selected package was inferior to the other proposed packages, the strategy of "cultivating the decision maker" had worked again.

This strategy is usually obvious to those familiar with the acquisition game, but may not be so obvious to a department head whose success with data processing may depend on the outcome. Sometimes the game is played so intensely and at such an early stage in the acquisition process that the specifications for the desired hardware or software are written so that only one particular vendor can meet them (usually an advantage that only a vendor currently "in" the installation can enjoy).

How does a user make certain this vendor strategy is not working against the best interests of his organization? The following should help:

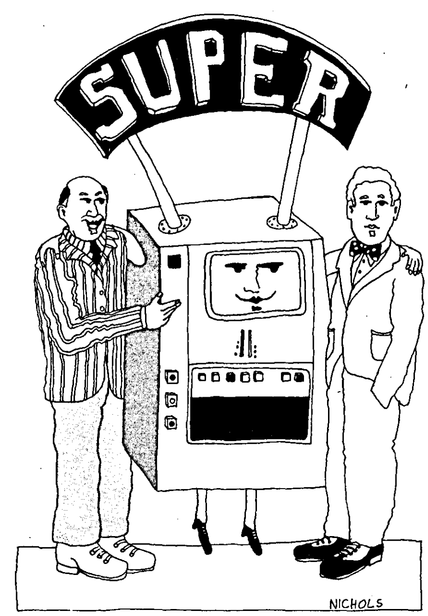
1. Vendor marketing and systems personnel generally have the time to spend with additional individuals in the organization, if the demands are placed on them. Encourage the user department head to see that he and his people make the time available to become knowledgeable in the alternatives being considered, and to schedule involvement with vendor personnel.

2. See that the vendor marketing and systems personnel are actively integrated into the data processing education schedule and that each affected user department receives its share of classes and special sessions. This requires that the user department head coordinates schedules and requirements with the director of data processing.

3. Make it apparent to the vendor marketing personnel that user department heads are important links in the decision making process of the organization. In this way, you assure them of attention from vendor personnel.

Strategy No. 3 *Oral intimidation: the art of using jargon*

One municipality implemented a soft-



ware package called SUPER. As its name implied, SUPER was to solve all of the city's data processing problems. Later, city administrators who had accepted the vendor's proposal because of the package's impressive name were quite disappointed to find that the package could not solve the city's major data processing problems. SUPER performed exceptionally well in its major function of allocating the central processing unit resources, but it could not improve coordination and communications among the departments or improve the skills of the staff, which were the city's most vexing impediments to a smooth data processing operation.

Vendors have become competitively creative in the fine art of obfuscation. There are several strategies that can help a user dig through the snowdrifts of jargon, whether used by a new vendor or by a familiar vendor with a new product:

1. Never allow yourself to be intimidated by such terminology. Don't be afraid to show lack of knowledge in the presence of others.
2. Keep abreast by reading industry publications that explain and use computer terminology.
3. Spend time with your dp technicians. Ask them to explain new terminology and learn to use the terminology correctly.
4. Focus on the concept rather than on the terminology.

Strategy No. 4 *Increased sophistication: appealing to snobbishness*

One county data processing department prided itself in its showcase hardware display. To maintain its reputation for being a sophisticated hardware user, the department usually was the first in the state to install newly announced equipment. The vendor played on this department's self image and pressured the data processing manager to sign advance orders to ensure early delivery of forthcoming products. Because of the need to be first and the pressure to reserve equipment, little time was spent on justification. In no time at all, this county's hardware budget far exceeded that of other counties of comparable size.

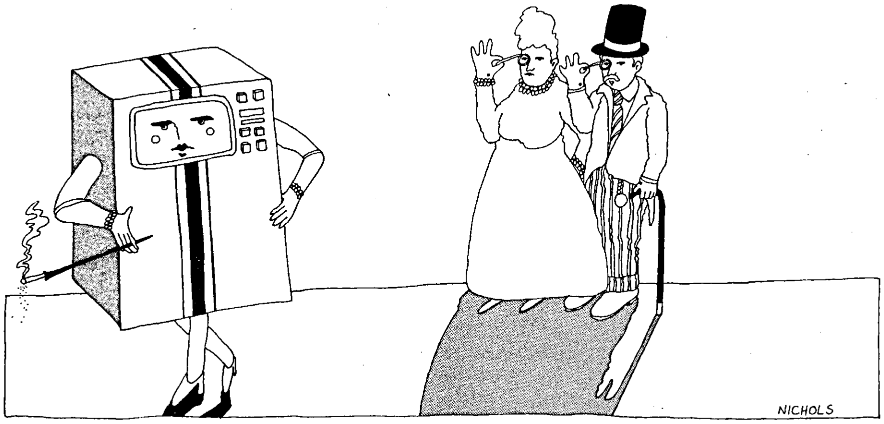
A facilities management group exposed the department's vulnerability to the county's board of supervisors and eventually received a contract to manage the department and to implement their cost-saving ideas (which did not include having to immediately obtain all the latest hardware developments).

Appealing primarily to the naive excitement of susceptible individuals is a standard marketing ploy. Having the Cadillac of computing has great snob appeal, even though a Volkswagen could perform the job adequately. Vendors often play to such emotional decision making, presenting splashy demonstrations and lavish shows augmented by food and booze. With the prospect suitably softened, the vendor pushes for an early decision, "before the delivery schedule forces a two year wait."

Sometimes, in these high-pressure situations, it appears that great benefits can be realized by the user because the new system hardware involves only a small additional cost. However, such an increase may be only the tip of an iceberg if the system requires that software be modified. Gambling with impulsive buying of computer hardware and software rarely yields many benefits and can cause many problems.

There are three types of hard-nosed questions that the user can ask to ascertain the emotional overtones of an acquisition decision:

1. What are the true cost differences between the new and old equipment? Will existing software be impacted? Will the new system require a completely new operating system? How much staff time will be required in the learning and implementation process? Will a new access method be required?
2. Are you completely convinced that the benefits so greatly outweigh the costs that you can skip the analysis phase that might result in a later delivery time?



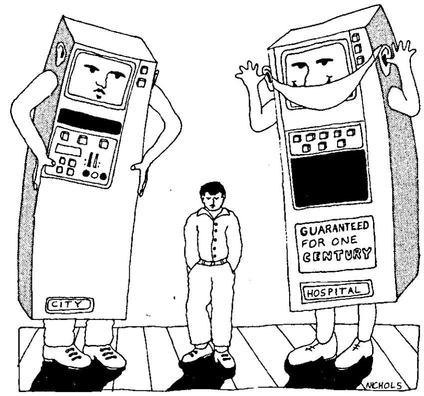
3. If analysis proves that the equipment already installed is preferable, does it concern you that the department's reputation for sophistication may be short lived?

Strategy No. 5 *Long range fiascos: the best laid plans of users and vendors*

A large county hospital developed its own plan for data processing apart from the county's dp department. The hospital hired its own dp staff and acquired its own computer. The successful hardware vendor in this situation had helped the hospital establish a five-year plan (which, by coincidence, allowed the vendor to propose and sell a larger system than would have been required originally). Even though the larger system would not be fully utilized at first, the excess capacity was justified by future savings resulting from not having to change systems as the hospital expanded its applications.

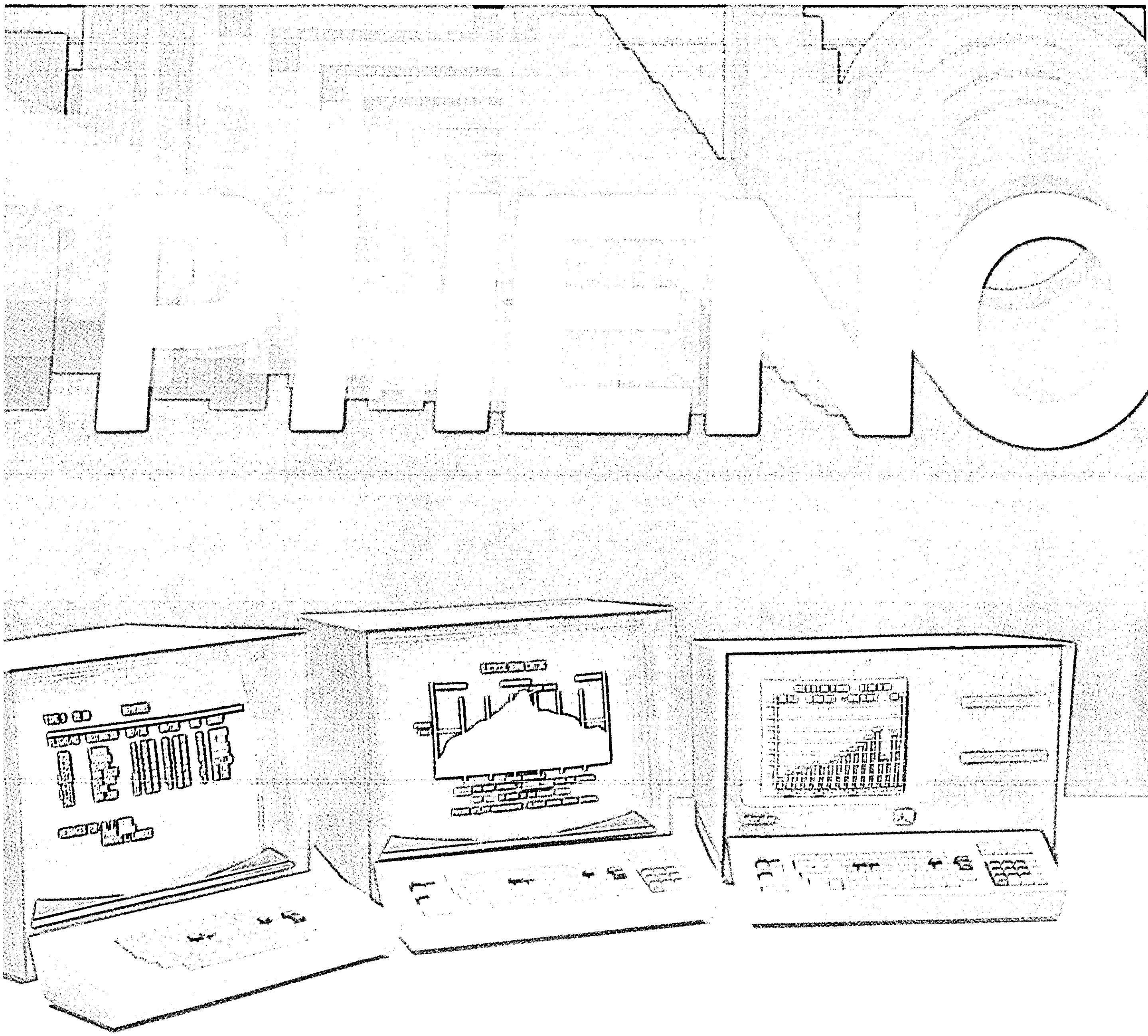
As fate would have it, during the first two years of development, changes occurred in the staff of the hospital administration, the county dp department, and the board of supervisors. Along with the different political climate came a decision to merge the hospital's data processing into the county's dp department. Consequently, the excess hardware capacity the hospital had been paying for for two years was never utilized.

Had the hospital administrators been communicating more effectively with other sectors of the county government, they might have foreseen the inevitability of the power shift and adjusted their plans accordingly. The process of switching from an in-house system to the county system created extra work. It also created a great deal of frustration among the hospital user personnel who developed considerable animosity toward data processing. Eventually, the hospital administrators helped devise a new long range plan that was integrated into a countywide plan for data processing—*without* the assistance of any vendor personnel.



As was the case in this scenario, vendors will often use long range planning as a tool to help customers justify purchasing equipment as opposed to leasing it. Although it is impossible for any individual or organization to foresee all problems and arrive at the perfect long range plan, users should always be extra cautious about accepting plans calling for excessive capacity useful only in contingency situations. The following questions should help the user establish realistic long range plans:

1. Are the long range plans of various departments coordinated with the long range plans of data processing? Are these plans coordinated with the plans of career administrators as well as elected officials who could become involved in the planning process?
2. What capabilities are needed now? What capabilities might be useful at some time in the future? Can "frill" capabilities be justified?
3. What are the actual costs of future changes? How were these costs calculated? (Remember that some newer software is engineered to prevent expensive future conversions.)



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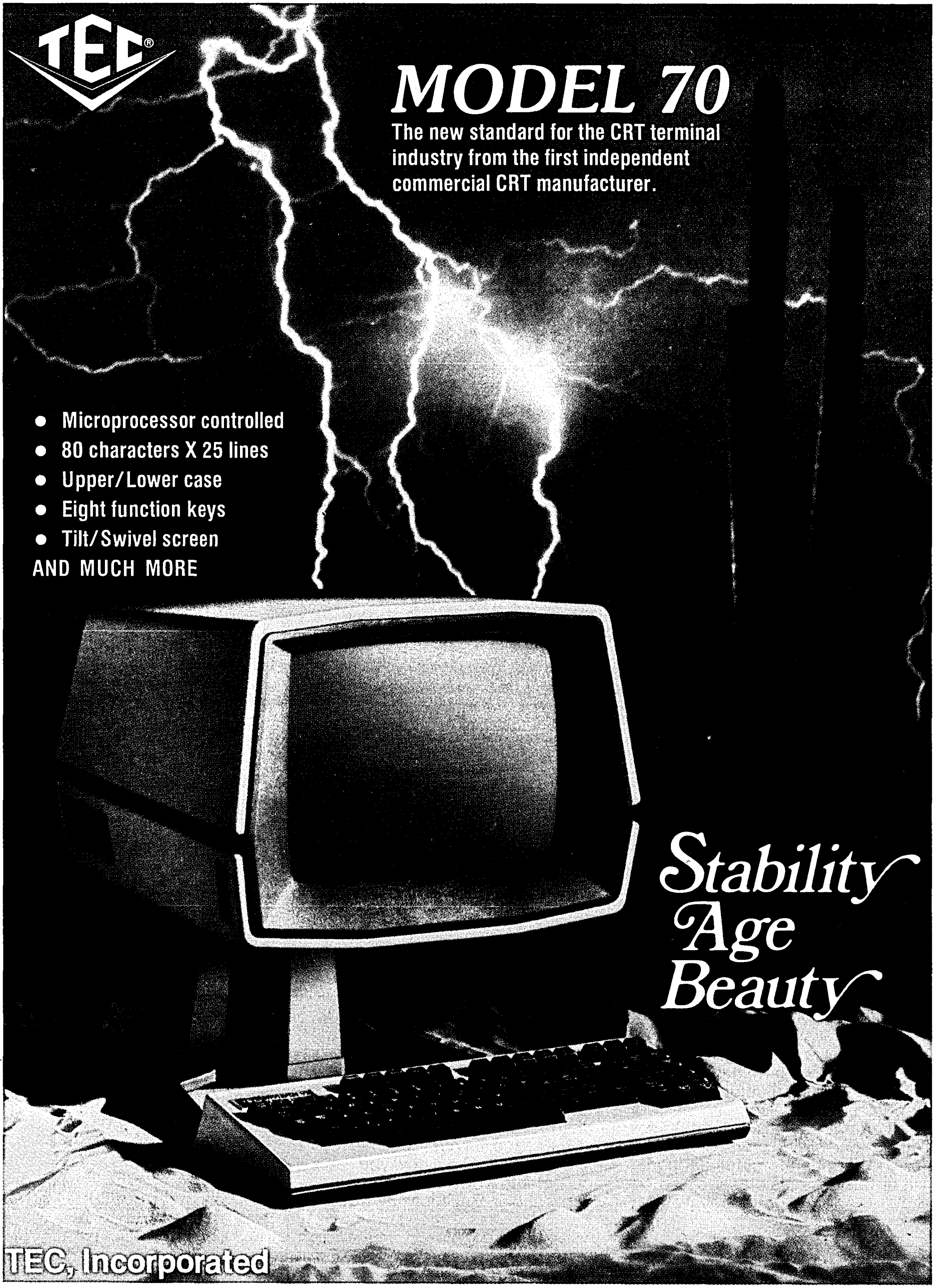

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Strategy No. 6 *Financial analysis: making the shoe fit*

Upon the announcement of the vendor's newest hardware model, one representative tried to convince a city that it should purchase, rather than lease, the new model. The vendor rep worked up an elaborate financial analysis supporting his position and presented it to the city. Impressive computer printouts presented "all of the costs" associated with purchase and amortized them over the next seven years, comparing them with lease costs over the same period. The vendor further emphasized his point by preparing a similar analysis showing what the city would have saved if it had purchased, instead of leased, its current system six years earlier when it was installed. Besides the alleged operations savings in the "what if" situation, the city was shown that it would have "made a killing" on the sale of that model on the used hardware market today.

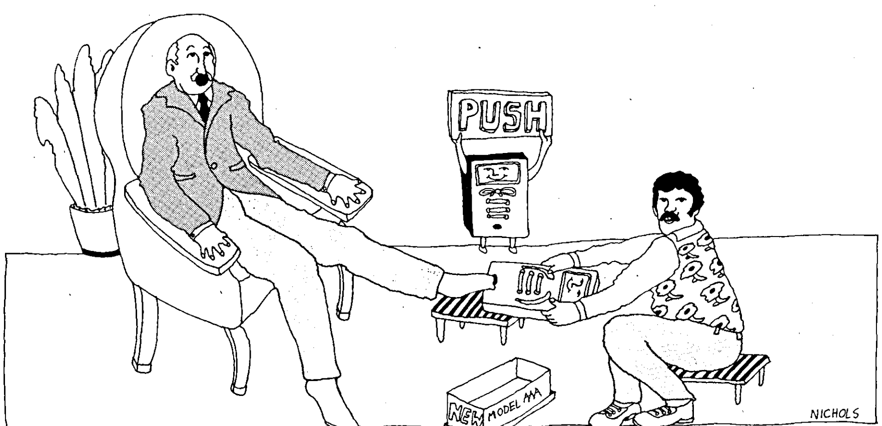
Finally impressed, the city decided to purchase the new model. Again fate intervened: within one year the hardware vendor announced an even newer model with capabilities the old machine did not have. The city sorely needed the "newer" model to implement some of its applications. Fancy analysis aside, the city had to face an unanticipated large dollar outlay to convert its "new" model to the "newer" model.

Financial analysis techniques supplied by vendor representatives actually can be quite useful to the potential customer. Vendor developed software packages used to prepare these analyses can be accessed directly by the sales rep. The analyses can help achieve a reasonable perspective on the highly fluid financial picture affected by the rapidly changing technology. A good financial analysis can provide long range costs, plus net monthly costs incurred with such alternatives as leasing, purchasing, or a combination of the two.

Unfortunately, vendor reps can manipulate their financial analysis package. The net monthly cost figure can be minimized for a desired alternative simply by controlling the input parameters, such as the life of the product, the salvage value, the interest and discount rates, the depreciation rate, the tax and insurance rates, overtime usage, etc. Since the package operates quickly, the rep may run a number of iterations with different parameters, and then select only those analyses which best support his marketing goals.

The following questions provide a useful counterstrategy:

1. Have all alternatives been analyzed and presented, or just the ones that the vendor wants considered? Some vendors, for example, use third-party lease arrangements extensively, while others never consider such arrangements.
2. During the process of selecting appropriate input parameters, what assumptions were made for the user organization? Each of these input parameters should be carefully analyzed.
3. Is the analysis really sophisticated and thorough? Or do the fancy printouts overplay the significance of the analysis? Examine the analysis at each level of detail.



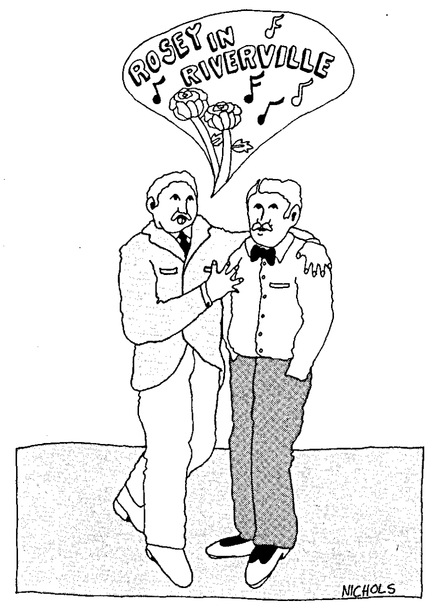
Strategy No. 7 *They're doing that job in Riverville: the reference sell*

One county planning staff wanted to develop an unusual model for planning purposes and they expressed interest in a particular minicomputer system they had observed successfully handling the desired application. However, they were persuaded by the county's current hardware vendor to try his mini system instead. The vendor also assured the planning department of the mini's capabilities by referencing a successful implementation of the application in "Riverville." Not wanting to insult the vendor, the accuracy of his reference was never verified.

Once the mini was delivered, severe problems were encountered in attempting to implement the application. When the Riverville planning department was finally contacted, it was discovered that their application was really quite different and that they could be of little assistance.

Some salesmen have a tendency to mention supposedly successful installations without being certain of the validity of the source. They also usually assume that the prospective user will have neither the time nor the tenacity to contact the referenced location. In some cases the rep may simply lack current information. For whatever reasons, the reference sell is often sloppily played by the vendors, and the user need only apply the following counterstrategies to beat the vendor at his own game:

1. Check the past history of the vendor as far as reliability in the use of references. (This sometimes can be accomplished by simply checking with other departments in your organization.)
2. Carefully check all references. Make certain that the software and/or hardware is performing the same job that you want it to accomplish and that the users are truly satisfied. The cost of a few phone calls may prevent expensive headaches later.



3. Inform the vendor of your intention to verify his references. This may well force him to do better homework before quoting references to you.

Strategy No. 8 *This package will do anything you want: generalized software*

One county government's dp department had two unfortunate experiences in trying to use its hardware vendor's generalized packages. In adopting the vendor's teleprocessing monitor, the county found that it was slow and consumed excessive memory because of its generalized nature. Consequently, the county looked elsewhere and found a specialized teleprocessing monitor which was tailored to meet its needs of timing and memory utilization.

The next major software package desired by the county was for a data base package. Unfortunately, the teleproces-

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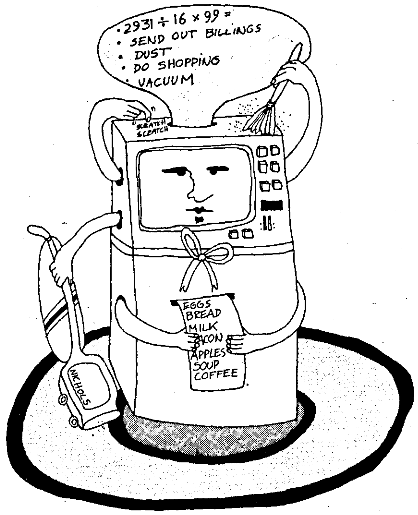


sing monitor experience was repeated: the vendor's data base package was installed, found to be too generalized, slow, and inefficient, and a more specialized package had to be found from a software vendor.

The costly aspect of the above scenario, of course, is the time and effort wasted by the dp staff and the inconvenience to the user departments of having to survive two development and implementation efforts for each package.

The following suggestions indicate how a user can learn time and space costs or modification costs before accepting a software package:

1. Don't accept carte blanche what your hardware vendor offers. Consult many different sources for information about software packages. Objective sources include Data Pro Research, Delran, N.J.; Minicomputer Software Quarterly, Wayland, Mass.; and Skinny (ICP software directory), Carmel, Ind.

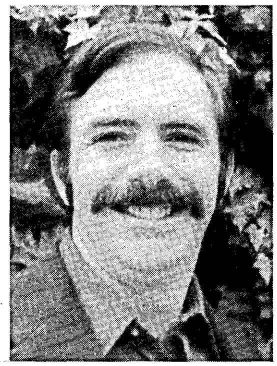
A more critical examination of vendor motivations and resulting strategies may pay large dividends to the end user.

2. Determine if the particular software package is generalized or specialized. Match your requirements against those provided by the package. Accurate estimates of modification requirements may then be made.
3. Contact users of the software package in similar types of organizations. Analyze their experiences and estimates of timing and cost requirements.

Better decisions aren't free

Most of the strategies that have been discussed require an increase in computing expertise by the user. Better decisions are not free. The suggested countermeasures add to the costs of increased information gathering for the user. However, these measures should lead to an overall reduction in computing costs and a healthy increase in user satisfaction.

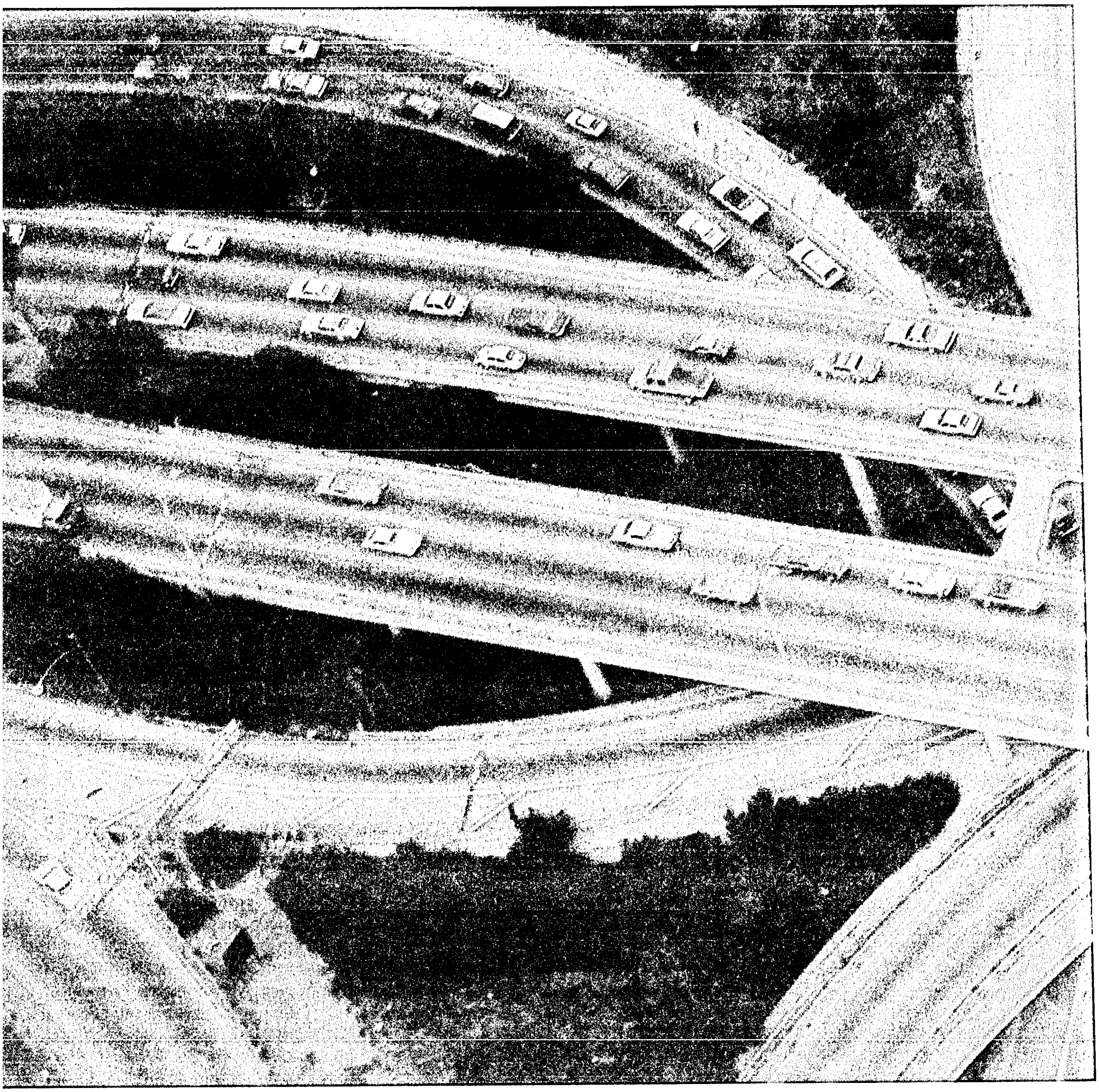
Vendor representatives should not be the only information source used, but they definitely can be helpful. It is up to the user to analyze the various strategies the vendor may use and to place in perspective his offerings. The user will never have perfect information concerning vendor organizations or representatives. But a more critical examination of the motivations and resulting strategies of the vendor may pay large dividends to the end user. ❊



Mr. Crabtree studied economics at Stanford Univ., marketed computers for IBM, and was on the faculty of business at California State Univ. at Fresno before coming to the Univ. of California at Irvine in 1975. He has been an associate in the department of information and computer science at Irvine, and is currently a principal of Executive Systems Plus, a Newport Beach, Calif., firm specializing in hotel reservation and accounting systems.

Dr. Kling is an assistant professor of information and computer science at the Univ. of California at Irvine. He is also an editor of the department of social impacts of computing for *Communications of the ACM* and chairman of the IFIP working group on the social accountability of computing. Before coming to Irvine in 1974, he was on the faculty at the Univ. of Wisconsin, Madison, and at the Artificial Intelligence Center of SRI International.

This article is based on studies administered through the Public Policy Research Organization at U.C. Irvine.



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Data Processing's Role in Complex Litigation

When a company goes to court, dp carries an extra load of work, hassles, and risks.

by Royal Daniel and Alan Paller

For years, various IBM litigations have been front page news in the computer industry. All told, hundreds of $millions are still at stake in IBM cases alone, and the outcome of these disputes will affect the survival of many different plaintiffs.

But IBM is not the only organization facing litigation. Last year, over 130,000 noncriminal cases were filed in federal district court, almost twice the volume of 10 years earlier. Thousands more are filed each year in state courts, and large numbers of businesses face countless administrative proceedings held by the Federal Trade Commission, the Dept. of Labor, the Securities and Exchange Commission, and a legion of other federal and state regulatory agencies.

Not altogether by accident, the great increase in litigation coincides with the spread of information processing technology throughout corporate America. Easy access to data allows lawyers to automate the gathering of information relevant to litigation. They now find both judicial records (statutes and court decisions) and corporate records (personnel, sales, cost, and management data) in computer readable formats, and they have begun to rely upon data processing professionals for help.

For their part, most persons in dp consider the practice of law to be esoteric. They have little tolerance for the imprecision of the judicial process in data gathering and analyzing. Also, they are likely to have little experience to draw on when they become involved in legal actions. For a company facing a lawsuit, this lack of appreciation and experience in legal proceedings could have catastrophic consequences for the careers of its employees or for the firm's survival. Fortunately, a small amount of forethought can reduce the personal and corporate risks of litigation.

If it happens to you

Imagine we are dp managers in a medium sized corporation. One day, we are called to a meeting of department heads to discuss "a possible litigation problem." Our lives are in for big changes.

Someone has so wronged the company that we must sue them to vindicate our rights. Or perhaps the government or a private party has decided to sue us for some alleged misdeed. It might be a group of former employees who accuse us of discrimination in hiring, mismanagement of employee benefits, or using unsafe equipment. Maybe some hero in the bureaucracy believes we deceive our customers, make unsafe products, or lie through our teeth in business reports. An esteemed customer, creditor, or competitor may feel we have broken a solemn promise or committed an unfair act.

Whatever the complaint, our world soon will have more lawyers and executives in it than before. We will be answering long, dumb questions about all of the business records we maintain. As dp professionals, we greet this development with some enthusiasm, for it presents a great opportunity to demonstrate the importance and the capabilities of our installation. Yet, there is also some anxiety, for we face personal risks, and so does the whole dp department.

In much antitrust or products liability litigation, the outcome of the lawsuit will determine whether the company can stay in business or compete in a particular market. Because the company itself might be on the line, the very highest levels of management will monitor our work. We should become accustomed to seeing our chief executive officer more frequently than before.

If the company uses benefit/cost analysis on large projects, we will find that the ratio is nearly infinite when the survival of the company rests in the balance. Normal budgetary restraints and procedures might disappear, and the pressure will be on us to produce quickly "regardless of cost."

We will be the central figures in generating management information for the case. With creative thought followed by prompt production of helpful information, we may get much of the credit for a swift and successful resolution of the case.

But if we can't provide what the attorneys ask for, or if it is difficult or impossible to take on the additional burdens of litigation data processing without compromising the normal daily operation, we may earn reputations as obstructionists. Then, if the case comes out well, the company may have threatening ideas about improving its computing operation. Worse, if the case is not handled successfully we may receive much of the blame.

Unfortunately, even describing what happens to dp during complex litigation is no small undertaking. It must be approached through the people involved, the information used, the physical products of our efforts, the sequence of the tasks, and the controversies or problems we can expect. Each dimension deserves individual attention.

Attorneys and users

Besides the dp people, there are three types of participants in the process: the immediate client or user group, the opponents, and the judge (or jury) who may ultimately hear and decide the facts.

Most dp interaction will occur with the user group, an amorphous collection of attorneys, executives, experts, consultants, and their respective staffs.

At the beginning, we will be meeting with the company's general counsel or the person who performs that function. We will always come out of these meetings with a long list of action items. Typically, the list will include tasks to be done for other persons, as the general counsel will act more as an administrator than as a case developer.

As the case progresses, we will get to know several members of the law firm, if one has been engaged to defend or prosecute the suit. We may have already met one of them earlier, and all our completed work will already have been transmitted to them. Naturally, it is far more comfortable to work on a direct basis with them, and we will expect to do so if internal politics permit.

Our new attorney-clients will have all the characteristics of an uninformed customer or user. As is widely known in the data services field, such a user can wreak disaster for everyone if the computer service provider is also weak or careless. Here are some characteristics of attorneys we should appreciate:

The attorneys will not be paying for the demands they make on our installation; in fact, the more demands they make, the greater their apparent interest or industry in the case. They will request data if it seems even slightly useful, because they cannot afford to overlook any potential resource.

They may have uncommonly high expectations of data processing in general, and may have heard particularly flattering remarks about us from buck-passing corporate executives. They will tend to overestimate the amount of information available, the speed with which it can be retrieved, and the reliability of the results.

They may not fully understand the flow of documents or information through the corporation, and be unwilling to admit it.

They will be so busy with other aspects of case preparation and litigation that they will have neither the time nor the inclination to learn about the benefits we can provide or the problems we face in meeting their demands.

Thus, unless we are energetic and skilled, it is almost certain that the litigation preparation will be disorderly, expensive, wasteful, hectic, and perhaps ineffective.

The same may not be true of other members of the "user" group. If the case is very large—involving commercial, economic, or statistical issues—outside experts, especially economists, may get into the act. Unlike attorneys, these experts are accustomed to dealing with data processing, and we can expect them to make heavy and sophisticated demands. They will want to work directly with us, not through any lawyer intermediary.

As we deal with these different members of the user groups, our primary object should be to build in them a sense of trust and confidence in our work. We cannot let ourselves and our department be looked on as "the machine"—an impersonal facility that is occasionally and sporadically helpful. This confidence building can be achieved in part by realizing that information flow between and among our offices and the user group's offices takes the form of a circle, a kind of "Chinese telephone." Ideas may generate among top levels in the user group, be developed through intermediate and lower staff levels, and be communicated to lower level persons in our organization, where the product will be developed. After it's developed, we will submit it to our bosses and to other members of the user group.

This kind of circular tasking is very dangerous, and the final product may be largely different from the earliest expectations. Most of our time will be spent in interaction with the lower level people, but the highest people will decide how effective we are. The channels of communication within each office in the user group must be clear and unambiguous, so that we can rely upon the lower level persons to provide accurate intelligence about the demands of the higher level people.

The opponents and decision-makers

Our opponents are a different matter altogether. For a long time, we will never see them or their representatives. They will remain a completely unknown commodity. We must imagine that they are informed, intelligent, diligent, and well-funded. We must assume that they will see our work and closely scrutinize it, that they do not share our assumptions, and that they are hostile to our beliefs.

The third participant is the legal decision-maker. The decision-maker's information needs—and the rules for satisfying them—are of great importance to us. This subject will occupy the attorneys exclusively in their preparation for the trial. They will try to discover and analyze evidence and legal precedent to persuade the ultimate decision-makers on legal and factual matters.

We must remember three factors: the nature of proof in the forum, the degree of technicality with which factual matters must be presented, and the sophistication of the ultimate decision-maker.

This sophistication can go from complete ignorance of business or data processing, as might be found in a typical jury, to a rather sophisticated and thorough understanding of the industry and of the methods by which the industry solves its problems, as might be found in a panel of arbitrators. There may be pockets of ignorance concerning specific aspects of the business or of dp. One may have little need to worry about the technical qualification of exhibits, or one may have every need to be extremely careful to satisfy all of the rules of evidence.

Parenthetically, we should note that most litigation never comes to trial, but is settled by negotiation between the opposing parties. Thus, in some degree, the materials developed for the trial in the early stages of litigation are actually being "pitched" to a different audience, namely the negotiators on the other side who might thus be induced to concede on a point or two.

The information needed

The bulk of our work will be the raw material for more delicate and less scientific selection by the attorneys. They will choose what information to use to negotiate a settlement or to try the case. The attorneys will soon learn that the computer can come up with "all" instances of something almost as easily as it can come up with a selection of instances. They will find the physical size of the output impressive, and may seek to use the sheer mass or volume of output as a tool to influence the other side or the judge.

However, unless physical volume is specifically sought for tactical purposes, the attorneys will be grateful if we tell them beforehand of the number of inches (or feet) of printout they are actually asking for. Very often, a small amount will serve and the whole universe need not be examined or reported upon.

The products we will be called upon to provide fall into the following categories:

Indices and guides. Because we are the only executives with an overview of the document flow through the corporation, we will be called upon (or should volunteer) a set of indices to files maintained by the company (both manual and automated) and keys for interpreting them. Such indices would include, for example, a description for the uninitiated concerning the proper method of reading a record layout, and what the record layouts are for key automated files. We will also provide definitions of the statistics that might be employed, together with other guides or aids.

> If we ever had a detached respect for the attorneys' quiet confidence, we will lose it.

Extracts and tables. From data on hand, and from data we can readily accumulate, we will be asked to produce many extracts and tables. This would involve, for example, a breakdown of the employees in the company by job grade, age, or sex; a breakdown of the sales of the products of the company for certain years; and other aggregated financial data.

Research. Some of the requests from the attorneys will force us to collect information not readily available, such as custom tabulations from existing computer files, manual tabulations, or data from outside sources. The outside information must be integrated into the corporate data to produce comparative evidence.

Graphics. An especially valuable set of products will be the graphs and charts that we will produce to summarize various presentations of data. A trial transcript contains so many words that a few charts can be very effective in breaking the monotony and highlighting key arguments.

Narrative summaries. The world of the attorney in litigation is a verbal one. While graphs and charts are useful evidence, attorneys' briefs and the court's decision will be in verbal form. A good attorney will want pithy narrative summaries of each exhibit we produce, including explanations of where the data came from, how the data were processed or how the table was constructed, what the terms mean, and what implications the particular material has to the issues in the case.

While it is not our responsibility to construct a statement of proof for the case, our views concerning the meaning of this material will be extremely important to the attorneys.

The first request will be for easy-to-obtain summaries that may already be on hand in a notebook in somebody's desk. As soon as possible, we should volunteer these tabulations to give the attorneys a working understanding of some of the magnitudes with which they will be dealing, the number of cases, the detail of the data, limitations, etc.

We should appoint a fairly senior person in the office to be a contact for the attorneys, and have that person gauge the amount of company information and the level of detail needed at the outset. The contact should have a working knowledge of the acquisition of general business statistics, as he or she will get to know more intimately than anyone else the way in which the attorneys plan to use company data.

As preparations for trial progress into second stage, we will be asked to participate in meetings where alternative approaches to proof will be discussed, including methods of presenting the available data. The discussion might also cover the acquisition of additional evidence through surveys or other research. Thus, we should all brush up on statistics and check out the various common sources for business information.

Very often, disputed facts will overshadow in importance the legal arguments. For example, the corporation might have to prove that it was "reasonably diligent" in performing some task, or that it had the "inclination or capability" to perform it. Such questions will call for input from all over the corporation, to create a "circumstantial case" on the point. That is, the proof will simply permit a series of inferences based on plausibilities, without direct evidence.

As trained systems analysts, we may be able to devise a strategy for presenting such proof, using all the relevant information resources available through the company. This "development of the facts" will begin early in the game, and continue right up to the end of the trial.

Although the task will change on a daily basis, and last-minute deadlines

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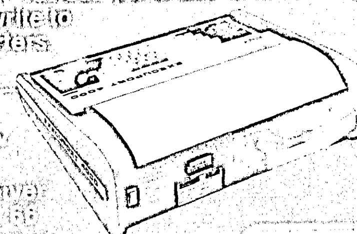

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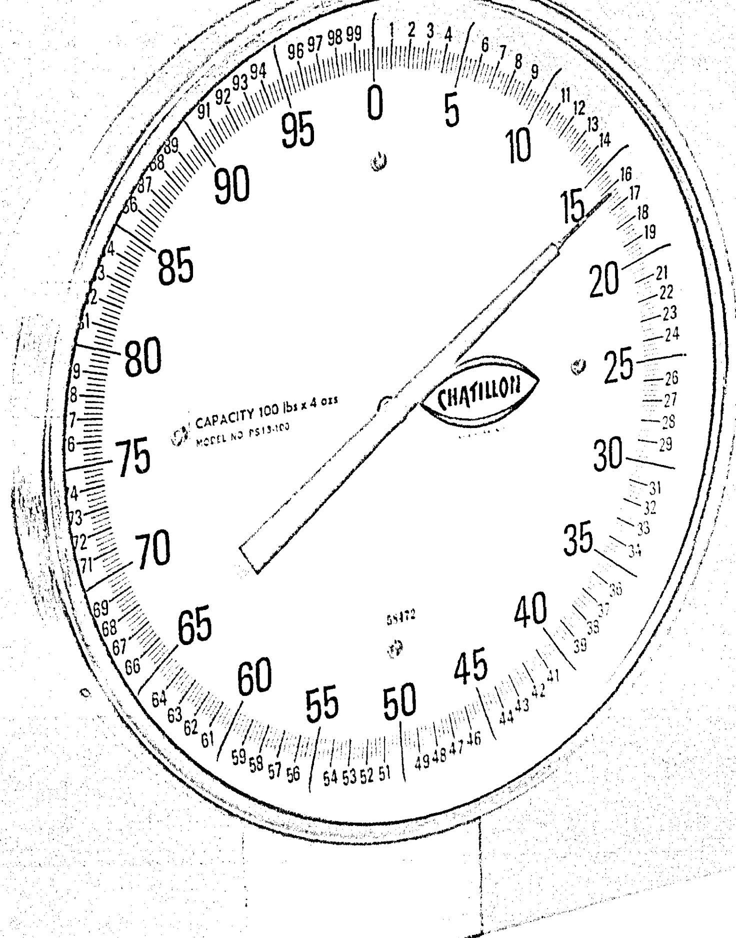
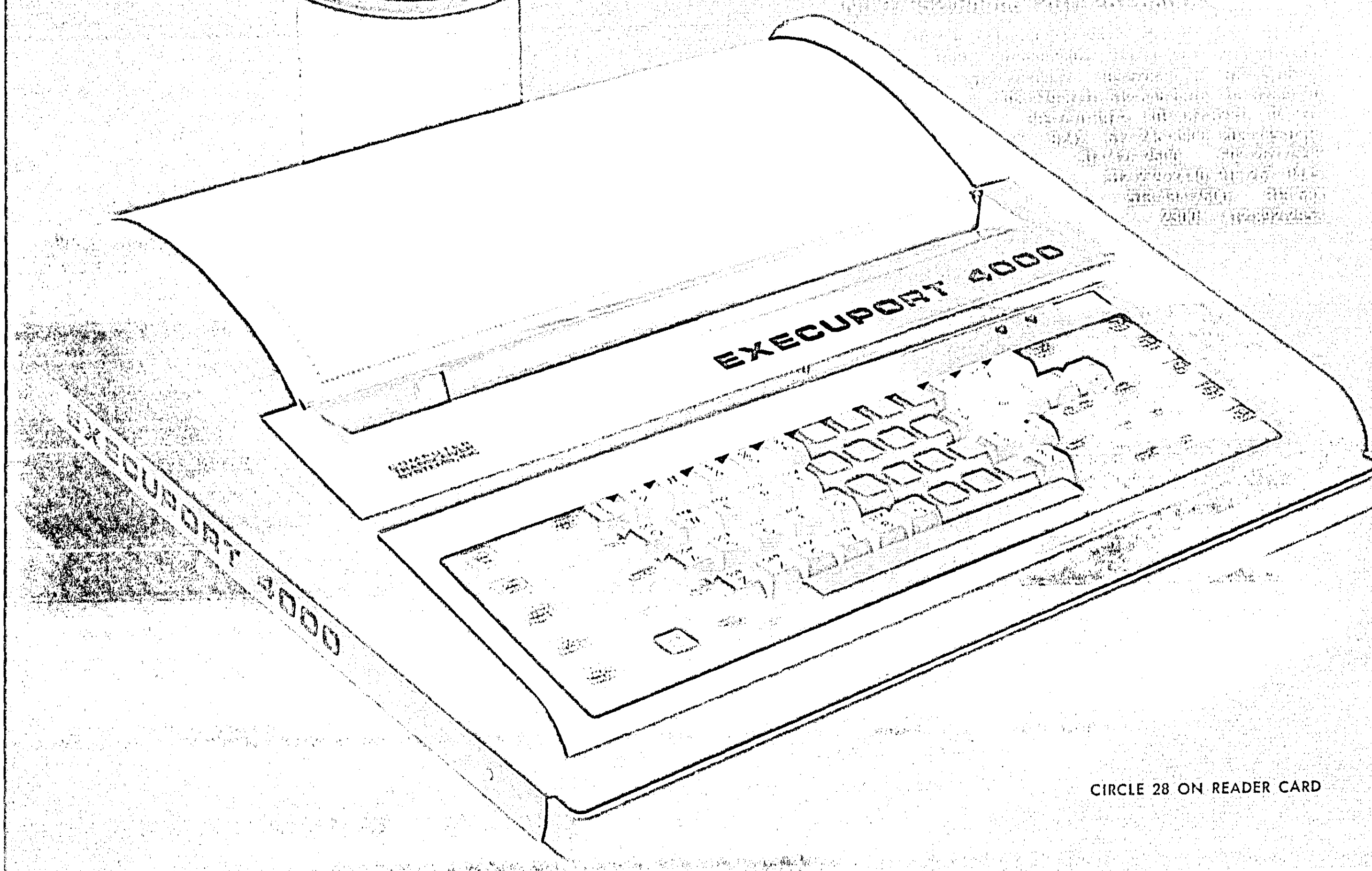




CIRCLE 28 ON READER CARD

will be the rule rather than the exception, the litigation itself may last for several years, and we must be able to go back to a job that was completed years earlier to learn how that development of the facts was done. Although there will be little time for documentation, it will be extremely important.

Our methods, programs, data bases, and documentation may all be subject to review by opposing experts during the discovery process prior to trial. Good, clear, complete documentation may have a favorable psychological effect on any experts that might otherwise testify negatively. Further, if we fail to provide good documentation, others may be led to infer, unjustifiedly, that we had something to hide.

As the trial date nears, we will be asked to convert many of the facts into exhibits. Evidence may be presented as maps, organization charts, graphs, tables, or other compilations. Compared with all the other efforts going on to prepare for the case, the amount of money involved in preparation of these exhibits will be very small; however, the impact of a well-prepared, professionally produced graphic exhibit is substantial, and we must be prepared to meet this demand with the appropriate skilled, professional support. Nothing so flaws a presentation as an exhibit with a minor inaccuracy or one that requires considerable explanation. The first loses credibility; the second never gains it. *We must guarantee that each exhibit we prepare will be simple, accurate and impressive.*

Taking the stand

With this, our work may be almost over. Yet one last job might become the most important. The employee under whose supervision some or all of the evidence has been prepared will be asked to testify concerning the method of preparation. Perhaps if some form of technical expertise is involved, that employee will also be asked about conclusions that may or may not be drawn from the exhibits. Every word we utter will be written down and read over and over by the lawyers on both sides and perhaps by the most senior executives.

Testimony to qualify exhibits can be very tricky if the other side is prepared to challenge the assumptions underlying them, the procedures employed in creating them, or the reliability of the data upon which they are based. A short, taciturn direct examination, followed by a courteous, but uncooperative cross-examination is the very best that we can expect to do.

A clever adversary will flatter us or show high professional esteem, tempting us to talk garrulously about various dp problems that might face us in the performance of the job. Inevitably, he will seize upon some small detail or ambiguity and expand it into a discourse to make us appear critical of the company or of its dp procedures.

The alternative, if we are not well prepared, is that the adversary will seek to show the court why we are not believable witnesses because we can't discuss any matter on a very detailed basis. On direct examination, we are on the offensive; but on cross, *we play the game protectively and conservatively,* winning little and conceding nothing.

Problems to expect

So far, we have looked at a task which, though unusual, might be scheduled just as any other corporate service occasionally required of our department. Yet supporting complex litigation is more than just an out of the ordinary dp job. A number of peculiarities soon become obvious, demanding the application of extra management skill and creativity.

First, we may lose control over the priorities of the office to corporate officers unfamiliar with our day-to-day responsibilities. At the height of the confusion and activity, it may seem we are being asked to "make bricks without straw," unless we have built a little excess capacity into the shop ahead of time, and have successfully impressed upon the higher-ups the importance of our other duties.

> After the case is over, some of the information by-products may be worth continuing.

Second, the new users—the attorneys—are likely to be a very fickle lot. The crisis of Thursday will have been forgotten by Friday. The schedule will be totally different and the specifications altered. In the early stages of the litigation, the attorneys will be "sponges" for information, seeking almost indiscriminately any information that may exist on a particular subject. By contrast, they will become extremely discerning during the last minute preparations for trial. Only a very small part of the material we produce actually will be used at the trial.

Third, much of the legal preparation will be done by junior members of the attorneys' office. There may be turnover, and the attorneys may fail to appreciate the impact of some of our best work. If we ever had a detached respect for their quiet confidence, we will lose it.

Fourth, as trial approaches, things will become even more hectic, and more and more work will be "culled" as unnecessary for trial. Though helpful to preparation, it will probably never be displayed or referred to in front of a judge or jury.

We should not be misled, however. The attorneys are not seeking to determine truth in a scholarly sense, or to find an interesting set of facts. Instead, *they are seeking to persuade.* In past assignments our products have rarely been used in this environment, and it is hard to become accustomed to the new criteria. Our object is to support certain arguments and to refute others; extraneous information can be worse than useless—it can deflate other points or create inconsistencies.

An effective response

Given this unmanageable task of dealing with demanding and uninformed users over extended periods when much of the work will not actually be used and when the persons making the demands do not suffer any of the consequences of meeting them, what kinds of preparations and defenses can we undertake? The first important principle is that we must take the initiative ourselves. There are many things we can do, or avoid doing, to improve our ability to respond effectively and to come out on top in the end.

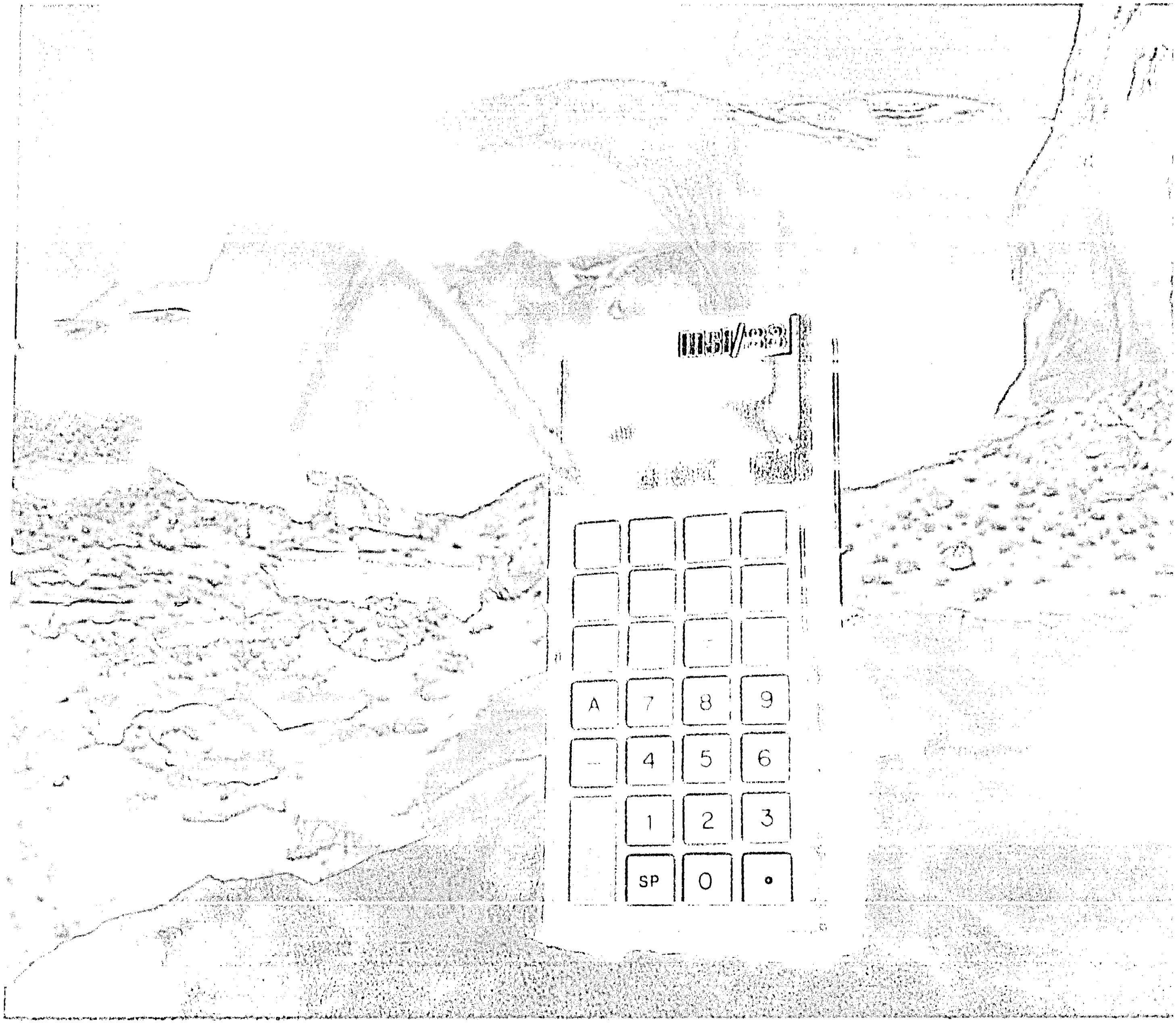
1. Start early and volunteer. As soon as we learn that there may be major litigation, we should make our knowledge of this subject area and our interest in it known to the corporate attorneys, who will be most pleasantly surprised.

2. Read up on the case. We should invest enough time to become familiar with the factual underpinnings of the case to permit us to act positively and to make useful suggestions at an early stage.

3. Monitor outside information sources. Early in the game, decide to learn about all of the business and demographic data that might be useful as evidence when compared with or added to data generated within and about the company. For example, we could gather industry data from the Dept. of Commerce or trade association sources. Our marketing people may have a number of surveys or compilations of public data concerning purchasers or users of the particular product of service involved.

4. Hire a research assistant. We may need additional personnel simply to keep track of the litigation projects. A competent research assistant could also answer requests for information about the corporation and compile information from public or other sources. In the later stages, this person would be intimately involved with exhibit preparation.

For exceedingly complicated cases, it may even be worthwhile to hire a research assistant, an administrator, file clerks, and other support personnel as well. Resist the temptation to make existing staff work longer hours. It is far more expensive to pay overtime, morale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will suffer, and the quality of the work will deteriorate.

5. Intensify training of slower or newer people. When we face the most burdensome tasks, everyone will expect the normal services to be maintained. The best approach to being able to do that is to transfer as many regular processing tasks as possible to the slower or newer people. Litigation deadlines will be short, the visibility of the job will be high, and it is likely that we will really need the best people to help meet these requirements.

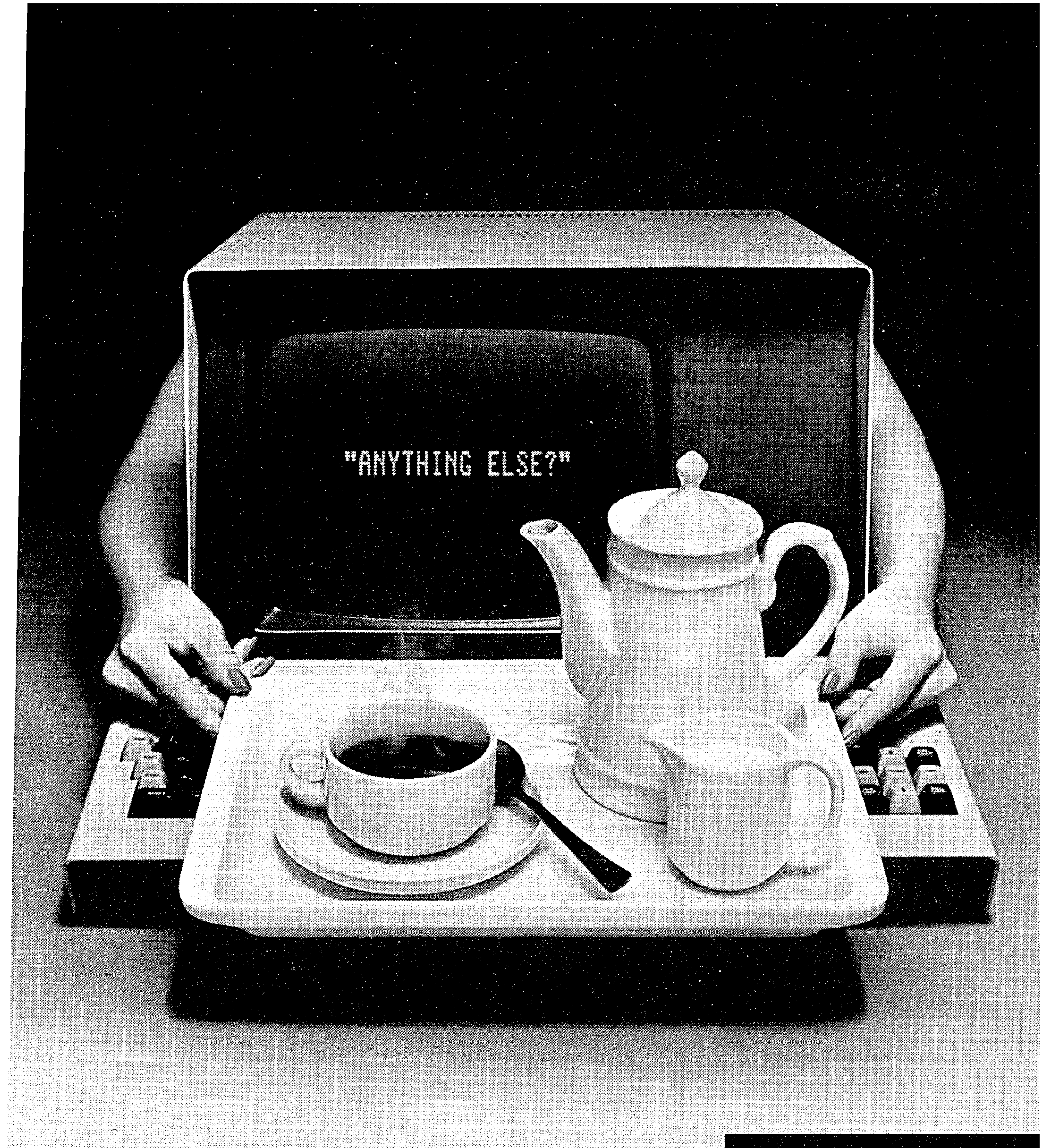
6. Learn where outside dp help can be found. Both staff and machines will become overloaded at several points. Just as a good pilot is always watchful for a place to make an emergency landing, we should always know where to acquire additional personnel and machine time in the event of an overflow from the normal operation.

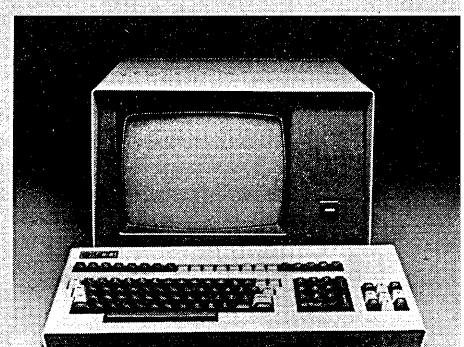
7. Educate the lawyers. The legal staff's lack of understanding of our problems can disrupt the operation and cost the company dearly. Make sure that the legal staff understands the company's procedures and record keeping system. Make sure they understand what dp can and cannot do. Teach them to ask first "Is it feasible?" and second "How long will it take?"

8. Handle attorneys with kid gloves. The "JD ego" can be very fragile, and the right amount of obsequiousness at the outset will keep personalities from interfering with progress. The lawyers and dp people will be working together for a long time, and almost nothing is more important than cordial working relationships. Just as the lawyers may hold dp operations in awe, so should we start with considerable deference. Very soon we will figure out which of the attorneys are all right and which must be treated more carefully.

9. Learn not to have easily bruised feelings. The attorneys will identify every fault in the exhibits and in the materials we prepare. They must be satisfied that everything is flawless, both in content and presentation. They are really being paid to be "nitpickers" and will welcome our help in getting through that process. The more important the exhibit or matter, the more carefully the job will be done.

10. Don't perform studies without clearance from the attorneys. Frequently, people in dp have an interesting idea, which they seek to pursue without first checking to see if it could be helpful. Often, the result would not even be admissible in a trial, or the inferences would need so much explanation or qualification as to make the item useless for persuasion. Worse yet, such studies may actually generate un-


"ANYTHING ELSE?"



favorable information and, because it may be revealed in discovery proceedings before the trial, provide evidence for an adversary.

11. Every analysis should be formally tasked and supervised by the attorneys. There's another reason why dp people shouldn't start off on something on their own. Because of long-standing judicial policy that communications between a lawyer and client are privileged from discovery, and because of another policy that the work product of a lawyer cannot be discovered by his adversary, work performed under the supervision of an attorney and at his request might be shielded from discovery. Even communications between the attorney and client, perhaps including the dp manager, can be kept out of discovery as privileged communication. A judge has much discretion in applying these rules, and the modern tendency is to favor disclosure rather than to exclude information from the court. Nonetheless, a sensitivity to this kind of protection will help everyone in preparing for litigation.

12. Guarantee consensus on every subject. No single legal strategy will be established and maintained throughout the course of the litigation. Rather, there will be fits and starts down many paths. We may be filling orders from various quarters of the user group—outside consultants, outside counsel, inside lawyers, other corporate departments. It is crucial to resolve any apparent lack of consensus among these groups early, so we will not expend effort to fill one request when some other user thinks it is a waste of time. Remember the "Chinese telephone" problem.

13. Consider the method of proof for each fact. In complicated trials, often the worst way of communicating information is to have a witness answer direct questions. Where the issues involve patterns or tendencies (as in the case of employment discrimination, price fixing, restrictions in a distribution channel, product or safety defects, etc.), graphic proof can be especially persuasive. Visual displays, often those generated by a computer, will be greeted by the attorneys as extremely promising exhibits. (A secondary benefit of producing computer-generated graphics for the trial is that top management of the company will, perhaps for the first time, become aware of the capability. Computer graphics are one of the few tools that top managers find of personal value in absorbing much information in a short time.)

Teach the lawyers to ask "Is it feasible?" and then "How long will it take?"

14. Prepare, prepare, prepare the testimony. Almost every litigating attorney would like to have every direct examination question written out ahead of time and rehearsed with the witness. Despite the appearance of a staged and rehearsed performance, he will at least know the answer to every question that he intends to ask. Furthermore, an attorney would like to have a "nasty questions session" the night before cross-examination, to prepare the witness for the types of attacks that might be made on his testimony by the opposition.

Often in the heat of the trial, there is not enough time to prepare every witness in this ideal manner. All witnesses should undertake to write out questions and answers, especially if the attorneys fail to do so. This will greatly speed the process, and will make sure that no one is surprised by a question from our own lawyers. If the witness cannot be cross-examined ahead of time by someone posing as an adversary, he should try to read the transcript of the case or attend part of the trial ahead of time to obtain an appraisal of the lawyers who might be conducting the cross-examination. Spend at least four hours in preparation for each hour of testimony.

All of this is designed to anticipate and to avoid surprise.

15. Consider hiring outside experts. Many companies and law firms bring in outside experts as a standard procedure in the pursuit of a litigation. In most complicated corporate litigation, it is the expert testimony that carries the most weight with the court concerning matters of reasonableness, prudence, standard practice, etc. Psychologists, economists, engineers, specialized attorneys, all may be asked to testify concerning the actions or procedures of the company. If we can help identify potential expert witnesses in the early phase, and then assist them in preparing their testimony, it will simplify the administration of the litigation, and everyone will be grateful.

16. Carefully document your work. Improper documentation of good work will hurt its impact at trial, if no one can testify to precisely what was done or what the conclusions were. At the same time, an injudicious or unthinking choice of words in an early stage may come back to haunt us, especially in a memorandum that appears to be critical of the company, its actions or policies, or contradictory to some assertion necessary to be proved.

One important by-product of litigation is the amount of information concerning our business and our corporation that we will generate in response to requirements of others. Much of this information will be of value to management in planning and in the ongoing

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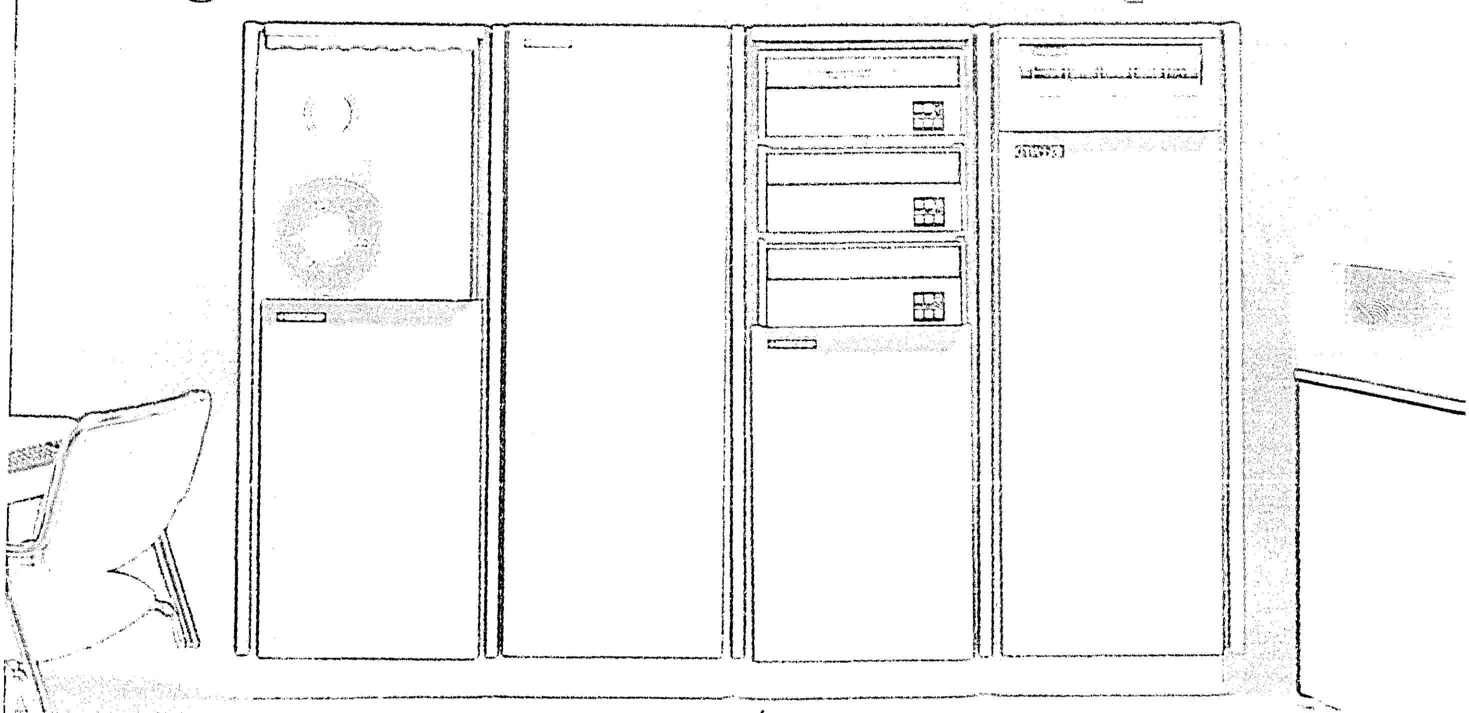

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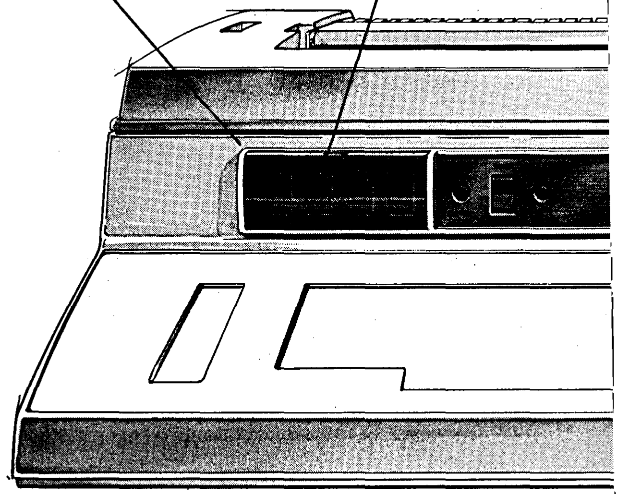

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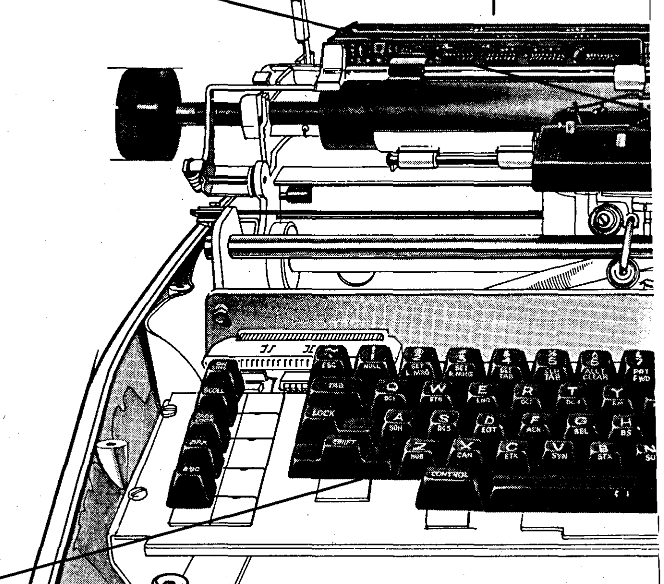
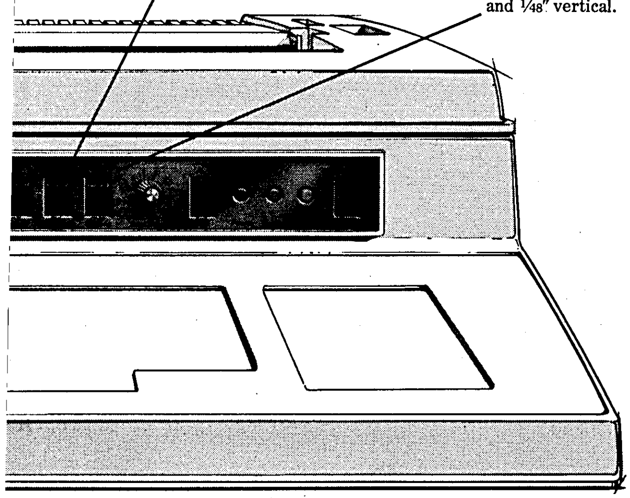


Comprehensive command set—59 powerful user oriented commands provide format flexibility. And to make it even easier, commands are printed on the keycaps.



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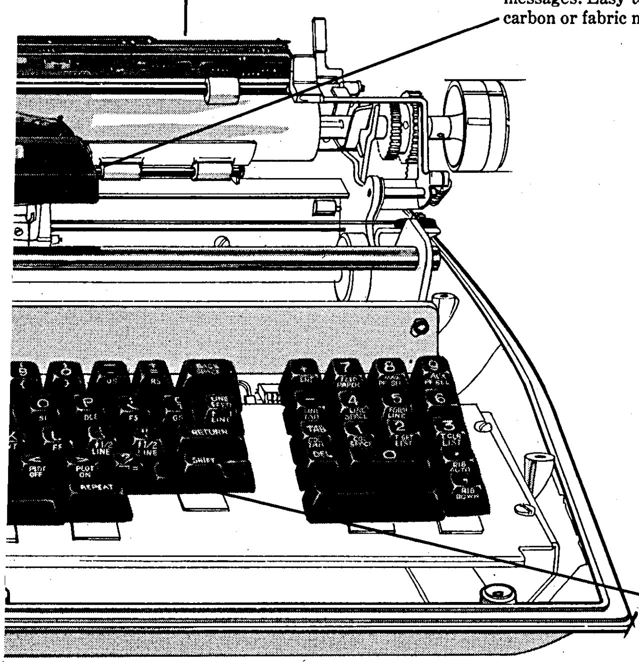

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business of the company. We should point out these benefits, when they appear, to ease the emotional burden of facing the financial and administrative costs of complying with the request of attorneys. After the case is over, some of these by-products may be worth continuing. ✲

Mr. Daniel is an attorney with the Washington, D.C., law firm of Hogan & Hartson. He has worked in the government to design and employ computer techniques to assist in the public administration of legal systems, and has participated in computer litigation.

Experienced in the use of computers for legal research and document retrieval, he has directed a course for the District of Columbia Bar Assn. in 1977 on computer assisted legal research and litigation support. Mr. Daniel is also the editor of a forthcoming introductory handbook on computers and the law, published by the American Bar Assn.

Mr. Paller is president of the Washington, D.C., data processing firm of Applied Urbanetics, Inc., and a specialist in forensic data processing and presentation. He has worked both inside and outside government, directing development of computer systems that translate large volumes of data into graphic management-oriented summaries.

He has testified as an expert in Federal District Court and in proceedings of the Federal Trade Commission, and has directed a series of workshops for George Washington Univ. on Effective Congressional Testimony and Effective Statistical Presentation.

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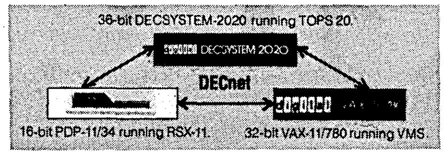

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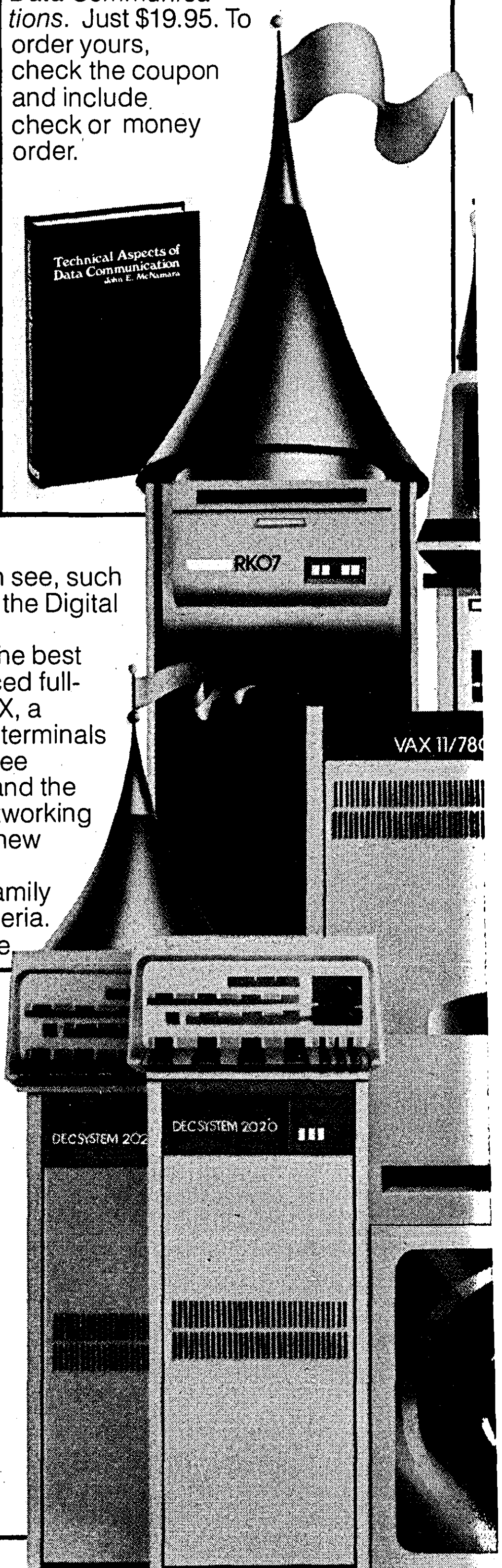

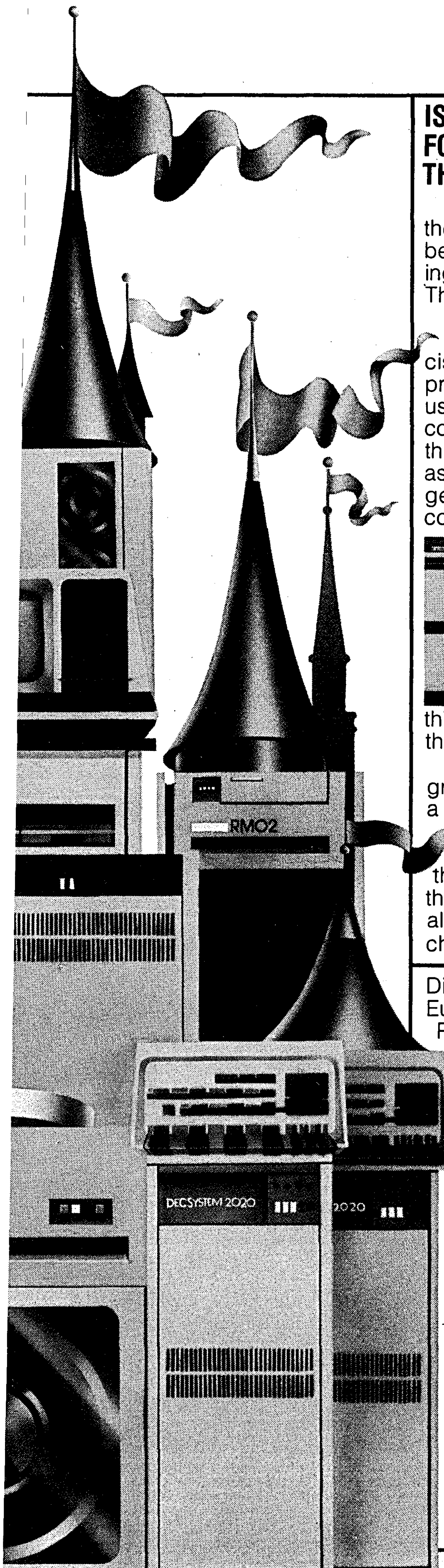

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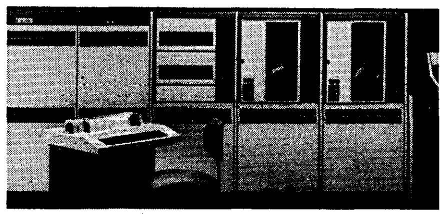
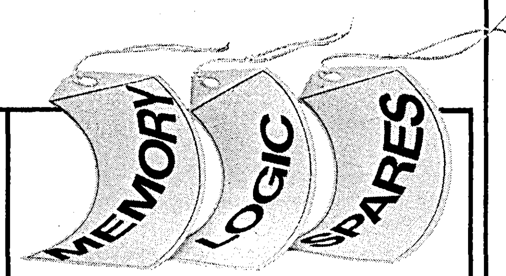
The incredible performance of the VAX-11/780 minicomputer, in benchmark after benchmark, is making serious FORTRAN users wonder. The 7600 is faster, of course. But VAX speed is exceptional. 1050K Whetstone instructions single precision—711K Whetstones double precision–fast enough for most 7600 users. And then… The difference in cost, and all that implies. Take throughput. If the 7600 is twelve times as fast, you can buy a dozen VAX's, get the same throughput, and save a cool $6 million! FORTRAN users who



think speed but really need throughput take note.

And there is the matter of program size. VAX virtual memory, and a gigantic 32-bit address size, allow directly addressable programs 1,000 times larger than the 7600! FORTRAN users who think they need a 7600 for large programs also take note. Or take pencil and check box.



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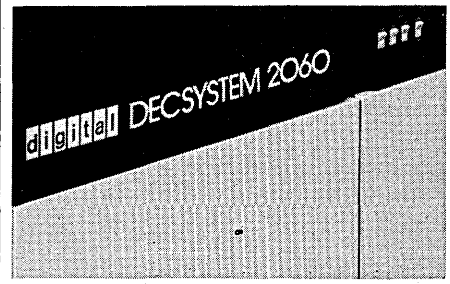

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Measure for Productivity

by Donald E. Peeples

Measuring company-wide productivity across 14 data centers required a small initial investment in software, five man-days per month, and some machine time—cheap, considering the return.

Data processing, the agent of productivity measurement and improvement for many departments in a company, in most cases is woefully lacking in performance standards itself. A dp department can be considered to be giving excellent service by some users, yet not measure up to criteria applied by others. Data processing management is pushed and pulled between opposing philosophies and usually reacts to whatever shrine the boss is worshiping at the moment.

GTE Data Services (GTEDS), struggling with similar problems and with an inability to articulate improvements we thought we were making, developed a system of measurements analogous to typical measurement programs of our customer groups. The technique, very simple in concept and implementation, was started in the computer operations area and was so successful it was expanded into the systems development function in 1975. Today, most of the dp budget is under some measurement program.

Our business involves managing 14 data centers for as many individual telephone companies. Thus the measurement program is implemented in centers ranging in size from an IBM 360/40 shop with 22 people to a site with three IBM 370/165s and 300 people.

Being a typical data processing organization prior to beginning the measurement program, we encountered various inhibitors in establishing it: historical data either was not available or was inconsistent; there was a lack of agreement within user departments on what constituted reasonable service levels; the interrelationships of dp functions were (and are) sometimes subtle and not conducive to measurement; and, finally, the business we are in is constantly changing, causing reevaluation of any objectives we did establish. In short, our dp operation looked just like everyone else's.

"Improvements" will occur in all measured functions, so make certain they are in the best interest of the total enterprise.

In spite of these, we developed several objectives to guide our program:

1. *Establish performance objectives.* We wanted to establish an objective or standard of performance for each data center or project such that the manager of each unit would accept the measurements as truly representative of his performance. This is a tough (but not impossible) task in data processing where one is dealing with such a wide variety of operations.

   The objectives should reflect some improvement in performance for every item and be weighted in accordance with the primary goals of the organization.
2. *Record and report total performance.* We wanted a method which was acceptable to both the customer and to our own management. Too often the only event remembered of dp is the last payroll or systems project that was late or in error. We wanted a method of smoothing over infrequent, isolated problems with acceptable statistics indicating a history of good performance.
3. *Provide a basis of comparison.* We wanted to provide a standard basis of comparing projects and centers as an aid in determining future requirements as well as in indicating areas where cost reductions could be made.
4. *Maintain historical records.* An objective was to maintain historical records in as many areas of the business as possible for spotting developing trends in service and performance. We also wanted to be able to adjust erroneous objectives based upon actual history.
5. *Measure and compare performance.* It was essential that we be able to measure and compare performance of one data center or project to another. Unique procedures or a stream of exceptions would make the program unmanageable.
6. *Foster competitive spirit.* We believed that competition could be an incentive for improving service and performance.
7. *Provide management and customer visibility.* We considered it very important to demonstrate to various executive, customer, and other user groups that data processing management was concerned about increasing productivity

while improving the overall quality of its products and services.

Assuring top management that the data processing resource is being well managed and controlled has never been more important. With the acceleration of on-line systems, a data base hierarchy, and the ever growing minicomputer activity, the dp department takes on an increasing level of management complexity. As many functions as possible must be removed from the "art" category of management. As developed at GTEDS, the measurement program attempts to bring a more scientific and credible approach to the major functions of managing a dp installation. By focusing dp management and user attention on specific costs and on sensitive user-related services, appropriate leverage is applied to generate a broad spectrum of improvements (see Table 1, page 224).

Operations

It is certain that we have not completed the process of data processing measurement even though we have been at it for six years. New work function relationships and methods for improving productivity are constantly being learned. However, our experiences have shown that computer operations and its outputs are significantly easier to measure than is the systems development process. While both functions have been embraced in the GTEDS program, the operations area was begun first because of a greater availability of productivity data and a relatively clearer understanding of outputs.

The computer operations measurement program is divided into three major parts: timeliness in meeting output schedules, local systems development support (the systems development function is considered as important a customer as any other), and computer efficiency (really a measure of the utilization of both labor and equipment).

Our productivity measurement and improvement program, for operations and for all other branches of dp, is basically one of awarding "points" for meeting goals. The system may sound simple, but we've found it leads to impressive performance improvements. Its success depends largely on how well management weights each aspect of performance, but it allows for easily changing the weightings as management learns more about productivity measurement.

Thus each organization which adopts the method will establish its own weightings as GTEDS did. In all likelihood, those weightings will be different from ours, and will change with time. Our specific ratings, then, are shared primarily for understanding the method.

Certain managers had even taken to hanging signs saying "This Unit Out of Service" to prove they could do without them.

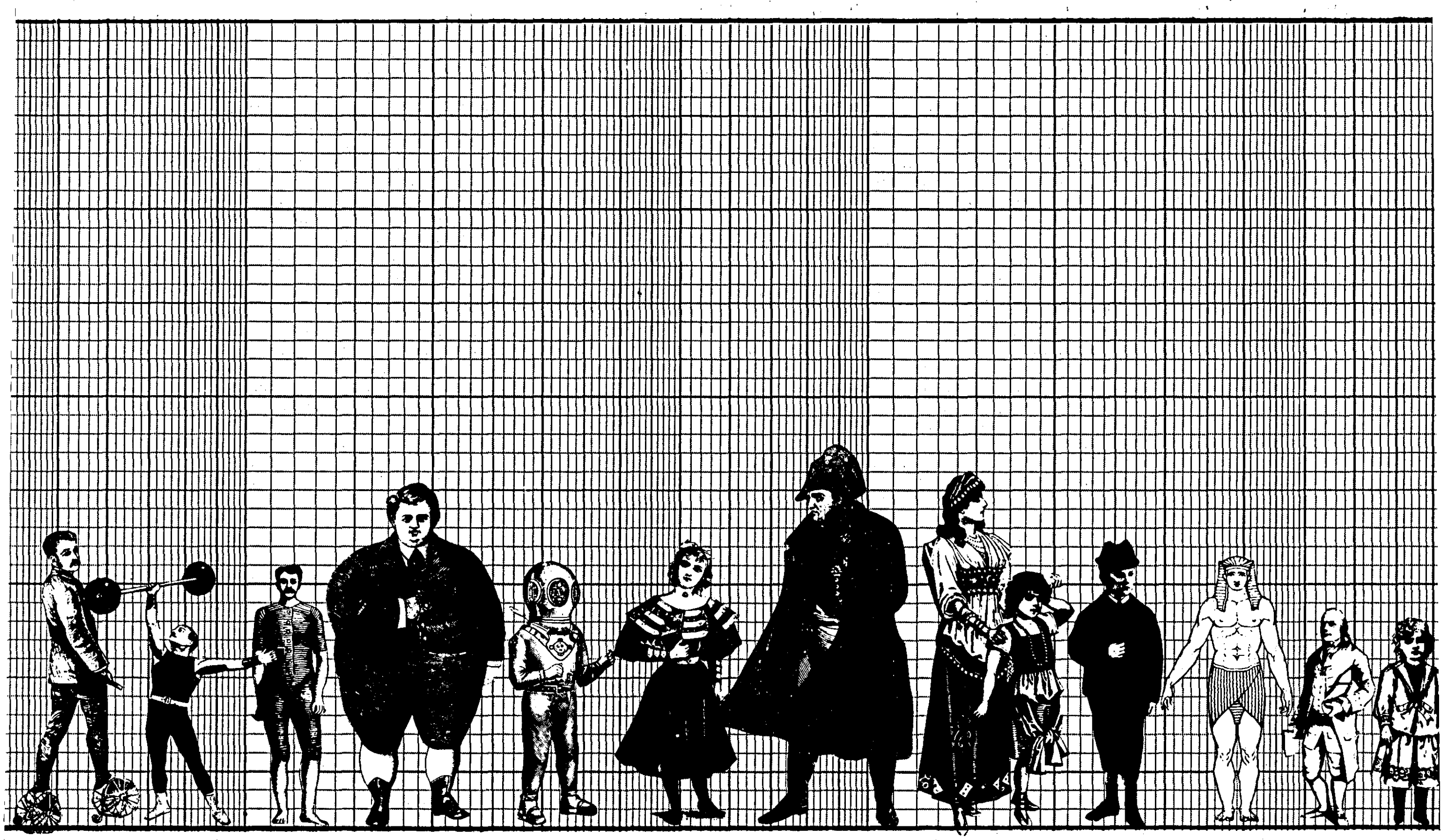
The first weighting applied to computer operations was intended to reflect that the department's *effectiveness*—in supporting outside departments and the systems development group—is more important than the *efficiency* with which its hardware is used. Specifically, the timeliness and local support aspects were given 66% of the total points, but the detail of how points are awarded requires some explanation.

Efficiency measures

The points for efficiency were initially established from studies done at various computer centers before this particular measurement program was begun. Historically, of course, computer utilization measurement has received much more attention than any other aspect of dp. Some of this earlier measurement was quite imaginatively done. Certain managers had even taken to hanging signs ("This Unit Out Of Service") on individual devices for 30 days at a stretch to prove their centers could operate with fewer resources.

Our interest was in driving up computer utilization, increasing the productivity of all computer room resources, and, in essence, extending the life of current equipment. The financial return of this part of the program has been significant. During the first three years, equipment expenses were reduced 14.7%, 3.6%, and 6.7%—reductions amounting to $1.4 million—and this was done while workload was increasing at a 12% annual rate.

Today, the efficiency side of the mea-



surement program is used primarily as a cost-avoidance instrument. The standard criteria for GTEDS-wide service and equipment afforded by this measurement provides a quantitative basis for management analysis of proposed configurations and equipment additions.

Reruns. We are tracing the percent of rerun time to total computer time. The percent of dp-caused reruns are measured, although reruns for all causes are recorded. The objective is that dp-caused rerun time should not exceed 2% of all computer hours.

To create an incentive for higher degrees of improvement, points were distributed in increments of 0.5%. In other words, a center that only had 0.5% rerun time got four points; centers having 2% received one point, and over 2% qualified for zero!

% Rerun to total utilization	Points
0% - 0.5%	4
0.51% - 1.0%	3
1.01% - 1.5%	2
1.51% - 2.0%	1
Over 2.0%	0

There has been no particular relationship of incidence of reruns to size of installation. It has been proven, to us at least, that management expertise and organization are more meaningful than installation size.

Multiprogramming activity percent (MAP). The MAP measurement relates to the efficiency of job mix on a single computer. It is calculated to increase, to a certain level, the running of concurrent jobs on a single computer. Basically, the theory of the calculation is that there must be more than one job in operation to register any MAP at all. The formula used is:

$$\text{MAP} = \frac{T - M}{(P - 1)M}$$

EXHIBIT I — Summary of GTEDS Measurement Performance Indicators

Measured Function	Points Allocated	Unit of Measure	Period Under Measurement	% Improvement	Ending Average Performance Level
I. Data Centers					
Efficiency Indicators					
Computer Utilization	–	CPU Cycles	6 Yrs.	+29%	86.7%
Multi Programming	4	CPU Hours	6 Yrs.	+23%	57.2%
Reruns	5	CPU Hours	6 Yrs.	+22%	1.4%
Device Utilization – Tape	3	Meter Hours Per Device	6 Yrs.	+57%	368 Hrs.
Device Utilization – Disk	4	Meter Hours Per Device	5 Yrs.	+14%	610 Hrs.
Device Utilization – Readers	2	Meter Hours Per Device	6 Yrs.	+35%	450 Hrs.
Device Utilization – Printers	2	Meter Hours Per Device	6 Yrs.	+23%	452 Hrs.
% Labor Overtime	5	Ratio of Hours	4 Yrs.	+56%	2.0%
Computer Hour Per Operator Hour	5	Ratio of Hours	3 Yrs.	+39%	1.33 Hrs.
Jobs Per Data Control Hour	2	Jobs/Control Hours	3 Yrs.	+80%	17.0 jobs
Test Turnaround	2	% Within 24 Hours	5 Yrs.	+ 5%	97.7%
	34				
Effectiveness Indicators					
Timeliness					
Class A Priority	8	100% On-Time Objective	6 Yrs.	+ 3%	99.9%
Class B Priority	8	98% On-Time Objective	6 Yrs.	+ 9%	98.6%
Class C Priority (8 Systems)	22	95% On-Time Objective	6 Yrs.	+ 3%	98.7%
	38				
Local Systems Support					
Projects On-Time	8	Project Quote	6 Yrs.	+6.2%	98.7%
Projects Within Cost	8	Project Quote	6 Yrs.	+13%	99.7%
Projects Weighted By Size	8	Project Quote	6 Yrs.	+ 2%	99.7%
Problem Response	4	Performance to Objective	6 Yrs.	+23%	97.1%
	28				
II. Systems Development (Long-Range)					
Development					
Schedulable Activities	70	Activities to Schedule	2½ Yrs.	+19%	95.5%
Maintenance					
Enhancements On-Time	10	Project Quote	2½ Yrs.	+ 9%	97.5%
Enhancements Within Cost	10	Project Quote	2½ Yrs.	+21%	99.0%
Enhancements Weighted By Size	10	Project Quote	2½ Yrs.	*	98.2%
Problem Resolution	20	Performance to Objective	2 Yrs.	+36%	99.7%
Problem Balance	–	Aged Over Objective	18 Mos.	+67%	3.6%
Problems per	10	1000 Lines of Code	2 Yrs.	+59%	.058
Support Hours per	10	1000 Lines of Code	1 Yr.	+47%	1.86 Hrs.

* INSIGNIFICANT CHANGE

Table 1. The measurement program was started in computer operations, and after it proved itself there was expanded to include systems development and maintenance. Now most dp-related functions are included, and almost all have shown long term improvements.

Where:

T = the gross elapsed clock time in hours. Gross hours refers to all time of all jobs in all partitions or regions of the computer.

M = cpu meter hours, the actual meter time for a month.

P = partitions or regions or what is specified as optimal concurrent problem programs. (Some typical assignments to memory size are: DOS=3, OS-256K=3, 512KB=5, 1MB = 7, 2MB = 11.)

A 65% multiprogramming index is the objective, and qualifies for a maximum of 4 points.

For local systems support, the objective was to force concentration on *what is quoted.*

Device utilization. This measurement has been extremely profitable. High standards of performance have been established for each kind of device; with the exception of disc, they are based on average hours *per device* per month: 2 points are awarded for 475 hours or more on a printer or card reader; 2 points for 400 hours or more on a tape drive.

Disc and tape management are also rated. Efficient track utilization measured by the proportion of improperly blocked disc data sets, is worth 2 points. Disc allocation—measured by the proportion of allocated but unused space—is worth another point. Properly blocked tapes are worth 2 points. And what we call "short files" is worth 1 point; we measure this to isolate short tape files which ought to be moved to disc. Currently 70% of all disc and tape data sets must meet these test criteria to qualify for the points.

Percent overtime to regular labor hours. This particular category measures the amount of labor overtime for computer room and support personnel. All hourly personnel connected with computer operations, exclusive of systems and programming, are included. Maximum points (4) are awarded for using 2% or less overtime.

Computer operator hours. Studies were performed to determine what labor was spent servicing various computer room components such as consoles, tape drives, disc drives, etc. A "par" was established for each component based upon the average hours required in the data centers. Five points are awarded for making par or beating it by being able to operate with less labor than planned. The labor hours objective is adjusted each month for swings in cpu meter hours, which compensates for additional or decreased work. As I/O devices are added or eliminated at a center, a corresponding addition to or reduction in labor is anticipated.

Job steps per data control hour. The objectives in this area were based upon history in our work environment and include a count of job steps staged and processed by data control personnel. Maximum points (3) are achieved by producing 15 or more job steps per data control hour (OS/VS centers) and 5 or more for DOS centers.

Test turnaround. Test turnaround, while perhaps more properly considered a "service" measurement, is included within the computer category for management purposes. Two points are awarded if 90% of the tests are turned around within 24 hours.

This completes the computer operations segment of the measurement, where a maximum of 34 points can be awarded. The next major section of the program is the timeliness measurement.

Effectiveness measures

Timeliness. The timeliness category simply records, tracks, and measures performance in delivering the most significant outputs of the data center. Since all our data centers are involved primarily with telephone company reports, we were able to standardize on the objectives by specific output. As many outputs as one may wish to isolate could be included. However, there are three major parts:

- outputs which have a 100% on-time objective;
- outputs which have a minimum 98% on-time objective; and
- outputs which have a minimum 95% on-time objective.

Thirty-eight points are distributed over all output types in whatever manner one chooses to emphasize. Generally some points can be won in each category for "acceptable"—though not perfect—performance. However, points are also *deducted* for unacceptable performance in critical service areas.

It is also an important feature of the program to let the customer user group determine whether an output is on time, or the degree of lateness. In some isolated cases you might find an unfair or leveraged customer ranking, but usually this technique will provide gains in user awareness and cooperation not previously experienced—especially if user groups were properly introduced to the objectives at the beginning!

Local systems support. The objective in this entire area is to assure that local system projects are completed within the time frame and cost quoted. These projects, by nature, are relatively short range development activities or enhancement

Measurement Program

The cost to implement and administer a measurement program fits easily within the budget of even a small data center.

The first requirement is a computer Job Accounting System that extracts time accounting information from computer resources and summarizes it into measurable statistics on hardware performance. GTEDS uses the Job Accounting Report System from Johnson Systems, Inc.

On the human resource side, a project management system is used to capture systems and programming time against approved customer requests for service. Such a system not only provides timely information for tracking project progress against a work plan, it also provides historical data for measuring schedule and cost estimate performance. QUICK-TROL from Quality Data Products, Inc. is used.

These software packages are available for around $6,000 each. In addition, to measure disc and tape management, the ALERT package from COMTEN, Inc. is used. It runs around $9,000.

From an administrative standpoint, approximately two man-days a month in each data center and three additional man-days at headquarters are spent compiling the results reported by the various data centers and producing the final summaries.

In addition to installing the software and writing a few interface routines, the initialization of a measurement program will require a review and possible update of operating standards covering:

- the method of controlling and reporting job reruns
- JCL job accounting conventions
- procedures for submitting and controlling tests
- procedures for scheduling jobs and reporting late outputs
- a formal method for securing customer approval and project team commitment on costs and schedules for all systems and programming work
- a formal method of documenting problems on existing operational systems

This effort of reviewing and updating operating standards as well as setting the measurement objectives can easily be handled by one full time staff person working with the data center line management. ❊

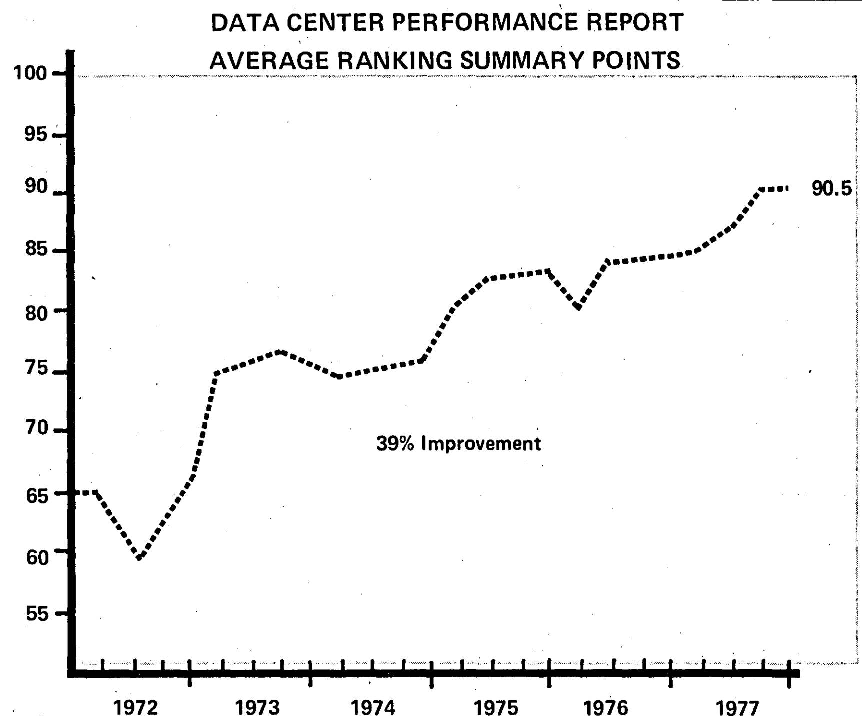


Fig. 1. Two-thirds of the points awarded for computer operations performance go for improving service, only one-third for efficient use of resources. The plot above tracks company-wide improvement.

and maintenance of existing systems. The operative word in this section is "quoted." Before implementing the measurement system, GTEDS was frequently late and over cost on many projects. The objective was to force concentration upon *what is quoted.*

In order to maintain a smooth trend in this area, six month-to-date statistics are used.

A maximum of 28 points are awarded in this section:

Category	Maximum Points
Projects on time	8
Projects within cost	8
Within costs/weighted by size	8
Problem response	4
Total	28

Projects on time. Maximum points (8) are awarded for those system projects completed within the originally quoted completion date or approved variance caused *only* by: a reordering of priorities at the customer's request, or a change of job specifications by the customer. One must complete 95%-100% of all projects on time to get the full 8 points. The following areas measure the ability to achieve "within" the quoted estimate. ("Within" means within a window of +5% or -20% of the approved estimate.)

Projects within cost. To get all 8 points, one must be within the total cost estimated 99%-100% of the time. If performance is below 92%, no points are awarded.

Within cost/weighted by size. This category was created to place a heavier weight on large project completion within estimated hours. "Within cost/weighted" is the hours worked on projects completed within cost estimates as a percentage of hours worked on all completed projects.

The idea here is if you must overrun an estimate, do so on a smaller, and presumably less important, project. Eight points are awarded for a range of 98%-100% performance with fewer points granted for poorer performance.

Problem response. A total of 4 points are awarded for responsiveness in repairing errors in an operational system (maintenance). Maximum points are attained by resolving problems within 30 days more than 95% of the time. Negative points are charged when problems remain unresolved over 90 days.

Bonus. There were two areas where we wanted to place some emphasis, but realized there might be extenuating circumstances that would prohibit universal achievement. These are included as a bonus category for those managers and centers who, over all obstacles, were able to achieve extraordinary results.

A bonus is awarded for anyone who could meet original project estimates even though the customer admitted a specification or priority change. This item provides an added value benefit to customer relations by motivating data processing management to overcome certain events normally considered beyond the control of data processing. Two bonus points are available for this achievement.

Two more bonus points are awarded for centers which can keep their cpu utilization at 90% or greater. This is not enough to jeopardize the service categories, but rewards a good, well managed operation where service levels are high and utilization is maintained above objective levels.

This completes the detail procedures behind the computer operations productivity measurement. A monthly data center performance report with all statistics is provided to each data center manager. A three-year graph of total points earned for each data center and a year-to-date average of total points for each center is calculated.

This year-to-date average is used for ranking purposes, with the center achieving the most points being ranked number one in the company. The total company trend of points since the program was begun shows the overall data center improvement experienced (see Fig. 1).

Systems development

The systems development measurement program, similar to that for data center performance, is a self-contained system of indices based on the various work functions involved in this process. The success in data center measurement was so outstanding that the concepts were extended to the long range systems development function in 1975.

The program developed is divided into three major sections: development measurement, maintenance/enhancement measurement, and administrative measurement.

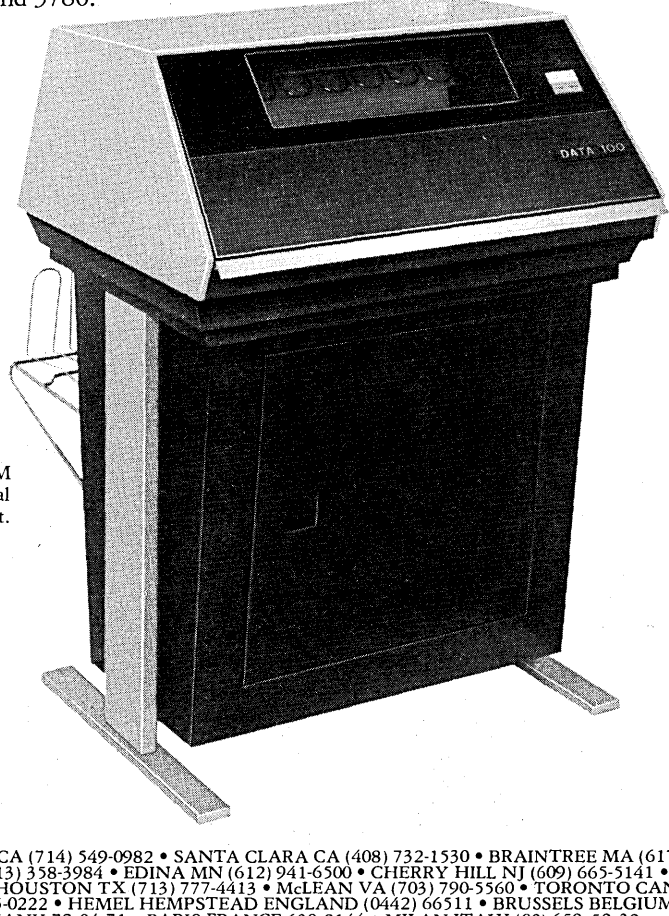
The computer operations area and its outputs are easier to measure than is systems development.

Again, an attempt is made to balance the total management responsibility for systems development by placing emphasis, as signaled by an allocation of points or index, in varying degrees based upon our own judgment of what is most important during the entire development cycle.

Development and/or maintenance receive a weighting of 70 points each. If a project does development work only, it is measured in the development category only, as is the case when a project has maintenance responsibilities only. If a project has both development and maintenance responsibility, the points scored in each category are averaged to yield a point value no greater than the 70 total points allocated to these activities. The administrative category makes up the remaining 30 points to provide a total possible index of 100 for all functions.

Development measurement

As indicated, the basic objectives in the



development side of the equation are to force detailed planning and to control the schedule. The philosophy here is simple: if planning is emphasized at a detailed level early in the development cycle and before quoting any delivery dates, a better overall estimate will be provided and the less likely one will have a major embarrassment at the end of the project.

A project which is entering the development cycle must have a detailed work plan. Each task, subtask, or "activity" of a stage is estimated both as to the level of effort required and when it should be accomplished. By our definition, an activity may not be greater than 120 hours. The activities included in that plan are what the project is measured against; and the measurement continues throughout the applicable stage of development.

The team can be behind one month, catch up the following month and recoup some lost points. However, if the final estimated stage date is missed, the project gets zero points that month and every month thereafter until the stage is completed. The process is repeated for each subsequent stage and the team gets to start fresh at the beginning of each stage. The total year accumulative effect of prior missed commitments, however, will be a continuing part of the team's overall measurement.

Points are awarded based upon the degree of attainment of the activities completed to date. Those projects completing all their activities on schedule get the full 70 points and will continue to do so each month if they meet or exceed their original plan commitment. Similar to the data center performance program, a scale is created for awarding points for "acceptable but not perfect" performance.

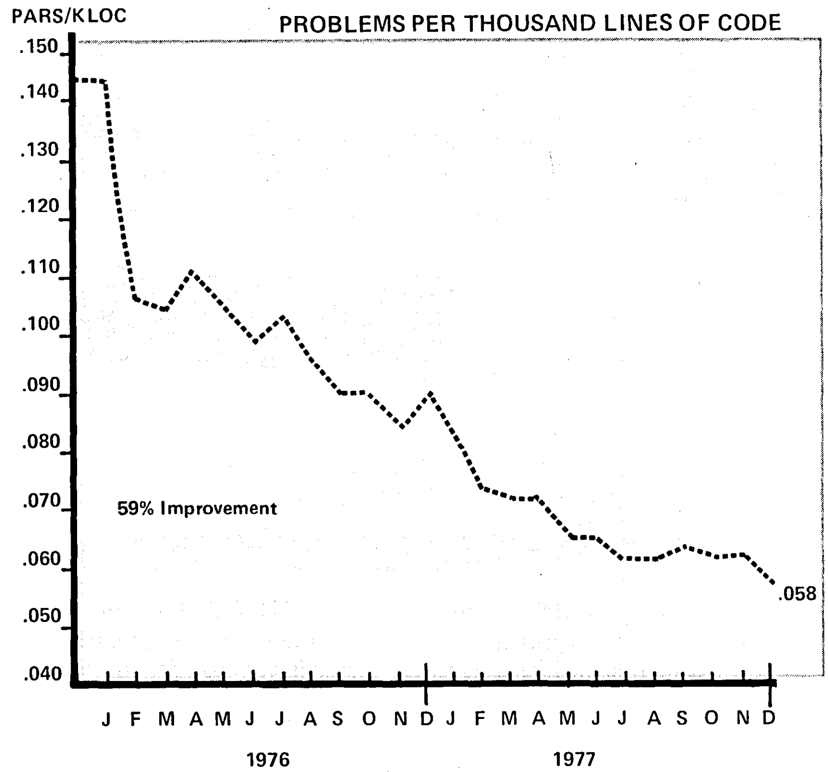


Fig. 2. The problems per thousand lines of code measure is directed toward the quality of the code when it first goes out the door. Thus the cumulative number of problems discovered is divided by the months in service to yield the index plotted above.

A programming or development productivity index based on thousands of lines of code seems feasible.

Plans are adjusted only upon permission of the customer monitor group and only when additional specifications are added to the project descriptions. Simply being behind schedule is not cause to readjust this measurement.

Maintenance/enhancement measurement

A project team may have responsibility for maintaining an earlier release of a system while developing a more modern version. In these cases, the project manager is measured in both functions—development and maintenance. GTEDS project teams are measured on the effectiveness of their support of over two million lines of code in 17 data centers across the U.S. and Canada.

Enhancements. The maintenance category is comprised of numerous subcategories. The first of these is enhancement work, which is similar to a work order—adding new function to an existing system.

Problem response. Measurement of responsiveness in correcting bugs in operational systems is also important. The general idea is to reduce cost and improve the speed at which we are able to exorcise these little devils from live production systems.

Six month-to-date statistics are maintained in the problems segment of the measurement, which means one month's poor performance by any project will carry forward for six full months of measurement.

Also included in the maintenance section of the program are two calculations which indicate the quality of systems installed and the productivity of the maintenance function.

In "Problems per thousand lines of code," measurement is directed toward the quality of the system as it leaves the development door and goes into service. This measurement is intended to build incentive to that end.

Problems per thousand lines of code (KLOC) is calculated by dividing the number of problems discovered by the months the code has been in use. This measurement relates the total number of program change problems received over the life of a product to the total number of lines of code in service. A number of problems are expected upon the new release of any system. However, an incentive is created to reduce those problems as quickly as possible by awarding points on a constant level.

The trend of performance for all projects supported since the measurement program began is shown in Fig. 2.

Similarly, we try to use fewer "support" or "maintenance" hours in order to generate additional development capability. This is an effort to reduce the overhead of the systems cycle. Support hours per KLOC is calculated by dividing the 12 month average of hours spent resolving problems by the thousands of lines of code supported. Progress to date is shown in Fig. 3.

Our current use of new concepts, such as structured programming, on-line maintenance and perhaps data base constructed systems, should reduce maintenance requirements and be reflected in future trend lines.

We also considered developing a programming and/or total development productivity index based upon thousands of lines of code, which appears to be feasible. However, existing data was insufficient to include such a calculation in the current GTEDS measurement program. The necessary variables now have been tracked for two years, and such an index has been included in the 1978 program.

Administrative. A combination of 30

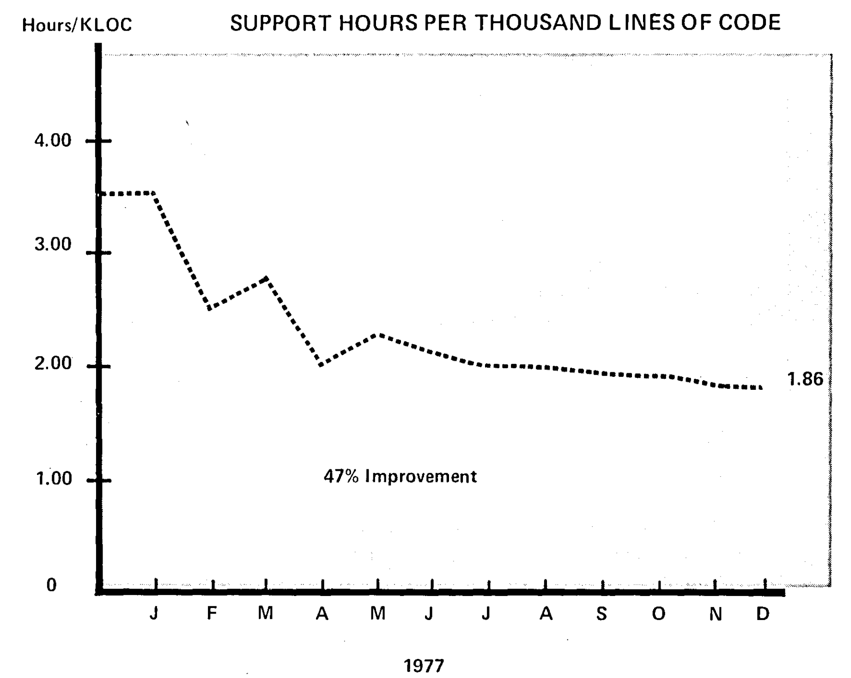


Fig. 3. Support hours are figured by dividing the 12 month average of time spent resolving problems by the number of lines of code in service.

points is awarded in two areas referred to as "administrative." Basically, good budgeting of productive labor hours and computer test requirements are rewarded.

Composite weighting. Upon completion of each of the measurable systems development categories discussed, the total points earned in each section is related on a performance scale of 100. Each project is then placed upon a ranking chart and compared to every other project.

There are many permutations and combinations of work relationships in the systems development function and coming to grips with good productivity and quality indices is a constant challenge. The essential ingredient to a viable program is a continuing awareness of discrete functions which can be related to an increase in output or quality.

As indicated earlier, there has not been the experience in the systems development functions as in field operations; however, improvement has been noted monthly since this program began. Fig. 4 shows the monthly trend of overall performance for systems development.

A year-to-date comparison of each project's monthly score is kept and each project compared to each of the other projects on a point basis. Whether or not the number one ranked project is that much better than the last place project is debatable at this time. It is clear, however, that the top projects on this measurement basis have indeed resolved more of their problems—better balanced the demands for competing resources—and generally are responding to customer needs better than the bottom scoring projects.

Measuring causes change

What are the overall results of the measurement programs? As the procedure basically *measures* performance but does not in itself change performance, one might not expect to observe any changes. However, as noted in Table 1, long term improvement has been experienced in *all* categories so measured. The measurement system utilizing a distribution of weights, attempts to reconcile what some people call "conflicting objectives," but is, in essence, a balancing of objectives. The measurement program simply highlights the degree to which management is successful in this balancing act and concentrates data processing management attention on doing just that.

The program is achieving the overall objectives established. Data processing can now defend the resources used in a data center or development project and provide either a record of good service performance or the means to identify causes when standards are not met.

Maintenance of performance statistics also takes the sting out of unique problems encountered from time to time in a data center or project. The user community and top management can now follow progress in various service categories and recognize improvements in productivity as additional work is added to existing or even lesser resources.

To do it right . . .

A measurement program in data processing can be a very powerful management tool. A successful implementation will consider the following points:

Establish a track record. A measurement program as discussed here is somewhat controversial in many circles, including any employee group. To be successful, one should neither force nor rush a program. It is much easier to begin a program in the operations area, where the goals and attainment measurement are much easier to achieve. Establish a good track record for goal attainment in operations prior to tackling the more difficult functions of systems development.

Get the managers' attention. The measurement program should be focused at the manager level, or wherever the resource decision making occurs. This is done to measure a manager's ability to manage resources as well as control the quality of his product. Such a program should not be installed at the individual or first-line supervisory level, although certain aspects of it might be.

Don't let the tail wag the dog. Be firm but flexible. Management must stand by the standards established and insist upon a program of accomplishment, but recognize that changes in technology might necessitate tuning the standards. For example, the benefits of data base technology have an attendant overhead cost. Certain measurement goals may have to be adjusted to compensate for this. Similarly, on-line programming may cause a more liberal adjustment of some of the data center productivity goals but, on the

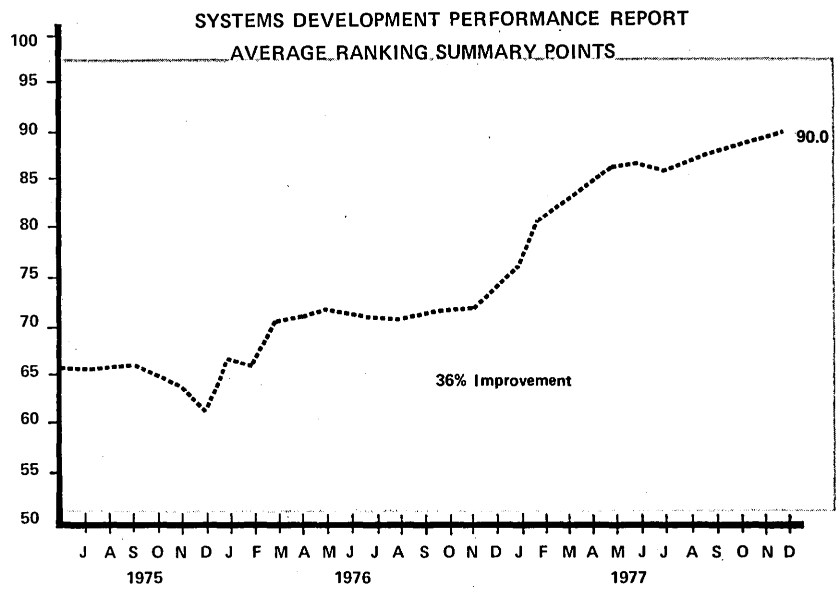


Fig. 4. The composite index for systems development reflects new products development, maintenance, and administrative points—all figured on a per-project basis and lumped together to produce the single measure plotted above.

other hand, should deliver additional productivity and quality for the systems development functions. Also, on-line application systems with a requirement for high availability may necessitate duplexing various facilities, and adjusting the measurement program.

Expect intangible benefits. Efforts toward gaining better control of a data center operation or systems cycle may yield unexpected benefits. For one, a measurement program, no matter how primitive, causes individuals or teams to concentrate on the measured function, thus causing them to be performed at a somewhat higher level. Managers will manage *to* the measurement! "Improvements" will occur in all measured functions, so make certain they are in the best interest of the total enterprise.

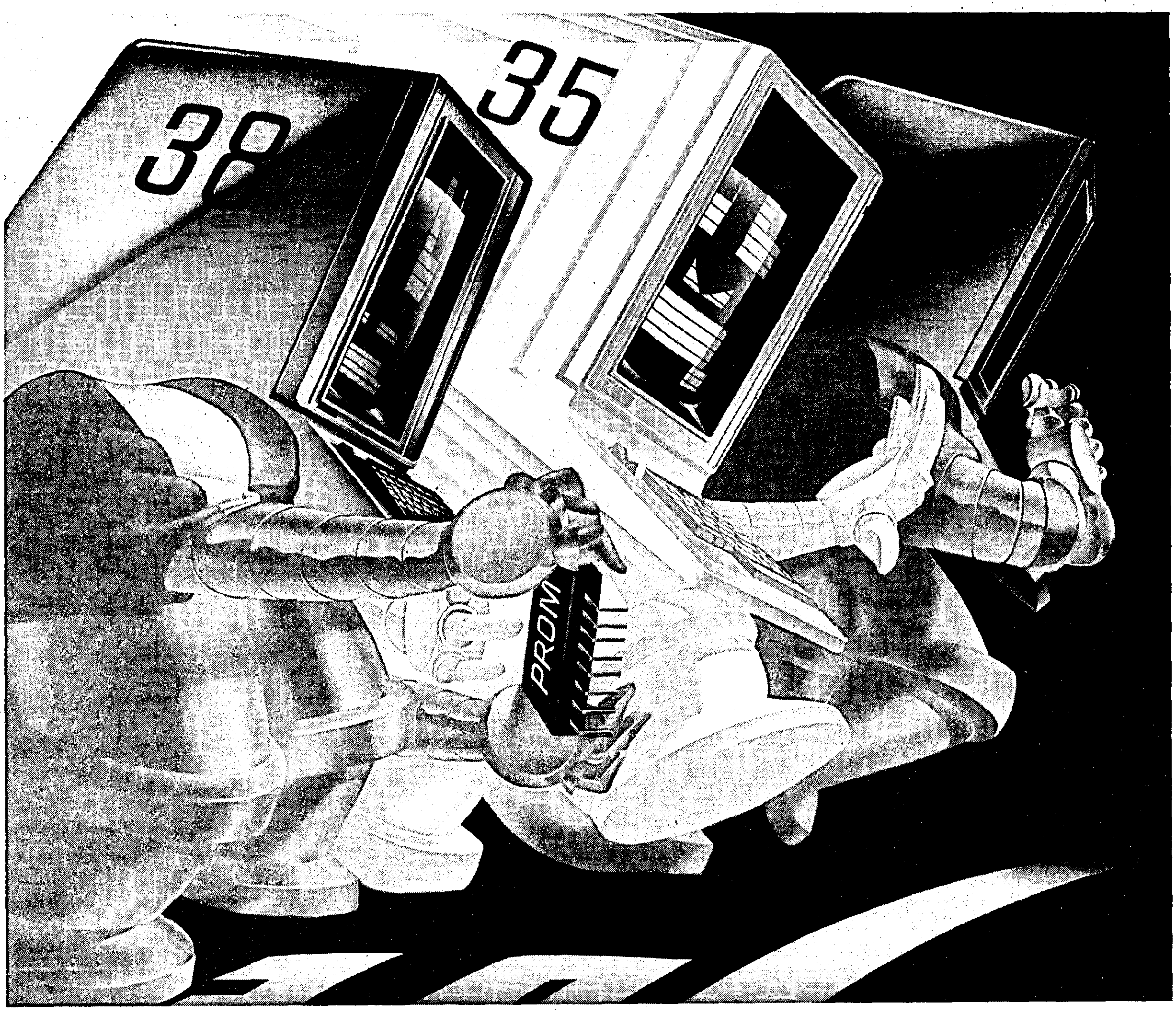
A measurement program designed to result in a comparison of different work groups generates peer pressure and a level of competition for attainment, which not only improves the performance of all groups, but tends to identify winning managers. A new spirit of inventiveness and innovation of measured teams will be noticed—assuming the program is realistic and the people can identify with the goals. It is this "trickle-down" motivating aspect of a good measurement program which, of itself, lends added value to the supervision function.

Finally, senior management and customer or user groups will better respect data processing management for their efforts in implementing a more professional approach toward the technocracy over which it presides.

This then is what an MIS measurement program is. What it is not is a cure-all for every data processing problem or development effort. One must still have well trained and properly motivated people, and managers with the experience to detect problems and the courage to correct them. Good estimating techniques, project control mechanisms, and technical expertise are still necessities. And a good working relationship with users is vital. A measurement program is simply another tool which can be used by an alert management to increase productivity and quality, and to make the overall job of managing data processing easier. ❄

Since June 1971, Mr. Peeples has been vice president, operations, for GTE Data Services, Inc., a part of General Telephone & Electronics. In this position he is responsible for GTEDS' 14 computer locations plus companywide systems development.

He began his career with GTE in 1957 as a traveling auditor, but had become GTE Southwest's dp systems manager by 1962. His career with the phone company was interrupted only briefly when he went to IBM in 1966, where he worked on management information systems. He returned the next year to be GTE Southwest's dp director, and later became GTEDS' regional dp manager, from where he went to his present post.



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Teleprinter Terminal Survey

by David H. Axner and Fonnie H. Reagan

There are 2,000,000 teleprinter terminals in the field now, with 700,000 more to be added this year. Most of the new ones are on this menu of 145 products from 54 sources.

The computer terminal market will continue to be the fastest growing segment of the computer industry. The market has been growing at an annual rate of about 30%, and this is expected to go on through 1980. By then, annual shipments are expected to reach $3 billion.

This volume makes for a large population of products, presently pegged at more than 3 million units when specialized hardware such as teller and point of sale terminals are included. Teleprinter terminals account for about 1.9 million units of that base, roughly 63%, and their number is expected to grow by 710,000 members this year alone.

Teleprinter terminals, and particularly the ones produced by Teletype Corp., have been in greatest demand as low cost terminals for general purpose interactive applications such as those served by time-sharing services. The most widely used of these terminals is the Teletype Model 33 KSR, which is available from Teletype at a purchase price below $1,000 and from leasing companies for as little as $60/month. Such a price is tough to beat and, until quite recently, kept the more sophisticated forms of interactive terminals from seriously impacting the market.

However, cost is no longer the determining factor in selecting a teleprinter over a display terminal. With the introduction of the microprocessor, crt terminal costs have plunged, and many of the so-called "dumb" crt's are now available for as little as $1,200 (or $1,000 in quantities of 100 or more).

But the microprocessor has found its way into teleprinters as well. Vendors have found that the magic device substantially cuts design, development, and production costs, and that it precludes obsolescence. Still the fact remains that printer mechanisms are more costly to produce than electronic components, and unless a new technique eliminates the printing and paper-moving mechanisms, or new production methods are implemented, typical teleprinter costs will continue to be substantially above those of basic display terminals.

So why do teleprinters continue to constitute a large and viable segment of the interactive terminal market? Simply because there continues to be a strong demand for printed copy; some applications cannot survive without it. Typical examples are messages or records that must be retained for reference, reports that must be distributed, printouts for programming, and unattended reporting (such as transmission after office hours, when rates are lowest).

The giants

One company, Teletype Corp., accounts for a disproportionate share of that installed base and dollar volume. An AT&T subsidiary, its broad family of teleprinters dominates the market and forms the primary de facto standard which most other manufacturers emulate.

Teletype's clout was manifested in December 1974 by the production of the company's 500,000th Model 32/33—which was gold-plated. And that model represents only half of the firm's production of 1 million units to date.

Many of those 1 million units are in AT&T or Western Union private networks, and are not usually included in statistics on the installed base, but they are real hardware nonetheless. And that brings up some unique aspects of Teletype's market position. As a subsidiary of AT&T, it enjoys a huge built-in market, as suggested. Its equipment reaches end users not only on a purchase basis through its own sales department, but also on a rental or lease basis as part of AT&T's Bell System offerings.

But there are some drawbacks to being part of AT&T, too, and Teletype is forced to operate under several constraints. The major agreement that dictates its market approach is a 1956 antitrust consent decree signed by AT&T. The decree prevents AT&T from marketing anything it does not use in its own communications network; therefore Teletype cannot offer a product until AT&T has offered it as part of AT&T's services. But that hasn't slowed the terminal maker too much.

Of course IBM is another big force in the teleprinter business, as it is in any dp-related activity, even though it doesn't approach Teletype in numbers of terminals installed. Of special interest is the IBM 3767 Communication Terminal, introduced in 1974 with the company's Advanced Function for Communications announcement. The product was designed to communicate with IBM 370 mainframes through the company's SDLC communications discipline (but it can also speak in binary synchronous form to facilitate conversion from earlier IBM 2740 and 2741 products).

Although SDLC is not seen as having an appreciable impact in the immediate future, it is likely that it will eventually become a de facto standard and more and more terminals will soon claim to be compatible with the 3767.

> This article and the accompanying tables are condensed from material published in Datapro 70, a three-volume looseleaf information service that includes reports on a wide variety of computer related products. The 42-page report "All About Teleprinter Terminals" can be obtained separately from Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075. The price is $12. ✻

Reading the tables

The accompanying tables summarize the characteristics of 145 commercially available teleprinter terminals from 54 sources in the U.S. and Canada. There are not 145 different products or 54 manufacturers, however. As is the case with the products from Teletype Corp. mentioned earlier, many of the terminals are available from several suppliers. We felt it worth listing all the sources since sometimes their pricing or configuring of the basic products is different from that of other sources.

The information displayed was supplied by the vendors, mostly during the months of January and February of this year. Care has been taken to report that information accurately, but the vendors should be contacted directly for any additional data or clarification. (We'll supply some mechanisms for doing that easily.)

The tables have been made as self-explanatory as possible in the space afforded them, but some background will be helpful.

Print mechanism

The majority of today's teleprinter terminals employ serial printers, so named because they print one character at a time. Serial printers are grouped into two broad categories: those that mechanically strike or "impact" the paper to produce a printed image, and those that produce a printed image by some other means. Based on this key distinction, printers are generally classed as either *impact* or *nonimpact* printers.

Both basic printing techniques can be further divided into two subcategories: those that produce a "full-character" (typewriter-like) image, and those that produce a character image formed by a matrix of dots. Of the two printing techniques, full-character printing is the more favorable form because of its high legibility and appealing appearance. But full-character serial printing generally does not lend itself well to printing speeds above 30 to 35cps. This restriction results from the complex mechanical arrangement required to select the character, position the print mechanism, and strike the printed image.

Impact printing

The speed limitation on full-character impact printers served as the impetus for printer manufacturers to seek a different approach that would extend the upper limit of printing speed for serial impact printers. Their effort led to the development of the matrix printer, a compromise (though it has been a successful one) between decreased character legibility and substantially increased print speeds well beyond 100cps.

The matrix impact printer produces an image formed by a rectangular matrix of dots, typically 7 dots high by 5 dots wide. Printing is performed by moving a print head containing a column of 7 pins across the paper and selectively actuating the pins at 5 successive intervals to form each character.

Centronics, a leading oem manufacturer of serial impact printers that employ the matrix printing technique, has attained a speed of 660cps with its Model 104. The 104 uses four print heads that move bidirectionally along the same axis and in unison, so that each print head travels across just one quarter of the paper width.

Though they contain comparatively few moving parts, matrix printers are subject to an increased amount of wear within the print head as a result of the succession of pin movements required to create each character.

The apparent speed limitation for full-character serial impact printers has been shattered by at least one manufacturer, Printer Technology, which produces the Printec 100, a full-character unit rated at 100cps. Printer Technology approached the problem with a multiple-actuator printing technique that is really a cross between line printer and serial printer technology. This "print-on-the-fly" technique uses a set of six actuators, a type wheel, and a throw-away ink roller. The type wheel contains three contiguous sets of print symbols; each set is arranged in a helix (or spiral) and is serviced by two actuators so that each actuator services one half of the character set. The spinning type wheel travels on a horizontal axis across the paper in unison with the six actuators moving behind the paper.

General Electric is another company that has developed a high speed, full-character impact printer for use in typewriter-style terminals. GE's TermiNet 1200, a high speed version of the successful TermiNet 300 terminal, employs a line printing approach to produce printed copy at speeds up to 120cps. The TermiNet's printing arrangement consists of a type belt containing two symbol sets that moves horizontally in front of a row of print actuators. This "chain printer" technique has also been adopted by Teletype Corp. in its Model 40 printer, rated at 296 to 416cps.

Numerous teleprinter terminals are currently available that feature full-character impact printing and range in speed from 10 to 30cps. Among the more popular terminals in this class are


Just how big a force Teletype Corp. is in the terminal business was nicely illustrated in October 1974, when the AT&T subsidiary produced its 500,000th Model 32/33 terminal. The device was gold plated, appropriately, and used only once—by company president Floyd C. Boswell to send a message to friends in the industry.

the IBM 2740 and 2741, which contain a version of the ubiquitous IBM Selectric typewriter, the GE TermiNet 1200, the Teletype family of typewriters, and the Univac DCT 500, to name a few.

Each of these terminals employs a different printing technique. IBM uses a replaceable "golf ball" print element that permits the operator to change type styles rapidly by snapping out the existing element and snapping a new one into its place. General Electric employs a moving type belt and a row of actuators, one per print position. Teletype, in its Models 33 and 38, uses a rotating cylinder that contains the type face and, in principle, operates much the same as the IBM Selectric typewriter. In its Models 35 and 37, Teletype uses a type block with type pallets embedded in the block; a single actuator is used. Univac uses a helical print wheel and throw-away cartridge ink roller, a simplified version of the technique employed by Printer Technology.

The Diablo Hy-Type, Qume Sprint, and Perkin-Elmer Carousel impact printers, because of their novel approach, represent a significant contribution to the serial printer industry and a challenge to the IBM Selectric printer. With fewer than 12 moving parts, these printers (equipped with stepping motors) are rated at 2 to 3½ times the print speed of an IBM Selectric. Printing can be performed in either direction and paper fed either up or down. Character and line spacings are variable, with up to 120 increments per inch horizontally and up to 48 vertically to permit proportional letter spacing or incremental plotting.

The print element used by the Diablo and Qume printers is a flat disk with petal-like projections called a "daisywheel," while that of the Perkin-Elmer printer is shaped like a cup with finger-like projections. At the end of each projection is an embossed character.

The Diablo, Qume, and Perkin-Elmer printers offer good-quality printing at a low noise level, easily changeable type fonts, and higher speeds than most serial printers. It's apparent that these units will become familiar items in the serial printer market. Many terminal vendors have included these printer mechanisms in their products, as noted in the tables.

Nonimpact printing

Members of the other basic class of printers—the nonimpact units—employ various electronic and chemical techniques to produce printed images formed by solid lines or a matrix of dots. Some of the nonimpact printing techniques have evolved from the development of facsimile communications; others were specifically developed for use in high speed printing applications, where print speeds of better than 2,000 lpm are not uncommon, or as low-cost alternatives to impact printing.

The electrothermal (or thermal) printing technique is the most commonly used of the nonimpact techniques and is employed in the terminals produced by two leading manufacturers of nonimpact printers, NCR and Texas Instruments.

The ink-jet technique, simultaneously and independently developed by A.B. Dick and by Teletype Corp. for high speed printing applications, sprays a stream of electrically charged ink droplets onto ordinary paper to produce printed characters. Character formation is performed by electrostatic deflection plates that control the direction of the charged ink droplets in much the same manner as the electron beam movement is controlled within a crt. The technique is relatively expensive and has a limited market potential, as indicated by the small number of units delivered. Production of these units has been terminated by both A.B. Dick and Teletype. The ink-jet printing technique, however, has been simplified and employed in a printer introduced by Casio, Inc. as the Typuter.

Another familiar nonimpact printing technique is the xerographic principle used in the ubiquitous Xerox copiers. Although it is a comparatively expensive technique, xerographic printing has one major advantage over most other nonimpact techniques: it uses ordinary paper. Xerox Corp. has combined the xerographic principle with a computer technology to produce a 4,000 lpm printer that prints on ordinary 8½ by 11 inch paper.

Reliability of most nonimpact printers is comparatively high because they have few mechanical parts; 3,000 hours or more between failures is not uncommon.

There are some quiet environments where the noise of an impact printer simply cannot be tolerated. The virtually silent nonimpact printers are especially desirable in these locations, but sometimes their inability to produce more than one copy at a time is a crippling disadvantage.

Terminal types

Teleprinter terminals are typically available in three basic configurations: Receive-Only (RO) which includes only a printer; Keyboard Send-Receive (KSR) which includes a keyboard and printer; and Automatic Send-Receive (ASR) which includes a keyboard, printer, and some storage device, often a papertape reader/punch.

There are three commonly used punched tape widths and four standard *character code* levels (where levels specify the number of bits per character). Five-level Baudot code is associated with 11/16 inch tape and is used with terminals like the old Teletype 28. Six-level code is relatively rare. Seven-level codes, using 7/8 inch wide tape, include Correspondence (a Selectric terminal code introduced by IBM), BCD and EBCDIC. The most common code is eight-level ASCII; it is associated with 1-inch tape.

In recent years, paper tape has become less important as diskettes, tape cartridges, and tape cassettes, have moved in as relatively inexpensive recording media.

Programmable

The term *programmable* is used here to identify units operating under the direction of a stored program, either a user's application program or an emulation program which apes the operation of another terminal (usually one produced by another manufacturer). Most terminals have not reached this level of sophistication, primarily due to cost; those that have usually employ a microprocessor.

Editing

Editing, by line and/or character, featured only on terminals that provide some form of buffering, allows the operator to correct data that has been erroneously keyed prior to transmission. Some terminals, such as those that include a punched tape capability, provide editing by character only. Those that contain an internal buffer, however, usually permit the entire buffer to be erased so that a line containing an error at the beginning can be retyped instead of having to backspace character-by-character to reach the erroneous entry. On some of the more flexible terminals, such as those that contain dual cassette recorders, the editing facilities include the ability to update an existing tape. Keyed data can be merged with data read from the existing tape to produce an updated version.

Communications

Each teleprinter terminal contains a communications *interface* that enables communications between the terminal and the central computer site. There are three operating modes: *simplex* (transmission in one direction only), *half-duplex* (transmission in both directions, but not simultaneously), and *full-duplex* (simultaneous transmission in both directions).

Data is transmitted synchronously or asynchronously. *Asynchronous* transmission is characterized by the transmission in irregular spurts, where the duration of time can vary between successive transmitted characters; the transmission from an unbuffered teletypewriter is a good example. *Synchronous* transmission implies the transmission of data in a steady stream. Each transmitted character is clocked, and the time interval between successive characters is always precisely the same. The communications interface either provides clocking or accepts external clocking signals from the dataset.

The transmission *speed* of the terminal is specified in bps and is usually limited by the speed of the printer or other I/O device unless the terminal contains an internal buffer. Buffered operation permits the printing to be performed at the rated speed of the printer, although the transmission speed may be much greater. Most teleprinter terminals are unbuffered due to cost considerations and therefore operate at low transmission speeds.

Parity checking and/or generation are important features that safeguard the accuracy of transmitted data. Some terminals perform only parity checking on received data, while others only generate character parity for each transmitted character. Still others provide both checking and generation. Some even allow the operator to select odd or even parity or to inhibit the parity functions.

Terminals that are designed to operate in a multistation environment (multidropped from a leased line) must include a *polling and addressing* capability so that computer messages can be directed to a specific terminal and terminal messages can be selectively transmitted to the computer; otherwise the multidropped terminals would be required to contend with one another for the computer by "bidding" for use of the line.

The *autoanswer* feature permits the terminal to respond automatically to a call via the dial network from the remote computer. The terminal responds by readying itself to receive and print the incoming message.

Most other features of these devices are too familiar to need explanation. Should additional information or clarification be required, either write for the expanded version of this report mentioned on page 000, contact the vendors directly at the addresses listed in the vendor index on page 251, or circle the appropriate numbers on the reader service card bound into this issue. (The latter option is probably easiest.) ✽

Mr. Axner is responsible for research and reports on terminals for *Datapro Reports on Data Communications.* He previously was responsible for reports on peripherals in *Datapro 70.*

Mr. Reagan is managing editor of *Datapro Reports on Data Communications,* at Datapro Research Corp., Delran, N.J. Prior to taking this position, he was responsible for the preparation of Datapro's reports on data entry, computer peripherals, and data communication products for *Datapro 70.*

Manufacturer	Acrodyne	Acrodyne	Acrodyne	Acrodyne	Acrodyne
Model Highlights	Model 28*	Model 32*	Model 33*	Model 35*	Model 40 ROP
1st ship/# shipped	1968 See Model 40	1968 See Model 40	1968 See Model 40	1968 See Model 40	1974 1,000+ (all mods)
Print mechanism	Type box, impact	Rotating cyl., impact	Rotating cyl., impact	Type box, impact	Type belt, impact
Print speeds	10cps	10cps	10cps	10cps	296-416cps
Terminal types	RO, KSR or ASR	RO, KSR or ASR	RO, KSR, or ASR	RO, KSR or ASR	RO, KSR or ASR
Character codes	Baudot	Baudot	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	ASR only	ASR only	ASR only	ASR only	No editing
Compatibility	Teletype 28	Teletype 32	Teletype 33/35	Teletype 33/35	Teletype 40
Printing					L/c alpha optional
Line width	72 cols @ 10/inch	72 cols @ 10/inch	72 cols @ 10/inch	72 cols @ 10/inch	80 cols @ 10/inch
Vertical spacing	4 or 6 lines/inch	4 or 6 lines/inch	6 or 3 lines/inch	6 or 3 lines/inch	6 or 3 lines/inch
Forms feed	Friction or pin feed	Friction or pin feed	Friction or pin feed	Friction or pin feed	Friction or pin feed
Other features	Optional tab	Optional tab	—	Tab & vertical format standard	—
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	70-75bps	70-75bps	110bps	110bps	1200bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C
Parity checking	No parity	No parity	Generate std; check opt.	Generate std; check opt.	Check std.
Buffer	No buffer	No buffer	No buffer	No buffer	1,000-char buffer
Other features	Autoanswer standard; polling/addressing opt.	Autoanswer standard; polling/addressing opt.	Autoanswer standard; polling/addressing opt.	Autoanswer standard; polling/addressing opt.	Autoanswer standard; polling/addressing opt.
Keyboard	32-key teleprinter	32-key teleprinter	53-key teleprinter	50-key teleprinter	No keyboard
Pricing	Purchase price NG	Purchase price NG	Purchase price NG	Purchase price NG	Purchase price NG
1-year lease (inc maintenance)	$105/month (ASR)	$65/month (ASR)	$65/month (ASR)	$150/month (ASR)	Lease price NG
Comments	*Price includes modem; built by Teletype as Model 28	*Price includes modem; built by Teletype as Model 32	*Price includes modem; built by Teletype as Model 33	*Price includes modem; built by Teletype as Model 35	*Built by Teletype as Model 40 ROP

Manufacturer	Agile	Alanthus	Alanthus	Alanthus	Alanthus
Model Highlights	Series A1 Data Terminal	T-133 Data Terminal*	T-300 Data Terminal*	Miniterm 701, 702 & 703*	T-1240 Data Terminal*
1st ship/# shipped	08/77 150 shipped	1969 5,000 shipped	1974 4,000 shipped	1976 # shipped NG	01/76 # shipped NG
Print mechanism	Print wheel, impact	Print cylinder, impact	7x7 dot matrix, impact	5x7 dot matrix, nonimpact	5x7 dot matrix, impact
Print speeds	30, 45 or 55cps	10cps	10, 15 or 30cps	10, 15 or 30cps	180cps
Terminal types	RO, KSR or ASR	RO, KSR or ASR	RO, KSR or ASR	RO, KSR or ASR	RO, KSR or ASR
Character codes	ASCII	ASCII	ASCII	ASCII	ASCII
Programmable?	Programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Editing	Char. editing only	Char. editing only	No editing	No editing
Compatibility	Teletype 33/35, IBM 2741	Teletype 33/35	Teletype 33/35; opt. IBM 2740 & 2741	Teletype 33/35	Teletype 33/35; opt. IBM 2740 & 2741
Printing	Upper and lower case		Upper and lower case	Upper and lower case	Upper and lower case
Line width	132/158 cols @ 10/12/inch	72 cols @ 10/inch	132 cols @ 10/inch	80 cols @ 10/inch	132/158 cols @ 10/12/16.5
Vertical spacing	6 or 8 lines/inch (variable)	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction, pin or tractor feed	Friction feed	Adjustable tractor feed	Friction feed	Adjustable tractor feed
Other features	Tab, vertical format, bidirec. print, prop. spacing std.	—	Opt. tab and vertical format	—	Opt. tab and vertical format; bidirec. print, low-paper indicator, last char. visibility
Communications	Asynchronous	Asynchronous	Asychronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110, 300, 600 or 1200 bps	110bps	110, 150 or 300bps	110, 150 or 300bps	75-9600 bps
Interfaces	RS232C	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C
Parity checking	Generate and check std.	Generate std; check opt.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	256- or 2480-char buffer	No buffer	16-character buffer	2K- or 4K-char buffer	1K to 9K-char. buffer
Other features	Polling/addressing, auto-answer & coupler opt.	Polling/addressing, auto-answer, modem and coupler opt.	Polling/addressing, auto-answer, modem and coupler opt.	Opt. autoanswer, modem (on 701 & 703), coupler (std. on 703)	Opt. polling/addressing and auto answer
Keyboard	Typewriter with auto repeat, numeric pad, programmable keyboard	53-key teleprinter with char. repeat std; numeric pad opt.	60-key typewriter with char. repeat std; numeric pad opt.	Typewriter with char. repeat and numeric pad std.	53-key teleprinter with char. repeat std; numeric pad opt.
Pricing	$3,475-$3,875	$800-$2,000	$1,535-$2,5000	$1,335-$2,135	$2,795-$3,595
1-year lease (inc maintenance)	$140/month	$58-$76/month	$79-$120/month	$75-$100/month	$140-$155/month
Comments	Uses Qume printer and Intel microprocessor; mini-diskette; programs can be downline loaded; plotting software avail.	*Teletype 33KSR & ASR with acoustic coupler or modem for TWX & DDD networks	*Digital Equipmant LA 36 DECwriter II	*Produced by Computer Devices as Miniterm 1201, 1202 and 1203; portables	*Produced by MI² as Design 2400

Manufacturer	Anderson Jacobson	Anderson Jacobson	Anderson Jacobson	Allied Computer	Applied Computer
Model Highlights	Model AJ 630	Model AJ 830/832	Model AJ 860	SA 300	Hyterm 1620
1st ship/# shipped	11/71 3,000+ shipped	05/75 2,000+ shipped	06/77 #shipped NG	10/77 25 shipped	06/76 400+ shipped
Print mechanism	5x8 dot matrix, nonimpact	Print wheel, impact	6x9 dot matrix, impact	Daisywheel, impact	Daisywheel, impact
Print speeds	10, 15 or 30cps	10, 15, 30 or 45 cps	10, 60 or 120cps	10, 15, 30 or 45cps	45cps
Terminal types	RO, KSR or ASR	KSR or ASR	KSR or ASR	RO, KSR or ASR	RO (1610); KSR (1620)
Character codes	ASCII (APL available)	ASCII (APL available)	ASCII (APL optional)	ASCII (APL optional)	ASCII (APL optional)
Programmable?	Not programmable	Not programmable	Not programmable	Programmable in BASIC	Not programmable
Editing?	No editing	No editing	No editing	Editing	No editing
Compatibility	Teletype 33/35	Teletype 33/35; opt. IBM 2741	Teletype 33/35	Teletype 33/35; IBM 2741; opt. IBM 3767	Teletype 33/35; IBM 3767 opt.
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	140 cols @ 10/inch	132/156 cols @ 10/12/inch	132 cols @ 10/inch	132/158 cols @ 10/12/inch	132/158 cols @ 10/12/inch
Vertical spacing	6 lines/inch	6 or 8 lines/inch	6 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch
Forms feed	Friction feed	Friction or pin feed	Tractor feed	Friction, pin or tractor feed	Friction, pin or tractor feed
Other features	Std. tab	Tab and vertical format std; opt. tractor feed and plotting	Bidirec. print & paper feed, standard tab, graphics	Bidirec. print & paper feed, plot and word processing, std. tab & vertical format	Bidirec. print & paper feed, plotting, std. tab & vertical format
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110, 150 or 300bps	110, 135, 150 or 300bps	110-1200bps	Up to 300bps	110, 150 or 300 bps
Interfaces	RS232C, acoustic, or DAA	RS232C	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	Generate and check std.	Generate and check std.	Generate only	Generate and check std.	Generate and check std.
Buffer	No buffer	128- or 256-char buffer	350-char buffer	No buffer	158-char buffer
Other features	Opt. autoanswer, modem, and coupler	Opt. coupler	Optional coupler	Opt. modem and coupler	Opt. coupler
Keyboard	68-key typewriter with char. repeat, manual CR/LF, opt. numeric pad	68-key typewriter with char. repeat, manual CR/LF, numeric pad	Typewriter with char. repeat, numeric pad, true underscore, graphics	Typewriter with char. repeat, numeric pad	Typewriter with char. repeat, numeric pad
Pricing	$2,500	$3,150-$2,495	$2,950	$4,500-$7,500	$2,800-$3,395
1-year lease (inc maintenance)	$110/month (30-day avail.)	$130/$140/month (30-day avail.)	$120/month	$225-$375/month	$200-$210/month
Comments	Portable		Cassette Optional	Upgraded ACS 3780; employs Diablo HyType printer mechanism; diskette; up to 64KB of memory	Microprocessor-controller; portable

Manufacturer	Carterfone	Carterfone	Carterfone	Centronics	Centronics
Model Highlights	*Model 33 Data Terminal	*LA-36 DECwriter	*C 1620	Model 330	Model 530
1st ship/# shipped	1969 6,000 shipped	01/76 #shipped NG	03/76 #shipped NG	09/75 #shipped NG	09/75 #shipped NG
Print mechanism	Type cylinder, impact	7x7 dot matrix, impact	Daisywheel, impact	9x7 dot matrix, impact	9x7 dot matrix, impact
Print speeds	10cps	10, 15 or 30cps	10, 15 or 30 cps	165cps	165cps
Terminal types	RO, KSR or ASR	KSR or ASR	RO, KSR or ASR	KSR	KSR
Character codes	ASCII	ASCII (APL optional)	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Editing optional	Editing optional	Editing optional	Character edit only	Character edit only
Compatibility	Teletype 33/35	Teletype 33/35	Teletype 33/35	—	—
Printing		Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	72 cols @ 10 or 16.5/inch	132 cols @ 10 or 12/inch	132 or 158 chars at 10/inch	80 or 132 cols @ 10/inch	132 cols @ 10/inch
Vertical spacing	3 or 6 lines/inch	6 lines/inch	6 or 8 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction or pin feed	Pin or adj. tractor feed	Friction or pin feed	Tractor feed	Tractor feed
Other features	—	Tab, vertical format & auto line feed all opt.	Bidirec. print; tab and vertical format; reverse line feed	Std. tab; opt. vertical format; last character visibility	Std. tab; opt. vertical format; last character visibility
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110bps	110, 150 or 300bps	110, 150 or 300bps	110-1200bps	110-1200bps
Interfaces	Current loop; opt. RS232C	Current (opt. RS232C;CCITT)	RS232C	RS232C or current loop	RS232C or current loop
Parity checking	Generate standard	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	No buffer	16-char buffer	158-char buffer	120-char buffer	120-char buffer
Other features	Autoanswer, modem and coupler optional	Autoanswer, modem and coupler optional	Autoanswer and coupler optional	Autoanswer optional	Autoanswer optional
Keyboard	53-key teleprinter with char. repeat, opt. numeric pad	58-key typewriter with char. repeat and break, opt. numeric pad	58-key typewriter with char. repeat and numeric pad	53- or 62-key teleprinter with character repeat	53- or 62-key teleprinter with character repeat
Pricing	$950-$1,450	$1,750-$3,200	$3,250-$3,450	$2,700-$3,000	$2,950-$3,250
1-year lease (inc maintenance)	$51-$65/month (18 mos.)	$79-$130/month	$137-$145/month	Lease price NG	Lease price NG
Comments	*Cassette tape standard; made by Teletype as Model 33 ASR	*Cassette tape std; made by Digital Equip. Corp.; Techtran 4200 opt. @ $77/mo. or $1,900 purchase	*Cassette tape std; made by Diablo Systems as 1620		

Manufacturer	Centronics	ComData	ComData	ComData	ComData
Model Highlights	Model 761	Series 33*	Model 43*	Series 700*	Series 933
1st ship/# shipped	02/77 #shipped NG	Over 4000 shipped	Date and # shipped NG	1974 500+ shipped	1974 200 shipped
Print mechanism	7x7 dot matrix, impact	Type cylinder, impact	7x9 dot matrix, impact	5x7 dot matrix, nonimpact	Daisywheel, impact
Print speeds	60cps	10cps	10 or 30cps	10 or 15cps	10, 15 or 30cps
Terminal types	KSR	RO, KSR, or ASR	RO or KSR	RO or KSR	RO, KSR, or ASR
Character codes	ASCII (APL available)	ASCII	ASCII	ASCII	ASCII, APL
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	Character edit only	No editing	Editing (some models)	No editing
Compatibility	—	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35; IBM 2740-1; opt. IBM 2741
Printing	Lower case optional		Upper and lower case	Lower case optional	Upper and lower case
Line width	132 cols @ 10/inch	74 cols @ 10/inch	80/132 cols @ 10/13/inch	80 cols @ 10/inch	132/156 cols @ 10/12/inch
Vertical spacing	6 lines/inch	6 or 3 lines/inch	6 lines/inch	6 or 3 lines/inch	6 or 8 lines/inch
Forms feed	Friction or tractor feed	Pin feed	Friction or pin feed	Friction feed	Pin or tractor feed
Other features	Opt. tab & vertical format; bidirec. printing; last character visibility	—	Last character visibility; diagnostics	—	Std. tab, vertical format, incremental plotting (30pps)
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110-300 bps; others opt.	110bps	110 or 300bps	110, 150 or 300bps	110, 150 or 300bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	Generate and check std.	Generate std; check opt.	Generate and check std.	Generate std.	No parity
Buffer	256-char buffer	No buffer	No buffer	No buffer	128-char buffer
Other features	Polling/addressing std; autoanswer opt.	Polling/addressing and autoanswer opt.	Optional modem	Polling/addressing (733); autoanswer optional	Polling/addressing and autoanswer optional
Keyboard	IBM Selectric with numeric pad, additional buffering	53-key teleprinter with char. repeat, opt. numeric pad	67-key typewriter with character repeat	55-key teleprinter with char. repeat and break	73-key teleprinter with char. repeat, break, and numeric pad
Pricing	$1,895-$2,025	$895-$1,924	$1,143-$1,377	$1,350-$3,500	$2,850-$5,975
1-year lease (inc maintenance)	Lease price NG	$81-$175/month	$104-$125/month	$123-$319/month	$259-$544/month
Comments	Microprocessor-controlled	*Produced by Teletype as Model 33	*Portable; produced by Teletype as Model 43	*Produced by Texas Instruments as Silent 700 family	Cassette tape; diskette

Manufacturer	ComData	ComData	ComData	ComData	Computer Devices
Model Highlights	Series LA-36*	Series LA 180*	LS 120*	Design 2400*	Teleterm 1132
1st ship/# shipped	1975 750 shipped	1975 #shipped NG	10/77 #shipped NG	09/77 #shipped NG	08/74 1,000+ shipped
Print mechanism	7x7 dot matrix, impact	7x7 dot matrix, impact	7x7 dot matrix, impact	5x7/9x9 dot matrix, impact	5x7 dot matrix, nonimpact
Print speeds	10, 15 or 30cps	180cps	10, 30 or 180cps	180cps	10, 15 or 30cps
Terminal types	RO, KSR, or ASR	RO	KSR or ASR	RO, KSR or ASR	KSR
Character codes	ASCII or APL	ASCII (APL optional)	ASCII (APL optional)	ASCII	ASCII or APL
Programmable?	Not programmable	Not programmable	Programmable formats	Not programmable	Not programmable
Editing?	No editing	No editing	Editing optional	No editing	No editing
Compatibility	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	132 cols @ 10/inch	132 cols @ 10/16.5/in	132 cols @ 10/16.5/inch	132/158 cols @ 10/12/16.5/inch	132 cols @ 10/inch
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Tractor feed	Tractor feed	Tractor feed	Tractor feed	Friction feed
Other features	Optional tab; vertical format	Top-of-form indicator	Opt. tab; vertical format, "paper out," auto new line and line feed	Opt. tab; bidirec. print & paper feed, auto view, low paper alarm	—
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Simplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110, 150 or 300bps	Up to 9600bps	Up to 4800bps	75-9600bps	110, 150 or 300 bps
Interfaces	Current loop; RS232C opt.	RS232C or current loop	RS232C or current loop	RS232C	RS232C
Parity checking	No parity	Check only	Check only	Generate and check std.	Check only
Buffer	No buffer	256-char buffer	1,000-char buffer	192-230-char buffer	No buffer
Other features	Opt. polling/addressing, autoanswer, modem, and coupler	Autoanswer std.	Autoanswer std; opt. modem (300bps) and coupler	Polling/addressing opt.	Std. modem & coupler
Keyboard	68-key typewriter with char. repeat, break, and numeric pad	No keyboard	58-key typewriter with numeric pad	74-key typewriter with numeric pad and four selectable char. sets	58-key typewriter with char. repeat, numeric pad opt.
Pricing	$1,650-$2,980	$2,500	$2,900	$3,300	$3,285
1-year lease (inc maintenance)	$150-$264/month	$228/month	Lease price NG	Lease price NG	$145/month
Comments	*Cassette tape, diskette; microprocessor-based unit; produced by Digital Equip. Corp. as LA-36 DECwriter	*Produced by Digital Equip. Corp. as LA 180 DECprinter	*4K-16K RAM; LS 120 DECwriter III	*Produced by MI² as Design 2400	

anufacturer	Computer Devices	Computer Devices	CTSI	CTSI	Control Data
odel Highlights	Miniterm 1201, 1202 1203	Miniterm 1204 & 1205	Execuport 300 Series	Execuport 3800	Models 9317 & 9318
t ship/# shipped	02/76 #shipped NG	Date and # shipped NG	1975 6500 shipped	07/76 1,000+ shipped	01 & 02/77 # shipped NG
int mechanism	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x11 dot matrix, nonimpact	7x7 dot matrix, impact
int speeds	10, 15 or 30 cps	35cps	10, 15 or 30 cps	10, 15 or 30 cps	180 and 360 cps
rminal types	RO (1201), KSR (1202 & 1203)	KSR or ASR	RO (380), KSR or ASR	RO, KSR or ASR	RO
haracter codes	ASCII (APL optional)	ASCII	ASCII or APL	ASCII or APL	ASCII
ogrammable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
diting?	No editing	Editing	No editing	No editing	No editing
ompatibility	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35	—
rinting	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Lower case optional
ine width	80 cols @ 10/inch	80 cols @ 10/inch	80 cols @ 10/inch	80/132/136 cols @ 10/inch	132 cols @ 10/inch
ertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 or 24 lines/inch	6 lines/inch
orms feed	Friction feed	Friction feed	Friction feed	Friction feed	Tractor feed
ther features	—	Optional tab	Bidirectional, vertical spacing	Bidirectional; vertical spacing	Std. tab (9317); vertical format optional
ommunications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
ransmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Simplex
peeds	110, 150 or 300bps	110, 300 or 1200bps	110, 150 or 300bps	110, 150 or 300bps	150-9600bps
nterfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C
arity checking	Check only	Generate and check std.	Generate only	Generate only	Check only
uffer	No buffer	1,000-char buffer	No buffer	40-char buffer	1,000-char buffer
ther features	Opt. modem (std.on 1203), opt. coupler	Opt. modem and coupler (std. on 1205)	Autoanswer, modem and coupler	Autoanswer; modem; coupler	Autoanswer optional
eyboard	58-key typewriter with char. repeat; numeric pad	58-key typewriter with char. repeat; numeric pad	65-key teleprinter with char. repeat, numeric pad	53-key teleprinter with numeric pad opt; char. repeat	No keyboard
ricing l-year lease (inc maintenance)	$1,385/$1,585/$2,185 $75/$85/$100 per month	$3,385/$3,785 $165/$185 per month	$1,795-$3,270 $70-$125/month	$3,395-$3,775 $140-$158/month	$2,035/$2,535 OEM sales only
Comments		Mini-cassette; provides 7-31KB memory; cassette storage for 68KB	Cassette tape	Cassette tape; plotting and 36-char non-print set available	Accommodate 5-part forms 4-16.75 inches wide x 2-18 inches long

Manufacturer	Data Access	Data Access	Data Access	Data Access	Data Access
Model Highlights	DASI 43*	DASI 360*	DASI 725*	DASI 733*	DASI 735*
1st ship/# shipped	1977 50 shipped	1974 #shipped NG	1971 1,000+ shipped	1974 500+ shipped	1974 1,000+ shipped
Print mechanism	4x7 dot matrix, impact	5x7 dot matrix, impact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact
Print speeds	47cps	10 or 30cps	10, 15 or 30cps	10 or 30cps	10, 15 or 30cps
Terminal types	KSR	RO, KSR or ASR	RO or KSR	KSR or ASR	KSR
Character codes	ASCII	ASCII (APL optional)	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	ASR only	No editing
Compatibility	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Lower case optional	Upper and lower case
Line width	132 cols @ 13/inch	132 cols @ 10 or 16.5/inch	80 cols @ 10/inch	80 cols @ 10/inch	80 cols @ 10/inch
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction or pin feed	Pin feed	Friction feed	Friction feed	Friction feed
Other features	Last character visibility	Optional tab, vertical format, auto line feed, numeric pad	—	Last line visibility	—
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex	Full- or half-duplex
Speeds	110 or 300bps	110 or 300 bps	110, 150 or 300bps	110 or 300bps	110, 150 or 300bps
Interfaces	RS232C	RS232C	RS232C	RS232C	RS232C
Parity checking	Generate only	Generate and check std.	Generate only	Generate only	Generate only
Buffer	64-char buffer	No buffer	No buffer	No buffer	No buffer
Other features	Autoanswer optional; modem optional	Polling/addressing and coupler optional	Autoanswer optional; std. modem & coupler	Opt. modem & coupler	Autoanswer optional; coupler standard
Keyboard	Typewriter with repeat standard	Typewriter with char. repeat and break std.	61-key typewriter with character repeat	Typewriter with char, repeat and break	Typewriter with char. repeat and break
Pricing 1-year lease (inc maintenance)	$1,295-$1,495 $80/month	$1,490-$4,832 $85/month	$950 $80/month	$1,645(KSR)-$2,945(ASR) $85/(KSR)-$145(ASR)/month	$1,750 $90/month
Comments	*Built by Teletype as Model 43	*4K-16K RAM; built by Digital Equip. Corp. as DECwriter II	*Portable; built by Texas Instruments as Model 725	*ANSI tape, dual cassette; built by Texas Instruments as Model 733	*Portable; built by Texas Instruments as Model 735

Manufacturer	Data Access	Data Access	Data Access	Data Access	Data Access
Model Highlights	DASI 743*	DASI 745*	DASI 763/765*	DASI 120*	DASI 180*
1st ship/# shipped	1975 400+ shipped	1975 3,000+ shipped	1978 10 shipped	1977 100+ shipped	1977 100+ shipped
Print mechanism	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	7x7 dot matrix, impact	7x7 dot matrix, impact
Print speeds	10 or 30cps	10 or 30cps	10 or 30cps	180cps	180cps
Terminal types	RO or KSR	KSR or ASR	KSR or ASR	KSR	RO
Character codes	ASCII	ASCII (APL optional)	ASCII	ASCII (APL optional)	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	Editing (763 only)	No editing	No editing
Compatibility	Teletype 33/35	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55
Printing		Lower case optional	Upper and lower case	Upper and lower case	Upper and lower case
Line width	80 cols @ 10/inch	80 cols @ 10/inch	80 cols @ 10/inch	132 cols @ 10/inch	132 cols @ 10/inch
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction feed	Friction feed	Friction feed	Tractor feed	Tractor feed
Other features	Last character visibility	Last character visibility	Last character visibility	Optional tab & vertical format; self-test; last character visibility	Std. tab & vertical format; self-test; last character visibility
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half-duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110 or 300bps	110 or 300bps	110, 300 or 9600bps	110, 300 or 1200bps	110, 300 or 1200bps
Interfaces	RS232C	RS232C optional	RS232C	RS232C	RS232C or current loop
Parity checking	Generate only	Generate only	Generate only	Generate and check std.	Check only
Buffer	No buffer	8-char buffer	80-char buffer	256-char buffer	256-char buffer
Other features	—	Autoanswer opt.	Modem opt. (std. on 765)	—	—
Keyboard	Typewriter with char. repeat, break, and numeric pad	Typewriter with char. repeat, break, and numeric pad	Typewriter with char. repeat, break, and numeric pad	Typewriter with char. repeat and break std.; numeric pad optional	No keyboard
Pricing	$1,150-$1,295	$1,825-$1,975	$2,595(763)-$2,895(765)	$2,895-$3,200	$2,795
1-year lease (inc maintenance)	$70-$80/month	$90-$100/month	$115(763)-$135(765)/month	$135/month	$135/month
Comments	*Portable; built by Texas Instruments as Model 743	*Portable; built by Texas Instruments as Model 745	*20K-80K bubble memory; portable; built by Texas Instruments as Model 763 and 765	*Built by Digital Equip. Corp. as DECwriter III	*Built by Digital Equip. Corp. as DECprinter I

Manufacturer	Data Access	Data Access	Data General	Data Measurements	Data Measurements
Model Highlights	DASI 1620*	DASI 1641*	Dasher	DMC 220A	DMC 442
1st ship/# shipped	1976 1,500+ shipped	1977 10 shipped	11/76 3,000 shipped	03/70 3,500+ shipped	06/74 700 shipped
Print mechanism	Daisywheel, impact	Daisywheel, impact	5x7 dot matrix, impact	IBM Selectric, impact	Daisywheel, impact
Print speeds	45cps	45cps	10, 15, 30 or 60cps	14.8cps	30cps
Terminal types	RO or KSR	KSR	RO or KSR	KSR	KSR or ASR
Character codes	ASCII or APL	ASCII	ASCII	BCD	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	Editing	Editing
Compatibility	Teletype 33/55	Teletype 33/55; IBM 2741; IBM 3767	Teletype 33/55	—	IBM 2740-2; IBM 3767
Printing	Upper and lower case	Upper and lower case	Upper and lower case		Upper and lower case
Line width	132/158 cols @ 10/12/inch	132/158 cols @ 10/12/inch	132 cols @ 10/inch	132/156 cols @ 10/12/inch	132/156 cols @ 10/12/inch
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch
Forms feed	Friction, tractor or pin	Tractor, pin or friction	Pin feed	Friction feed; opt. pin	Pin feed
Other features	Std. tab & vertical format; graphics; changeable fonts	Std. tab & vertical format; graphics (HyPlot), changeable type font	Opt. vertical format; view mode	Standard tab; split platen; document insertion	Std. tab & vertical format; opt. split platen
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full-duplex	Half-duplex	Full- or half- duplex
Speeds	110 or 130bps	110-1200bps	110, 150, 300 or 600bps	75-1200bps	134.5-2400bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C
Parity checking	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	158-char buffer	256-char buffer	40-char buffer	1,000-char buffer	440 to 32K-char buffer
Other features	—	—	Autoanswer standard	Polling/addressing std.; modem optional	Polling/addressing std.; modem optional
Keyboard	Typewriter with char. repeat, break, and numeric pad	Typewriter with std. numeric pad	Typewriter with char repeat and numeric pad	58-key typewriter	55-key typewriter with optional numeric pad
Pricing	$2,995	$3,220	$2,200-$2,650	$4,650	$4,995-$7,500
1-year lease (inc maintenance)	$145/month	$157/month	Lease price NG	Lease price NG	$250/month
Comments	*Built by Diablo Systems, Inc. as Model 1620	*Built by Diablo Systems, Inc. as Model 1641		Designed for consumer finance industry; avail. from Bell of Canada	Optional crt; avail. from Bell of Canada as Datacomm 600

anufacturer	Data Measurements	Data Terminals	Data Terminals	Data Terminals	Decision Data
odel Highlights	DMC 1100	DTC-300/S	DTC-302	DTC 382	Models 3240/6540
st ship/# shipped	1977 150 shipped	08/73 5,000 shipped	01/76 1,000 shipped	09/77 200 shipped	01/78 #shipped NG
rint mechanism	Daisywheel, impact	Daisywheel, impact	Daisywheel, impact	Daisywheel, impact	9x7 dot matrix, impact
rint speeds	35 or 55cps	10, 15 or 30cps	45 or 55cps	55cps	120cps
erminal types	KSR or ASR	KSR	RO, KSR or ASR	RO, KSR or ASR	RO or KSR
haracter codes	ASCII APL optional)	ASCII (APL optional)	ASCII (APL optional)	ASCII	ASCII
rogrammable?	Parameters programmable	Not programmable	Not programmable	Not programmable	Not programmable
diting?	Editing	No editing	No editing	Editing	No editing
ompatibility	Teletype 33/55; IBM 2740; IBM 2741	Teletype 33/55	Teletype 33/55	Teletype 33/55; IBM 2741	Teletype 33/55
rinting	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
ine width	132 cols @ 10 or 12/inch	132/158 cols @ 10/12/inch	132/158 chars @ 10/12/inch	132/158 cols @ 10/12/inch	132 cols @ 10/inch
ertical spacing	10 or 12 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch	6 lines/inch
orms feed	Friction, pin or tractor	Friction, pin or tractor	Friction, pin or tractor	Friction feed	Tractor feed
)ther features	Standard tab, vertical format, bidirec., plotting, subscript, superscript, overstroke	Std. tab and vertical format; incremental plotting	Std. tab and vertical format; incremental plotting	Std. tab and vertical format; biderec.; metal print wheel; prop. spacing	Std. tab and vertical format; bidirec.; last character visibility
:ommunications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
'ransmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
;peeds	110-9600bps	Up to 300bps	110-1200bps	Up to 9000bps	110, 300 or 1200bps
nterfaces	RS232C	RS232C or current loop	RS232C or current loop	RS232C	RS232C or current loop
'arity checking	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.
3uffer	512-char buffer	128-char buffer	128-char buffer	256-char buffer	512-char buffer
)ther features	Optional polling/addressing and autoanswer	Opt. polling/addressing, autoanswer, modem and coupler	Opt. modem & coupler	Optional autoanswer and coupler	Std. autoanswer
(eyboard	58-key typewriter with char. repeat, 128-char buffer, 19-key numeric pad std.	72-key typewriter with char. repeat and numeric pad	78-key typewriter with char. repeat, break, and numeric pad	88-key typewriter with char. repeat, numeric pad; opt. programmable keys	81-key typewriter with numeric pad; opt. second character set
Pricing	$4,350	$3,195-$3,500	$2,980-$4,590	$3,750-$5,000	$2,850/$2,395
1-year lease (inc maintenance)	Lease price NG	$145-$200/month	$128-$189/month	$155-$212/month	$125/$104/month
Comments	RAM, diskette, 8080A microprocessor with up to 60KB memory; avail. in Canada	Employs Diablo HyType I printer; other transmission speeds and codes optional	Diskette; imploys Diablo HyType II printer; other transmission speeds and codes optional	Diskette; employs Diablo HyType II printer; microprocessor-based unit. For word process, opt. video	Microprocessor-based

Manufacturer	Design 100	Diablo	Diablo	Diablo	Di/An Controls
Model Highlights	CT45 and CT55	HyTerm 1620	Model 1641	Model 1660	Models 60 and 120
1st ship/# shipped	09/77 #shipped NG	Date & # shipped NG	Date & # shipped NG	Date & # shipped NG	03/76 2,000 shipped
Print mechanism	Daisywheel, impact	Daisywheel, impact	Daisywheel, impact	7x9 dot matrix, impact	7x7 dot matrix, impact
Print speeds	45 or 55cps	45cps	45cps	200cps	60 or 120cps
Terminal types	RO or KSR	KSR	KSR	KSR	RO, KSR or ASR
Character codes	ASCII or APL	ASCII (APL optional)	ASCII, EBCDIC or APL	ASCII (APL optional)	ASCII (APL optional)
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	No editing	No editing
Compatibility	Teletype 33/55; IBM 2741	Teletype 33/55	Teletype 33/55; IBM 2741	Teletype 33/55	Teletype 33/55
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	132/158 cols @ 10/12/inch	132/158 cols @ 10/12/inch	158 cols @ 10 or 12/inch	132 cols @ 10/inch	132 cols @ 10/inch
Vertical spacing	6 lines/inch; others avail.	6 or 8 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction, tractor, pin	Friction, tractor, pin	Friction, tractor, pin	Tractor feed	Tractor feed
Other features	Std. tab and vertical format; bidirec. print and paper feed, prop. spacing	Std. tab, vertical format, plotting	Std. tab and vertical format	Standard tab and vertical format	Optional tab and vertical format; view key; "paper out"
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110-1200bps	110, 150 or 300bps	110, 300, 1200 or 1800bps	300, 1200, 1800, 4800bps	110, 150, 300, 600, 1200bps
Interfaces	RS232C or current loop	RS232C	RS232C	RS232C	RS232C or current loop
Parity checking	Check only	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check opt.
Buffer	256-char buffer	158-char buffer	256-char buffer	256 to 1000-char buffer	68 to 2K-char buffer
Other features	Opt. polling/addressing and autoanswer	—	Optional autoanswer	Autoanswer	Optional autoanswer
Keyboard	Typewriter with char. repeat and numeric pad	Typewriter with char. repeat, numeric pad, 8-char send buffer	46-key typewriter with char. repeat, numeric pad	46-key typewriter with char. repeat and numeric pad	64-key typewriter with char. repeat and opt. numeric pad
Pricing	$3,250/$3,725	$3,125	$3,000-$3,500	$3,200-$3,600	$1,500-$3,000
1-year lease (inc maintenance)	Lease price NG	Lease price NG	Lease price NG	Lease price NG	Lease price NG
Comments	Z80 microprocessor; also provides auto text justification, incremental & vector plotting	Contains HyType II printer			4K or 8K edit buffer

Manufacturer	Di/An Controls	Digital Equipment	Digital Equipment	Digital Equipment	Extel
Model Highlights	Model 8170	LA 35/LA 36 DECwriter II	LA 180	LS 120 DECwriter III	AH and AHS Series
1st ship/# shipped	12/76 1,000 shipped	Over 100,000 shipped	01/76 # shipped NG	09/77 #shipped NG	1972 60,000 shipped
Print mechanism	7x7 dot matrix, impact	7x7 dot matrix, impact	7x7 dot matrix, impact	7x7 dot matrix, impact	5x7 dot matrix, impact
Print speeds	100cps	10, 15 or 30cps	180cps	10, 30 or 180cps	15 or 30cps
Terminal types	RO or KSR	RO, KSR, or ASR	RO	KSR or ASR	RO
Character codes	ASCII	ASCII (APL optional)	ASCII (APL optional)	ASCII (APL optional)	ASCII or Baudot
Programmable?	Not programmable	Not programmable	Not programmable	Formats programmable	Not programmable
Editing?	No editing	No editing	No editing	Editing optional	No editing
Compatibility	Teletype 33/55; IBM 2740	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55
Printing	Lower case optional	Upper and lower case	Upper and lower case	Upper and lower case	Optional lower case
Line width	132 cols @ 10/inch	132 cols @ 10 or 16.5/inch	132 cols @ 10 or 16.5/inch	132 cols @ 10 or 16.5/inch	69/74/80 cols @ 10/11/12/ in
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	4.4 or 6 lines/inch
Forms feed	Tractor feed	Pin or tractor feed	Tractor feed	Tractor feed	Friction or pin feed
Other features	Optional tab and vertical format	Optional auto line feed	Top-of-form	Optional tab & vertical format; auto new line & feed, "paper out"; last character visibility	—
Communications	Synch/asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Simplex	Full- or half- duplex	Full- or half- duplex
Speeds	Up to 9600bps	110, 150 or 300cps	Up to 9600bps	75-4800bps (selectable)	300bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	Generate and check opt.	Generate and check std.	Check only	Check std.	Check opt.
Buffer	68 to 2K-char buffer	16-char buffer	256-char buffer	1,000-char buffer	No buffer
Other features	Optional polling/ addressing & autoanswer	Optional modem and coupler	Optional autoanswer	Autoanswer std.; opt. 300-bps modem and coupler	Opt. polling/addressing, autoanswer, and modem
Keyboard	Typewriter	58-key typewriter with char. repeat and break; opt. numeric pad	No keyboard	58-key typewriter with numeric pad; opt. answerback	No keyboard
Pricing	$2,300-$3,000	$1,900-$2,100 base	$3,240-$3,770	$3,990 base	$1,580
1-year lease (inc maintenance)	Lease price NG	Lease price NG	Lease price NG	Lease price NG	Lease price NG
Comments	Designed as PARS airline passenger ticket printer	4K-16K RAM; provides 60-cps catch-up feature		4K-16K RAM 1 to 3 PROMs	Portable; leased by RCA, Translux and Teleprinter Leasing Corp.

Manufacturer	Extel	Extel	Extel	Facit-Addo	Facit-Addo
Model Highlights	Model B 200	Model B 300S	Model B 300 PS	Model 4540	Model 4555
1st ship/# shipped	12/75 # shipped NG	01/76 # shipped NG	02/76 # shipped NG	1977 # shipped NG	1973 # shipped NG
Print mechanism	5x7 dot matrix, impact	5x7 dot matrix, impact	5x7 dot matrix, impact	7/9x9 dot matrix, impact	5x7 dot matrix, impact
Print speeds	30cps	30cps	30cps	250cps	60cps
Terminal types	KSR	KSR or ASR	KSR or ASR	RO	RO
Character codes	ASCII or Baudot	ASCII or Baudot	ASCII or Baudot	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	Optional editing	No editing	No editing	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	—	—
Printing	Optional lower case	Optional lower case	Optional lower case	Upper and lower case	
Line width	69/74/80/90 cols @ 10/11/12/in	69/74/80/90 cols @ 10/11/12/in	69/74/80/90/ cols @ 10/11/12/in	155 cols @ 10/inch	80 cols @ 10/inch
Vertical spacing	4.4 or 6 lines/inch	4.4 or6 lines/inch	4.4 or 6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction feed	Friction feed	Friction feed	Tractor feed	Pin feed
Other features	Boldface characters; half-line feed	Boldface characters; half-line feed	Boldface characters and half-line feed	Std. tab & vertical format; bidirec. print; low paper indicator	Form control
Communications	Asynchronous	Asynchronous	Asynchronous	—	Synch/asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Simplex	Simplex
Speeds	45-300bps	45-300bps	45-300bps	Speeds not given	110-600bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C	RS232C or current loop
Parity checking	Generate and check opt.	Generate and check opt.	Generate and check opt.	Generate and check std.	No parity
Buffer	No buffer	No buffer	No buffer	256-char buffer	No buffer
Other features	Opt. polling/addressing, autoanswer, and modem	Opt. polling/addressing, autoanswer, and modem	Opt. polling/addressing, autoanswer, and modem	—	—
Keyboard	58-key typewriter	58-key typewriter	58-key typewriter	No keyboard	No keyboard
Pricing	$1,750-$2,150	$1,950-$2,850	$3,485-$4,450	$3,900	$1,745
1-year lease (inc maintenance)	$85-$104/month	$95-$139/month	$169-$215/month	Lease price NG	Lease price NG
Comments	Microprocessor-based; leased by Teleprinter Leasing Corp.	2K-4K memory; microprocessor-based; leased by Teleprinter Leasing Corp.	2K-10K memory; microprocessor-based; leased by Teleprinter Leasing Corp.	Microprocessor control; Katakana, OCR-A and other character sets available	

Manufacturer	General Electric	General Electric	General Electric	General Electric	Harris
Model Highlights	TermiNet 30	TermiNet 300	TermiNet 1200	TermiNet 1232	Models 1030 and 1035
1st ship/# shipped	03/75 # shipped NG	07/69 # shipped NG	10/72 # shipped NG	09/77 # shipped NG	08/69 see Model 1040
Print mechanism	9x7 dot matrix, impact	Type belt, impact	Type belt, impact	Print belt, impact	IBM Selectric, impact
Print speeds	10, 20 or 30cps	10, 15, 20, 30 or 60cps	10, 20, 30, 60 or 120cps	10, 15, 30 or 120cps	15cps
Terminal types	RO KSR or ASR	RO, KSR or ASR	RO, KSR or ASR	RO, KSR or ASR	KSR or ASR
Character codes	ASCII	ASCII	ASCII	ASCII	EBCDIC or Correspondence
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	No editing	Editing (1035 only)
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55	IBM 2741
Printing	Optional lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	80 or 132 cols @ 10 or 16.5/in	80 or 118 cols @ 10/inch	80 or 120 cols @ 10/inch	132 cols @ 10/inch	130 or 156 cols @ 10/12/in
Vertical spacing	6 or 3 lines/inch	6 or 3 lines/inch	6 or 3 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch
Forms feed	Pin feed	Friction, pin or tractor	Tractor feed	Tractor feed	Friction or pin feed
Other features	Optional vertical format	Opt. tab & vertical format	Opt. tab & vertical format	Std. tab & vertical format; front/rear paper feed; low paper indicator	Std. tab; forms aligner; opt. half-line spacing
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Half-duplex
Speeds	110-1200bps	110, 150, 200, 300 or 600bps	110, 200, 300, 600 or 1200bps	110, 150, 300 or 1200bps	134.5bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or acoustic
Parity checking	Generate and check std.	Generate std.; check opt.	Generate std.; check opt.	Check std.	Generate and check std.
Buffer	No buffer	No buffer	No buffer	1,000-char buffer	No buffer
Other features	Opt. autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. modem & coupler
Keyboard	Typewriter with std. char. repeat; opt. numeric pad	Typewriter with std. char. repeat; opt. numeric pad	Typewriter with std. char. repeat; opt. numeric pad	Typewriter with std. char. repeat; opt. numeric pad	55-key typewriter with std. char. repeat
Pricing	$1,685-$2,691	$3,460-$6,610	$4,315-$7,270	$2,850-$5,155	$1,600/$2,400
1-year lease (inc maintenance)	$83-$131/month	$112-$237/month	$144-$250/month	$155-$175/month	$89/$129/month
Comments	Cassette tape	Cassette tape	Cassette tape	Casette tape	1035 includes tape cartridge recorder; both models avail. on an "as returned" basis

Manufacturer	Harris	IBM Office Products	IBM Data Processing	IBM Data Processing	IBM Data Processing
Model Highlights	Model 1040	CMC/ST	2740 Models 1 and 2	Model 2741	Models 3767-1, 2 and 3
1st ship/# shipped	07/71 4,000 (all mods)	10/71 # shipped NG	Date and # shipped NG	Date and # shipped NG	02/75 # shipped NG
Print mechanism	IBM Selectric, impact	IBM Selectric, impact	IBM Selectric, impact	IBM Selectric, impact	7x8 dot matrix, impact
Print speeds	14.8cps	14.8-15.5cps	14.8cps	14.8cps	40, 80 or 120cps
Terminal types	KSR	KSR	KSR	KSR	KSR
Character codes	EBCDIC or Correspondence	EBCDIC	BCD' EBCDIC, or Corr.	BCD, EBCDIC, or Corr.	EBCDIC and ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	Editing	Editing optional	No editing	Editing
Compatibility	IBM 2740-1; IBM 2741	—	—	—	IBM 2740 and IBM 2741 optional
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	130 cols @ 10 or 12/inch	130 or 156 cols @ 10/12/inch	130 cos @ 10 or 12/inch	130 cols @ 10 or 12/inch	132 cols @ 10/inch
Vertical spacing	6 or 8 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch	6 lines/inch
Forms feed	Friction or pin feed	Friction or pin feed	Friction or pin feed	Friction or pin feed	Friction or pin feed
Other features	Std. tab; forms aligner; opt. half-line spacing	Std. tab & vertical format	Split friction platen and ledger card handler opt.	—	Std. tab; opt. vertical format; alternate char. sets
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	SDLC, asynchronous opt.
Transmission	Half-duplex	Full- or half- duplex	Half-duplex	Half-duplex	Half-duplex
Speeds	134.5bps	135bps	75, 134.5 or 600bps	134.5cps	300, 600, 1200 or 2400bps
Interfaces	RS232C or acoustic	RS232C	RS232C	RS232C	RS232C optional
Parity checking	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	No buffer	8,000-char buffer	120/246/440-char buffer	No buffer	256-char buffer
Other features	Opt. polling/addressing, modem and coupler	—	Polling/addressing std.		Polling/addressing std.; opt. modem & coupler
Keyboard	55-key typewriter with std. char. repeat	44-key typewriter	55-key typewriter with char. repeat std.	55-key typewriter with std. char. repeat	44-key typewriter with character repeat
Pricing	$1,600	$10,970	$3,930-$11,806	$3,930-$4,900	$5,800-$9,228
1-year lease (inc maintenance)	$89/month	$255/month (6-mo.)	$95-$282/month (30-day)	$95-$140/mo (30-day)	$176-$307/mo (30-day)
Comments	Available on an "as returned" basis	For word processing use; each card stores 5,000 chars.; mag. card recorder opt.			Supercedes IBM 2740 & 2741 terminals; magnetic stripe reader opt.

Manufacturer	Intertec	LogAbax	LogAbax	LogAbax	MI^2 Data Systems
Model Highlights	Superterm	LX 180/KSR	Model LX 180/57	Model LX 1010	Design 2400
1st ship/# shipped	11/76 3,000+ shipped	1972 2,000+ shipped	1972 3,500+ shipped	1976 200 shipped	01/76 # shipped NG
Print mechanism	7x7 dot matrix, impact	7x7 dot matrix, impact	7x7 dot matrix, impact	9x7 dot matrix, impact	5x7, 9x9 dot matrix, impact
Print speeds	10-180cps	180cps	180cps	180cps	180cps
Terminal types	RO, KSR or ASR	KSR	KSR	KSR	RO, KSR or ASR
Character codes	ASCII	ASCII	EBCDIC	ASCII	ASCII
Programmable?	Programmable (BASIC)	Not programmable	Not programmable	Programmable	Not programmable
Editing?	Editing	No editing	Editing	Editing	No editing
Compatibility	Teletype 33/55	Teletype 33/55	IBM 2740-2	Teletype 33/55; IBM 2740; IBM 2741	Teletype 33/55
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	132 cols @ 10/inch	132-220 cols @ 10-16.5/in.	132-220 cols @ 10-16.5/in.	132-220 cols @ 10-16.5/in.	132/158 cols @ 10/12/16.5
Vertical spacing	6 or 8 lines/inch (var.)	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Pin or tractor feed	Tractor feed	Tractor feed	Friction, tractor or pin	Tractor feed
Other features	Std. tab; opt. vertical format; double-width char. & reverse print opt.	Std. tab and vertical format; second tractor for front feed opt.	Std. tab & vertical format; second tractor feed and front feed opt.	Opt. tab; std. vertical format; opt. 2nd tractor feed; front feed	Opt. tab; bidirec. print & paper feed; auto view; low paper alarm
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- cr half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110-4800bps	150-9600bps	600, 1200 or 2400bps	150-4800bps	75-9600bps
Interfaces	RS232C or current loop	RS232C	RS232C	RS232C	RS232C optional
Parity checking	Generate and check std.	Generate opt.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	1,000-char buffer	256-char buffer	256-char buffers (dual)	Up to 16k-char buffer	192 to 320-char buffer
Other features	Opt. polling/addressing and autoanswer	Optional modem and coupler	Polling/addressing std.; modem opt.	Polling/addressing and autoanswer opt.; modem and coupler opt.	Opt. polling/addressing
Keyboard	Typewrtiter with char. repeat, view mode; opt. numeric pad	58-key typewriter with std. numeric pad	58-key typewriter with 10 keys for pre-recorded messages	58-key typewriter with char. repeat, numeric pad, function keys	74-key typewriter with numeric pad and four selectable char. sets
Pricing	$1,995-$2,795	$4,500-$4,850	$6,200	$6,000-$8,000	$2,795-$3,595
1-year lease (inc maintenance)	$89/month (base)	$178-$188/month	$199/month	$204-$240/month	Lease price NG
Comments	Cassette; microprocessor-based; any character set can be programmed			Microprocessor-controlled; protocol emulation	1K to 8K RAM; controlled by dual Intel 8085 microprocessors; elongated characters optional

Manufacturer	Microdata	NCR	NEC	Okidata	Okidata
Model Highlights	Matrix Printer	260 Series	Models 5510 and 5520	Models CP110 & CP210	Mod 22
1st ship/# shipped	1974 1,000+ shipped	05/71 10,000+ shipped	12/77 40 shipped	Date and # shipped NG	Date and # shipped NG
Print mechanism	9x7 dot matrix, impact	5x6 dot matrix, nonimpact	Print thimble, impact	5x7 dot matrix, impact	5x7 dot matrix, impact
Print speeds	120 or 165 cps	10, 15 or 30cps	55cps	110cps	120cps
Terminal types	RO or KSR	RO, KSR or ASR	RO or KSR	RO	RO
Character codes	ASCII	ASCII	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	Editing (260-6)	No editing	No editing	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	—	—
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Lower case opt. (110); std. (210)	Upper and lower case
Line width	132/156 cols @ 10/12/inch	80 cols @ 10/inch	136/163 cols @ 10/12/in	80 or 96 cols @ 10 or 12/in	132 cols @ 10/inch
Vertical spacing	6 lines/inch	3 to 6 lines/inch	6 to 8 lines/inch (select.)	6 or 8; 5 or 6 lines/in.	6 or 8 lines/inch
Forms feed	Tractor feed	Friction feed	Friction, pin or tractor	Friction, pin or tractor	Tractor feed
Other features	Std. tab & vertical format; bidirec. print & paper feed; graphics	Opt. tab; standard vertical format	Std. tab & vertical format; bidirec. print & paper feed; plotting	Expanded-width chars.	Std. vertical format; eight character sets
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Simplex	Simplex
Speeds	110, 300 or 1200bps	110, 150 or 300 bps	110, 300 or 1200bps	110-9600bps	110-9600bps
Interfaces	RS232C or current loop	RS232C or acoustic	RS232C or current loop	RS232C	RS232C
Parity checking	Generate only	Generate and check std.	Generate and check std.	Check only	Check only
Buffer	320-char buffer	256-char buffer (260-6)	256-char buffer	128-char buffer	2,000-char buffer
Other features	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. autoanswer, modem (260-6); opt. coupler (std. 260-5)		—	Opt. polling/addressing
Keyboard	63-key typewriter with numeric pad	57-key typewriter with numeric pad (260-6); character repeat	58-key typewriter with char. repeat and numeric pad	No keyboard	No keyboard
Pricing	$2,500	$2,495-$3,295	$2,775-$3,335	$1,625-$3,245	$3,030
1-year lease (inc maintenance)	Lease price NG	$75-$150/month	Lease price NG	Lease price NG	Lease price NG
Comments	Microprocessor control; Selectable Dual Character Set available	Cassette tape	Microprocessor (8080) based unit	CP210 is a passbook printer, a modified version of CP110	

Manufacturer	Olivetti	Olivetti	Perkin-Elmer	Perkin-Elmer	Perkin-Elmer
Model Highlights	Model TC 481	Model TC 485	Carousel 310	Carousel 320	Carousel 350
1st ship/# shipped	1977 see Model TC 485	1977 50 (both models)	1975 2,500 shipped	1975 50 shipped	1976 1900 shipped
Print mechanism	7x4/5 dot matrix, impact	7x4/5 dot matrix, impact	Print cup, impact	Print cup, impact	Print cup, impact
Print speeds	30cps	30cps	30cps	30cps	30cps
Terminal types	RO or ASR	KSR or ASR	RO (opt.) or KSR	KSR or ASR	KSR
Character codes	ASCII	ASCII	ASCII (APL optional)	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Editing	Editing	No editing	No editing	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	132 cols @ 10/inch	132 cols @ 10/inch	132/165 cols @ 10/12.5/in	132 cols @ 10/inch	132/165 cols @ 10/12.5/in
Vertical spacing	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Pin feed	Pin feed	Friction or tractor feed	Friction or tractor feed	Friction or tractor feed
Other features	Optional tab; vertical format	Optional tab; vertical format	Std. tab & vertical format; plotting; split plated; forms handling	Std. tab & vertical format; plotting; split platen; forms handling	Std. tab & vertical format; plotting; dual platen; forms handling
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	300-1200bps	300-1200bps	110, 150, 300 or 1200bps	110, 150, 300 or 1200bps	110, 150, 300 or 1200bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	Current loop	RS232C
Parity checking	Check only	Check only	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	64-char buffer	64-char buffer	128-char buffer	128-char buffer	128-char buffer
Other features	Autoanswer optional	Autoanswer optional			—
Keyboard	Typewriter with char. repeat std.; numeric pad opt.	Typewriter with char. repeat std.; numeric pad opt.	Typewriter with char. repeat & numeric pad	Typewriter with char. repeat & numeric pad	Typewriter with char. repeat & numeric pad
Pricing	$1,950	$2,100	$2,995	$3,595	$3,995
1-year lease (inc maintenance)	Lease price NG	Lease price NG	Lease price NG	Lease price NG	Lease price NG
Comments	Cassette and mini-diskette	Tape cassette and 8K RAM			

Manufacturer	Printer Technology	Qume	Randal Data Systems	Randal Data Systems	Randal Data Systems
Model Highlights	Printec 100 Series	Sprint Micro 5	Model LA 36*	Model LA 180*	HyTerm*
1st ship/# shipped	10/71 2,000+ shipped	1977 30,000 (all mods)	06/73 16,000+ shipped	02/76 750 shipped	03/76 250 shipped
Print mechanism	Split-helix wheel, impact	Daisywheel, impact	7x7 dot matrix, impact	7x7 dot matrix, impact	Daisywheel, impact
Print speeds	100cps	45 or 55cps	30cps	180cps	10, 15, 30 and 45cps
Terminal types	RO	RO or KSR	KSR	RO	RO or KSR
Character codes	ASCII or MICR E-13B	ASCII	ASCII	ASCII	ASCII (APL optional)
Programmable?	Not programmable	Parameters programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	No editing	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/55
Printing	Upper and lower case	Upper and lower case			Upper and lower case
Line width	132 cols @ 10 or 6/inch	132/158 cols @ 10/12/inch	132 cols @ 10/inch	132 cols @ 10/inch	132 cols @ 10 or 12/inch
Vertical spacing	6 or 8 lines/inch	6 lines/inch (and others)	6 lines/inch	6 lines/inch	6 or 8 lines/inch
Forms feed	Pin or tractor feed	Friction, pin or tractor	Pin feed	Pin feed	Friction or pin feed
Other features	Std. vertical format	Std. tab & vertical format; incremental plotting and self-test	Opt. tab & vertical format	Opt. tab and vertical format	Opt. tab, vertical format, tractor
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Simplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110-19,200bps	110, 150, 300, 600 or 1200bps	110, 150 or 300bps	300, 600 or 1200bps	110, 150, 300 or 1200bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C	RS232C	RS232C or current loop
Parity checking	Check opt.	Generate and check std.	No parity	No parity	Generate and check std.
Buffer	266-char buffer opt.	224-char buffer	No buffer	No buffer	No buffer
Other features	Polling/addressing opt.		Opt. polling/addressing, autoanswer, and coupler	Opt. polling/addressing, autoanswer, and coupler	Opt. polling/addressing and coupler
Keyboard	No keyboard	78-key typewriter with char. repeat and numeric pad std.	Typewriter with char. repeat, break, and numeric pad std.	No keyboard	58-key typewriter with numeric pad std.
Pricing	$3,215-$8,995	$2,000-$2,850	$1,910	$3,085-$3,885	$3,100/$3,200 (KSR)
1-year lease (inc maintenance)	Lease price NG	Lease price NG	$100/month	$156/month (15-mo.)	Lease price NG
Comments	Also prints MICR E-13B font	Microprocessor-based unit; programs can be downline loaded; the Sprint Macro 3, an oem version, is also avail.	*Produced by Digital Equipment Corp.	*Produced by Digital Equipment Corp.	*Produced by Diablo; diagnostics std.

Manufacturer	Randal Data Systems	RCA Service Co.	RCA Service Co.	RCA Service Co.	RCA Service Co.
Model Highlights	Model 1552	Extel Teleprinter*	Teletype 28*	Teletype 33*	Teletype 35*
1st ship/# shipped	03/75 300 shipped	Date and # shipped NG	Date and # shipped NG	Date and # shipped NG	Date and # shipped NG
Print mechanism	Daisywheel, impact	5x7 dot matrix, impact	Type box, impact	Type cylinder, impact	Type box, impact
Print speeds	10, 15, 30 and 45cps	10, 15 or 30 cps	10cps	10 or 15cps	10cps
Terminal types	RO or KSR	RO	RO, KSR or ASR	RO, KSR, or ASR	RO, KSR or ASR
Character codes	ASCII (APL optional)	ASCII and Baudot	Baudot or CCITT	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Editing	No editing	Character editing only	Character editing only	Character editing only
Compatibility	IBM 2740; IBM 2741	Teletype 33/55	—	Teletype 35	Teletype 33
Printing	Upper and lower case				
Line width	132 cols @ 10 or 12/inch	72 cols @ 10/inch	72 cols @ 10/inch	72 or 88 cols @ 10 or 12/in	72 or 88 cols @ 8/10/12/in
Vertical spacing	6 or 8 lines/inch	4 or 6 lines/inch	4 or 6 lines/inch	4 or 6 lines/inch	4 or 6 lines/inch
Forms feed	Friction, tractor or pin	Friction feed	Friction or pin feed	Friction or pin feed	Friction or pin feed
Other features	Opt. tab and vertical format	—	Opt. tab and vertical format	—	—
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Simplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	300, 600 or 1200bps	110 or 150bps	74.2bps	110bps	110bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C, current loop or CCITT
Parity checking	Generate and check std.	Check opt.	No parity	Check opt.	Check opt.
Buffer	No buffer	No buffer	No buffer	No buffer	No buffer
Other features	Std. polling/addressing; opt. modem & coupler	Opt. polling/addressing and autoanswer; opt. modem and coupler	Opt. polling/addressing, autoanswer, modem and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler
Keyboard	55-key typewriter with numeric pad std.	No keyboard	53-key teleprinter with char. repeat std.; numeric pad opt.	53-key teleprinter with char. repeat std.; numeric pad opt.	53-key teleprinter with char. repeat std.; numeric pad opt.
Pricing 1-year lease (inc maintenance)	$5,500 (base) Lease price NG	Purchase price NG $64-$70/month (90-day avail.)	Lease only $73/$86/$144/mo. (90-day avail.)	Lease only $50/$52/$67/mo. (90-day avail.)	Lease only $80/$86/$144/mo. (90-day avail)
Comments	Microprocessor-based; diagnostics std.; uses Diablo Hytype I	*Made by Extel (Models AF and AH)	*Made by Teletype	*Made by Teletype	*Made by Teletype

Manufacturer	RCA Service Co.	RCA Service Co.	Redactron	SCM/Kleinschmidt	Scope Data
Model Highlights	Teletype 38*	GE TermiNet 30*	Comm./Editing Typewriter	7300 Series Teleprinters	Series 200
1st ship/# shipped	Date and # shipped NG	Date and # shipped NG	Date and # shipped NG	06/74 # shipped NG	08/74 # shipped NG
Print mechanism	Type cylinder, impact	5x7 dot matrix, impact	IBM Selectric, impact	Impact	7x9 dot matrix, nonimpact
Print speeds	10cps	10, 20 or 30cps	14.8 cps	30cps	240cps
Terminal types	RO, KSR or ASR	KSR or ASR	ASR	RO, KSR or ASR	RO or KSR
Character codes	ASCII	ASCII	ASCII or Correspondence	ASCII or Baudot	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Character editing only	Character editing only	Full editing	Editing via tape	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/35; IBM 2746, IBM 2780 avail.	Teletype 33/55	Teletype 33/55
Printing	Upper and lower case		Upper and lower case		Upper and lower case
Line width	72 or 132 cols @ 10/inch	80 cols @ 10/inch	130 or 156 cols @ 10 or 12/in	72 or 80 cols @ 10/inch	80 or 132 cols @ 10/16.5/in
Vertical spacing	4 or 6 lines/inch	6 lines/inch	3, 4 or 6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction or pin feed	Pin or adj. tractor feed	Friction or pin feed	Friction or pin feed	Friction feed
Other features		Ribbon cartridge, std. vertical format	Std. tab; opt. vertical format	Opt. tab & vertical format; char. counter, sgl/dbl line feed & tab opt.	Last character visibility
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110bps	100, 200 or 300bps	110, 134.5 or 300bps	50 to 300bps	75 to 2400bps
Interfaces	RS232C or current loop	RS232C	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	Check opt.	Generate and check std.	Generate and check std.	Generate and check opt.	Generate only
Buffer	No buffer	No buffer	512-char buffer	No buffer	64 or 256-char buffer
Other features	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Optional autoanswer and modem	Opt. polling/addressing and autoanswer	Opt. polling/addressing, autoanswer, and coupler
Keyboard	53-key teleprinter with char. repeat; opt. numeric pad	63-key typewriter with character repeat	58-key typewriter	59-key typewriter with char. repeat std.	58-key typewriter with char. repeat std.
Pricing 1-year lease (inc maintenance)	Lease only $60/$69/$86/mo. (90-day avail.)	Lease only $85/$95/142/month	$7,661-$11,011 $245-$360/month	Purchase price NG Lease price NG	$1,595-$2,010 $75-$95/month
Comments	*Made by Teletype	*Cassette tape; microprocessor-based unit; TWX/DDD available; built by GE	Designed for word processing applications; cassette tape and magnetic card unit		

Manufacturer	Selecterm	Selecterm	Selecterm	Selecterm	Selecterm
Model Highlights	33 ASR Data Terminal*	Execuport 300*	System 75	Beta	LA 36 DECwriter II*
1st ship/# shipped	Date and # shipped NG	01/68 4,000+ shipped	05/74 # shipped NG	07/70 # shipped NG	Date and # shipped NG
Print mechanism	Type cylinder, impact	5x7 dot matrix, nonimpact	Daisywheel, impact	Type wheel, impact	7x7 dot matrix, impact
Print speeds	10cps	10, 15 or 30cps	10, 15 or 30cps	10, 15 or 30cps	10, 15 or 30cps
Terminal types	KSR or ASR	KSR or ASR	RO or KSR	KSR or ASR	KSR
Character codes	ASCII	ASCII	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Formats programmable	Not programmable	Not programmable
Editing?	Editing with cassette	Editing with cassette	Editing with cassette	Editing with cassette	No editing
Compatibility	Teletype 33/55	Teletype 33/55	Teletype 33/55	Teletype 33/35	Teletype 33/35
Printing		Upper and lower case	Upper and lower case		Upper and lower case
Line width	72 cols @ 10/inch	80 cols @ 10/inch	132 or 158 cols @ 10 or 12/in	132 cols @ 10/inch	132 cols @ 10/inch
Vertical spacing	3 or 6 lines/inch	6 lines/inch	6 or 8 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Friction or pin feed	Friction feed	Pin or tractor feed	Pin feed	Pin or tractor feed
Other features	—	—	Std. tab and vertical format; 2-color ribbon; plotting	—	—
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110bps	110, 150 or 300bps	110, 150, 300 or 1200bps	110, 150 or 300bps	110, 150 or 300bps
Interfaces	Current loop	RS232C	RS232C or current loop	RS232C	RS232C, current loop
Parity checking	Generate only	Generate only	Generate and check std.	Generate and check std.	No parity
Buffer	No buffer	No buffer	200-char buffer	No buffer	No buffer
Other features	Opt. polling/addressing, autoanswer, and coupler	Opt. outoanswer; std. modem and coupler	Opt. autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, and coupler	—
Keyboard	53-key typewriter with character repeat	58-key typewriter with char. repeat; numeric pad std.	65-key typewriter with char. repeat, numeric pad std.	Typewriter	58-key typewriter with opt. numeric pad
Pricing	$1,427	$3,225-$3,895	$5,400	$1,400-$2,200	$1,795
1-year lease (inc maintenance)	$55/month	$135/month	$200/month	$120-$205/month	$90/month
Comments	*Cassette tape: made by Teletype as Teletype 33 ASR	*Cassette tape; portable; made by Computer Transceiver Systems as Execuport 300	Employs Intel 8008 microprocessor and Diablo HyType printer mechanism	Cassette tape; employs Univac DCT 500 printer mechanism	*Produced by Digital Equipment Corp.

Manufacturer	Siemens	Siemens	Siemens	Tally	Teletype
Model Highlights	Model T-1000	Model PT80	PT80 Ink Jet	Model T1612	Model 33
1st ship/# shipped	01/77 # shipped NG	10/77 # shipped NG	01/78 # shipped NG	11/77 # shipped NG	1962 # shipped NG
Print mechanism	Daisywheel, impact	12x9 dot matrix, impact	12x9 dot matrix, nonimpact	7x7 dot matrix, impact	Type cylinder, impact
Print speeds	6, 10 or 13.3cps	10, 15, 30 or 60cps	10, 15, 30 or 60cps	160cps	10cps
Terminal types	RO, KSR or ASR	RO, KSR or ASR	RO, KSR or ASR	RO or KSR	RO, KSR or ASR
Character codes	CCITT or Baudot	ASCII and CCITT	ASCII and CCITT	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Parameters programmable	Not programmable
Editing?	No editing	No editing	No editing	No editing	No editing
Compatibility	—	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 35
Printing		Upper and lower case	Upper and lower case	Upper and lower case	
Line width	69 to 80 cols @ 10/inch	80 or 132 cols @ 10/inch	80 or 132 cols @ 10/inch	To 218 cols @ 10/12/16.5/in	72 cols @ 10/inch
Vertical spacing	3, 4, 5 or 6 lines/inch	3, 4, 5 or 6 lines/inch	3, 4, 5 or 6 lines/inch	6 or 8 lines/inch	6 or 3 lines/inch
Forms feed	Friction or pin feed	Friction or pin feed	Friction or pin feed	Tractor feed	Friction or pin feed
Other features	Last character visibility; single feed opt.	Std. tab; last character visibility; single feed opt.	Std. tab; last character visibility; single feed opt.	Std. tab and vertical format; bidirec. printing; last character visibility	Prints lower-case alpha as upper-case
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	60, 75 or 100bps	110, 150, 300 or 600bps	110, 150, 300 or 600bps	300-9600bps	110bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	No parity	Generate and check std.	Generate and check std.	Generate and check std.	Generate std; check opt.
Buffer	No buffer	No buffer	No buffer	Up to 4K-char buffer	No buffer
Other features	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing, autoanswer, modem, and coupler	Opt. polling/addressing; std. autoanswer	Opt. polling/addressing; std. autoanswer; opt. modem
Keyboard	60-key typewriter with char. repeat std.	77-key typewriter with char. repeat std.; numeric pad opt.	77-key typewriter with char. repeat std.; numeric pad opt.	60-key typewriter with 14- or 16-key numeric pad and alt. char. opt.	53-key Typewriter with character repeat
Pricing	$2,600-$3,900	$2,600-$3,900	$2,800-$4,100	$3,485(RO)-$3,900(KSR)	$717-$1,595
1-year lease (inc maintenance)	$112/month (3-year)	$119/month (3-year)	Lease price NG	Lease price NG	Purchase only
Comments	Cassette tape	Cassette tape		Programs can be down-line loaded; micro-processor-based unit; can print double-width characters	Cartridge tape; also available from third-party lessors

Manufacturer	Teletype	Teletype	Teletype	Telex Terminal	Texas Instruments
Model Highlights	Model 35	Model 40 ROP	Model 43	Model TC-241	Model 732
1st ship/# shipped	1962 # shipped NG	1973 # shipped NG	Date and # shipped NG	12/73 5,500 shipped	01/73 # shipped NG
Print mechanism	Type box, impact	Type belt, impact	7x9 dot matrix, impact	Type wheel, impact	5x7 dot matrix, nonimpact
Print speeds	10cps	296-660cps	10 or 30cps	30cps	6, 7, 10 or 13.3cps
Terminal types	RO, KSR or ASR	RO	RO or KSR	KSR	RO, KSR or ASR
Character codes	ASCII	ASCII	ASCII	ASCII	Baudot
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	No editing	No editing	No editing	Editing (ASR only)
Compatibility	Teletype 33	Teletype 33/35 opt.	Teletype 33/35	IBM 2741	Teletype 28/32
Printing		Lower case optional	Upper and lower case	Upper and lower case	
Line width	72 cols @ 10/inch	80 or 132 cols @ 10/inch	80 or 132 cols @ 10/13/in	132/158 cols @ 10/12 inch	80 cols @ 10/inch
Vertical spacing	6 or 3 lines/inch	6 or 3 lines/inch	6 lines/inch	6 or 8 lines/inch	6 or 3 lines/inch
Forms feed	Friction, tractor pin	Friction, tractor, or pin	Friction or pin feed	Friction, pin or tractor	Friction feed
Other features	Std. tab and vertical format; prints lower case alpha as u. c.	Opt. tab and vertical format	Last character visibility; diagnostics	Std. tab and vertical format; auto blank suppress; extra 2K buffer	—
Communications					
Transmission	Asynchronous Full- or half- duplex	Asynchronous Half-duplex	Asynchronous Full- or half- duplex	Asynchronous Half-duplex	Asynchronous Full- or half- duplex
Speeds	110bps	—	110 or 300bps	75-180bps	50, 75 or 100bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C	RS232C or current loop
Parity checking	Generate std; check opt.	Check only	Generate and check std.	Generate and check std.	Generate only
Buffer	No buffer	1,000-char buffer	No buffer	511 or 2047-char buffer	No buffer
Other features	Opt. polling/addressing; std. autoanswer; opt. modem	Opt. polling/addressing; std. autoanswer	Optional modem	Std. polling/addressing and autoanswer; opt. modem	Opt. autoanswer and modem
Keyboard	50-key teleprinter with character repeat	No keyboard	Typewriter with character repeat	77-key typewriter with character repeat	32- or 57-key typewriter with char. repeat std.
Pricing	$2,442-$5,650	$3,529-$4,550	$1,000	$5,000	$1,560-$3,290
1-year lease (inc maintenance)	Purchase only	Purchase only	Purchase only	$175/month (2-year)	$90-$164/month
Comments	Cartridge recorder; heavy-duty unit; also avail. from third-party lessors	Hard-copy output for Teletype's Model 40 display system	Portable; available from Bell System operating companies	Microprogrammed; three switch-selectable programmable formats (2 fixed, 1 variable	Tape cassette

Manufacturer	Texas Instruments	Texas Instruments	Texas Instruments	Texas Instruments	Texas Instruments
Model Highlights	Model 733	Model 742	Model 743	Model 745	Model 810
1st ship/# shipped	01/73 # shipped NG	09/74 # shipped NG	01/76 # shipped NG	01/76 # shipped NG	06/77 # shipped NG
Print mechanism	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	5x7 dot matrix, nonimpact	9x7 dot matrix, impact
Print speeds	10, 15 or 30cps	10, 15 or 30cps	10 or 30cps	10 or 30cps	150cps
Terminal types	RO, KSR or ASR	ASR	KSR	KSR	RO
Character codes	ASCII	ASCII	ASCII	ASCII	ASCII
Programmable?	Not programmable	Programmable	Not programmable	Not programmable	Not programmable
Editing?	Editing (ASR only)	Editing	No editing	No editing	No editing
Compatibility	Teletype 33/35	—	Teletype 33/35	Teletype 33/35	Teletype 33/35
Printing	Lower case optional				Optional lower case
Line width	80 cols @ 10/inch	80 cols @ 10/inch	80 cols @ 10/inch	80 cols @ 10/inch	132 cols @ 10 or 16.5/in
Vertical spacing	6 or 3 lines/inch	6 or 3 lines/inch	6 lines/inch	6 lines/inch	6 or 8 lines/inch
Forms feed	Friction feed	Friction feed	Friction feed	Friction feed	Pin (tractor) feed
Other features	—	—	—	—	Std. tab and vertical format
Communications					
Transmission	Asynchronous Full- or half- duplex	Asynchronous Full- or half- duplex	Asynchronous Full- or half- duplex	Asynchronous Full- or half- duplex	Asynchronous Simplex
Speeds	110, 150 or 300bps	110, 150, 300 or 1200bps	110 or 300bps	110 or 300bps	110-9600bps
Interfaces	RS232C or current loop	RS232C	RS232C or current loop	RS232C	RS232C or current loop
Parity checking	Generate only	Generate and check std.	Generate only	Generate only	Generate and check std.
Buffer	No buffer	425-char buffer	No buffer	No buffer	256-char buffer
Other features	Opt. autoanswer and modem; coupler std.	Std. polling/addressing and autoanswer; opt. modem	Optional modem	Standard coupler	—
Keyboard	55-key typewriter with char. repeat std.	57-key data entry with char. repeat and numeric pad	Typewriter with char. repeat and numeric pad	Typewriter with char. repeat and numeric pad	No keyboard
Pricing	$1,485-$4,275	$5,195-$6,300	$1,395-$1,590	$1,995	$1,895-$2,495
1-year lease (inc maintenance)	$85-$183/month	$230-$283/month	$85-$93/month	$125/month	Lease price NG
Comments	Tape cassette	2 cassette recorders	Microprocessor-based (TMS 8080)	Microprocessor-based portable unit	Microprocessor-based; self-test capability

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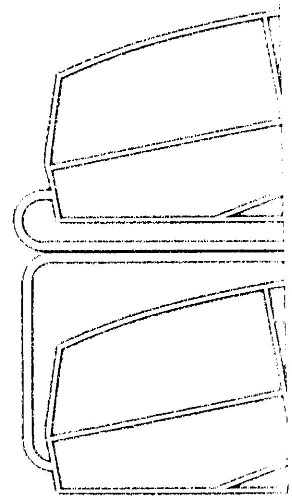

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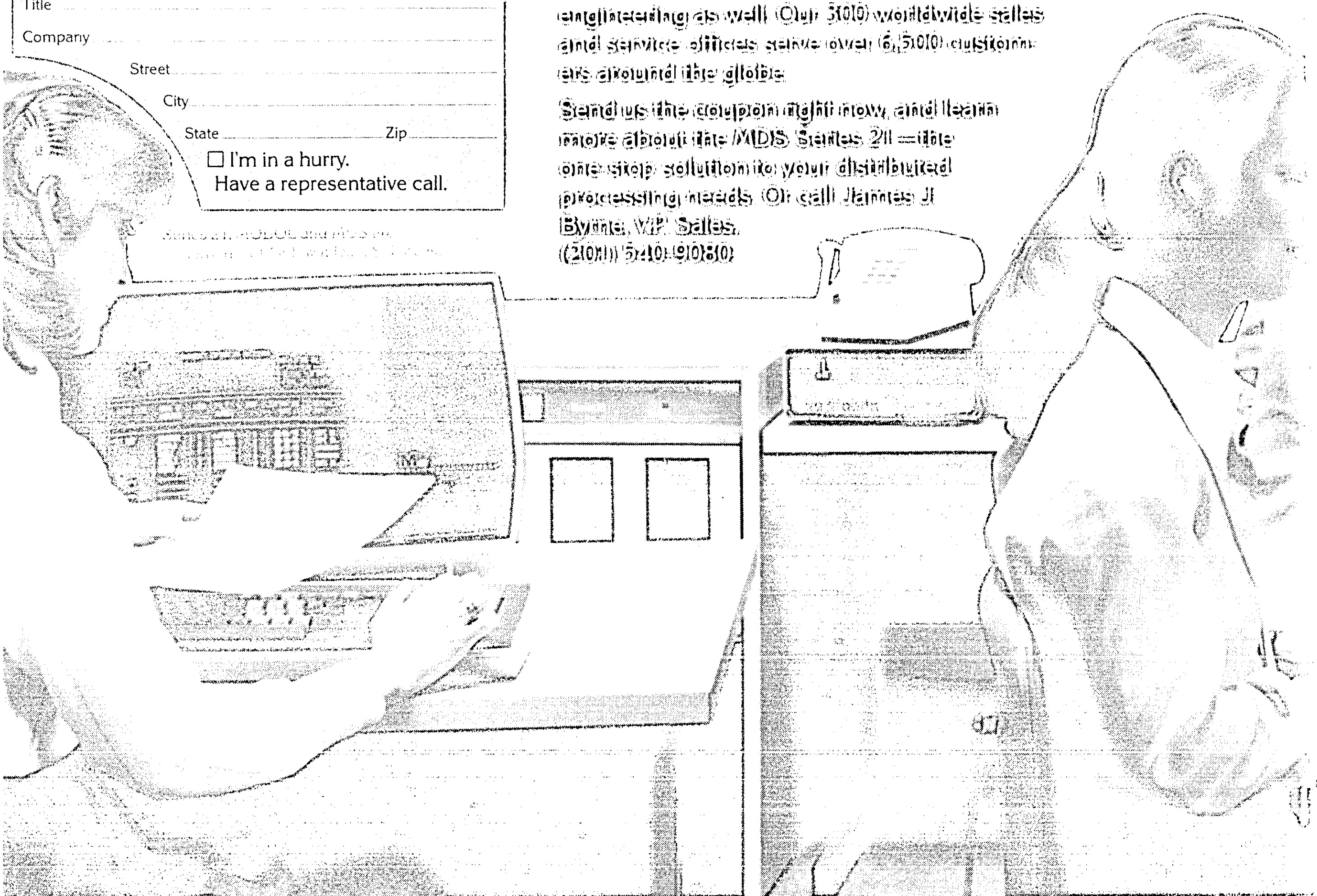
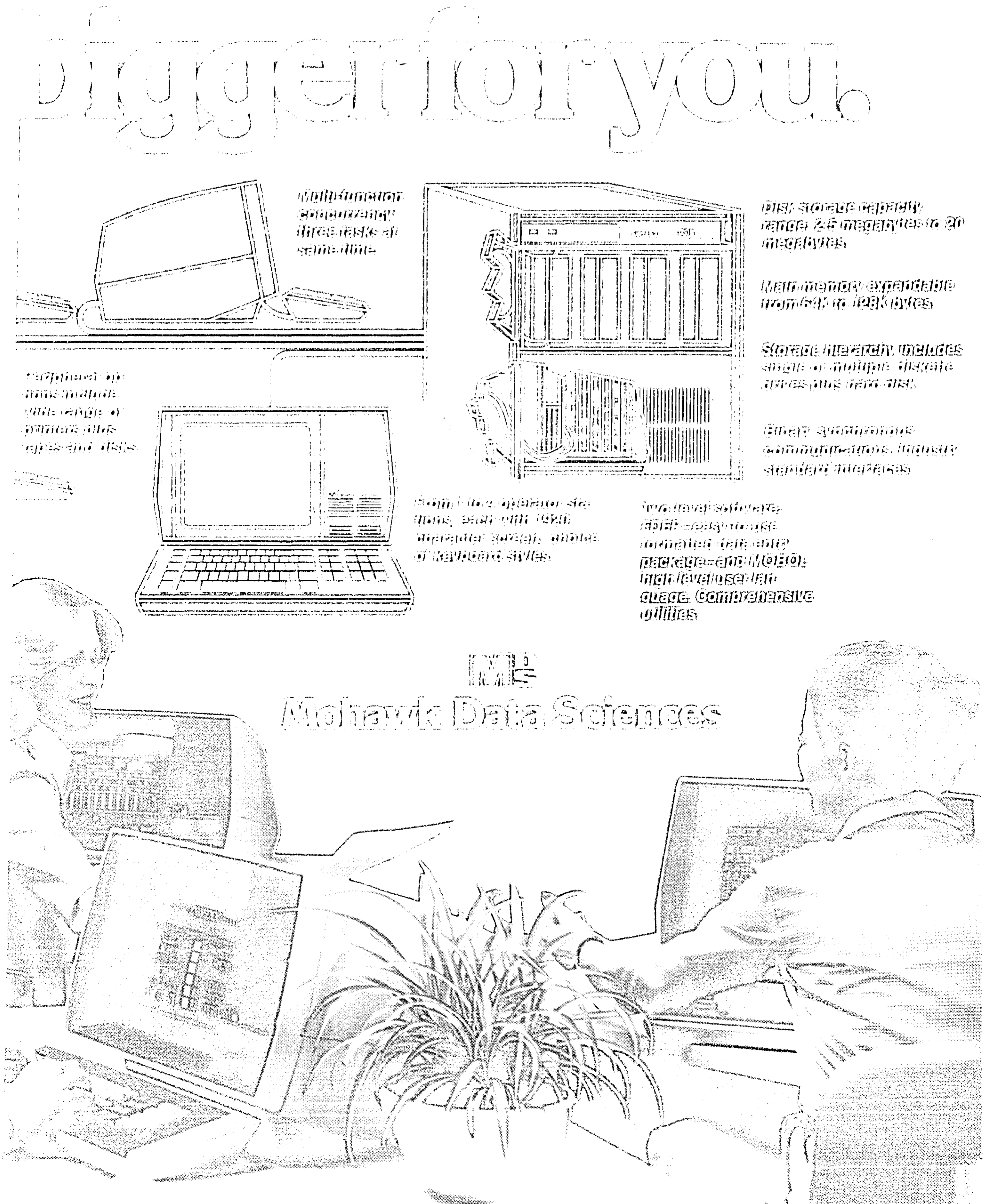




CIRCLE 54 ON READER CARD

Manufacturer	Trans-Lux	Trendata	Trendata	Tycom	Tycom
Model Highlights	Teleprinter	Model 4000	Trendwriter	Models 35/37	Model 38
1st ship/# shipped	12/74 # shipped NG	01/75 2,000 shipped	01/76 1,500 shipped	01/75 # shipped NG	01/71 # shipped NG
Print mechanism	5x7 dot matrix, impact	Daisywheel, impact	7x7 dot matrix, impact	IBM Selectric, impact	IBM Selectric, impact
Print speeds	6.6 or 13.3cps	30cps	10, 15 or 30cps	10 or 15cps	10cps
Terminal types	KSR or ASR	RO, KSR or ASR	KSR or ASR	KSR or ASR	KSR
Character codes	Baudot	ASCII, BCD or Corr.	ASCII (APL optional)	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Character editing only	No editing	No editing	Char editing 37 only	No editing
Compatibility	—	Teletype 33/35	Teletype 33/35	Teletype 33/35; IBM 2741 opt. (37)	Teletype 33/35
Printing		Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	69 cols @ 10/inch	132/158 cols @ 10/12/in	132 cols @ 10 or 16.5/in	132/156 cols @ 10/12/in	132/156 cols @ 10/12/in
Vertical spacing	4.25 lines/inch	6 or 8 lines/inch	6 lines/inch	6 or 8 lines/inch	6 or 8 lines/inch
Forms feed	Friction feed	Friction, pin or tractor	Tractor feed	Friction or pin feed	Friction or pin feed
Other features	—	Std. tab; opt. vertical format; reverse tab; interchangeable fonts	Opt. tab and vertical format	Opt. tab; opt. vertical format (37); 120cps printing via cassette tape	Opt. tab; upper case only and auto CR opt.
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Simplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	66wpm	110, 150 or 300bps	110, 150 or 300bps	110, 150, 300 or 1200bps	110bps
Interfaces	RS232C or current loop	RS232C or current loop	Current loop, RS232C opt.	RS232C or current loop	RS232C or current loop
Parity checking	No parity	Generate and check std.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	2,048-char buffer	1,024-char buffer	16-char buffer	32-char buffer	32-char buffer
Other features	Std. polling/addressing and autoanswer	Std. polling/addressing; opt. autoanswer, modem, and coupler	Opt. polling/addressing and external coupler	Opt. polling/addressing and autoanswer; std. modem and coupler	Opt. polling/addressing and autoanswer; std. modem and coupler
Keyboard	Typewriter with character repeat	Typewriter with numeric pad	Typewriter with numeric pad	53-key typewriter	53-key typewriter
Pricing	$2,195	$4,295-$5,500	$1,995	$2,950/$4,550	$2,350
1-year lease (inc maintenance)	$70/month	$155-$250/month	$97/month	$150/$125/month	$100/month
Comments	Designed for lease on WU Telex network; can be used on leased facilities	Cassette; diskette; storage is avail. as external I/O units; microprocessor-based	Cassette, diskette; storage is avail. as external I/O units; microprocessor-based unit uses DECwriter mechanism	Cassette; Tycom provides applique for customer-supplied IBM Selectric typewriter; 2K-16K memory	Tycom provides applique for customer-supplied IBM Selectric typewriter; 2K-16K memory

Manufacturer	Univac	Univac	Western Union	Western Union	Western Union
Model Highlights	DCT 475, 500 and 524	DCT 1000	Model EDT 33*	Model EDT 35*	Model EDT 300
1st ship/# shipped	07/70 # shipped NG	05/71 # shipped NG	10/70 9,000+ shipped	10/70 1,000+ shipped	05/72 5,000+ shipped
Print mechanism	Type wheel, impact	Type wheel, impact	Type cylinder, impact	Type box, impact	Actuator, impact
Print speeds	10, 15 or 30 cps	10, 15 or 30cps	10cps	10cps	10, 15 or 30cps
Terminal types	RO, KSR or ASR	RO, KSR or ASR	KSR or ASR	KSR or ASR	KSR or ASR
Character codes	ASCII, EBCDIC, A/H	ASCII	ASCII	ASCII	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	No editing	Character editing only	Character editing only	Character editing only	Character editing only
Compatibility	Teletype 33/35	—	Teletype 33/35	Teletype 33/35	Teletype 33/35
Printing					Upper and lower case
Line width	132 cols @ 10/inch	132 cols @ 10/inch	72 cols @ 10 or 12/inch	72 cols @ 10 or 12/inch	75 or 118 cols @ 10/inch
Vertical spacing	6 lines/inch	6 lines/inch	6 or 3 lines/inch	6 or 3 lines/inch	6 or 3 lines/inch
Forms feed	Pin feed	Pin feed	Friction or pin feed	Friction or pin feed	Friction or pin feed
Other features	—	Opt. tab and vertical format	—	Opt. tab; std. vertical format	Opt. tab; std. vertical format
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	110, 150 or 300bps	300-4800bps	110bps	110bps	110, 150 or 300bps
Interfaces	RS232C	RS232C	RS232C or current loop	RS232C or current loop	RS232C or current loop
Parity checking	Generate and check opt.	Generate and check std.	Generate std.	Generate std.	Generate std; check opt.
Buffer	No buffer	Two 160-char buffers	No buffer	No buffer	No buffer
Other features	Opt. polling/addressing, autoanswer, and modem	Opt. polling/addressing and autoanswer	Opt. autoanswer, modem, and coupler	Opt. autoanswer, modem, and coupler	Polling/addressing std; autoanswer opt.
Keyboard	Typewriter	Typewriter	53-key teleprinter with std. char. repeat; opt. numeric pad	55-key teleprinter with char. repeat std.; numeric pad opt.	62-key teleprinter with char. repeat std.; numeric pad opt.
Pricing	$2,592-$7,720	$6,400-$27,745	Lease only	Lease only	Lease only
1-year lease (inc maintenance)	$85-$253/month	$185-$742/month	$54-$130/month (90-day avail.)	$89-$166/mo (90-day avail)	$115-$191/mo (90-day avail)
Comments			*Cassette tape; Teletype Model 33	*Cassette tape; Teletype Model 35	Cassette tape

Manufacturer	Western Union	Western Union	Xerox	Xerox	Xerox
Model Highlights	Model EDT 1200	Model EDT 1232	Model 1700	Model 1720	Model 1760
1st ship/# shipped	05/73 2,000+ shipped	08/77 500+ shipped	1976 # shipped NG	01/78 # shipped NG	01/78 # shipped NG
Print mechanism	Actuator, impact	Actuator, impact	Daisywheel, impact	Daisywheel, impact	7x9 dot matrix, impact
Print speeds	10, 30 or 120cps	10, 20 30 or 120cps	45cps	45cps	200cps
Terminal types	KSR or ASR	RO, KSR, ASR	RO or KSR	KSR	KSR
Character codes	ASCII	ASCII	ASCII or APL	ASCII (APL optional)	ASCII
Programmable?	Not programmable	Not programmable	Not programmable	Not programmable	Not programmable
Editing?	Character editing only	Character editing only	No editing	No editing	No editing
Compatibility	Teletype 33/35	Teletype 33/35	Teletype 33/35	Teletype 33/35; IBM 2741	Teletype 33/35
Printing	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case	Upper and lower case
Line width	80 or 120 cols @ 10/inch	132 cols @ 10/inch	132/158 cols @ 10/12/inch	132/158 cols @ 10/12/inch	132 cols @ 10/inch
Vertical spacing	6 or 3 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch	6 lines/inch
Forms feed	Pin or tractor feed	Tractor feed	Friction, pin or tractor	Friction, pin or tractor	Friction or tractor feed
Other features	Opt. tab; std. vertical format	Std. tab and vertical format; front and rear paper feed	Std. tab, vertical format, and graphics	Std. tab, vertical format, and graphics	Std. tab and vertical format; bidirectional printing
Communications	Asynchronous	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex	Full- or half- duplex
Speeds	100, 300 or 1200bps	110, 200, 300 or 1200bps	110, 150 or 300cps	110, 134.5, 300, 600 or 1200bps	300, 1200, 1800 or 4800bps
Interfaces	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C or current loop	RS232C
Parity checking	Generate std; check opt.	Generate std; check opt.	Generate and check std.	Generate and check std.	Generate and check std.
Buffer	No buffer	1K-char buffer	156-char buffer	256-char buffer	1,280-char buffer
Other features	Std. polling/addressing; opt. autoanswer, modem, and coupler	Std. autoanswer; opt. modem and coupler	Optional coupler	Optional coupler	Optional coupler
Keyboard	62-key teleprinter with char. repeat std.; numeric pad opt.	73-key teleprinter with std. char. repeat and numeric pad	Typewriter with std. numeric pad; opt. 8-char. buffer	Typewriter with char. repeat and numeric pad, 32-char buffer	Typewriter with char. repeat and numeric pad; 32-char. buffer
Pricing	Lease only	$4,600-$4,775	$3,240	$3,450	$2,990
1-year lease (inc maintenance)	$171-$256/mo (90-day avail)	$155-$175/mo (90-day avail.)	$128/month	$138/month	$150/month
Comments	Cassette tape	Cassette tape	Microprocessor-based unit; uses Diablo HyType II printer mechanism	Microprocessor-based unit; uses Diablo HyType II printer mechanism	Microprocessor-based unit

Teleprinter Terminal Vendor Index

For more information about the terminals included in this survey, either contact the vendors directly at the addresses below, or circle the appropriate numbers on the reader service card bound into this issue.

Acrodyne Data Devices, Inc.
1217 Summit Avenue
Union City, NJ 07087
(201) 865-3220
CIRCLE 487 ON READER CARD

Agile Corporation
1050 Stewart Drive
Sunnyvale, CA 94086
(408) 735-9904
CIRCLE 488 ON READER CARD

Alanthus Data Communications
(formerly Leasco)
20030 Century Boulevard
Germantown, MD 20767
(301) 428-0500
CIRCLE 489 ON READER CARD

Anderson Jacobson, Inc.
521 Charcot Avenue
San Jose, CA 95131
(408) 263-8520
CIRCLE 490 ON READER CARD

Applied Computer Systems
615 N. Mary Avenue
Sunnyvale, CA 94086
(408) 733-3733
CIRCLE 491 ON READER CARD

Carterfone Communications
1111 West Mockingbird
Suite 1400
Dallas, TX 75247
(214) 630-9700
CIRCLE 492 ON READER CARD

Centronics Data Computer
Hudson, NH 03051
(603) 883-0111
CIRCLE 493 ON READER CARD

ComData
8115 N. Monticello Avenue
Skokie, IL 60076
(312) 677-3900
CIRCLE 494 ON READER CARD

Computer Devices, Inc.
25 North Avenue
Burlington, MA 01803
(617) 273-1550
CIRCLE 495 ON READER CARD

Computer Transceiver Systems (CTSI)
Box 15
East 66 Midland Avenue
Paramus, NJ 07652
(201) 261-6800
CIRCLE 496 ON READER CARD

Control Data Corporation
Box 0
Minneapolis, MN 55440
(612) 853-4656
CIRCLE 497 ON READER CARD

Data Access Systems, Inc.
100 Route 46
Mountain Lake, NJ 07046
(201) 335-3322
CIRCLE 498 ON READER CARD

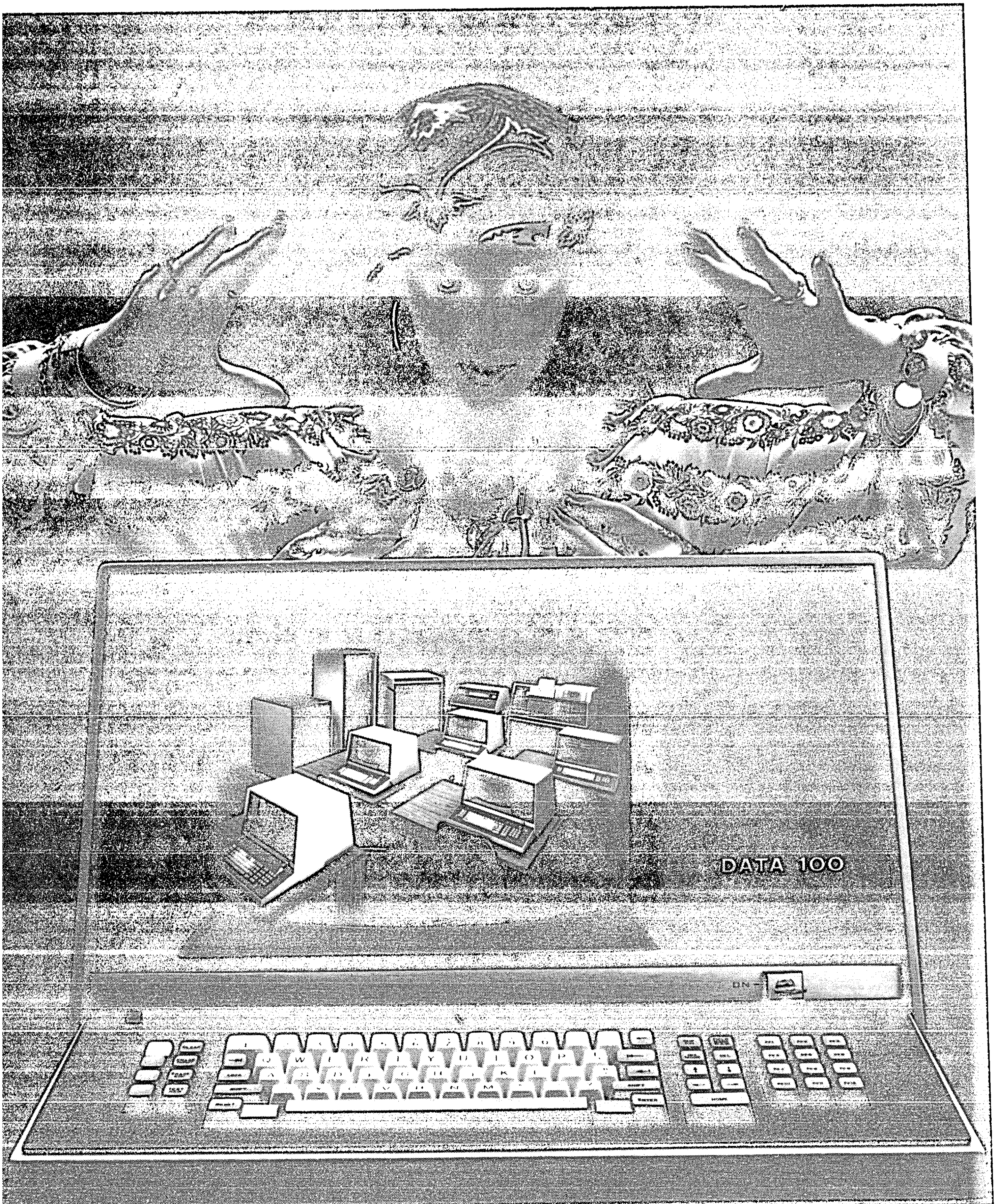
Data General Corporation
Route 9
Westboro, MA 01581
(617) 366-8911
CIRCLE 499 ON READER CARD

Data Measurements Corp.
2300 Owen Street
Santa Clara, CA 95051
(408) 249-1111
CIRCLE 500 ON READER CARD

Data Terminals & Communications
1190 Dell Avenue
Campbell, CA 95008
(408) 378-1112
CIRCLE 501 ON READER CARD

(Continued on page 254)

Look closely.



Very closely at our new Model 85 remote information system.

How many functions do you see?

There are more than meet the eye.

Batch communications and volume data entry should be easy to spot.

And on-line file management and stand-alone processing should be apparent to those who've kept up with Data 100's continuous progress in distributed processing.

But your needs keep growing.

And so does our commitment to fulfill those needs.

Our Model 85 remote information system introduces the functions of remote file management and high level language processing at your remote sites efficiently and economically.

Model 85 is a display based system featuring up to 100MB disk storage, 15 interactive work stations, a multi-tasking operating system and concurrent communications.

For ease of use, two disk based high level languages are available: RPGII and COBOL. With COBOL, a *local* compiler lets you compile programs on your Model 85. And a *cross* compiler allows stronger central site control by permitting you to compile and debug COBOL programs on the mainframe for execution on your Model 85.

The Model 85 gives your network the best of both worlds. The degree of central site control you need *and* remote processing capabilities to reduce communications costs and mainframe processing time.

And the Model 85 can communicate with our other proven Data 100 multifunction data processing products.

Now look closely at *your* growing needs for multifunction data processing.

Then call your nearest Data 100 sales office or one of the numbers listed below.

DATA 100 CORPORATION

multifunction data processing

LOS ANGELES 213/645-4300 • SAN FRANCISCO 415/546-6000 • CHICAGO 312/992-0850 • BOSTON 617/848-6100 • DETROIT 313/358-5065 • MINNEAPOLIS 612/941-6500 • NEW YORK 212/867-6200 • PITTSBURGH 412/391-5425 • HOUSTON 713/784-4130 • WASHINGTON D.C. 703/790-5560 • WOODBRIDGE N.J. 201/634-7800 • ATLANTA 404/455-3895 • ST. LOUIS 314/878-4911 • TORONTO 416/494-0434 • MONTREAL 514/761-5894 • LONDON ENGLAND (05827) 63161 • MELBOURNE AUSTRALIA (03) 267•3544 • FRANKFURT GERMANY 72•04•71 • PARIS FRANCE 630•2144

CIRCLE 37 ON READER CARD

Teleprinter Terminal Vendor Index *(Continued)*

Decision Data Computer Corp.
100 Witmer Road
Horsham, PA 19044
(215) 674-3300
CIRCLE 502 ON READER CARD

Design 100 Corporation
540 Opper Street
Box 578
Escondido, CA 92025
(714) 743-5587
CIRCLE 503 ON READER CARD

Diablo Systems, Incorporated
(A Xerox Company)
545 Oakmead Industrial Parkway
Sunnyvale, CA 94086
(408) 733-2300
CIRCLE 504 ON READER CARD

Di/An Controls, Incorporated
44 Dorchester Avenue
Dorchester, MA 02125
(617) 288-7700
CIRCLE 505 ON READER CARD

Digital Equipment Corporation
Components Group
One Iron Way
Marlborough, MA 01752
(617) 481-7400
CIRCLE 506 ON READER CARD

Extel Corporation
310 Anthony Trail
Northbrook, IL 60062
(312) 272-8650
CIRCLE 507 ON READER CARD

Facit-Addo Incorporated
66 Field Point Road
Greenwich, CT 06830
(203) 622-9150
CIRCLE 508 ON READER CARD

General Electric Company
Data Communications Products
Waynesboro, VA 22980
(703) 942-8161
CIRCLE 509 ON READER CARD

Harris Corporation
Data Communications Division
11262 Indian Trail
Dallas, TX 75234
CIRCLE 510 ON READER CARD

International Business Machines
Data Processing Division
1133 Westchester Avenue
White Plains, NY 10604
(914) 696-1900
CIRCLE 511 ON READER CARD

International Business Machines
Office Products Division
Franklin Lakes, NJ 07417
(201) 848-1900
CIRCLE 512 ON READER CARD

Intertec Data Systems Corp.
19530 Club House Road
Gaithersburg, MD 20760
(301) 948-2400
CIRCLE 513 ON READER CARD

LogAbax
U.S. Division
10889 Wilshire Boulevard
Los Angeles, CA 90024
(213) 477-0494
CIRCLE 514 ON READER CARD

Microdata Corporation
17481 Red Hill Avenue
Irvine, CA 92714
(714) 540-6730
CIRCLE 515 ON READER CARD

MI² Data Systems
1356 Norton Avenue
Columbus, OH 43212
(614) 481-8881
CIRCLE 516 ON READER CARD

NCR Corporation
EDP Products
Dayton, OH 45409
(513) 449-2041
CIRCLE 517 ON READER CARD

NEC Information Systems, Inc.
5 Militia Drive
Lexington, MA 02173
(617) 862-6410
CIRCLE 518 ON READER CARD

Okidata
111 Gaither Drive
Moorestown, NJ 08057
(609) 235-2600
CIRCLE 519 ON READER CARD

Olivetti
500 Park Avenue
New York, NY 10022
(212) 371-5500
CIRCLE 520 ON READER CARD

Perkin-Elmer Data Systems
Terminals Division
Route 10 and Emery Avenue
Randolph, NJ 07801
(201) 366-5550
CIRCLE 521 ON READER CARD

Printer Technology, Inc.
8 Gill Street
Woburn, MA 01801
(617) 933-3510
CIRCLE 522 ON READER CARD

Qume
2323 Industrial Parkway Left
Hayward, CA 94545
(415) 783-6100
CIRCLE 523 ON READER CARD

Randal Data Systems
2807-F Oregon Court
Torrance, CA 90503
(213) 320-8550
CIRCLE 524 ON READER CARD

RCA Service Company
Division of RCA Corporation
Camden, NJ 08101
(609) 779-4129
CIRCLE 525 ON READER CARD

Redactron Corporation
100 Parkway Drive South
Hauppage, NY 11787
(516) 543-8700
CIRCLE 526 ON READER CARD

SCM/Kleinschmidt
Division of SCM Corporation
Lake Cook Road
Deerfield, IL 60015
(312) 945-1000
CIRCLE 527 ON READER CARD

Scope Data Incorporated
3728 Silver Star Road
Orlando, FL 32808
(305) 298-0500
CIRCLE 528 ON READER CARD

Selecterm Incorporated
2 Audubon Road
Wakefield, MA 01880
(617) 246-1300
CIRCLE 529 ON READER CARD

Siemens Corporation
186 Wood Avenue South
Iselin, NJ 08830
(201) 494-1000
CIRCLE 530 ON READER CARD

Telex Terminal Communications
Box 27228
Raleigh, NC 27611
(919) 834-5251
CIRCLE 533 ON READER CARD

Tally Corporation
8301 South 180th Street
Kent, WA 98031
(206) 251-5500
CIRCLE 531 ON READER CARD

Teletype Corporation
5555 Touhy Avenue
Skokie, IL 60076
(312) 982-2000
CIRCLE 532 ON READER CARD

Texas Instruments, Incorporated
Digital Systems Division
Box 1444
Houston, TX 77001
(731) 494-5115
CIRCLE 534 ON READER CARD

Trans-Lux Corporation
625 Madison Avenue
New York, NY 10022
(212) 751-3110
CIRCLE 535 ON READER CARD

Trendata Computer Systems
610 Palomar Avenue
Sunnyvale, CA 94086
(408) 732-1790
CIRCLE 536 ON READER CARD

Tycom Systems Corporation
26 Just Road
Fairfield, NJ 07006
(201) 227-4141
CIRCLE 537 ON READER CARD

Univac Division
Sperry Rand Corporation
Box 500
Blue Bell, PA 19422
(215) 542-4011
CIRCLE 538 ON READER CARD

Western Union Data Services Co.
70 McKee Drive
Mahwah, NJ 07430
(201) 529-1170
CIRCLE 539 ON READER CARD

Xerox Corporation
701 South Aviation Boulevard
El Segundo, CA 90245
(213) 679-4511
CIRCLE 540 ON READER CARD

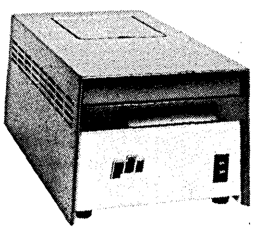
Input to improve data handling output, from Peripheral Dynamics Incorporated

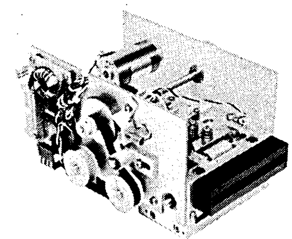
pdIntelligence

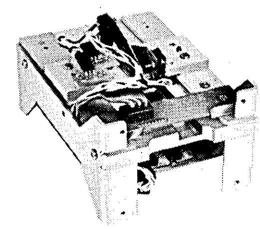
Number two in a series

PDI OFFERS THREE WORK/DATA COLLECTION READERS THAT CAN BE CONFIGURED IN MANY DIFFERENT WAYS

Flexibility in our line is the name of the game. If you use cards or badges in your time/attendance, security/access or work/data collection system, consider PDI. Any one of the three readers described here can be furnished in a variety of configurations, ranging from a complete unit with current loop or RS-232 interface, through to a "mechanism only" unit. And that's just our standard flexibility! To see what else we can do, read "Specials Are Our Speciality."







O-A-T Card Reader

The 100 Series O-A-T (one at a time) Card Readers are miniaturized, self-contained models designed to accept punched hole and/or mark sense cards on a hand-fed basis. They have the dexterity to read data in any format and to process cards from 22 columns long up to any practical length. Key standard features include 50/60 Hz input power, universal power supply (100/115/200/230 volts ac), operation with or without clock track for mark sense reading, and data resynchronization to compensate for misregistered data. These units are compatible with all automatic PDI card readers.

Circle No. 80

Card/Badge Reader

The CB3 Series are designed to be mounted in a data collection terminal or used as stand-alone readers. They accept both standard and mark sense tab cards, as well as type 3 plastic badges—all on an intermixed basis. A reciprocating mechanism in these units permits reading during the insertion and/or the return, thus verifying data. CB3 Series Readers have an operating life of 15,000 hours and a MTBF of 3,000 hours. OEM users have judged them the best in the industry—at any price. Various configurations permit a direct replacement of most other make readers.

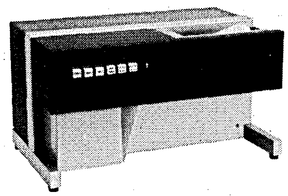
Circle No. 81

Badge Reader

These self-contained badge readers are designed for manual operation and for use as stand-alone devices or mounting in a data collection terminal area. They handle type 5 badges, with or without a plastic loop attached to the badge. A unique feature precludes the possibility of the wrong type of badge from being read, as well as improper badge insertion. A simple latch mechanism engages positively with the reference hole only when the badge is in the correct orientation. The B50 interfaces to most computers, terminals, and other electronic equipment.

Circle No. 82

NEW ADDITION TO OUR CARD READER FAMILY



PDI is proud to announce the 2022 Series Automatic Card Readers, which have been specially configured and priced for large OEM manufacturers with requirements for low speed and low volume card input. With a nominal speed of 200 cards per minute and a hopper capacity of 200 cards, they fill the gap between manual fed readers and medium speed automatic readers. Like other distinguished members of the PDI family, (up to 600 cpm.), this series is UL listed and can read punched hole cards in 80-column formats or mark sense cards (any color) in 40- or 80-column formats, with or without clock track. Delta head models capable of reading both are available. 2022 Series Readers come in table top and rack mounted configurations, have 50/60 Hz input power, and a universal power supply.

Circle No. 83

APPLICATIONS ENGINEERING

Specials Are Our Specialty

In addition to the work/data collection devices described here, PDI makes special units available through a very active applications engineering program. Examples of recent custom-made data input devices are an intrinsically-safe badge reader for use in a hazardous bulk distribution environment, and a special mechanism for handling multi-thickness/multi-width forms for use in the wagering market. If you have a forms handling, packaging, or data logic problem, we can solve it. A call will get things started.

pdi SEE IT ALL IN NCC SHOW BOOTH 4149

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1850 Gravers Road, Plymouth Township • Norristown, PA 19401
Telephone (215) 277-8484 • TWX 510-660-1368

Companies

CalComp's New Look Under Canova

Unprofitable since 1974, it hopes for a turnaround in 1978

George Canova was elected chairman of financially troubled California Computer Products, Inc. (CalComp) on April 7, 1977.

There was speculation at the time that CalComp's banks were going to give Canova a year to turn the company around and would bring in an outsider if he failed. CalComp had had two money losing years and its expensive antitrust suit against IBM had been dismissed. The company owed its four banks, led by Citibank, N. A. $45 million and had missed a $2.5 million debt payment on March 31 of last year.

CalComp has reduced its debt to $38,000,000. Canova last month said the company had reduced its debt by some $5 million over the last six months and that over the last two years it had reduced debt by between $15 and $20 million. "We're reducing debt at the rate of about $1½ million per quarter."

The company has not had a profitable year since 1974 when it earned $9,132,000 on revenues of $130,633,000. This fiscal year, which ends June 30, may just be the turnaround. Following two losing quarters, the company in its third quarter ended April 2 earned $987,000 (including $550,000 from sale of stock in an unaffiliated company) on revenues of $29,833,000, bringing the nine month total to earnings of $318,000 on revenues of $85,448,000.

Canova has been running CalComp since June 1976 when he replaced Lester Kilpatrick as president.

CalComp also last month had reached an agreement in principle on a restructuring of its revolving credit agreement with its four major banks. Under the restructuring, CalComp will get an initial revolving credit line of $40,000,000 until Sept. 29, 1978, with the availability of funds reducing by $1,500,000 each calendar quarter beginning Sept. 30, 1978 and ending at final maturity of the credit on Sept. 30, 1980.

Replaced Kilpatrick

Canova has been running CalComp since June 1976 when he replaced Lester Kilpatrick as president. His election as chairman also deposed Kilpatrick, a CalComp founder, who advanced Canova $1 million in 1968 to help launch Century Data Systems which CalComp completely acquired in 1973.

His has not been an easy job. "We had to take a hard look at what we had going for us and decide what to do from there," he said of his position when he began running the company. One of the things he did, beginning in the fall of 1976, was to reorganize the company into five operating divisions along product lines as opposed to previously used functional groupings. Each division is headed by a vice president and general manager and operates almost as a separate company.

Canova believes this is working well. "Because of the diversity of our product lines, an executive would have to be a superman to be knowledgeable about all of them." He says the reorganization has been morale boosting. "A sailor may hate the Navy and want to get out and still be loyal to his ship or to his unit."

Another thing Canova did was to discontinue manufacture of end user IBM plug-compatible products. "With limited resources available and because of the

The first two of the so-called "West Coast Cases" against IBM to go to trial involved California Computer Products Corp. (CalComp), Anaheim, Calif., and Memorex Corp., Santa Clara, Calif.

Both firms charged IBM with antitrust violations and, in both cases, the litigation grinds on.

CalComp filed its lawsuit in October 1973. It went to trial in a Los Angeles federal court in November 1976. At the end of the presentation of the CalComp case, on Feb. 11, 1977, the judge granted an IBM motion for a directed verdict in IBM's favor. CalComp appealed. Oral arguments are being heard by the Ninth Circuit Court of Appeals this month.

Memorex's case is still in the trial stage. A San Francisco federal court judge in early April denied an IBM motion for a directed verdict and IBM now is taking its turn in court. The defense is expected to take the trial into July.

In the meantime, how are the two companies faring? California Computer Products, where it is today, is covered in these pages. Next month, Memorex.

GEORGE CANOVA
Not an easy job

H. EUGENE BREWER
Every five years

rate they (IBM) were obsoleting them, we decided to put our development resources into graphics and oem memory," said Darrel McCollough, vice president and general manager of the Data Processing Products & Services Div. which, among other things, refurbishes plug compatibles and provides service to the lease base.

Canova said continual selling off of portions of the end user plug compatible lease base with no investment except for sales expense, has made a substantial contribution to the company's debt reduction. He feels this activity has "many years of life left."

H. Eugene Brewer, vice president and general manager of the Graphics Products Div., characterizes CalComp as a company whose major thrust has changed every five years. "The first five years it was military R&D. Then came the golden years of graphics. Next were the plug compatibles. Now how CalComp looks depends on what the customer is."

From the beginning

Brewer has been with the company almost since its inception in 1959. He came out of the Autonetics Div. of North American Aviation as did three of CalComp's founders, Kilpatrick, Eugene Side, and Don Cone. Actual origins of the firm go back farther, to 1953 when Side and Robert Morton tried to bid on a digital plotter contract from Alwac Computer. They didn't get the contract but they did develop a plotter that worked and they sold it to Alwac. But nothing followed and the fledgling company was reduced to Morton operating out of a small shop on Jefferson Blvd. in Los Angeles. Kilpatrick, Side, and Cone began doing free-lance engineering work in Morton's shop prior to resigning from North American to officially form CalComp in '59. When formed, the company's main activity was to be military research and development. "Nobody ever thought about making a living selling plotters," Brewer recalls. But the firm did sell plotters and by 1964, Brewer said, the dollar volume from plotters was as big as from military R & D. In the 1966-69 period, he said, "there was an explosive growth in graphics and the military business went down."

CalComp's last military contract, with NASA for work on the Nimbus satellite, ran out last year.

Canova believes that CalComp now is "beginning a new growth period. We have growth plans for all divisions." His vice presidents and general managers feel this way too.

"This fiscal year there has been a dramatic increase in the number of drum plotters we've been selling," said Brewer of Graphics. His division is an extension of the original commercial part of CalComp's business. It sells four different kinds of plotters, drum and belt bed which CalComp pioneered, classical flatbed and graphics COM (computer output microfilm) units. Brewer said the market for the latter is not as large as for the others but "it's showing a lot of potential now." The division also makes and markets plotter controllers.

> "The first five years it was military R & D. Then came the golden years of graphics."

Only limitation

Brewer said the only limitation to the growth of his markets is "the ability of men to use computing devices." He sees two main barriers, input problems and a lack of understanding of the benefits that can come from computer handling of data. He said market surveys have shown that the most common reason for purchase of a plotter is "some group has a problem it wants to solve. They're doing their thing, turning out lots of plots."

Now he says he's beginning to see companies appointing plotting coordinators. He'd like to see this spread.

Brewer's division employs 575 persons, 85 in hardware and software development, 90 in sales and marketing, 4 in administration and the remainder in manufacturing.

Somewhat larger in terms of employees, just under 1,000, is the oem Memory Products Div., a direct descendent of Century Data Systems. It is headed by Jim Payton who was a vice president of Century Data and is housed in the same building used by Century Data before it was acquired by CalComp.

Payton left CalComp for a time to operate his own third party leasing business. He returned with the divisionalization which "I advocated all along. We have a tremendous difference in products. For economic considerations I consider more is lost by diffusing management attention." His division develops, produces and sells hard and floppy disc memories to oem's. It also is developing and selling control units which allow most of its memories to be attached to minicomputers.

Increased demand

"There has been a tremendous increase in the demand for memory," Payton said. "As we drive prices down we are broadening our application base." The division sells used floppy discs in the hobbyist market for use with microprocessors.

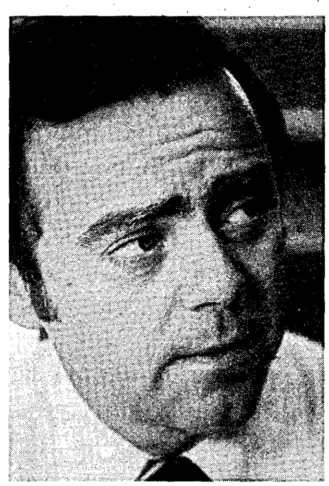
Payton's division has two subsidiaries, Airform Precision Metals, Inc., which produces sheet metal frames and skins for CalComp products and "does a modest amount of outside business," and Transmask, which produces masks for the semiconductor industry.

Payton said his involvement with


FORNATARO


PAYTON


MC COLLOUGH


SECKENDORF

Transmask, a $3 million a year company, "is mostly financial now," but he hopes in the future to use the company as means of getting "more into the custom integrated circuit area."

The OEM Memory Products Div.'s sales force is being beefed up by Payton both with added direct salesmen and a network of sales representatives. He started building the rep network in the fall of last year and it's "adding more revenue than expected."

The division looks to McCollough's Data Processing Products & Services Div. for service for its oem products, usually based on ultimate user contracts.

McCollough's division provides service for all CalComp products from 46 offices and also services customers of other manufacturers. In addition, it markets IBM compatible printers produced by Data Printer, add-on memory for the IBM 370/158 and 370/168, produced by National Semiconductor, CalComp's large Automated Tape Library (ATL), and plug compatible disc equipment.

Not yet

A CalComp product for which McCollough's division does not yet have to provide service because it isn't yet available is the newest product of a division

> He's beginning to see companies appointing plotting coordinators. He'd like to see this spread.

which really isn't a division yet. It's an interactive graphics system, many man-years in development, which will be the entry product for what will become the Interactive Graphics Div. on July 1. The organization has existed as the Interactive Graphics Systems Venture Team since November 1976.

Joe Fornataro, director of Interactive Graphics Systems, introduced the group's first product, the IGT-500 system which enables local control and manipulation of graphic images on a crt, at a design and drafting show in San Francisco last month.

The soon-to-be division also has come up with what it calls the interactive graphics language (IGL). Fornataro describes this as a verb oriented compiler with the power to generate new applications in a very short time. IAG also will show its new system at the National Computer Conference in June in Anaheim.

Canova said he is "bullish" on IAG. "CalComp historically has been a graphics company—the graphics company."

It's more than that. It's an international company and the International Div., under the direction of Paul F. Seckendorf, vice president and general manager, is into more things in some ways than the basic CalComp. Because, as Seckendorf explains, it's important to keep operations in foreign companies as totally national as possible, cash flow must support each individual operation so the division has added non-CalComp equipment to be sold through these operations under the CalComp name. These include a Gould electrostatic plotter and a digitizer made by Digitizer Co.

First thrust

International operations, as an extension of domestic marketing, started some 10 years ago. The first thrust was to establish an office in Amsterdam. Now the company has operating subsidiaries in Germany, England, France, and Italy and is about to convert a branch office in Japan to subsidiary status. The division handles all CalComp products but, Seckendorf said, 65% of international business is in graphics. The division accounts for approximately 25% of CalComp's revenues.

International sells products of other CalComp divisions on a transfer-buy basis. It's kind of an arms-length thing as are most interactions between company divisions.

Canova said he meets individually with each of his general managers at least once a week. He holds staff meetings—himself, the general managers, his financial adviser, and his legal adviser—at least three times each month.

Although he picked his general managers in part for their "entrepreneurial bent," Canova is quick to admit "if there is a disagreement, I win."

Of the original CalComp founders, only Kilpatrick is still around as a director. Canova said he is a "vocal" director. Late last year Morton and Gene Beckman, another founder, retired from the board.

180 openings

Canova likes to point to the fact that we "have 180 openings to fill across the board" as an indication that CalComp is turning around. The company currently has 2,650 employees. Recruitment, Canova admits, is difficult in California's Orange County where real estate is highly inflated and the unemployment rate is at a unique 2%. "But," said Canova, "I'm not committed to keeping all operations in Orange County. We have enough business in Europe to justify a European manufacturing facility and it would not necessarily have to be under International."

One thing CalComp did when the Orange County labor market became tough was to institute a four day work week. It also contributed to cost cutting. Management asked employees if they would consider taking a 10% reduction in working hours and a 5% reduction in pay. "We were asking for 40 hours worth of production in 36 hours," Canova said, "and everyone agreed." The plan has been in effect since last August and apparently has been successful. Canova said he's talked to executives of other Orange County firms trying to recruit and "they can't compete with our four day week."

But his executives don't get off that well. "I took a day off once but I schedule at least half of my staff meetings on Friday." Under the CalComp four day week, Friday is supposed to be part of the weekend. **—Edith Myers**

Plug Compatibles

The Pampered IBM User

Independents court him with less than retail prices

There's no doubt about it. The IBM user is the most pampered lot in computerdom. No one seems to pay much attention to users of other mainframes, some of whom feel ignored even by their own vendor. But look at the IBM user.

He's courted by independent manufacturers of peripheral equipment that is plug-compatible with the IBM boxes he has and needs more of; the boxes made by the independents are cheaper. The number of software houses with programs that will run on IBM machines is legion.

As if all this attention from vendors weren't embarrassing enough, the IBM user is now being wooed by manufacturers of mainframes that are both software and plug-compatible with comparable IBM mainframes. Again, the prices being quoted by the independents are enticingly attractive. Like, why pay retail?

Within the last 30 days, a couple more makers of IBM-compatible computers announced their entry. One has a minicomputer with approximately the power of a 370/138 that will run 370 operating systems, including VS. This company, called Two Pi Corp., is a wholly owned subsidiary of the large Dutch conglomerate, Philips.

Then there's National Semiconductor, makers of the AS/4 and 5 computers being marketed by Itel Corp. National, which is now shipping more IBM-compatible computers than anyone else—IBM excepted, of course—earlier this month announced still another processor said to be more powerful than a 138 but at less than half its price. And this time National will sell to the end user.

But that's not even the end of it. The Series/1 minicomputer that IBM announced and began shipping in November 1976 has become the darling of the minicomputer systems houses and software companies. With help from IBM, these independent firms can be expected to start offering significant capabilities, initially for large end users.

For disc management

One such capability that IBM reportedly has but isn't publicizing or marketing is the use of Series/1s to perform the

JARED A. ANDERSON
Two Pi's president is mum about prices, estimated at 60% of IBM's

job of disc management. Here, one or two S/1s are set between two large 370s, just relaying files to a 370 as requested, the minicomputers having sole access to an entire bank of disc drives. A second capability is a network of S/1s communicating with an IBM 3705 front-end processor.

Still to be heard from is Magnuson Systems Corp., known to be preparing a 370 software-compatible computer in the 148 range, again at appealing discounts from IBM's price.

Earlier this month, National Semiconductor announced its entrance into the systems business with the System/400, a 370-compatible, microprocessor-based computer that is said to have 50% greater speed than a 370/138 but at approximately half its price. It will run IBM's DOS/VS and VM/370 operating systems without modification, and can be configured with up to 16 megabytes of main memory—4MB in the single base cabinet shown.

The 138, of course, is restricted to a maximum of 1MB, and the latest price seen on that cpu was $333,600, reduced recently from $405K. By comparison, National offers the cpu, half-meg, two I/O processors, four peripheral adaptors, console and associated service processor, plus a 200MB disc, 120KB tape, and floppy disc for loading microcode—all this for $165K. It sounds like the kind of offer one gets only on television commercials shown after midnight.

But the people behind this offer are the same ones who make the AS/4 and 5 mainframes being sold and installed by Itel Corp. National says it now is shipping more IBM-compatible computers than anyone else, and it further claims to be shipping more megabytes of memory systems than anyone else except for IBM. The company, which closes its fiscal year at the end of this month, should be reporting revenues of almost $500 million. Some 70% to 75% of that will come from the sales of semiconductor components, the remainder from the Itel mainframes, add-on memories, point-of-sales systems, and such consumer products as calculators. The percentage from systems is expected to increase.

The IBM Series/1 minicomputer has become the darling of the minicomputer systems houses.

Systems first

"We feel the semiconductor technology is driving us in the direction of the integrated manufacture of data processing systems," says National president Charles E. Sporck. "It is no longer possible to design useful semiconductor components without designing systems before you design the components" because the interrelationship is so strong, he adds. "So we are announcing our entrance fully into the systems business."

Giving them a running start in this direction is the fact the company already has service offices in 20 cities, staffed by some 250 people, all this stemming from its having shipped more than 13,000 POS terminals to the nation's supermarkets. Thus it has spare parts centers and the nucleus of a service staff that now must be trained to service the S/400s and other systems that National can be expected to introduce in a piecemeal fashion. (Likely candidates yet to be announced are a mini with about the power of a Digital Equipment Corp. PDP-11/70 and perhaps a megamini competitive with the HP-3000, VAX 780, and the like.)

National, which has scheduled initial shipments in the first quarter of 1979, is looking to sign up oem customers, in addition to selling directly to the end user. An Itel spokesman, asked if they too might be handling the S/400, said, "We're still looking at it."

Two Pi's V32

Like National Semiconductor's offering, the Two Pi machine is also software-compatible with the 370 and is said to be equivalent in performance to a 138. The so-called V32 will also run in the virtual mode and makes extensive use of firmware. But unlike the S/400, the V32 is limited to four megabytes of main memory.

Two Pi, formed three years ago and acquired by Philips about 18 months later, says it will not market to end users but rather to oem's and service bureaus. Indeed, the V32 was seen last month in these pages (p. 186) as the 3200 series being offered by National CSS, the Wilton, Conn., computer services firm. Two Pi president, Jared A. Anderson, would not disclose prices of the 32-bit minicomputer but said end-user prices should bear discounts similar to those applying to plug-compatible peripherals supplied by the independents. It's understood the suggested end-user price for a 1MB, 4-channel V32 is $190K, which appears to be about 60% of IBM's price.

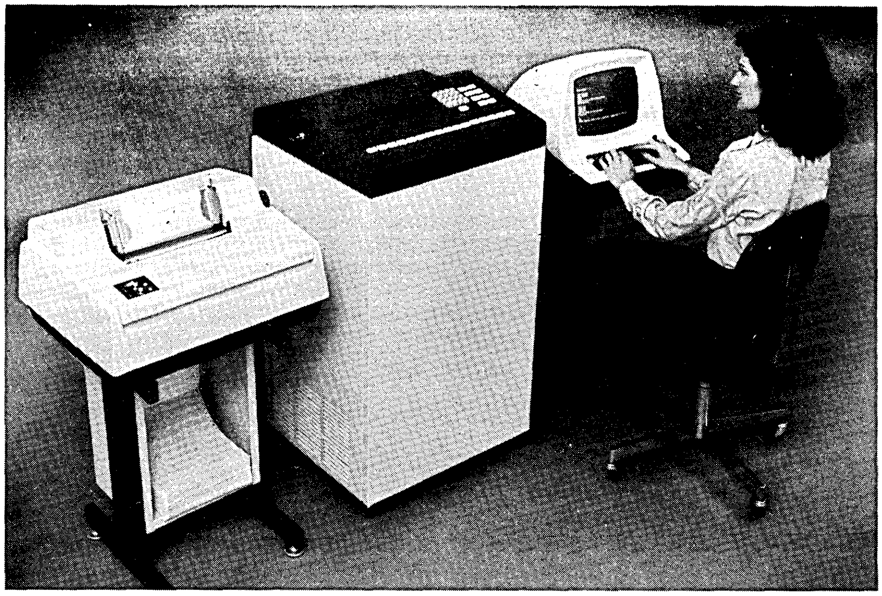
Anderson, formerly vp of research and development at Computer Machinery Corp., was earlier a founder and president of Decision Inc., an Oakland, Calif., manufacturer of peripherals for Data General minis. And many of his officers and cofounders at Two Pi were with him at Decision Inc., which was acquired in 1974 by Ball Corp. and subsequently renamed Ball Computer Products.

Controllers next

Anderson, whose PhD is in physics from the Univ. of California at Berkeley, says next year Two Pi will have a range of controllers that will allow the use of minicomputer peripherals. That will bring costs down, he says, and produce about a 2:1 price advantage over IBM. The V32 is housed in a refrigerated box, which eliminates the need to operate it in an air conditioned room. First production models should be available along about August, but quantity shipments are not due until next year.

Two Pi's computer is housed in a refrigerated box, which eliminates the need to operate it in an air conditioned room.

One of the obvious uses of these lower-priced computers from an independent is as a remote processor in a distributed processing environment. Having the ability to run programs that also run on the large 370s at the central site means that dp management might be able to control the programs that run on those



TWO PI's 32-bit minicomputer has minicomputer architecture internally but uses IBM 370 software and operating systems.

remote processors. All programs can be developed at, and downloaded from, the central facility, for example.

The scenario, then, would have IBM retaining account control at corporate headquarters, site of the central dp installation filled with large 370s and 303Xs, while the independents become suppliers of minis and small computers at regional and branch offices of those organizations. Certainly with this ability to produce a plug-compatible mini and mainframe at half IBM's price becoming so widespread, one must begin to wonder what IBM can do about it.

Not to worry.

A recent study of this situation shows one tack being taken by IBM. This is to make a Series/1 minicomputer such an attractive processor that oem's of whatever bent can fashion from it the answer to the prayers of every large 370 user. The Series/1, introduced in November 1976 as a barebones box with minimal software, can now be had with three IBM-developed operating systems. Included is a real-time system that supports PL/1 and FORTRAN. And some time this year IBM is expected to introduce a COBOL version of the mini, code-named Orbit.

Huge commitment

"The most impressive thing—perhaps scary thing—is the fact that IBM is committing so much in terms of resources to the Series/1," says an analyst at SBS Publishing, San Jose, Calif., which recently produced the study, "IBM Series/1—User Experience." Three operating systems in 14 months is no small accomplishment, he explains. And while a number of oem's are making a serious effort to direct-connect the S/1 to a 370, thus making it possible to provide a very fast file update capability, for example, IBM has already accomplished this, the analyst says.

IBM is about to bury 370s within a cluster of Series/1s.

"Several IBM sources have hinted to me that what IBM is going to do is develop a virtual management system for the Series/1. Also a TSO system for the Series/1, and a programmer workstation. And these will sit around the 370."

The researcher sees this type of effort as a defensive measure by IBM against the PCM's. Preparing for the day when scads of outfits will be able to supply low-cost, software-compatible computers, he believes IBM is about to bury 370s within a cluster of Series/1s. At that point, the 370 becomes as dependent on the S/1s as the minis are on the large mainframes. And now the PCM must replace not only a 370 but rather five machines—the 370 with four S/1s around it. And those five machines now have very sophisticated capabilities. "It becomes a very complicated thing to justify," the SBS analyst says.

It is into this cauldron that enterprising new companies are venturing. The excitement they are experiencing can also be shared by the casual observer, for their success would bode well for the industry and the user. But oh, what a witches brew they must contend with.

—Edward K. Yasaki

Security

Privacy: A Political Issue

That's the way some speakers looked at it in Phoenix meeting

Jerome Lobel, manager, Computer Security and Privacy, Honeywell Information Systems, called Honeywell's Computer Security and Privacy Symposium in Scottsdale, Ariz., last month "an international meeting."

The symposium, Honeywell's fourth, attracted a record attendance: 170, up 53% from last year, from six nations, 26 states, 87 business organizations, and 44 government agencies.

Certainly the concerns seemed to be international. Heading the list was concern over transborder data flow problems. "The transborder data flow issue is largely a political one and the final outcome will be based largely on the political environment," said Hugh Donahue of Control Data Corp. "The individual human right to privacy has been the vehicle to bring transborder data flow to a focal point but considerations in the economic, political, cultural, and technical areas need to be put on the table."

He ticked off some happenings that have been pushing the issue to the fore.

"The new French federal law on privacy requires that any firm operating phone-linked information processing systems and sending information by whatever means from the country must register with the National Commission of Data Processing and Freedom.

All airspace

"Colombia has declared that it controls all the airspace of its territory thereby setting itself in a position to decide which information may be sent into or collected from that airspace.

Nationalism and protectionism are the real European motives for restricting transborder data flow.

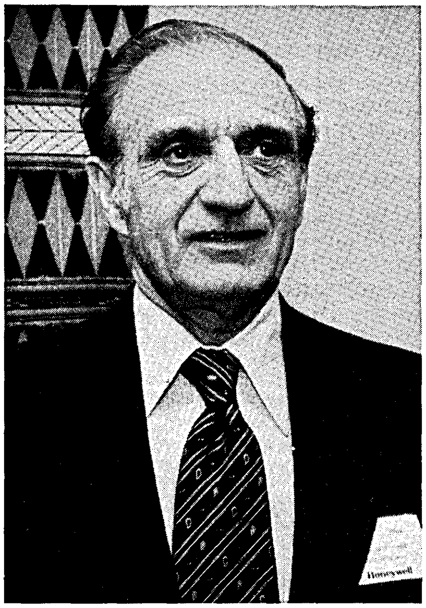
"Some of the Canadian provinces have restricted the transmission of credit data across their borders.

"The Swedish Data Act of 1973, the first such law, requires that the Data

Inspection Board approve the export of files or personal data.

"The developing countries are intending to prevent satellites from gathering data from their countries, such as that obtained by Landsat on crops and drought.

"And in Spain, there's a new wrinkle," Donahue said. "If you want to move a data file across the border you have to deposit dollars in an escrow account before you do it."



DAVID LINOWES
". . . a shocking absence"

As one country compares its national law to its neighbors, he said, "the transborder data flow issue arises instantly . . . If certain restrictions are placed on data within a nation and the files must be kept within that nation, it naturally promotes the establishment and growth of its own national data processing industry."

Surprise speaker

A surprise, not-on-the-program speaker, Knut Selmer, professor of law, Oslo Univ., Oslo, Norway, picked up on this note. "Motives are always mixed," he said. Nationalism and protectionism are the real European motives (for placing restrictions on transborder data flow). Many countries welcome restrictions because they profit from them. Don't blame them. Consider if IBM were a European company."

Both Selmer and Donahue referred to the "privacy umbrella" covering the issue of transborder data flow. Neither attempted to define privacy. Others tried and attempted as well to define security, the symposium's co-topic.

Lobel called them "twin subjects." Ralph Busch, senior market analyst, Honeywell Information Systems, said privacy is an individual's right to self determination of what information about him is collected while security is protection of hardware, software and data from destruction, disclosure, modification and denial of service. Dewey Manzer, a Honeywell vice president, said privacy is an attribute while security is a mechanism.

Donahue offered some advice for those who have not yet become interested or involved in privacy and the transborder data flow issue. "Become involved. Members of a multinational corporation must be sensitive to the fact that an adverse conclusion to this issue could effectively result in closing down business in many countries. At best, costs will increase compared with competitive corporations operating solely within that particular nation.

Privacy is the first means by which control and regulation will be placed on the data processing industry.

"Gather facts about abuses and the amounts of transborder data flow. We need to scope the problem.

All kinds of files

"The protection and security of private information should be applied to all kinds of files, not just those that are kept within computers and data processing systems. After all, it is human beings who invade the privacy of other human beings and not the computer itself.

"Each individual within the industry must act responsibly in his own operation. There is a tremendous force of public interest in the privacy issue and each person in the industry, in using the products of the industry, must act responsibly or severe federal laws and regulations will be placed upon private industry. Privacy is the first means by which control and regulation will be placed on the data processing industry. Transborder data flows represent an international expansion to such potential control and regulation.

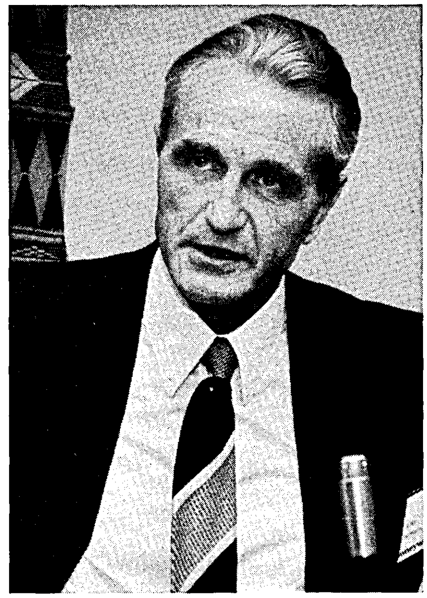
"Urge that the protection and security of data files be comensurate with the sensitivity of the data. Omnibus legislation which would apply a high level of security to all information is wasteful and unnecessary.

"Take a position for free flow of information. Information and service products are commodities of value. These products, under control of the producer, should be able to flow freely across borders without tariffs, nontariff barriers, and other restrictions.

"Lobby Congress to pass laws to assume federal jurisdiction over privacy issues. Last year, over 400 bills were introduced in state legislatures. Some 66 were passed. The situation in the United States could become the same patch quilt of Europe with dissimilar privacy laws unless a strong federal jurisdiction allows a harmonized atmosphere in which we all may operate."

Shocking absence

David L. Linowes, chairman, Federal Privacy Protection Commission, took a somewhat different view of state legislation. He called the absence of privacy laws at the state level "shocking." He said the very fact that his commission was established is a good sign. "Never before in history has the government gotten together a group of citizens to guard against a potential problem before harm is done. We don't have to wait as we did with automobiles to be suddenly faced with the problem of curing pollution."



KNUT SELMER
A surprise speaker

He said the majority of executives called to testify before his commission seemed initially to feel, "we're respectable executives and you're wasting your time." He said 99% turned to a "we didn't even think of that" attitude when questioned about potential abuse of sensitive data about their companies. One question he said was asked was, "Can foreign companies obtain such data and use it to acquire control?"

Thomas K. Welch, assistant director, Intercep, talking on "Electronics Communications Protection," also touched on the awareness problem. "Crimes involving data communications," he said, "require the theft or misuse of information first. Before further manipulation or specific information theft takes place, dial-up codes, ID codes, passwords or other necessary data to accomplish the crime through a dial-up or dedicated system are required. The importance of such information is often underestimated until put into perspective." He gave an example. "Swiss banks use timesharing computer services in the United States over satellite circuits. Their data may be taken from terminals anywhere in the world by knowing the passwords protecting it."

Preventive procedures

He said a variety of active and passive countermeasures equipment is available to the private sector. "An orchestrated combination of selected equipment, examination team personnel, and preventive procedures offer a potent deterrent force when coupled with access control measures and user identification procedures." But, he said, without security consciousness, all the countermeasures

New procedures must be developed and installed to deal with the processing of computer-related crime cases.

in the world will do no good."

But lack of consciousness is not the only problem. Timothy A. Schabeck, Seidman & Seidman, talking about "Computer Crime Investigation," said chances of a person caught at a computer crime going to jail are one in 33. "Most companies don't want their stockholders or their customers to know (about the crime)."

Susan Nycum, an attorney with Chickering & Gregory, San Francisco, agreed. "Computer abuse is like death. It's ok to talk about it in the abstract, but don't get too close. It's the it can't happen here syndrome."

Schabeck told of big payoffs in computer-related crime. "In 1976, the average bank robbery netted \$1,800 while the average computer-related bank embezzlement netted \$1,500,000. Computer crimes that have been reported are responsible for the loss of over \$100,000,000 annually in the U.S. It has been estimated that 85% of all 'white collar' crimes are not reported."

Wants new laws

He advocates new laws. "Our national justice system which tends to deal so lightly with the overall problem of white-collar crime should be reviewed for its effectiveness in handling this type of criminal. New procedures must be developed and installed to deal with the processing of computer-related crime cases."

Dwight Catherwood, Ernst & Ernst, would have companies review their contingency plans. He told of one company whose plan "was simply a three-page write-up explaining why a disaster could not occur there." Another, he said, "operated under the 'chapel plan.' They prayed it wouldn't happen there."

Phillip L. Schiedermayer, president, Profitect, Inc., decried government restraints on pre-employment screening. "We have a national blindman's buff of personnel selection." He urged security people to get the personnel manager reinvolved with hiring along with operations people. "Get them to go back to long, in-depth interviews. There aren't very many other things left."

There are a variety of ways to convince management of the need of security methods. Ira Gottfried, president, Gottfried Consultants, Inc., told how his firm convinced one bank. "We asked for a week to steal as much as we could. Every evening we stole \$1 million. Every morning we returned it. Each day we used a different method. The first day it was dial-up to the on-line system. The second day we snuck in through some construction and substituted deposit cards. By the end of the week they had totally revised their security."

—Edith Myers

Antitrust

Cary, Kennedy in Secret Meeting

IBM chairman Frank T. Cary and Sen. Edward M. Kennedy (D., Mass.) held a secret meeting in Washington only a few days after Kennedy, addressing the Computer & Communications Industry Assn.'s Fifth Annual Caucus, had blasted the IBM antitrust trial as a "sideshow" and called for interim relief in the case.

The meeting, which was held in a Washington hotel March 10, was initiated by Cary, who personally wanted to

Cary sought to challenge a number of statements Kennedy had made in his keynote address.

rebut a number of points Kennedy had made in his hard hitting speech, Washington sources say.

Kennedy, chairman of the Senate Antitrust and Monopoly Subcommittee, told CCIA members that an increasing number of computer companies were being driven out of business, or were experiencing problems bolstering market shares or finding necessary capital for expansion, because of IBM's dominant position in the industry.

He also endorsed a CCIA recommendation that the Justice Dept. seek interim relief in the IBM case, and asserted, "The IBM case has become a sideshow attraction for those concerned with effective and efficient antitrust enforcement."

In his meeting with Kennedy, which Washington sources describe as "low key" and "cordial," Cary sought to challenge a number of statements Kennedy had made in his keynote address. He presented the Senator with a point-by-point position paper prepared by his staff and a chart apparently designed to point up that, rather than being driven out of business, a number of computer companies were, in fact, flourishing and gaining an increasing share of the market.

Included on Cary's chart were Digital Equipment, with annual revenues listed as just over \$1 billion; Itel at \$400 million; Data General, \$254 million; Amdahl, \$188 million; Data 100, \$138 million, and Four Phase at \$88 million.

Reportedly, Kennedy's office later had the chart replotted to juxtapose the growth of these companies against IBM's \$18 billion plus annual revenues, which were not shown on the original.

Won't ask for relief

Significantly, a month after the meeting, Assistant Atty-Gen. John H. Shenefield announced the Justice Dept. won't ask for interim relief, although he said he thought it had good reason to seek it. He said the Justice Dept. was foregoing interim relief in the interests of expediting the trial which began May 19, 1975. IBM's Cary said, of the Shenefield statement, the Justice Dept. decided not to seek interim relief because it concluded that interim relief was not justified.

SEN. EDWARD M. KENNEDY

While the IBM camp may be concerned with Kennedy's increasing involvment in the antitrust case, the Justice Dept. is applauding his efforts. Shenefield lauded Kennedy's interim relief endorsement, and Justice representatives have been working behind the scenes to supply Kennedy's office with additional data on the IBM and AT&T cases, Washington sources assert. In effect, then, the Massachusetts senator has emerged as a key figure in one of the most important questions now confronting the computer industry.

—L.M.

Communications

The Money and Resources

That's what NTIA has, despite a lot of Washington grumbling

"Shipping the Office of Telecommunications Policy over to the Commerce Dept. is like depositing it very silently and efficiently into the nearest garbage can." This potentially prophetic pronouncement, made seven months ago by one garrulous government watcher, still echoes in the ears of even the most zealous government revampers. For it was President Carter's retinue of reorganizers which had targeted the eight-year-old White House telecommunications office for a spin off into Commerce—a move which has raised the ire as well as the hopes of communications supporters both in and out of government.

Declares one vocal former OTP'er: "The reorganization plan as it was applied to telecommunications and information issues was a mistake." Another Capitol Hill critic is even more blunt: "Unfortunately, Carter's political objectives overrode good policy." What both of these outspoken Administration debunkers share is a firm belief that the office should never have been moved out of the Executive Office of the President. And they're not the only ones who think this.

The reorganization drive that culminated in the recent creation of a born-again OTP began right after Carter took office. Other attempts to push the hapless agency into DOC's lap had proven futile during the Ford Administration. And that's mainly because Congress had put the heat on, forestalling any efforts to dismember the office, then headed by acting director John Eger.

However, no massive Congressional campaign was launched this time to try to thwart Carter's plans to shift the telecommunications authority over to DOC, although several key Congressional leaders were, and still are, skeptical about the reorganization move. So the new son of OTP, born at the end of March, has a new home in the Commerce Dept. and a new name—the National Telecommunications & Information Administration.

A broad goal

Combining forces with the already established Office of Telecommunications (also part of Commerce), NTIA has a broad "overall goal" of "helping to insure that the American public, industry, and government receive the full benefits that our national telecommunications and information system can provide, and are protected from major adverse effects in the development of that system." All agree that this is a laudable if somewhat obscure objective which implies solutions to many sticky technological, economic, and social issues which may prove hard to tackle.

In attempting to fulfill this far-reaching mandate, NTIA has set itself up as "a permanent focal point" for long-range telecommunications and information policy development. What that means in terms of day-to-day work is that the new OTP offshoot will be cranking out a lot of studies—both in-house and out-of-house (see following story).

> The document makes no real mention of exactly what NTIA's information policy responsibilities will be.

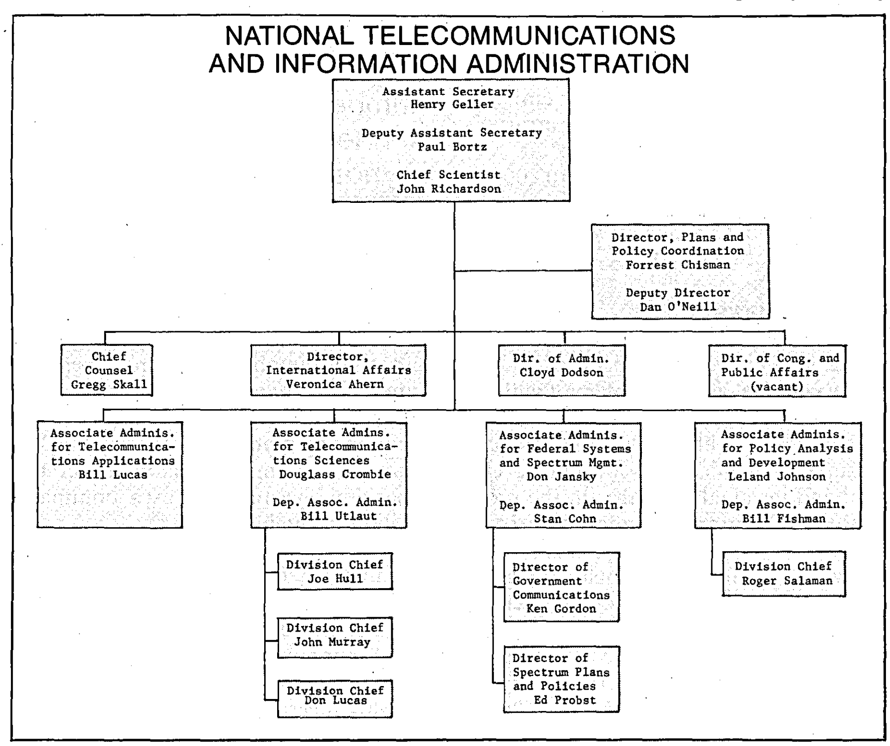
More than just a study group, NTIA will also serve as a key adviser on computer-communications matters, making policy recommendations when appropriate. Former Federal Communications Commission general counsel Henry Geller as the new Assistant Secretary of Commerce for Communications & Information will head the office and will act as principal adviser to the President on telecommunications.

All this sounds typically bureaucratic, leaving government watchers free to speculate on what if anything the NTIA will accomplish. Right now doubts and optimism seem equally mixed over exactly how effective NTIA will be—or will be allowed to be. The executive order creating NTIA, the battleground for various agencies fighting to protect their authority in certain areas, went through six major drafts, all of which, including the final version, have stirred controversy.

These bureaucratic battles, comments one former top OTP official, were "inevitable. It was unfortunate," he laments, "that it was permitted to happen. But it doesn't cripple it (NTIA) unnecessarily. It just puts it a half step back from the kind of full force that it might have had."

Another former OTP'er is less optimistic and refutes contentions that the executive order will not preclude NTIA from getting into areas not specifically spelled out. "Some people argue that NTIA can do whatever it wants. Politically I think that's bullshit. If the only way you can generate authority to do something is to go through a cumbersome legalistic hair-splitting reading of the chicken's entrails . . . you're going to get blown out of the water. So the words in that executive order are critically important."

A close look at those "critically important" words in the March 27 order reveals some of the reasons why disgruntled OTP supporters have expressed concern over the new office's authority. For one thing, the document makes no real mention of exactly what NTIA's information policy responsibilities will be. It also appears to delegate international policymaking



chores almost exclusively to the State Dept.

Information policy

Greg Skall, one of the many former acting general counsels at OTP and now chief counsel designate at NTIA, explains that NTIA's information policy functions were "already adequately handled by OTP's executive order." He points out that these derivative duties were mandated by giving OTP general policy development authority and charging it (now NTIA) with conducting studies and making recommendations on "the impact of the convergence of computers and communications technology." The inclusion of the key word information in Geller's title as well as the new office's title, he adds, also indicates that information issues will definitely not be overlooked by the fledgling federal policy group.

And to prove this, Geller himself firmly committed NTIA to work in this important area, outlining the thrust of the office's new integrated information policy program in a speech last month at an Information Industry Association conference in Washington. As described by Geller, the program, to be headed by Art Bushkin, former staff technical adviser to the Privacy Protection Study Commission, will focus on three main issue categories: issues surrounding the impact of information systems technologies; issues concerning information systems policy implications; and the

"Not only do we not know the answers, but we are still learning which questions to ask."

economic, political, legal, and social issues reflected by the use and misuse of information. As part of this final category, the office also will be scoping the information industry which has spawned many of these crucial concerns.

As examples of some of these information policy targets, Geller specifically cited the economic policy questions raised by the transborder data flow controversy and issues such as information access and value and the role of the public vs. private setor.

Geller seems anxious for NTIA to plunge into all of these pressing information policy issues. And as the group's activities in this area begin, he acknowledges that there will be redirections in the program's focus. "If there's anything that we can be certain of," he insists, "it's that (our) view will change. For not only do we not know the answers, but we are still learning which questions to ask."

In the general policy area, NTIA'ers report that their first priority will be to concentrate on domestic common carrier problems.

$12 million budget

The DOC has turned into Congress an earmarked budget request of around $12 million for the coming fiscal year for NTIA. The staff ceiling is close to 260. Both in terms of money and manpower, these resources represent a sizable boost compared to OTP's significantly smaller workforce and budget which last year was $8.5 million.

Yet even with this operating muscle, observers are still uncertain whether OTP's new offspring will have the clout and credibility that the old understaffed and underfunded OTP had. Former OTP acting director John Eger views the office's White House split off as a mixed blessing. "On the negative side," he points out, "it (NTIA) loses its stature and its visibility and is seen . . . as a lesser entity than OTP."

And appearances, Eger is quick to emphasize, are crucial in the bureaucratic backwaters of Washington, D.C. "Appearances," he adds, "are important because the executive branch really turns on how you're perceived in your relationship to the President—how close you are to him."

But Eger, as well as other OTP'ers, is the first to admit that his "access to the man" was more theoretical than practical. Which means he had to go through a lot of back doors to get OTP's views aired in the Oval Office. And sometimes he couldn't even get in through the back door. "A lot of battles," he now candidly admits, "I had to fight alone."

Still without the aura of the White House, Congress in particular worries how the "downgraded" Cabinet-level office will interface with some of the feistier federal fiefdoms. Reasons one subcommittee staffer, "We've (Congress) always thought it (OTP or any equivalent entity) should be in the executive office because at least there it had a little extra help when it went into these other agencies. And (NTIA) just isn't going to have that. When it goes to the Defense Dept., for example, DOD will just tell it to go to hell."

Expects support

Skall claims that if such a sticky situation arises and NTIA is right, then the new office is "going to need and expect the support of the Office of Management & Budget, the Domestic Policy Staff, the Office of Science & Technology Policy, and the National Security Council." NTIA, he adds, is counting on, and even now getting, support from these agencies and others.

This support, Skall insists, is crucial to the survival and success of NTIA. "If the organization (NTIA) is given proper support," he affirms, "then it could be very effective. . . . The combined resources of OT and OTP together in one organization make for a much stronger office. As Henry (Geller) likes to say, it's more than the sum of its parts."

Says Eger, "it's more than half a loaf." Skall responds to that by saying, "We don't know whether it's a full loaf yet or not. I think the proof will be in the pudding."

Got to go slow

Some government insiders speculate that the proof in that pudding will not really be known for another year. Predicts one source who sees NTIA laying low for a while: "I don't expect Geller to flail about and make a lot of statements. I think it would probably be wrong for him to do that because he'd just be inviting a fight early on. . . . What he's got to do is go slow, do some serious studies so that when the products start coming out they look good, they're thorough and responsible and address real concerns."

Another former OTP counsel agrees with this scenario but cautions that the new office could be in trouble if it holds back too long. "There's a push on within NTIA," he acknowledges, "to first get a reputation for excellence—to really push hard to make sure that everything is well worked out before it goes out. But if NTIA lays low for a year, given the things that are breaking now, when it finally surfaces everybody will be saying 'NTIA, what's that?' "

Former OTP acting director John Egér views the office's White House split off as a mixed blessing.

What NTIA is today is an office reconstructed out of the smoldering ashes of OTP. It's also an office that's scrambling to get on its feet so that it can get on with the important work of forging national telecommunications and information policies. And it wants to succeed.

One key to that hoped-for success may lie in the office's upgraded resources. At least that's what one optimistic OTP'er-turned-NTIA'er is banking on. Making a very unbureaucratic analogy, he quips: "It's like having an ugly girl walk down the street. She may be the nicest person in the world, but nobody's going to look at her. You get a pretty girl walking down the street and she may be a lousy person, but everybody's going to look cause she's got it. And at last we've got it. We've got the money and resources. So as far as I'm concerned, we have everything we had and more."

—Linda Flato

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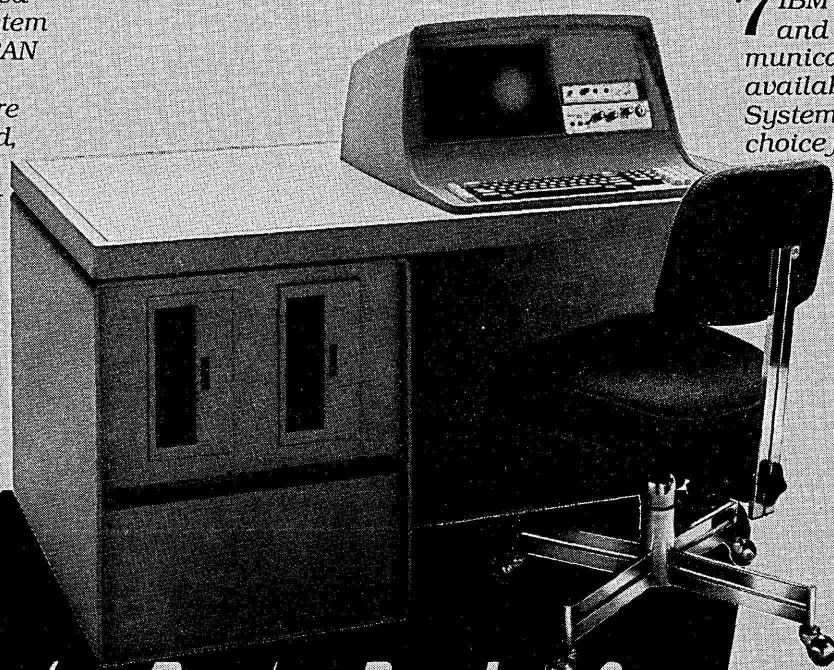

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CIRCLE 18 ON READER CARD

Plan for 60 Projects

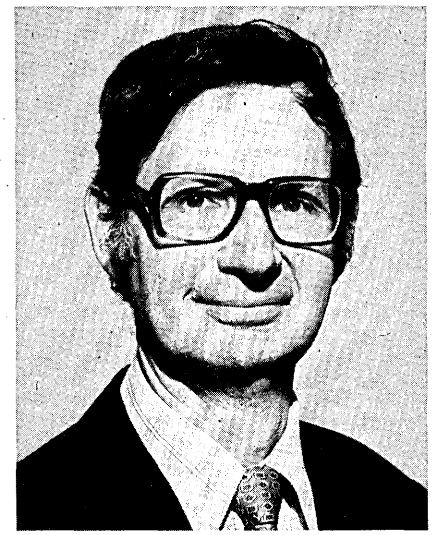
Among them are a rural telecommunications demonstration

A rural telecommunications demonstration, using satellite or terrestial circuits, is among 50 to 60 projects which the newly formed National Telecommunications and Information Administration (NTIA) plans to launch within the next year.

A teleconferencing demonstration is another one. Possibly it will include an electronic mail service for government agencies.

NTIA director Henry Geller and his deputy, Paul Bortz, discussed these plans last month in an interview held shortly after the Carter Administration issued its much-amended executive order establishing the new agency within the Dept. of Commerce.

Geller, former general counsel of the Federal Communications Commission, now is Assistant Secretary of Commerce for Communications and Information. He reports directly to Secretary of Commerce Juanita Kreps who, under the order, becomes the President's "principal adviser on telecommunications policies relating to the nation's economic and technological advancement and to the



HENRY GELLER
A Cabinet level post?

regulation of the telecommunications industry."

In the interview, Geller and Bortz both said it's too early to talk about specific policy initiatives, but they nevertheless dropped some hints.

Common carriers

On the common carrier industry, Bortz said, "we think you can have competition *and* universal service" in the dial-up telephone market. That's an idea that is anathema to AT&T and the other telephone carriers. They argue that offering dial-up service on a competitive basis would make it impossible to continue charging equivalent rates for higher-cost rural service and lower-cost urban service.

Bortz said one possible alternative would be to let specialized carriers offer dial-up service at rates pegged high enough to help subsidize rural telephone service. Presumably, this arrangement would eliminate any advantage specialized carriers might gain from "cream skimming," that is restricting their operations to the lower-cost big city markets, and permit competition with the telephone carriers solely on the basis of other factors such as technology and service.

Demonstration plans

NTIA's plan for a rural telecommunications demonstration will be based at least partly on a study completed late last year by OTP and an interagency working committee. The study found a substantial unmet need for a wide variety of health, education, and general information services in rural areas and suggested these services might be combined with existing telephone and television offerings. The study recommended launching one or more demonstration projects to define needs, opportunities and impediments more specifically.

Although NTIA is prepared to contribute seed money to this project, Bortz indicated the agency's primary function will be to help shape it into a package that is acceptable to all concerned parties.

Teleconferencing

The proposed teleconferencing demonstration involves essentially the same task by NTIA. The launching pad for this project probably will be an existing NASA system that provides voice, video, and facsimile interconnection among 55 loca-

PAUL BORTZ
Too early to talk

tions (NASA centers and contractor plants) around the country. Geller said he wants to find out if applications like this might be "aggregated."

The idea would be to establish common user networks, each dedicated to a related set of applications—e.g., teleconferencing, facsimile, electronic mail—and interconnecting government agencies. The latter, he indicated, might be federal, state, and local. The end result of the aggregation process would be to reduce existing costs and extend the benefits of on-line telecommunications and information services to a wider audience.

Electronic mail

Regarding electronic mail, Bortz said there are "great perils" in amending the private express statutes to exclude certain kinds of messages. The Association of Data Processing Service Organizations and the National Association of Manufacturers have been strenuously promoting such an amendment for some time. Last month, just before the House passed HR7700, the postal reorganization bill (April, p. 188), the membership defeated a change proposed by John Rous-

"We think you can have competition and universal dial-up service"

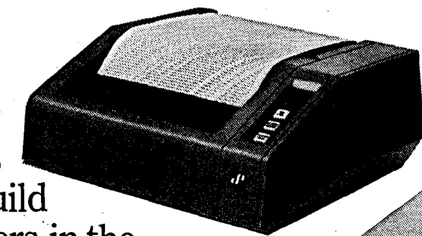
selot (R.-Calif.) that would have repealed the private express statutes and opened up first-class mail distribution to the private sector.

But when the Senate begins consideration of the House-passed postal reorganization bill, the subject is likely to come up again: Senator Strom Thurmond (R.-S.C.) has introduced a bill (S1641) that would amend the private express statutes to let private vendors carry several types of messages now regarded by USPS as letter mail—notably, data processing input and output material, and correspondence between affiliated organizations.

Communications dept.

Geller also is on record as supporting a cabinet-level communications department to formulate an effective U.S. telecommunications policy. It would be similar to one established within the

NOBODY CAN MANY WAYS AS



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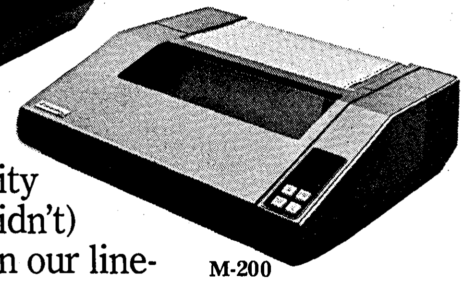

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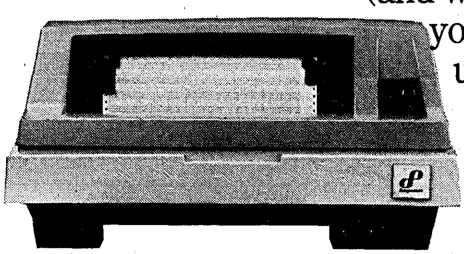

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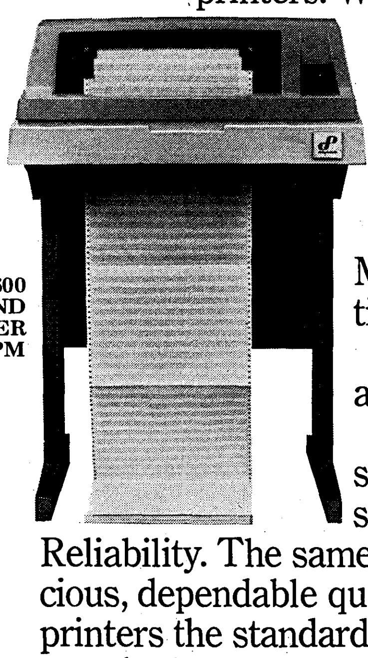

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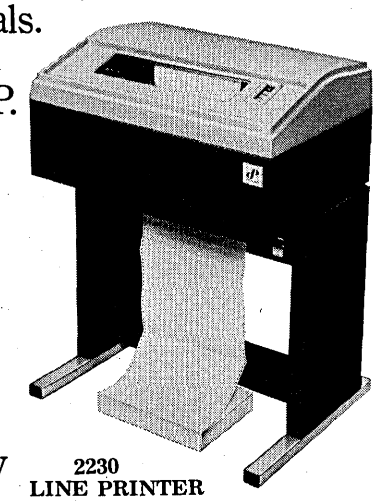

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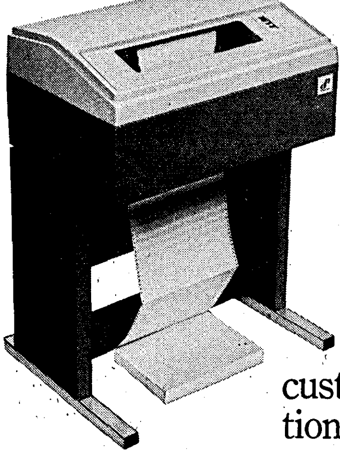

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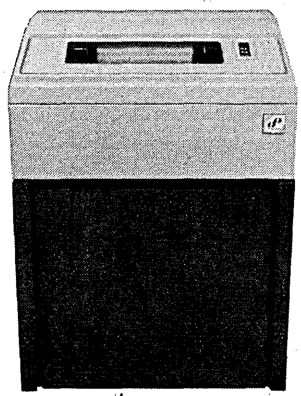

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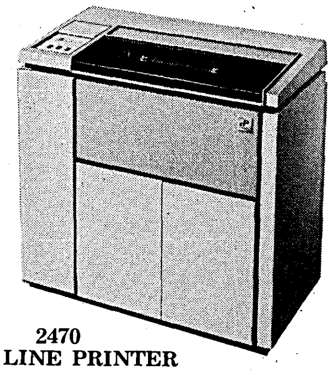

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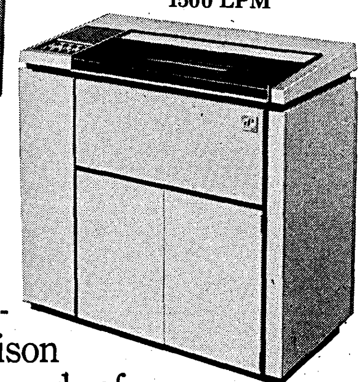

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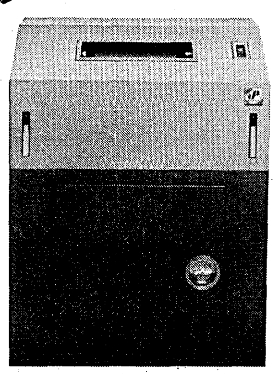

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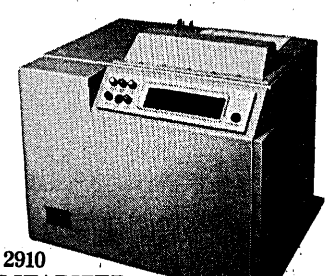

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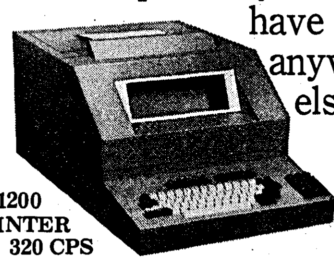

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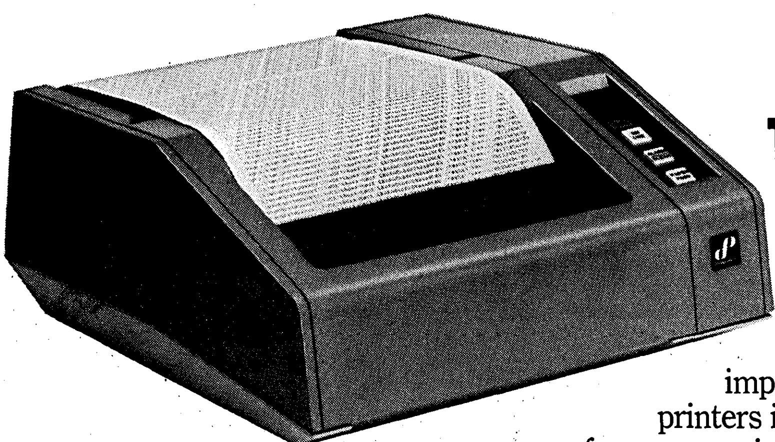

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CIRCLE 139 ON READER CARD

Canadian government. Geller admits that developing support for such a department in this country would have to be an "evolutionary process." (But the process may begin shortly. A staff member of the Senate Governmental Affairs Subcommittee, where Geller first made his proposal, said the question of upgrading the NTIA into a Cabinet department probably will be discussed during the subcommittee's forthcoming consideration of HR7700, the House-passed postal reorganization bill.)

Among those likely to oppose a department of communications are vendors of on-line computer services and systems, judging from the position they took several years ago during the FCC's first computer/communications inquiry, when the same basic question came up.

NTIA ultimately may evolve into a Cabinet-level department. At the moment, however, its main problem is to make do with the limited authority granted by President Carter's executive order.

Proposed legislation would let private vendors carry several types of messages now regarded by USPS as letter mail.

Geller seems to have far less authority than his predecessors at OTP. He said in the interview that the Secretary of Commerce and the White House will be informed of all NTIA initiatives before they are implemented, and NTIA will defer to the wishes of either or both "whenever they want to take over," as he put it.

Insufficient authority

It may be an overstatement to say that Geller and his staff are walking through a minefield without a map. Certainly he doesn't see things that way. But others aren't so sure. For example, at Geller's recent confirmation hearing before the Senate Communications Subcommittee, Chairman Ernest Hollings (D.-S.C.) said he still doesn't believe Geller has been given sufficient authority to act effectively as the government's telecommunications spokesman. Paul Zurkowski, president of the Information Industry Association, indicated a similar concern when he urged the subcommittee to give NTIA strong support. It will be needed, Zurkowski added, "in view of the great autonomy agencies have had in the past over information policy matters."

—Phil Hirsch

(Mr. Hirsch is a free-lance writer in Washington who writes regularly for this magazine on communications-related events)

Technology

Voice Input: Where It Stands

Is voice interface with computer systems an idea whose time has come?

George Glaser, president of Centigram Corp., Sunnyvale, Calif., is guessing that the program committee of the National Computer Conference (NCC) thinks so. Glaser is chairing a session on the subject at the NCC. "They gave us the largest room short of the amphitheater."

Interstate Electronics Corp., Anaheim, Calif., hopes so. Interstate last month introduced what it calls the first voice operated intelligent terminal.

Basic architecture of the Data General Nova-based terminal system is that of a clustered intelligent terminal. The control unit is programmable, said Daniel F. Fink, Interstate's manager of voice products marketing. "The user tailors operation to his voice and his application."

A user taking a basic system gets: a noise-canceling microphone with line switch; a work station with 16 character alphanumeric feedback display; a signal interface unit with one audio digitizer; a core memory voice recognition unit; system enclosure with fan, ac strip, power switch, front door and 24 by 32 in. work surface; and licensed use of voice executive software binaries, user manual, programming manual, stand-alone numeric and on-line Teletype application programs. Fink said the heart of the product is the executive software.

300 or 900 words

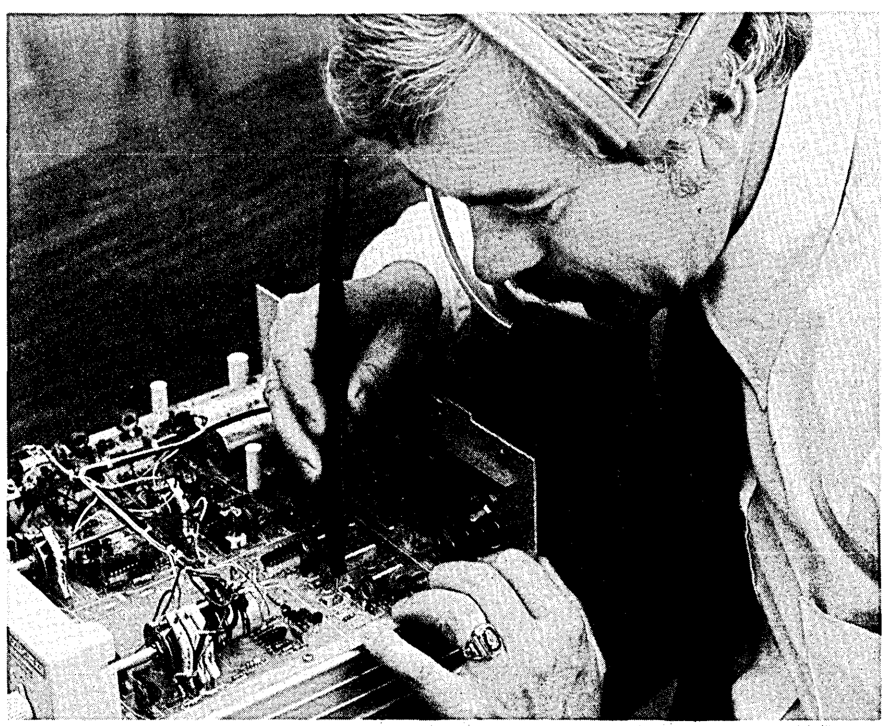
Interstate is offering a model 1832 with capacity for a 300 word, single user vocabulary for $18,750. A second model, 1764, can be had for $22,500 and affords capacity for a 900 word, single user vocabulary or four user, 250 word vocabularies.

Thomas C. Weston, Jr., vice president, marketing for Interstate, said applications must be a part of an existing computerized data entry system and should involve repetitive data entry and a defined number of operators. He said significant cost savings can be achieved where the system is used by people who normally would have to interrupt a task to enter data into a computer. He mentioned the oil industry for capture of exploration and production well data, interactive graphics, quality control inspection, aircraft maintenance, and automotive in the emission control area.

The big thing in voice recognition is how to make it work.

Fink said Interstate did a study with a number of airline companies to come up with a composite profile of major depot maintenance operations which showed a payback in 121 days could be achieved.

An available option for the Interstate system is a telephone interface. In this case an operator trains the system to recognize his voice as it comes over the telephone. The firm said geophysicists



QUALITY CONTROL inspector enters data as an inspection is in progress using Interstate Electronics intelligent voice terminal, increasing his productivity.

for a major Houston-based oil exploration company are using telephones to enter data into the company's data base. The intelligent voice terminal at the other end of the phone line automatically encodes spoken language into computer language while representing an audio response in the geophysicist's familiar scientific terminology.

Recognition accuracy

Interstate said recognition accuracy of the terminal system is better than 99%.

Fink said he's concerned about the hobby market as he feels voice recognition is a thing that will appeal to hobbyists. But he feels Interstate is not ready for that market right now.

Glaser's Centigram Corp. is. Its MIKE, first demonstrated at the 1977 NCC, is a low-cost, microprocessor-based, isolated-word voice recognition system that can learn the sounds of up to 16 words. Like the Interstate system, MIKE includes an audio response capability. It can operate as a remote computer terminal or can be connected directly to a computer.

Glaser said the big thing in voice recognition now is "how to make it work." He said there is a class of devices "that operate with big computers and do wonderful things but are not commercially viable." He said his session at this year's NCC will focus on "what we can do at a price we can afford."

One problem, he said, is there generally is no equipment available that will recognize continuous speech. Pauses of varying length are required between words. He said Nippon Electric has released brochures indicating they have a product they will introduce in the U. S. this year which will recognize continuous speech, but "not much information is available."

NCC session on voice recognition will review current applications in the technology area.

Not for the general public

Another problem cited by Glaser is the fact that all existing devices have to be trained by an individual to recognize his voice, which precludes use by the general public. And in use of voice recognition via the telephone, he said, "we're vulnerable to the vagaries of the phone system."

Glaser's double NCC session on the morning of June 8 will include consideration of the underlying technology and a review of current applications in the technology area.

Wayne A. Lea, Speech Research Communication Laboratory, Santa Barbara, Calif., will present the results of a study on how $5 million was spent by the Advanced Research Projects Agency (ARPA) on voice recognition. Lea has presented the results before to small groups of invited guests, but this will be the first public presentation.

Frederick Jelinek, IBM, will talk about what IBM is doing and Raj Reddy, Carnegie-Mellon Univ., will cover some pioneering work being done there. Michael Curran, U.S. Naval Air Development Center, Warminster, Pa., will describe specific things the government is doing. Applications at Texas Instruments, Inc., will be covered by George R. Doddington.

Thomas B. Martin, Threshold Technology, Delran, N.J., will talk about products that are commercially available today. Threshold was one of the pioneers of commercial voice data entry systems. Founded in 1970, Threshold today has systems installed throughout the country in such applications as warehousing, numerical control, quality control, and banking and commodity exchange applications.

Today's systems can handle some voice problems but not all. An Interstate spokesman said there had been some interest in his firm's system among air traffic controllers, but it was quickly determined that voice fluctuations to be expected in a high tension atmosphere could not be accommodated. But an operator of an in-place Interstate system with a chronic sinus condition found her problem could be handled. She simply trained the system to her voice twice—once when she was afflicted and once when she wasn't.

—E.M.

Administration

The Manager as a Typist

He's a tremendous manager—but can he type?

That question very probably will come up when electronic mail reaches the office of the future and perhaps requires that the manager write or answer his electronic mail from the keyboard on his terminal. "Typing is very slow and sometimes inaccurate," said a speaker at a recent discussion on the subject (December 1977, p. 200). He added: "It's also a low level function in most companies and not a single executive would be caught saying he's able to type."

The problem is so serious, says John J. Connell of Office Technology Research Group, Pasadena, that people who study human considerations in tomorrow's office are taking a close look at progress in

Most people think of the office of the future in terms of systems, equipment, and technology.

voice recognition systems. "Very likely," says Connell, "tomorrow's executive instead of typing his electronic mail, will dictate it to his terminal using a voice recognition device."

Connell left Atlantic Richfield Co. where he had been vice president of administrative services, to form the Office Technology Research Group late last summer, as an organization which will distribute up-to-date information to its members on office operations, particularly on the potential impact of the office of the future. Connell and eight consultants each month search through 10 databases for articles and research papers on the office of the future and then distribute reprints of pertinent ones to members. A 10-volume library of reprints covers case histories, descriptions of new developments and a selection of research papers and articles that cover word processing, telecommunications, electronic mail, conferencing, micrographics, reprographics, electronic storage, space planning, and human and organizational considerations.

Founding meeting

All of these topics will be discussed at a founding meeting of the organization June 12–14 at Olympia Village in rural Oconomowoc, Wisc., where Connell says some 40 representatives from the bluest chip companies will meet with experts for a series of round-table discussions. It is the first of a series of semiannual meetings that Connell says will help top management prepare to use tomorrow's

JOHN J. CONNELL
All about the office of the future

technology in running their companies.

"Most people today are thinking of the office of the future in terms of systems, equipment, and technology," Connell says. That will change because the emphasis must be placed on adapting technology to human beings rather than vice versa.

One speaker at the Wisconsin meeting, Dr. Jacques Vallee, president of Infomedia Corp., Palo Alto, and a former principal investigator at the Institute for the Future, Menlo Park, Calif., will address that question. He'll include a report on continuing research into the behavioral aspects of using computer-connected terminals in day-to-day operations. Senior officials from Satellite Business Systems will discuss what SBS learned recently in its presentations to industry on video conferencing as part of its much-publicized Prelude to the Eighties tests. Among the companies expected to attend are IBM, AT&T, Northern Telecom, Security Pacific Bank and Atlantic Richfield. Connell said the companies will send top level data processing and administrative people to the conference.

He said his group, which charges $2,400 a quarter for membership, is aimed at vice presidents of administration or persons with equivalent titles from among the top 100 companies in the U.S. and Canada. He said membership could go to as high as about 35 companies.

Meetings

No Mistakes in Software Buys

"For the businessman, selecting a computer is the smallest part of the automation problem," says Donald Shaw, a minicomputer-microcomputer applications specialist. The real crunch comes when the tough and often expensive software decisions have to be made. For it's in this area of software decision making that users "can't afford to make mistakes."

Picking up on this crucial question of software selection, a Mini/Micro Computer Conference and Exposition, held last month in Philadelphia, featured several sessions on the software "crisis" facing minicomputer and microcomputer users. The three-day conference, held April 18-20, attracted around 4,100 attendees—a substantially lower turnout than the 7,000 expected.

The exhibitor force at the show—around 100 in all—also were disappointed by the dismal draw, but most seemed willing to give the conference a second chance when it moves to Houston for another three-day stint next Nov. 7-9.

The show's software sessions, like most of the conference's 24 half-day sessions, also suffered from well below average attendance. But session-goers seemed pleased with the pragmatic points made by the program's more savvy speakers.

Shaw cautioned mini-micro users on some of the "pitfalls" in software selection. Speaking at a session on the "Criteria Used in Selecting and Evaluating a Minicomputer," Shaw insisted that "the choice and cost of applications development determine more than anything else the success or failure of a minicomputer installation." One user "escape," he noted, may be to go the package route, where development costs are shared among users. However, this tailoring of software packages to fit individual user application needs could spawn trouble, he warned.

Three day Mini/Micro conference draws 4,100 at Philadelphia.

Vendor support

Some of this trouble, Shaw pointed out, can be caused by the vendor. Users, he cautioned, should be sure that the vendor is willing and able to support these modified software packages. One possible way to get around this, he noted, is to opt for a do-it-yourself application kit which carries a low end purchase/lease price tag of around $4,500. Specifically tailored packages, which are vendor-modified and installed and range from $6,000 to $10,000, "can be traumatic and expensive" for users, he claimed.

Any way you look at it, Shaw argued, users face an application software decision of $6,000 to $60,000 "depending on how wise and lucky you are." And how wise and lucky you are as a user may depend in large part, he contends, on how good the software procurement process is.

Shaw feels an effective evaluation of potential vendors is crucial. He recommended that users look closely at different modes of procurement, "developing a rating scheme" to reduce the whole process to numbers or "figures of merit."

This evaluation process, he explained, could serve as the "starting point for . . . subjective analyses" which would weigh various factors. As an example of some of these key factors, Shaw cited: the features of the system and how that system squares with the company's needs; the

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reputation of the vendor—its financial and organizational strength and stability; transferability of software to other machines; training, documentation, and warranties; maintenance and support; and costs, especially on-going ones. "A carefully planned and executed procurement, especially of application software," he summed up, "can avoid pitfalls later on."

Lowering software costs

At another session on microcomputer software, Joseph Harakal of Intel Corp. pointed up the necessity of lowering microcomputer software costs "to keep pace" with steadily decreasing hardware costs. "Software, once relegated to the mainframe manufacturers, now is an integral part of not only the intelligent terminal manufacturers," he noted, "but also the microprocessor-based instrument and process control systems."

"As more companies attempt to combine functions under one software umbrella which offers significant price and performance advantages," he said, "the software role will continue to increase in importance and cost." The onus for these new software demands, he declared, will be placed squarely on the shoulders of the terminal and other end-user manufacturers.

"The urgency for value added software to be passed through to the end-user of systems is placing demands upon the terminal and other end-user manufacturers to provide sophisticated software systems," he said. This in turn is putting "increasing pressure upon the microcomputer vendors to support their customers through various software aids," which will decrease development time, step up reliability, and provide "modular portable software."

Users should be sure the vendor is willing and able to support modified software packages.

Urging users to "look for all advantages to aid their software design," Harakal put in a plug for system software "componentization," which he claimed was a key requirement "for future success in microcomputer system design."

—Linda Flato

Marketing

ICL Goes for the Bird

"ICL is young in the U.S., trying to get started, and so is badminton."

This was the explanation of Geoffrey D. Rowett, president of the marketing division of ICL Inc., for the sponsorship by the U.S. subsidiary of Britain's International Computers Ltd. of both an ICL open badminton tournament in Manhattan Beach, Calif., last month and of the U.S. women's team which is competing for the Uber Cup this month in Auckland, New Zealand. (The Uber Cup is the women's badminton equivalent of the Davis Cup in tennis.)

ICL's involvement began with Traci White, a member of the U.S. Uber team and a secretary in ICL's Los Angeles office. The U.S. team had won the right to Uber competition by defeating a team from the Republic of China in what are called zone finals. But the team is nonprofessional and money was needed for the long trip to Auckland. Traci managed to convince her employers that sponsorship would be good for both badminton and ICL.

GEOFFREY D. ROWETT, president, marketing division, ICL Inc., presents a trophy to Judianne Kelley, Costa Mesa, Calif., winner of the women's singles in an ICL sponsored badminton tournament.

"It isn't unusual for us (ICL)," said Rowett in between making trophy presentations at the Manhattan Beach tournament. "We sponsor golf and a grand prix in South Africa and a sailing race in Australia."

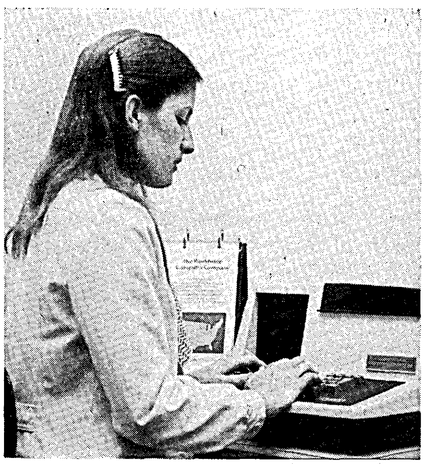
Bad for tennis

Rowett, who came to ICL Inc. from the parent company in January 1977, is not a badminton player himself. "I hear it ruins your tennis game." But, he said, badminton is a big sport in England. "England has the number one and number two women players." And he felt it could become big in the U.S. as well.

ICL contributed two round trip tickets from Los Angeles to Auckland at a cost of more than $3,000 as raffle prizes for the Manhattan Beach tournament. It also shelled out another $100 for sweat shirts for members of the Uber Cup team to be worn in New Zealand. These identify ICL as the team's sponsor so, Rowett explained, "will be worn only in warm-ups, not in actual competition where commercial identification is not allowed."

Program produces ranking in hours instead of weeks and sometimes months.

Winners in all the women's competition in Manhattan Beach received large "ICL Open" trophies which will be revolving trophies. All winners also re-



TRACI WHITE, ICL secretary and badminton player, inputs badminton tournament data for almost-instant player and team ranking. ICL sales executive, Philip Graves, wrote the program.

ceived plaques they can keep. Next year, Rowett said, ICL will provide revolving trophies for the men as well. The company also next year will sponsor a U.S. men's team in the Thomas Cup competition, the men's equivalent to the Uber Cup.

ICL's involvement goes further. Traci talked of badminton tournament problems with Philip Graves, a sales executive in the L.A. office. One of these is the length of time it takes to develop rankings. Situations such as player "A" beating player "B" who beat "C" who lost to "A" have to be considered. And games played later in the season weigh more heavily than those played in the beginning. Graves decided this could easily be handled by a computer and he wrote a program to do it. It took him one month.

The program was used during the Manhattan Beach tournament where data from that tournament was merged with other tournament data to produce rankings in hours instead of weeks and sometimes months. Data was entered via an ICL 1501-40 transaction terminal at the tournament site and processed on a disc system back at the ICL L.A. office.

Expandable

Graves said his program as it stands will rank up to 200 players and/or teams and can be expanded to 500 simply by using a bigger disc. The initial use was with a 2.5 megabyte fixed disc. The 1501 used had 16K bytes of memory.

Graves said the U.S. National Badminton Assn. currently is considering use of his program which ICL would make available free of charge. "It would have to be expanded but that would be easy." The national organization could buy computer time or its own computer, which it also could use for other things.

The U.S. team's chances of winning the Uber Cup are considered good. The cup currently is held by Indonesia, where badminton is the national sport. But a former Indonesian player, Utami Dewi, is now a member of the U.S. team thanks to marriage to Chris Kinard, one of the top U.S. male players. She is competing in New Zealand.

And if Rowett takes pride in the team's chances, it is matched by his pride in what ICL Inc. has done in the U.S. since January 1977. International Computers Ltd. formed its U.S. subsidiary following acquisition of the Singer-Cogar manufacturing plant in Utica, N.Y. Rowett said the plant has produced more than $35 million in equipment with a sales value of $80 million. "We're exporting for the United States." Rowett said ICL Inc. in its first nine months took ICL sales in the U.S. from less than $1 million to more than $9 million.

Rowett says, "I'm realistic enough to know we can't maintain that rate of increase," but maybe the identification with badminton will help. **—E.M.**

Implementation

New System in Four Months

Believing in miracles and taking risks to bolster those miracles is something most companies with any business smarts do very reluctantly. And that's probably because miracles don't happen every day—or even every century if you happen to be the 102-year-old American Safety Razor Co. (ASR) of Staunton, Va. But dreams die hard and the tenacious company, pinning its hopes on independence and a built from scratch in the nick-of-time computer system, captured its miracle.

For ASR, the miracle it needed didn't come easily. The gutsy company's success story is based on a substantial amount of nerve-racking risk taking—businesswise and systemwise. And the realization of these risks began last year

Getting an in-house computer backup as soon as possible was one of the razor company's primary concerns.

when a nine-member ASR management team acquired the company from Philip Morris of Richmond.

The tobacco king had put the Shenandoah Valley-based subsidiary up for sale in 1974. But after a series of deals fell through, including a promising $16.8 million offer in 1976 from the Bic Pen Corp., a group of adventurous ASR executives decided to launch their own takeover which went into effect last September.

One of the born-again company's most pressing problems was maintaining continuity in dp support, formerly furnished by parent Philip Morris. Further complicating this problem was the time factor. ASR, which set up its new operation last October, only had about four months in which to get a new system up and running. The actual deadline was Feb. 1.

J. Gray Ferguson, an eight-year ASR veteran and the firm's new v.p. of finance, explains the dp dilemma the company was confronting: "It wasn't a simple process of lifting what we were currently doing. It was lift, improve and implement, and do not make a mistake." Getting an in-house computer backup as soon as possible was one of the razor company's "primary concerns," he says.

Went to a service firm

Sharing this concern was John Broughton Associates, a small Richmond computer services company that ASR tapped to mount the system revamp effort. Under a $100,000 ASR contract, the Broughton consulting crew had a whole range of responsibilities. ASR's Ferguson explains what this work entailed: "The John Broughton group did a lot more than redesign an efficient and complete computer system. They helped set it up and reviewed the output and the way the system worked internally with users. They also did all the programming, which we reviewed, and final documentation."

They did it incredibly fast. Ferguson, who admits that the four-month system development schedule was "a very unrealistic timeframe to work with," is impressed that the new system went "live two days before the Feb. 1 deadline."

Ferguson also takes pride in pointing out that the company's fledgling computer setup "does more things, does them better and quicker." And what he's doing is making a comparison to the way ASR's dp chores were formerly handled by the Philip Morris computer facility in Richmond. He doesn't mean to disparage the

The ability to be flexible and make changes is very much a part of ASR's business thinking.

tobacco company when he declares emphatically that, "The data processing work (done for ASR by PM) was not adequate for our day-to-day purposes."

Lack of in-house muscle

One of the main reasons for this inadequacy, he feels, was the lack of any real in-house computer muscle. Supported by four mainframes, including an IBM 370/158, Philip Morris' dp operation handled all of ASR's routine tasks in accounting, finance, customer service and sales, and marketing. Under this setup, all orders would be processed at PM's Richmond headquarters, with the shipping instructions sent on to ASR in Staunton.

But the order processing through PM took three days, the third day being when the merchandise was shipped. With the new system, he claims, the turnaround has been cut 33%—"the order is in today and we ship tomorrow."

When forced into the system overhaul after the employee takeover, ASR decided to remove an IBM System/3 Model 10, in favor of an upgraded System/3 Model 15 which tackles all the routine dp jobs formerly done on the PM processors. The

Built into the system is a possible move into distributed processing.

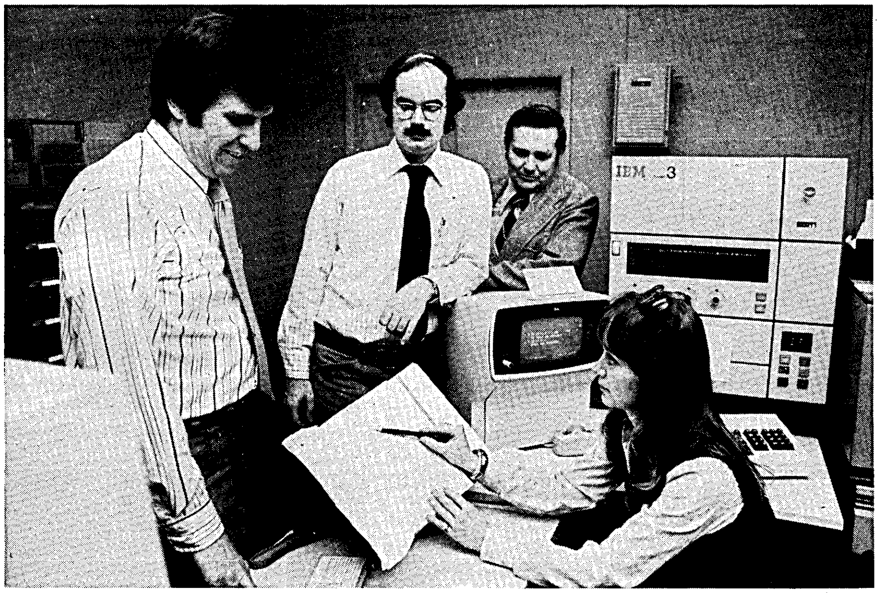
newly configured system also includes four associated disc drives, two tape drives and assorted peripherals such as an IBM 1403 printer, a card sorter, keypunches, and verifiers.

The company shells out $13,000 a month to lease the basic system hardware. Software costs are bundled into the Broughton package which included programming and systems analysis work. ASR's Ferguson emphasizes that the system was specially "tailored. We did not use any 'canned' programs," he insists.

DAILY REPORT generated by American Safety Razor Co.'s new computer system is examined by John Broughton, president of John Broughton Associates which developed the system; J. Gray Ferguson, vice president-finance with ASR; John R. Baker, ASR president; and Jerry Greene, JBA's project leader.

Praise for System/3

Ferguson also lavishes praise on the IBM System/3. "The reliability and dependability of the System 3," he maintains, "is absolutely outstanding." He says the system has gone down only once in the year and a half that it functioned as an in-house manufacturing system. This is one of the reasons, he explains, why ASR can get away with such a small dp staff since the machine doesn't require a maintenance crew. Out of a total work-



TOP dp officials with American Safety Razor and John Broughton Associates review data entry procedures on System/3 Model 15. From left, Joseph R. Mills, customer service manager with ASR; Fred Samuelson, JBA programmer/analyst; W.H. Schoenthaler, ASR data processing manager; and Dot Finch, programmer/analyst with JBA.

force of around 800, only 11 employees are on the ASR dp squad—a dp manager, two programmers, two computer specialists, and six keypunch operators. (The dp department has expanded since the PM split-off, gaining an additional programmer, computer specialist, and two more keypunch operators.)

One of the main advantages of the new computer setup, Ferguson says, is its ability to expand the company's dp operations into newer realms of technology. "We were careful in file selection and structure," he points out, "to allow us to look ahead to the potentiality of going on-line in several areas."

Can go to DDP

Also "built into the system," he adds, is a possible move into distributed processing. With various outside locations for finished ASR products, the company, he explains, may want the capability "to

Order processing with Philip Morris was three days, now it's cut to two.

transmit and receive information for shipments at other locations."

This ability to be flexible and make changes is very much part of ASR's business thinking these days. Ferguson tells why: "One of the things that we found out when we were a division of a large corporation is that you have to have the ability to introduce changes at the local level. Being in a consumer products area, we have to be able to change our business. And as we change, so do our operating techniques and controls—and of course, so do the systems that allow us to manage the business."

And managing the business to turn profits is what ASR is after. The optimistic company, standing on its own two feet after 17 years, hopes to double its net profits by 1981. ASR executives don't see this as a miracle but as a reality. They came through once against stiff odds in the takeover from mighty Philip Morris. And they came through again in getting their built-from-scratch computer system up and running way before some experts predicted they ever could.

Ferguson seems nonchalant now about the whole ordeal. But he also candidly admits: "In our situation, we could not afford to start losing customers because we couldn't process orders because we had no system. It's enough to have your competition going out and saying 'you fellows are going to liquidate.' But then, when we would be unable to process an order, that would've been a catastrophe."

—L.F.

Small Computers

Help for Buying Small Computers

Hillel Segal hopes to do for users of small computers what he's done during the past four years for time-sharing users—take some of the mystique out of buying decisions.

He's formed the Association of Small Computer Users to provide "a new source of unbiased, user-oriented information" on the mini and microcomputer market. For an annual membership fee of $25, users will receive literature describing each other's experience with small computers, publications that help them assess the market, and benchmark comparisons of competing systems.

"We will write programs that take in common needs and run them on competing systems," Segal says. Probably the programs will answer a variety of user needs, such as users who are computer bound, I/O bound, or who use a lot of storage or do a lot of file swapping. "Then we'll provide our members with run times on different machines."

Up to now, he says, there's been no source for comparing the efficiency of small computers. Adding to that confusion "are the hundred-plus small computer systems now available for business applications, which, because of the highly technical nature of the industry, make user evaluations very difficult."

Funded by ATSU

Segal, who is the founder and president of the 1,500-member Association of Time-Sharing Users (ATSU), will also be president of the new association which is being provided office space and a first year budget of $10,000 by ATSU. The time-sharing association provides members with cost comparisons and other information on time-sharing services and recently has been pushing these services to standardize the way users may access them.

Segal said the impetus for forming the small computer association came from

Up to now, there's been no source for comparing the efficiency of small computers.

ATSU members, many of whom will belong to the new group. He says he's identified a growing interest among time-sharing users in owning their own small computers, but he says that by no means is there a massive move away from time-sharing. "Revenues are growing in leaps and bounds," he says. (ADAPSO, the association of computer service organizations, says service firms in 1976 did $3.6 billion and that this will rise to $13.5 billion by 1985.)

The organization defines as small, computers priced at under $50,000 and under $100,000 when all the peripherals have been added.

Its headquarters are at 75 Manhattan Dr., Boulder, Colo. ✲

Flat Quarter for IBM: International Business Machines reported first quarter earnings of $589 million, up 2.7% from the first quarter of 1977, on total revenues of $4,431,878,000, which was an increase of 8.4%. The company said its cost of sales, rentals, service, and expenses rose 9.7% to $3.4 million, against $3.1 million a year earlier, thus contributing to a relatively flat first quarter. *Control Data Corp.* said its computer business earnings rose 19.8% to $4,362,000 as sales climbed 21.7% and rental and services revenues jumped 16.3%. CDC cited strong demand for its computer systems, oem peripherals and data services. Overall company revenues reached $523 million. *NCR Corp.* reported a 42.2% increase in earnings to $22,869,000 in its first quarter on revenues of $559,120,000, an increase of 8.5% over the $515,267,000 reported in the first quarter of 1977. *Burroughs Corp.* said its first quarter profit climbed 18% to $33,487,000 on revenues of $504,985,000 which represented a 14.1% increase over 1977's first quarter revenues of $442,604,000. *Honeywell, Inc.* does not break out computer profits, but it said its computer rental and services revenues in the first quarter increased 18.8% over the comparable 1977 period to $164.7 million. It said outright computer sales were up substantially. Total Honeywell sales in the first quarter reached $624 million and total profit reached $35.4 million, compared with $30.9 million in the first quarter of 1977.

Univac President: Richard L. Gehring has been named president of the Univac division of Sperry Rand Corp., succeeding Gerald G. Probst who will head Sperry Rand's Univac, Sperry, and Sperry Flight Systems divisions as a corporate executive vice-president. Probst held that title in addition to being president of Univac. The appointment of Gehring, 54, was a complete surprise to insiders at the computer division who expected the top Univac job to go to Joseph J. Kroger, 44-year-old executive vice president for worldwide marketing with Univac. Some insisted that Gehring's appointment would be a short term one while Kroger, a marketing whiz who held top posts in the Midwest and later became head of Univac's Americas marketing operations, is being groomed for the presidency. Gehring joined Univac in 1955 and most recently was an executive vice president in charge of the company's defense and aerospace business. He's been vice president of the company's Sperry Univac defense systems division, group vice president for special products, and vice president for Sperry's systems division.

RICHARD L. GEHRING

To Intel Board: Harold Steinberg, the man who put together the deal for Univac to acquire RCA's computer base and who later left Univac amid rumors that he'd been rejected for the presidency of the company, has been named a director of Intel Co., the San Jose semiconductor manufacturer. Steinberg, who formerly was a Univac executive vice president, now is president of Executive Action, Inc., a management consulting firm for the computer industry.

AT&T Sued Again: Southern Pacific Communications Co. filed an antitrust suit against AT&T and its operating companies that may ask damages of up to $200 million. The company charges the telephone behemoth with restraining trade by attempting to monopolize telecommunications service. In the suit, filed in Washington, D.C., federal court, Southern Pacific's president, C. Gus Grant, says his company has been hindered repeatedly in its attempts to offer a communications service that competes with AT&T, "despite numerous court and Federal Communications Commission decisions holding that companies such as Southern Pacific have a right to share in the growing national telecommunications market." Still pending is a $285 million antitrust suit brought against the telephone company by Wyly Corp., charging the company deliberately put DATRAN, its communications subsidiary, out of business.

ITT in Personal Computing: Giant International Telephone & Telegraph Corp. became the largest company to be involved in personal computing through an agreement to handle overseas sales of computers made by Apple Computer, Inc., Cupertino, Calif. The low-priced Apple computers, which sell for about $3,000, will be marketed through an expanded consumer products division of ITT's consumer electronics and appliances group headquartered in Brussels. An ITT spokesman said the personal computer business will amount to several millions of dollars over the next several years.

Credit for Pertec: Pertec Computer Corp. has established $55 million in new credit lines with a group of banks including Eitibank, N. A., Security Pacific National Bank, Irving Trust Co., and The First National Bank of Chicago. The company also set up a new, wholly owned, unconsolidated financial subsidiary, Pertec Computer Financial Corp., which will use $25 million of the new financing. James R. Grimm, senior vice president and chief financial officer, said the new agreements replace a $37 million bank line negotiated at the time of Pertec's acquisition of Computer Machinery Corp. in 1976.

Small Business Problems: Small companies need relief from "the growing tangle of government regulations that limit their ability to obtain financing," Charles Askanas, chairman and president of Quantor Corp., Mountain View, Calif., computer output microfilm company said at a Securities and Exchange Commission hearing. "There will be no small companies formed unless there are rewards consistent with the risk," he told the commission. Askanas listed as obstacles: the Tax Reform Act of 1976, which raised the effective maximum capital gain rate, thus eliminating the capital gains advantage for the people who historically have been investors; elements of ERISA which have caused pension fund managers to be conservative in their investing; inflation, which encourages short-term speculation and makes long-term, high-risk investments more difficult; and the elimination of fixed commissions, which has resulted in reduced income for securities brokers and diminished interest in smaller companies.

Microcomputers in Medicine: Sales of microcomputer-based medical systems will total $1.3 billion over the next ten years, says a 329-page study released by Frost & Sullivan Inc., New York City market research firm. "Not only will microcomputer systems find a place in medical applications not now covered by minicomputers, but also it is evident that the micro will invade current minicomputer markets," the study says. Titled, "Medical Microcomputer Markets," the study breaks the market into segments, giving sales totals for each. ✲

LOOK AHEAD

(Continued from page 18)
Archie McGill, now AT&T's head of Market Management and Development, Business. The network will involve virtually all major AT&T units, but the Long Lines Div. is said to have a major responsibility for the project. Salesmen are being trained at a Long Lines facility in Cincinnati and a prototype customer system is being tested in Florida. Computer Communications, Inc. has been working on front ends and Digital Equipment Corp. has an involvement in switching nodes for the network which will be an evolutionary design. AT&T management is said to be digging in for a long regulatory battle over the network. And there are rumors on the Washington grapevine that IBM and other manufacturers have already set their attorneys in motion to prepare opposition to the AT&T offering.

NEW TERMINAL FROM TI

Texas Instruments should be making its debut into the low priced KSR impact terminal arena any day now. The machine was described by one customer who had seen a prototype -- 150 cps. 132 columns, wire matrix assembly with a 7 x 9 dot format. The machine will be a member of TI's Omni 800 family of impact terminals and will likely bump up against Digital Equipment Corp.'s popular DECwriter.

REMOTE CARD AND PRINTER INTERFACE

Documation, the Melbourne, Fla., concern that introduced a 3,000 line per minute printer earlier this year, has a surprise in store for Paradyne, one of its oem customers. Documation intends to introduce a remote card and printer interface, called the Capri, that will compete with Paradyne's Text II system. Simultaneously employing two 9600 bps lines, Capri enables the user to interface remote peripherals to a host IBM 360 or 370 as though attached locally. Capri doesn't require communications software and hangs directly on the multiplexor channel.

$500,000 SYSTEM WITH NO PLACE TO GO

System Development Corp. in early 1976 was awarded a contract for some $500,000 to design a switching system to link Electronic Funds Transfer Systems (EFTS) of 13 California Savings & Loans by Savings Assn. Central Corp., a joint venture corporation. The system has been designed and has been sitting around waiting for use for more than six months. Observers said SDC, with rights to sell the concept outside of California, has been trying hard to sell it and even approached the Federal Reserve Board. Seems nobody wants it, not even the original subscribers to the joint venture effort. "They're (the California S & L's) fat, happy and comfortable and don't want to give up any competitive edges," said one observer. He feels they'll keep the system and the joint venture corporation on a back burner as "insurance" in case something heats up their competitive stance with commercial banks.

RUMORS AND RAW RANDOM DATA

Observers in Europe think IBM delayed the announcement of its Series E line when it found out the announcement might wipe out its System/3 rental base as these users upgraded to the new line which replaces the low-end 370 series. The announcement was expected last March 16, but IBM decided to withhold it until it had more time to assess the impact on the System/3...Sources say 80% of IBM's orders for the 303X line are for outright purchases. That would give the giant a $14.4 billion cash surplus by 1981...IBM's machine of the 80s, called the New Grad, would be a back-end and front-end system with very fast bus connection and would use System R, IBM's relational data base management system, replacing IMS.

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CIRCLE 50 ON READER CARD

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hardware

Off-line

"The automation scare of the 1950s could well be reality in the 1980s," according to Carl Page, Michigan State Univ. professor of computer science. Talking on the use of robotics in manufacturing, Page addressed recent advances in computer vision via television cameras. An unsighted, general purpose robot now sells for roughly $25,000, about what it costs to keep the two unskilled laborers it can replace on the payroll. Custom-made sighted robots now carry price tags in the $100,000 neighborhood, but price erosion is occurring rapidly. "With these kinds of changes, robots become both capital and labor, a point Marx did not anticipate. Who should own them? We may have only five to 10 years to answer these questions, because the technology is ready now," comments Page.

Texas Instruments has delivered to the Air Force Avionics Lab (AFAL) Electronic Research Div. a two-million bit bubble memory subsystem. Designated a breadboard unit, the microprocessor-controlled memory has to date shown much lower error rates than mechanical devices, according to Stewart Cummins, AFAL program manager.

Good news for small systems and word processing vendors, if the crystal ball gazing of SBS Publishers holds true: its report, Accounting Firms - Data and Word Processing Opportunities, predicts accounting firms will spend $3.5-billion in those two activities over the next five years.

AT&T introduced its Local Area Data Set (LADS), a short-distance modem, at the Interface '78 show in Las Vegas. LADS can operate at 2400bps or 4800bps over six mile distances, and 9600bps at up to three miles. Most Bell operating companies are expected to have filed tarriff applications by the third quarter.

Codex Corp., has received FCC approval for the direct connection of its 4800bps, 7200bps, and 9600bps LSI series of modems to the direct dial phone network.

Color Graphics

Up in Oregon, this vendor is methodically filling in the gaps in its line of graphics terminals. It started five or so years ago, with high-resolution storage tubes. Then, last November (November 1977, p. 200), it came out with a raster-scan crt for alphanumerics and graphics. Now it's augmented the raster-scan 402X line with a color tube.

The 4027 has a 13-inch diagonal color screen, an inch larger than the 4025. Aside from features related to color operation, the new terminal shares most of the features and specs of the 4025. These include a 34 line by 80 character screen capacity, 64/96 upper and lower case ASCII character sets, visual and logical attributes (blink, protected, numeric only, etc.), RS232 interface as standard equipment, 20mA current loop optionally, and optional peripheral interfaces for RS232 printers and IEEE-488-bus devices.

But, of course, it's color that makes this terminal noteworthy. Users can select colors from a 64-color palette. As many as eight colors can be displayed simultaneously. That's not really a hard limit, as the user can define as many as 120 patterns which may combine points of different colors (which tend to blend in the human eye, making a new color, see photo p. 124), or may be simply geometric in patterns, such as stripes or checkerboards.

For graphics, the 4027 uses the same host software as the 4025, with the addition of a color parameter. The Plot 10 Easy Graphing software supports graphing and plotter output; it allows users to paint colors under curves in a graph. The Plot 10 Interactive Graphics Library (IGL) gives more capabilities, including 3-D graphics, curve smoothing, picture segment manipulation, and additional character display fonts.

The 4027 will become available in the second half of this year, probably around October. Single units will be priced at less than $10,000. TEKTRONIX INC., Beaverton, Oregon.

FOR DATA CIRCLE 422 ON READER CARD

Multiprocessor 3033

As expected, IBM won't abandon the large users who have a desire for multiprocessor versions on its largest processor, the 3033. The tightly coupled multiprocessor systems are said to have roughly 1.8 times the internal operating speeds of a uniprocessor. And of course a multiprocessor can have twice the memory and twice the channels of a uniprocessor.

Multiprocessors run under OS/VS2 MVS; IBM says current MVS users won't need to make any program changes when upgrading. A field upgrade, priced at $5,500, can convert a purchased uniprocessor into a multiprocessor; lease customers getting the upgrade will, of course, have their monthly rental increased.

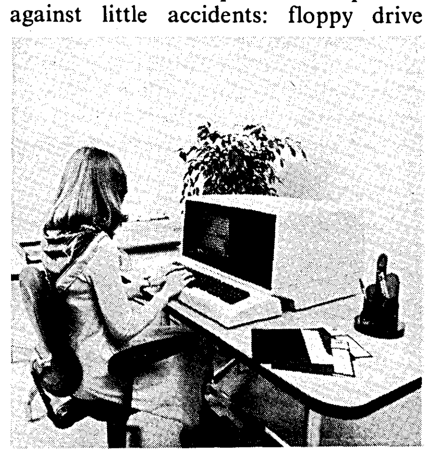
The physical coupling between multiprocessor versions of the 3033 consists of the 3038 multiprocessor communications unit (purchase price: $369,000). A significant feature of the 3038 (and one which appears to be new) is that it provides access to the channels of a disabled cpu, without manual intervention. It doesn't allow a single 3033 concurrent access to 32 channels, but it lets the single active processor switch between its own channels and that of the idled processor.

Under a 48-month contract a pair of multiprocessor 3033s, each with 4MB, 12 channels, console, power and cooling unit, and the necessary 3038 for interconnecting the two, leases for $154,130 per month. Monthly rental will be $169,520; outright purchase is $7,160,000. Deliveries are scheduled to begin in the third quarter of next year. INTERNATIONAL BUSINESS MACHINES CORP., White Plains, N.Y.

FOR DATA CIRCLE 421 ON READER CARD

Word Processing

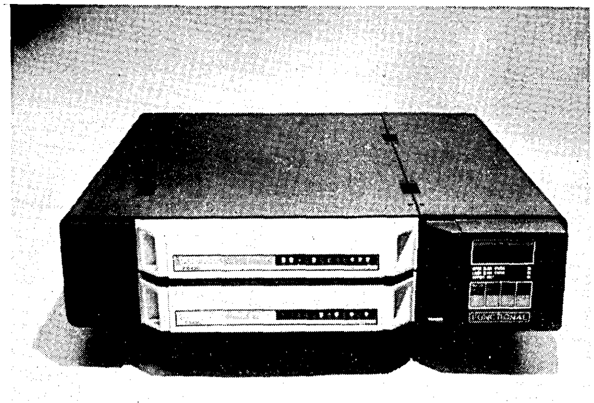
The fellows who designed the System 3000 Paperwork Processor built a lot of capability into a package that won't scare the office help. Features protect against little accidents: floppy drive



doors lock when in use, batteries back up the memory, and there's no off switch (powering down is a keyboard function which will execute only when the 6800 micro controlling the system knows everything is safe and sound on the diskette).

(Continued on page 298)

product spotlight



64-bit Computer

A 64-bit, 7.5MB mainframe seems like a mighty big undertaking for a firm's first computer, but they've got to have something mighty promising in hand to attract venture capital from the likes of T.A. Associates, CitiCorp Venture Capital Ltd. (a wholly owned subsidiary of CitiCorp), and First Capital Corp. (a wholly owned subsidiary of First National Bank of Boston). "Everything Richard Morley (company president and principal architect of the computer) touches turns to gold," noted one capital source.

The computer, known as the F6400, is based on 4-bit slice processors (Advanced Micro Devices 2901) cascaded to give a 64-bit word. The cpu doesn't bother with I/O; instead M6800 microprocessors absorb the overhead bringing things in and out of shared memory. The I/O throughput rate is speced at 40MBps. As many as 60 I/O ports can operate simultaneously. An F6400 can support up to 1.5 billion bytes of disc or 15 attached F6400s or a mix of discs and attached processors. System components are packaged in 34-inch wide cabinets. The F6400 runs off of 110/220 volt wall sockets, and contains fans for cooling. Air conditioning is not specified.

The firm doesn't plan to use virtual memory, instead it prefers to provide sufficient directly addressable memory for the application at hand. It feels price erosion in the memory chip market makes this economically attractive.

A software project, in parallel with hardware development, is busily working on a PL/1 compiler. PL/1 source will translate to an intermediate object code, said to be quite close to the processor's actual machine language. FORTRAN IV also is planned, but that's at least a year off.

Initial plans call for a single user operating system. The next planned evolution will provide multiuser support, and finally multiprocessor, multiuser capabilities.

The company's staff of roughly 30 professionals may understate the work in progress, as about half of the software effort reportedly has been delegated to outside subcontractors. Current projections call for six or so systems to be completed in calendar 1978, and 15 to 17 in 1979. With stringent quality control and week-long elevated temperature burn-in periods, delivery lead times may stretch to nine months. The vendor's commitment to quality assurance is demonstrated by its offering a one year parts and labor warranty on systems. The terms of the warranty call for the replacement of a failed module within 24 hours (initially in the Los Angeles and mid-Atlantic areas); the only qualifier is that no unapproved devices may be connected to the bus. That doesn't rule out connection of your favorite crt to an output port, but if you want to hang your own disc off the system you may invalidate the warranty.

The vendor expects to have a prototype available for tire kicking this summer, with deliveries commencing in the fourth quarter. PL/1 is slated for delivery at the time of first customer shipments.

An entry level system is expected to sell for $110,000. Such a system will consist of a cpu with 576KB of memory, 4K by 128-bit 500nsec writable control store, eight ASCII channels (to 9600bps), 3M data cartridge, 65MB disc drive with a two-drive controller, 300 lpm printer, color crt, and PL/1. FUNCTIONAL AUTOMATION, Nashua, N.H.

FOR DATA CIRCLE 415 ON READER CARD

(Continued on page 298)

- tremendous flexibility and ease of use
- warm restart and automatic recovery
- full-featured integrated data dictionary
- high level language query
- program independence
- minimum resource consumption
- upward-downward compatibility
- high performance
- full-featured report generator
- integrated telecommunications support with any TP monitor
- data independence
- guaranteed recovery
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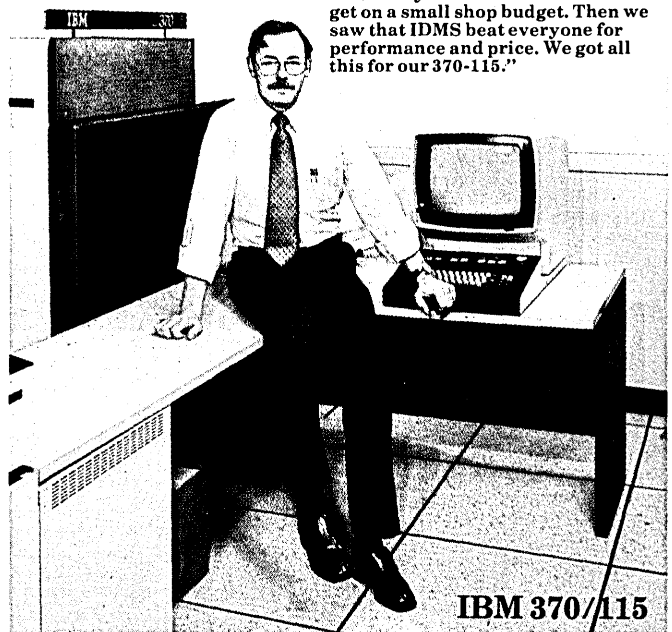
- outstanding vendor support
- rapid installation
- secondary indexing and sequential processing
- database administration utilities
- multi-threading



- tremendous flexibility and ease of use
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- full-featured integrated data dictionary
- high level language query
- program independence
- minimum resource consumption
- upward-downward compatibility
- high performance
- full-featured report generator
- integrated telecommunications support with any TP monitor
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- database administration utilities
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But some people believe that IDMS is too sophisticated and therefore not appropriate for small system users. These people couldn't be more mistaken — because IDMS is the one DBMS that easily provides big budget performance for all size budgets.

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CIRCLE 29 ON READER CARD

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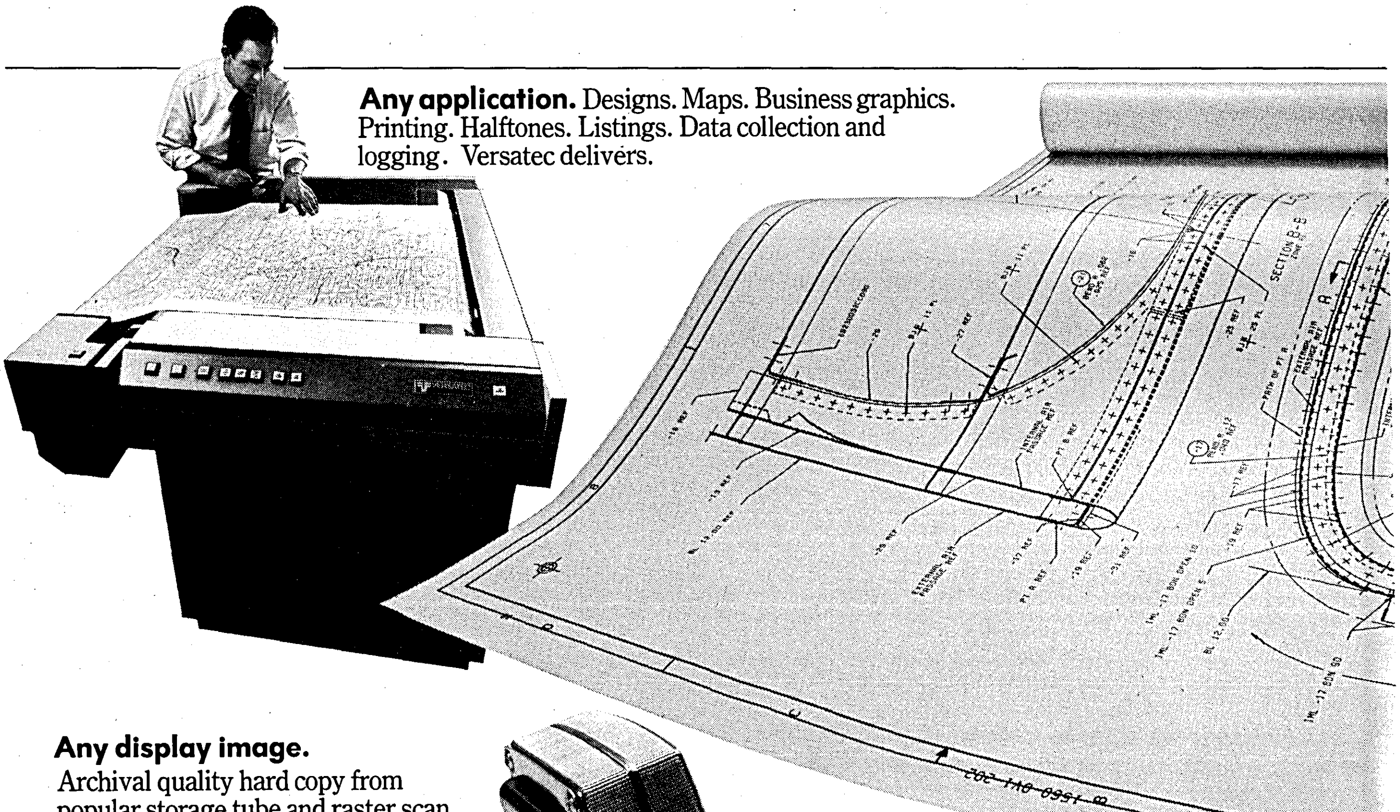

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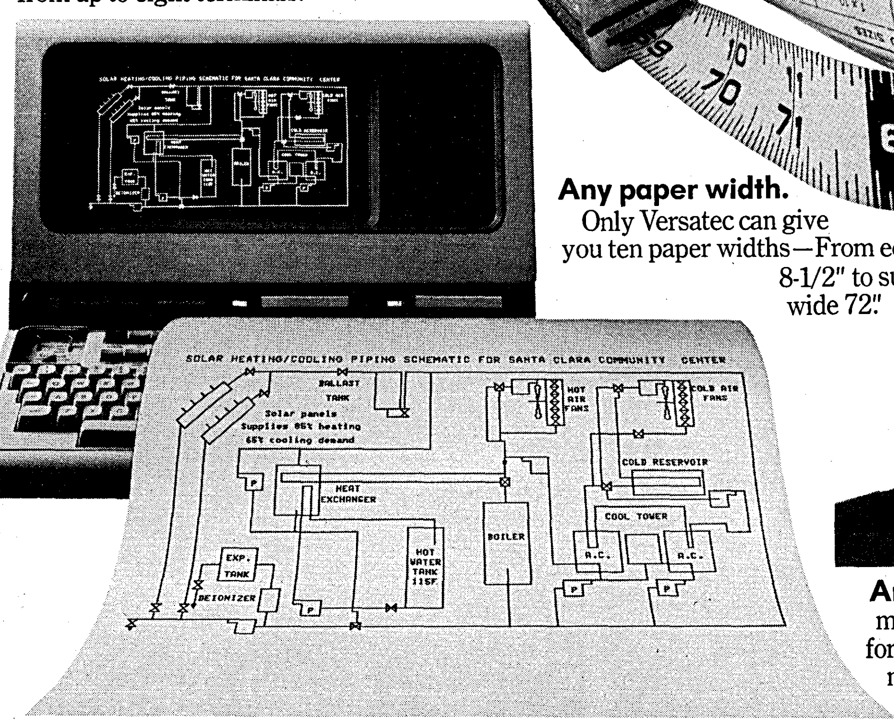
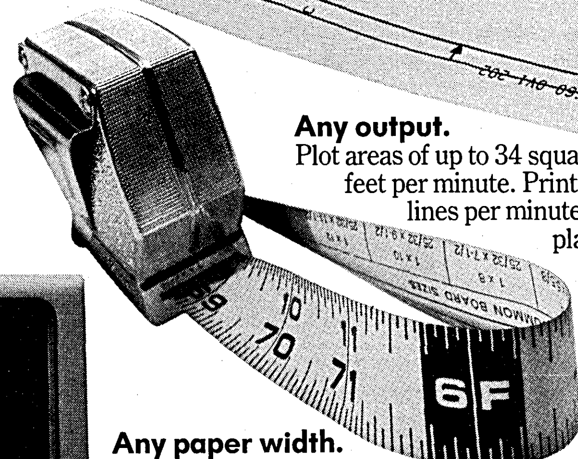


Any output.
Plot areas of up to 34 square feet per minute. Print up to 1200 lines per minute. Get hard copy from display in under twelve seconds.



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Only Versatec can give you ten paper widths—From economical 8-1/2" to super-wide 72."

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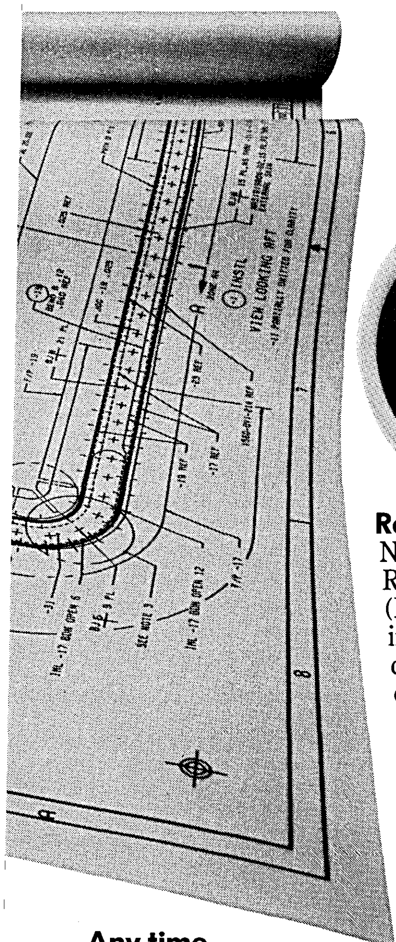
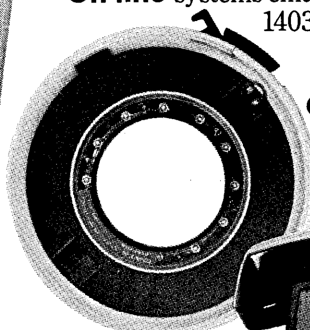
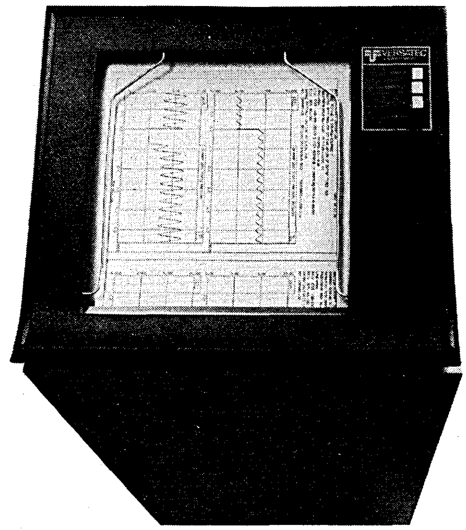


Any IBM 360 or 370 (OS or DOS). A complete family of output systems for IBM 360/370 accept vector data for fast electrostatic plotting without excessive CPU or I/O overhead.

On-line systems emulate IBM 3211/3811 or 1403/2831 printer/controllers.



Off-line systems accept vector, raster or print data on IBM generated tapes.



Remote systems. New Versatec RSVP™ (Remote Spooling Vector Processor) is the only complete remote system for electrostatic printing and plotting. It provides remote job entry like IBM 2780/3780 terminals, but dynamic output selection allows any combination of card, print or plot data for output on up to four Versatec printers, plotters or printer/plotters.

Any mini. Versatec pioneered mini-plotting. Our printer/plotters serve more mini models from more manufacturers in more installations than any other electrostatic. And no wonder. Versatec is the quiet, reliable way to put any information on paper.

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A. Get hard copy from display within 12 seconds.

B. Plot a 34" x 44" E-size production drawing in 22 seconds.

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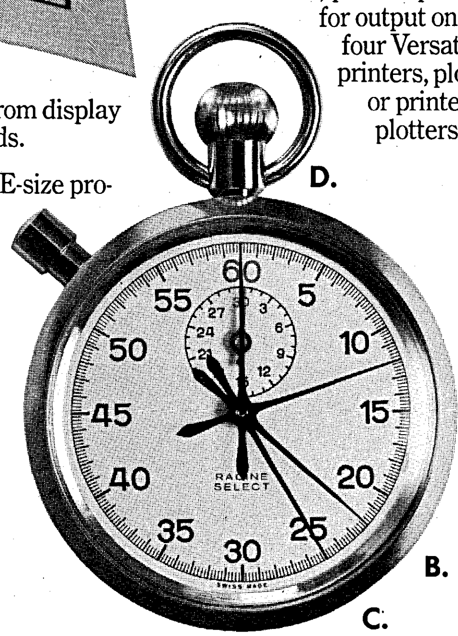

D.

A.

B.

C.

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Computer model and operating system ______
Organization ______
Address ______
City, State and Zip ______

VERSATEC
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hardware

(Continued from page 292)

Capabilities? Editing (which in the demo we saw seemed mighty fast), with nice features such as automatically adjusting moved text to fit the format of its new location, changing "automobile" to "car" with an automatic leading capital when "automobile" begins with a cap, and scrolling—forward, backward, left, and right. A variety of daisywheel printers from Qume and Diablo, including dual-headed models and a 240-column unit suitable for accounting balance sheets. Left flush, right flush, decimal, centered, and dot leader tabs. Security with passwords on entire diskettes or individual documents. And a really cute daisywheel mapping function that makes changing type fonts easy: a document typed originally for a font that includes "¼" will automatically be converted to "1/4" if the new font doesn't have the single character ¼. An optional statistical package can perform calculations on rows and columns of tabular data; the calculation specifications are stored with the document so changing a number in the table doesn't invalidate the total (or other result). And we heard rumors of a business BASIC package under development.

Optional asynchronous RS232 communications (up to 4800bps) come in two flavors: System 3000 compatible (with imbedded formatting codes), and ASCII (expanded as if the document was going to a printer).

A single station, single diskette, single printer system sells for $14,900. A dual station (the max), dual diskette, single printer system goes for $21,700. There's still room for another printer, and of course there are the communications options. Two, three, and five year leases also are offered. NBI, Boulder, Colo.

FOR DATA CIRCLE 417 ON READER CARD

Printer

The Media 12/7 is not your run-of-the-mill dot matrix printer. It can print 5 X 7-dot matrix characters at 200-some-odd-cps, but it does more. Quite a bit more. The bidirectional printer, controlled by a microprocessor, can make multiple passes over each line. The paper advance mechanism, of a straight-through design, advances the paper slightly before each pass, and the 7-pin impact print head fills in the gaps between previously printed dots. After two passes, the characters begin to look as if they were typed; after four passes it's difficult or downright impossible to distinguish between the printer's output and that of a typewriter. Of course, each pass decreases the printer's speed (in cps), but since fonts can be changed

under software control, it's possible to use a single-pass font for drafts and a high-quality, but slower, font for final copies. And there's more: the unit can print logotypes, signatures, or what-

PRINT SAMPLES
MEDIA 12/7 PRINTER

correspondence quality
(4 pass)
36 characters per second

116 characters per second

198 CHARACTERS PER SECOND.

144 CHARACTERS PER SECOND.

RCSanders.

ever, so long as they've previously been digitized for the controlling micro. As might be expected, the vendor has its eye on the word processing market, so in addition to the standard RS232 serial interface, the printer can be had with a Qume daisywheel compatible interface. We're told graphics support is on the drawing board, and an ancillary floppy diskette drive (for storing additional fonts) is on the way. The 100 unit price of the Matrix 12/7 is $2,010. Production shipments are scheduled to begin this quarter. R.C. SANDERS TECHNOLOGY SYSTEMS, INC., Derry, N.H.
FOR DATA CIRCLE 428 ON READER CARD

Intelligent Terminal

After building a $130-million business in photo typesetting, this vendor has decided to enter the general purpose intelligent terminal market with its MDT-400 series. The Mini Disc Terminal 400 includes a 16-line by 80 ASCII character display, 2,560-character buffer, microprocessor, and mini diskette drive. A bare-bones unit with 8KB of RAM lists at $4,275; an RS232 asynchronous communications interface adds $260 (with a second port for a printer, the interface goes for $350). Two communications emulators are offered: a Teletype model 33/35 ($200), and an IBM 2780 ($500). Editing software costs an additional $500. The terminal comes with software for file management and keyboard/crt handlers. Local applications may be developed in assembler or BASIC on a separate development system ($12,500 for an assembly language system; BASIC hasn't been priced yet, but

it's expected to add about $1,500). Maintenance, from the vendor's existing service force, is priced at $50 per month. Deliveries are slated to begin in October. COMPUGRAPHIC CORP., Wilmington, Mass.
FOR DATA CIRCLE 424 ON READER CARD

Array Processor

In the past the vendors of array processors seemed to fit one of two classes: those specializing in just array processors, and those mainframers (IBM, Cray, Burroughs) after the number-crunching market. We think this vendor is probably correct in claiming to be the first mini-maker to offer its own array processor.

The Eclipse AP/130 combines an Eclipse S/130 cpu with an 8KB array processor. The AP's dual-ported bipolar memory can be accessed by the AP, cpu, or peripherals with equal facility. The

hardware

200nsec microcycle AP features pipeline architecture, and once the pipeline is full, can produce a 32-bit floating point sum every 200nesec, and simultaneously multiply two 32-bit floating point operands every 400nsec. The unit is said to be capable of performing a 1K-point complex fast Fourier transform in 8.75msec. The vendor notes that in addition to applications in signal processing, the AP can act as a FORTRAN accelerator, speeding array calculations traditionally performed within the scope of a DO loop.

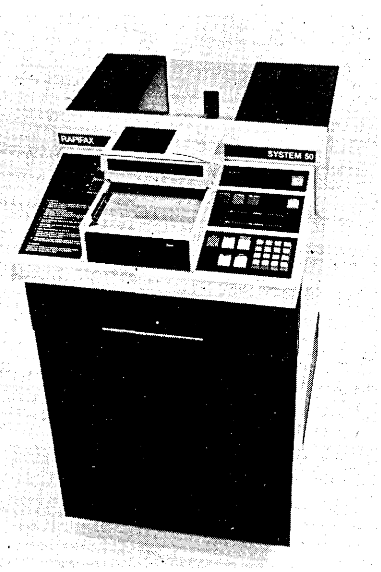
Array Processor Software (APS) provides a set of 46 high-level AP instructions. Invoked by calls from FORTRAN 5 or DG/L programs, the 46 APS instructions actually perform 134 distinct operations, depending on calling parameters.

An AP/130 system, with 128KB of memory, real-time clock, 30cps console printing terminal, 10MB cartridge disc drive, dual diskette drives, RDOS, FORTRAN 5, and APS lists for less than $60,000. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 429 ON READER CARD

Smart Facsimile

The System 50, a microprocessor-controlled high-speed (as fast as 35sec per page) facsimile transceiver, is called an electronic mail system by its manufacturer. To support its choice of words, the vendor cites the unit's unattended operation, auto dial/answer, and programmed polling capability. The units have automatic document feeders



capable of holding 50 pages, and hoppers for 500 pages of received documents. A central System 50 can be programmed to automatically dial remote units; a sequence of numbers may be programmed, along with specific times for the calls. Upon connection, the central unit can transmit documents and poll the remote unit for any pending transmissions. Security consists of matching access codes stored in both units. Operating over voice-grade phone lines, the System 50 transmits entire pages in 35sec, 50sec, or 90sec, depending on the resolution desired. A central site unit rents for $460 per month, a remote unit is $325 per month. Prices go up about $15 per month on July 1. No per-page charges are levied. RAPICOM, INC., Fairfield, N.J.

FOR DATA CIRCLE 427 ON READER CARD

Code Translator

The ST-1 uses an Itel 8035 microprocessor to translate serial data from one character code to another. The full duplex unit can be had with translations between ASCII, EBCDIC, and Baudot codes; the vendor offers other translations, or the user may program his own. The unit can function as a scrambling device for secure communications, it can base its translation on more than one character, and it can output a different number of characters than received. It's capable of data rate conversions, and operates asynchronously at speeds ranging from 100bps to 19.2Kbps. A ST-1 coded for bidirectional conversion between ASCII and EBCDIC sells for $525 for the first unit, $250 for each succeeding unit. SIGMA

Slipping In Mini Discs

Discs

This is truly the month for minicomputer disc announcements. Shugart Associates and Calcomp both announced inexpensive, Winchester-technology drives which will be shown at the NCC (see pp000,000). In the cartridge disc area, the big three independent mini-makers all announced new units with improved price/performance ratios.

Data General

This vendor doubled the bits-per-track density of its 10MB model 6045. The new 20MB model 6070 (10MB fixed, 10MB removable) is offered in subsystems consisting of a controller and one to four drives. The 6070 series is supported by AOS and RDOS on the vendor's Eclipse line, and by RDOS on its Nova line. Average rotational latency is 12.5msec, average seek time is 38msec, and the unit's data transfer rate is 625KBps. A 20MB subsystem, with controller and six cartridges, sells for $13,500; when purchased in a complete subsystem, each additional drive adds $8,000 to the price. A single add-on drive, sans controller, sells for $10,300. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 412 ON READER CARD

Digital Equipment Corp.

Three drives, ranging in capacity from 5MB to 67MB, joined this vendor's product line. The 5MB RL05 cartridge disc sells for $3,800; configured into a subsystem, with controller capable of handling four drives, a single RL05 subsystem is $5,100. Intended for use with PDP-11s and PDP-8s, the drive has an average seek time of 55msec, and a peak transfer rate of 512KBps. The RK07 (28MB) drive is functionally equivalent to the 14MB RK06. In a subsystem consisting of drive, cartridge, and controller, it sells for $14,500. Its average seek time is 36.5msec, and its peak transfer rate is 538KBps. The RK07 is intended for use with PDP-11s and the VAX-11/780. For use with larger systems (PDP-11/70, VAX, and DECsystem 2020), the 67MB RM02 provides an average seek time of 30msec, and peak transfer rate of 806MB. The top-loading pack drive sells for $18,000 when configured with controller. The controllers for both the RK07 and RM02 can handle up to eight drives. Discs on all three new drives rotate at 2,400rpm, providing average rotational latencies of 12.5msec. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 413 ON READER card

Hewlett-Packard

The 20MB 7906 is both plug- and cartridge-compatible with existing 7905As; it's software-compatible with the vendor's model 1000 computer systems and RTE systems using the vendor's 21MX series of minis. They did it by doubling the tpi density on the bottom, fixed disc, providing 10MB of fixed disc storage, and 10MB (as in the 7905A) of removable cartridge. The 7906 has an average seek time of 25msec, 8.33msec average latency, and a transfer rate of 937.5KBps. The 7906 comes in rack-mount or free-standing packages; in each version there are master (with controller) and slave versions. A master can have seven slaves. In the free-standing version, a master unit sells for $14,000, a slave for $10,500; deduct $1,000 if you want either version in the rack-mount package. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 414 ON READER CARD

DATA SYSTEMS, Palo Alto, Calif.
FOR DATA CIRCLE 416 ON READER CARD

Computer

Marking the first member of a new product line, the Classic Series 7860 appears an interesting 16-bit machine. That's not to say it's limited to working with 16-bit quantities, as the processor handles operands ranging from a single bit to 64 bits. Its integral floating point processor performs operations on 32-bit, 48-bit, and 64-bit operands in parallel.

Designed for general purpose use, the Classic series remains compatible with both programs and I/O devices originally intended for use with the vendor's earlier models II and IV.

To optimize multiprogramming under the vendor's MAX IV operating system, the processor uses a context file of 16 banks of 15 general purpose registers. Switching contexts between tasks doesn't require saving registers, but merely selecting the proper bank of registers. The virtual operating system also gets help from the memory, which may be fabricated of core or MOS chips. The memory expandable to 512KB in 128KB chunks, can be interleaved either two or four ways, yielding effective access times as low as 125nsec. Of the processor's 367 instructions, many execute in less than 1usec; for instance register-to-register 16-bit add, and load bit in register execute in 200nsec. A 64-bit, register-to-register floating point subtract takes 1.6 sec.

Support software for the Classic series includes FORTRAN IV, COBOL, a proprietary language for industrial applications (MAXINE), and Cincom System's Total data base management system.

A typical system with 256KB of memory, hardcopy console printer, 10MB of disc, a line printer, 16 channel terminal multiplexor, eight crt's, bisynchronous communications, and the MAX IV operating system goes for $89,000. MODULAR COMPUTER SYSTEMS, INC., Fort Lauderdale, Fla.
FOR DATA CIRCLE 418 ON READER CARD

Fiber Optic Link

The RSH-D1 turnkey fiber optic data link is particularly well suited for use in environments plagued with electromagnetic interference problems. Capable of operating at asynchronous speeds of up to 20Kbps, 300 foot fiber cables are supported in the standard version. An interface at each end translates between devices' RS232 signals and those in the light pipe. A pair of interfaces sells for $1,000, and full duplex fiber optic cable costs $1 per foot. VALTEC CORP., West Bolyston, Mass.
FOR DATA CIRCLE 426 ON READER CARD

Calculators

The folks who gave us the first pocket calculator have a new line now, replacing much of its low-end line. Dubbed the Series E, the units have larger displays, with automatic insertion of commas in large numbers. The model 31E ($60) descends from the 35 and is intended for the user buying his first electronic sliderule. It includes arithmetic, log and trig functions, and a number of conversions (rectangular/polar, inch/millimeter, etc.). The 32E ($80) is a descendant of the 45, and has all the capabilities of the 31E plus hyperbolic functions. The model 25 is replaced by the 33E ($100), a programmable unit which offers 49 lines of merged keystroke memory. The models 37E and 38E are designed for financial applications. The $75 model and 37E can develop amortization schedules, and offers statistical and mathematical functions. The 38E ($120) does everything the 37E does, plus calendar calculations and other goodies. The 38E is programmable, capable of handling as many as 99 program lines. HEWLETT-PACKARD CO., Palo Alto, Calif.
FOR DATA CIRCLE 425 ON READER CARD

FOR AMDAHL CIRCLE 150 ON READER CARD —

We're looking for only one kind of person at Amdahl.

The kind of person wh

OUR SUCCESS IS THE SUCCESS OF OUR PEOPLE.

Amdahl was founded by a bright and dedicated cadre of people, bound together by the opportunity and challenge to rethink large-systems technology, performance, reliability, serviceability and support. In a relatively short time, innovative thinking and performance have made Amdahl a major contender in the large-systems market. With a solid basis for continuing growth.

As Amdahl grows, more of the kind of people who made the company what it is today are needed.

People with a trailblazing spirit.

People who get involved. With their work. With each other. With ideas.

That's the kind of person who's good for Amdahl.

Today.

And tomorrow.

STATE OF THE ART IS A STATE OF MIND AT AMDAHL.

At Amdahl, the kind of thinking that went into advanced technology and architecture pervades most everything the company does.

That's why Amdahl produces the most advanced family of general-purpose computers. And why Amdahl has the most respected support and service organization in the industry.

Amdahl customer support teams don't just support Amdahl systems but, in fact, offer assistance to aid in diagnosing any hardware or software problems in the customer's environment. Regardless of the origin of the problems.

This total systems support philosophy, along with the unique remote diagnostic techniques afforded by the Amdahl Diagnostics Assistance Center (AMDAC), results in customer systems that deliver exceptional levels of availability. And, of equal importance, greater job satisfaction and professional growth for the Amdahl support and service people.

Wherever you work at Amdahl, you'll be among some of the best people in your field. And you'll find them just as involved and enthusiastic as you are.

Amdahl wouldn't want it any other way.

PEOPLE WHO DON'T GROW, SOON GROW BORED.

Talented people often feel their careers have reached an endless plateau. Or find their talents wasted on a slow track in a large, rigidly structured organization.

From the beginning, Amdahl has recognized the need to provide an effective means for personal and professional growth.

By creating an environment in which the efforts of the individual are recognized and rewarded.

And with the kind of commitment to employee compensation, benefits and continuing education that promotes continued satisfaction of the individual.

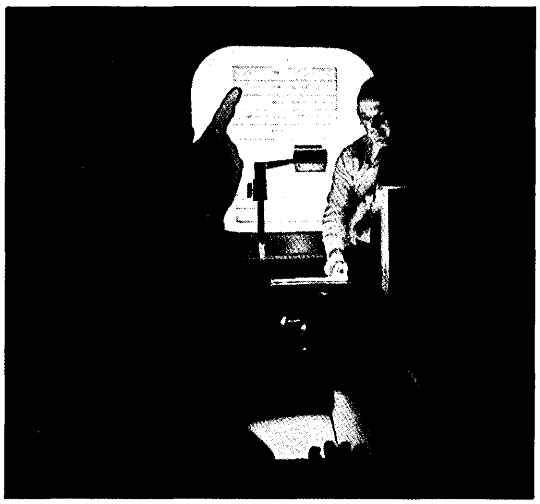
In 1977 the size of our staff more than doubled. So did our revenues and operating income. That kind of growth creates continuing opportunities for advancement.

Not just in management. But everywhere, including the hands-on state-of-the-art technical environment.

Amdahl's determination to maintain technological leadership doesn't leave Amdahl people much of a chance to grow bored.

That's good for Amdahl.

And good for people, too.



If you're interested, we're interested.

If you'd like to rethink your future, fill out this easy application and send it to Amdahl today. In strict confidence. With no commitment.

Amdahl would like to know about you.

And would like to let you know more about Amdahl. About specific opportunities that might be of interest to you.

You see, Amdahl thinks you're a valuable asset.

To yourself.

And maybe to Amdahl, too.

PERSONAL

NAME: Please PRINT or TYPE Last Name, First Initial and Middle Initial	HOME TELEPHONE NO.
ADDRESS: Street Number and Name, City, State, Zip Code	Message/Business No. + Ext.

POSITION DESIRED

Type of POSITION Desired:	Date Available
Geographic Preference	Salary Desired $

EDUCATION and TRAINING

Indicate Last Level of Education Completed	HIGH SCHOOL				COLLEGE or UNIVERSITY				GRADUATE SCHOOL		
	☐ 9	☐ 10	☐ 11	☐ 12	☐ 1	☐ 2	☐ 3	☐ 4	☐ 1	☐ 2	☐

NAME of SCHOOL High School and College	LOCATION City and State	MAJOR	DEGREE

EMPLOYMENT HISTORY (Please feel free to send us a resume or letter if you like.)

PRESENT EMPLOYER	Employment Dates
	From To
Description of Duties	Position

PREVIOUS EMPLOYER	Employment Dates
	From To
Description of Duties	Position

PREVIOUS EMPLOYER	Employment Dates
	From To
Description of Duties	Position

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Welcome to INTERFACE '78


THE NEW ERA IN PRINTERS

software & services

Updates

Half a dozen Australian hospitals have jointly developed a reporting and patient identification system which runs on Data General Nova minicomputers. The system, written by Hospitals Computer Service at Monash Univ., processes test results and prints cumulative reports on each patient. It also maintains patient records, and allows updating via terminals in the lab and patient reception areas. At Dandenong and District Hospital, the system currently produces cumulative reports covering biochemical and hematological patient histories; microbiological and histopathological data are slated for inclusion as the system evolves.

With protecting an author's rights to his software the hot button that it is (keep your eyes on CONTU), it should be interesting to follow the experience of Adam Osborne as he uses the copyright laws to protect his interest in the applications software his firm markets to consultants. Osborne & Associates of Berkeley, Calif., has put the magnetic representation of its payroll, accounts payable, accounts receivable, and general ledger packages in the public domain. On the other hand, they sell the copyrighted documentation for $15 a crack. They'll give the programs to consultants (who can modify the applications to fit clients' needs) but Osborne requires consultants to use his documentation.

Thirteen Ohio and Kentucky savings and loan associations have joined the nationwide roster of 100-some-odd financial institutions offering bill paying by telephone accounts. The service, administered by the savings and loans and Automatic Data Processing, uses a system developed by Telephone Computing Service of Seattle. Customers can call the service, give their account number and personal identification number to the operator, and specify how much to pay each participating merchant. Bills which remain constant from month to month can be payed automatically. At the end of the day, the service writes a single check to each merchant.

Intelligent Data Entry

The Incoterm Transaction Entry Management System (ITEMS) continues the trend toward adding more and more intelligent functions to what used to be the terminal end of a data processing link. Designed for this vendor's Series 30 and 40 systems, the software allows for data editing and report writing simultaneously on as many as eight displays and eight printers, each under the control of a program of its own, and all using IBM 3270 protocol.

The company stresses the software's "distributed processing" abilities, but the functions supported (as well as the name of the package) suggest the aim is primarily to distribute data massaging of the entry, editing, and retrieval types—and for the program development to support those functions.

Users will be assessed an initial fee of $7,500 plus a recurring charge of $2,400 per year; those fees allow customers to use ITEMS at any number of sites without additional charges. Included is a utility for translating existing forms (or presumably screens) to ITEMS own Transaction Development Language. INCOTERM CORP., Wellesley Hills, Mass.
FOR DATA CIRCLE 402 ON READER CARD

CICS Optimization

The STROBE program performance measurement package has been around for half a dozen years but is now getting a CICS interface. By sampling cpu and I/O activity, it profiles such things as how much of the time is spent in applications code, how much in CICS supervisor modules, and file-busy time broken down by unit, volume, and cylinder. Cpu time detail is by memory location, but optionally can be done by source program statement. And to cut the overhead for sampling, STROBE/CICS may be turned on or off by the user through a terminal.

Available to both IBM OS and VS sites, the CICS feature adds $2,000 to STROBE's base of $10,600. Installation, training, and one year's maintenance are included. PROGRAMART, Cambridge, Mass.
FOR DATA CIRCLE 403 ON READER CARD

Simulation

The MultiPurpose System Simulator (MPSS) allows users to evaluate the relative performance of competitive computer systems and to identify components needing enhancement in existing or proposed systems. It can simulate multi-cpu interactive systems. Systems under investigation are described by hardware configuration, data load, and software mix. Model input consists of cpu and memory peripheral devices, along with communications line and bus characteristics. The simulation takes into account data block types, and can schedule their arrival rates over constant, periodic, or Poisson probabilistic distributions. MPSS reports on cpu processing and idle times, data block backlogs, response times, software module response times, communications line use, and memory device use and contention. The package is written in FORTRAN IV (90%) for IBM's level H compiler, and 360 OS assembler (10%), and requires roughly 350KB on a 360. MPSS operates in batch mode. It comes on 9-track mag tape at a price of $930; documentation sells for $23. The package was developed by the NASA Goddard Space Flight Center. COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER, University of Georgia, Athens, Ga.
FOR DATA CIRCLE 408 ON READER CARD

"Free" Table Generator

Deep within the U.S. Department of Labor lies the Bureau of Labor Statistics, which is given the not-so-stimulating task of generating thousands of tables of data. Some of these are quite important to our everyday lives, like the consumer price index. All involve arithmetic calculations, data selection, cross-tabulations, and summarizing.

To make the work go easier, the bureau produced TPL, a Table Producing Language. (Actually, TPL was generated by the XPL compiler generator from the Univ. of California at Santa Cruz, which constructed it in a subset of PL/1 for the bureau.) The resulting product handles fixed or variable length data, all commonly used sequential file structures, and character, packed decimal, binary, and double-precision floating-point—all with enough care that the results are reasonably accurate to 18 positions.

Routines are included for regression, correlation, factoring, matrix manipulation, etc., and for shunting results into other statistical packages. Output may be to a line printer; the BLS often uses photocomposers.

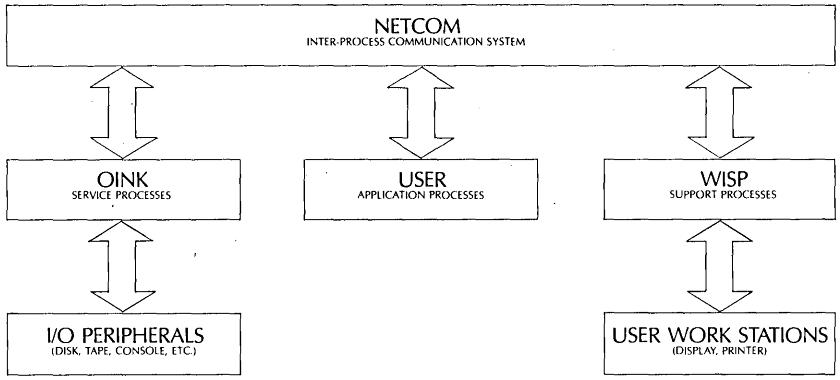
One of its nicest features is that the new version (number 4) comes on IBM standard labeled tape at 1600bpi, in object form, for only $300. BUREAU OF LABOR STATISTICS, Washington, D.C.
FOR DATA CIRCLE 400 ON READER CARD

M6800 Industrial Basic

This 4K BASIC interpreter is said to be optimized for industrial applications,

software spotlight

FINNET INFRASTRUCTURE



Networking

The Finnet networking software package, described in our November 1977 issue (p. 179) is available to users of Data General minis of both the Nova and Eclipse families. The package consists of Netcom, an interprocess communication system which operates over full duplex, multiline, multidrop synchronous lines as well as local high-speed interprocessor links via DG's multiprocessor communications adaptor (MCA). Messages containing from 1K to 2K bytes can be passed between processes within the same cpu or different cpu's; communication between remote sites is transparently handled by Netcom. An optional package, Oink, which runs only on Eclipse series processors, provides Infos data base and RDOS operations for processes on any cpu in the network. It runs under RDOS/Infos and can supply physical I/O functions for all processes in the network. An additional package, Wisp, provides workstation support for remote crt's and teleprinters. Central site systems must run under RDOS, remote sites may use RDOS or RTOS. Netcom comes in two versions, one supporting MCA interprocessor links, the other for synchronous links. Each version has a perpetual license fee of $4,000. There's an additional charge of $500 per MCA, and $1,000 per synchronous drop (cpu). Oink's license fee is $3,000; Wisp goes for $4,500. All prices are quoted in Canadian dollars. FINNING COMPUTER SERVICES LTD., Vancouver, B.C., Canada.

FOR DATA CIRCLE 401 ON READER CARD

(Continued from page 310)

sporting I/O capabilities for process control and monitoring. It provides for control of interrupts, direct memory access, and linkage to assembly language subroutines. The interpreter can reside in RAM or PROM; if both interpreter and program are burned in PROM, the system can automatically enter RUN mode at power on. It's available on a cassette tape for $95, in PROM on one of the vendor's ROM Modules for $299. The source listing costs $95, and an oem license goes for $2,000. WINTEK CORP., Lafayette, Ind.

FOR DATA CIRCLE 404 ON READER CARD

Pilot

Pilot, a language for writing computer assisted instructional dialogs, is available for 8080 and Z-80 based microcomputers running CPM or similar oper-

How Diablo improved my appearance.

By A. Letter

I didn't always look this good.

Sometimes I was even embarrassed to go out of the office. Then one day, my boss introduced me to the Diablo 1355 WP metal-clad print wheel. Suddenly my characters were coming out crisp. Proportionally spaced. And uniformly dense.

Since I discovered that Diablo has over 100 type styles, I'm never bored either. There's 88 characters to choose from in English. And 92 in foreign fonts. And the future looks even better. Because soon there will be 96 characters to choose from.

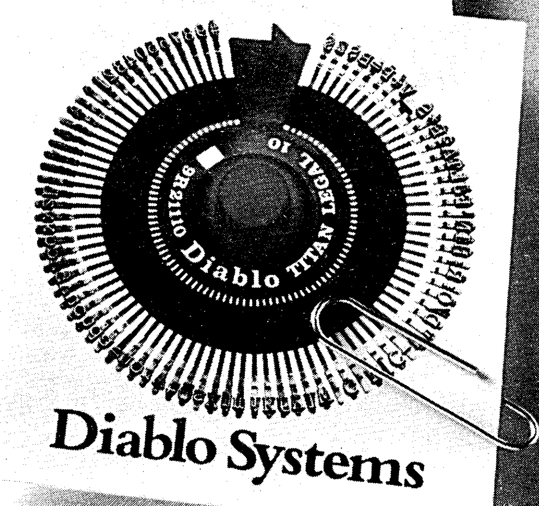
And thanks to the Diablo 1355 WP, I never have to worry about keeping up with the pace. Because the metal-clad wheel prints 40 characters-per-second.

It's durable too. In fact, the wheel that printed me today was no youngster. It was over 16 million characters old, but you'd never know it to look at me.

Not that I'm vain. But I am "camera ready" as soon as my page is finished.

And in my line of work it's important to make the right kind of impression.

Of course, it's only since they started using the Diablo 1355 WP metal-clad print wheel that I really became letter perfect.



XEROX

ating systems. The language is implemented as an interpreter and comes with a line-oriented editor (we're told the editor can be lifted from Pilot and inserted into other language processors, if desired). The language provides for conducting tutorial dialogs, asking questions along the way. A string-matching verb can be used to search for certain strings in student's response; the specific search strings can be anchored to either (or both) ends of a word. The program can branch based on whether or not a match occurred. The package, which is said to run on systems with as little as 24KB of memory and a single floppy drive, sells for $50 (object code), or $100 (with source code). It's available on 5¼-inch Northstar diskettes, or 8-inch CPM formatted diskettes. TSA SOFTWARE, Ridgefield, Conn.

FOR DATA CIRCLE 405 ON READER CARD

Operating System

Fast, an operating system for Interdata's 16- and 32-bit processors, obviates the need for fixed partitions by providing dynamic memory allocation. The operating system is installed in about half a dozen custom applications, and now the vendor is making it generally available. Fast is said to support as many as 100 terminals simultaneously. Multitasking Fast offers five different file access methods (HISDAM, QSAM, PSAM, BDAM, and CPAM), and provides spooling for printer output files, and overlapped I/O. Standard utilities include Aid (a debugger), Fastvp (a multiterminal program source editor), Slib and Plib (source and program library utilities). An assembler, said to incorporate features of both Interdata's and IBM's assemblers, is included; an optional IBM-source compatible assembler, which recognizes both mnemonics and directives from IBM's OS/VS assembler, is in the works. Much of the software developed for Interdata systems is said to run under Fast with little or no modification, allowing the use of many Interdata supplied programs. A caveat: some do not work, notably ITRAC (a transaction processing system), but this vendor says it has its own transaction system in the works. Fast runs on systems as small as 24KB of main memory, 2.5MB of disc, and a console terminal; SYSGEN requires 32KB. The 16-bit version of Fast goes for $7,500, the 32-bit version for $10,000. CYBERTEK COMPUTER PRODUCTS, INC., Los Angeles, Calif.

FOR DATA CIRCLE 406 ON READER CARD

Laboratory Subroutine Package

Laboratory users of the PDP-11 series, for the /03 up to the /70, can use the FORTRAN-callable subroutines in this package to process data acquired by other lab system software. Intended to free lab researchers from the task of writing their own subroutines, the LSP-11 software can handle peak processing, histogramming (reference points included at the user's option), fast Fourier transform, phase angle and multiple spectra, power spectrum, and correlation function. The operating systems which support LSP-11 are: RT-11 (with FORTRAN IV/RT-11) and RSX-11M (with either FORTRAN IV/IAS-RSX or FORTRAN IV-Plus). LSP-11 carries a $300 license fee. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 407 ON READER CARD

Communications

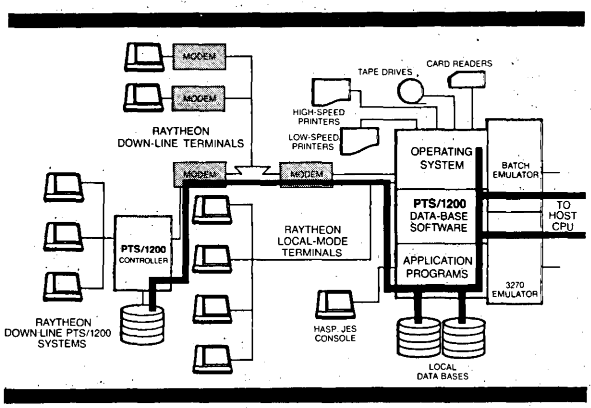
A terminal-speed-select program for IBM 3705 communications controllers using the Network Control Program (NCP) allows the 3705 to communicate with asynchronous ASCII terminals operating at 10cps, 15cps, 30cps, or 120cps. The vendor's modifications let NCP set speed and code type when a dial-up connection is made. Teletypewriters and 2741 terminals are supported. The package needs 300 bytes of 3705 storage, and leases for $100 per month. A free trial is offered, COMM-PRO ASSOCIATES, Manhattan Beach, Calif.

FOR DATA CIRCLE 409 ON READER CARD

The Raytheon Checklist. A distributed processing user's best friend.

The term distributed processing is new enough that many people, both users and manufacturers, mean many different things when they talk about it.

Rather than try to add another definition to the many now existing, Raytheon Data Systems has prepared this comparative checklist of the major functions that might normally be considered attributes of any distributed processing system.



Shown above is a typical schematic of a PTS/1200 distributed processing system with a hierarchy of local data bases, multiple terminals in multiple applications, all linked by one or more protocols to a central mainframe.

Regardless of the distributed processing system you eventually select, there are a number of capabilities you will want that system to possess. Obviously, the more features the system has, the greater its capacity to do all the work you have planned now—or might need tomorrow.

Our checklist itemizes many of the most important features you should consider. They are not the only features, but we think they are the most important.

And—to make the point that Raytheon's PTS/1200 MARK•I and MARK•II systems are extraordinarily powerful distributed processing systems—we've taken the liberty of itemizing their capabilities in each of the columns shown. Do that with other vendors' equipment, and we think you'll choose Raytheon.

Then check prices. The MARK•I is lowest.

After you've looked at the variety of products on the market, you'll also want to see what each costs.

We can tell you about Raytheon's pricing. The PTS/1200 MARK•I is the lowest. By low, we mean up to 30 per cent below the most popular alternative models. The PTS/1200 MARK•II costs a little more, but is more than twice as powerful as the MARK•I. You won't be able to compare its cost directly with other equipment, because no other equipment can come close to matching its performance.

Solving the installation and productivity problems that these users encounter takes patience, skill and the commitment of an experienced vendor. It takes going beyond a standard product, and finding customized solutions, and often products, to meet a user's requirement.

Most of all, it takes doing it. Over and over and over again. Raytheon has done it over and over and over again.

Fast, easy installation and growth is vital.

Not shown in the checklist is another vital aspect of distributed processing systems—immediacy of installation and ease of expansion. The Raytheon PTS/1200 MARK•I can be installed in less than a day, with no change to host hardware, or systems or applications software. You become productive right away. And when you want to grow, you simply add capacity—within a single system, or by adding additional systems or devices. Every PTS/1200 is compatible with every other—and with your host mainframe system and protocols in almost every case.

Look hard at experience too.

Beyond the hardware, the price and the easy compatibility, there is the experience factor. The vendor with experience can save the user without it a lot of grief.

Raytheon is the world's largest non-mainframe supplier of intelligent terminals and distributed processing systems. Some of our customers use more than 2,000 Raytheon terminals in data networks located at more than 300 locations either domestically or around the world. Many others have one or several PTS/1200 distributed processing systems at work in remote locations, linked on-line to a central mainframe.

A typical four-station MARK•I system with a 64K-byte controller, 10 MB disk, and one 165cps printer leases for $850 per month, including all software and maintenance.

The 54-Point Checklist

Feature	Typical Configuration	Importance of Feature	Product Capabilities PTS/1200	Brand X	Brand Y	Brand Z
INTELLIGENCE	✓ Dependent totally on host processor ✓ Stand-alone (non-shareable) intelligence in each station ✓ Small-cluster (shared by 1-8 stations) ✓ Large-cluster (shared by 1-24 or more stations)	Intelligence is based upon the amount of available programmable memory a system possesses. Its purpose is to facilitate local application development and execution. The larger the available memory, the better the applications freedom.	N/A All resources shareable by all stations 64K to 128K bytes 64K to 128K bytes			
CONTROLLER	✓ Word size ✓ Number of operator stations per controller ✓ Number of peripheral attachments per controller ✓ Availability of high level languages ✓ Ability to perform multi-tasking	The controller is the central processor of a distributed system. Its power in terms of word size, attachment capacities, programmability and ability to perform multiple tasks concurrently is the key limiting factor in its ultimate performance.	16-bit 1-8 stations, or 1-24 stations 1-4 peripherals, or 1-20 peripherals Yes: MACROL; COBOL in the future Yes Up to 32 tasks concurrently on one controller			
TERMINALS	✓ Variety of screen sizes ✓ Variety of keyboard options ✓ Availability of user-definable function keys ✓ Ability to provide operator prompting ✓ Ability to attach remote terminals on phone line	The terminal is the point of operator interface and should be capable of being comfortable to use, easy to use, and easily matched to one or many different applications through customizing.	960 or 1920 3270 typewriter, data entry 16 program function keys; plus any key programmable Yes: by screen, audio and light indicators Yes			
PERIPHERAL ATTACHMENTS	✓ Number of attachments per controller ✓ Low-speed printer devices ✓ High-speed printer devices ✓ Card reading devices ✓ Magnetic tape transports ✓ Printer's word processing quality	The ability to attach a variety of peripheral equipment of various speeds and capacities is a measure of the range of work a system can do.	1-4, or 1-20, any combination 45-165 CPS 3 models 300 LPM and 600 LPM 300 CPM 800 and 1600 BPI Yes			
COMMUNICATIONS PROTOCOLS	✓ Asynchronous ✓ Synchronous ✓ Binary Synchronous —Batch —Interactive ✓ Synchronous Data Link Control (SDLC)	The ability to support more than one protocol —at the same time on the same system—adds immeasurably to the number of tasks and number of networks a system can work in without additional user development effort.	Yes, TTY RS-232 Yes Yes Yes Yes, in 1979			
INTELLIGENT 3270 OPERATIONS	✓ Local format storage ✓ Local printing ✓ Ability to access and update local data bases ✓ Transactions stored locally, batched for transmission to host ✓ Field verification at each terminal location ✓ Application program decides when to go to host	This feature assures that the system can work immediately and easily with the most popular terminal devices in use today, and extend the performance of those devices in a variety of ways.	Yes Yes Yes Yes Yes Yes			
EMULATION CAPABILITIES	✓ 3270 interactive (dumb) ✓ 3270 interactive (intelligent) ✓ 2780 batch ✓ 3780 batch ✓ SDLC batch/interactive ✓ HASP remote job entry ✓ Non-IBM protocols ✓ Specialized protocols	Emulators are software tools that permit a system to operate as a look-alike under other vendors protocols and procedures. Their advantage is to permit direct and immediate attachment to networks using a specific device protocol.	Yes Yes Yes Yes Yes, in 1979 Yes Yes Yes			
DATA BASE STORAGE	✓ Multiple disk storage capacities ✓ Memory management software ✓ Ability to expand to very large local storage	Local data base storage under sound memory management techniques assures powerful local filing, easy off-loading of large central files and elimination of unnecessary communications to and from host.	Yes; from 10 to 320MB Yes Yes; to 320 MB per system			
SOFTWARE LANGUAGE	✓ Assembly language ✓ Strong macro command repertoire ✓ High-level compiler language(s) ✓ Easy-to-learn and use ✓ Numerous screen manipulation and interactive programming aids ✓ Parameter-driven aids where required	Language is the facility that makes it possible to tap the power of the basic system by allowing applications to be written easily. Simple but rich high-level language that can be learned easily by programmers or used by non-programmers extend a system's reach that much further.	Yes; not needed by user personnel Yes; 150 instructions MACROL now; COBOL in 1979 Yes Yes Yes; for format creation and source data entry			
NETWORK ENHANCEMENTS	✓ Concurrent communications operation ✓ Downline control of multipoint networks ✓ Remote program development support for mainframe in any language ✓ Teleprinter network on terminal lines ✓ Downline program debugging ✓ Downline terminal loading ✓ High-speed data transmission rates		Yes; batch and interactive at same time Yes; up to 10 drops per controller Yes Yes, on same lines at same time Yes Yes To 9600 BPS			

Raytheon—50,000+ terminals in use now.

When you select Raytheon, you are selecting a total single-source supplier who has installed more than 50,000 intelligent terminals. A supplier with a worldwide field maintenance organization that is linked together by its own distributed processing network that keeps track of every equipment outage for every customer. A supplier that does not need to offer third-party leasing, because it maintains its own self-financed leasing company. And a supplier whose customer list includes a very high percentage of the world's largest industrial, commercial, financial, insurance and government data systems users.

Raytheon. The company to pick when you've completed your distributed processing checklist.

Tell me more about the Raytheon PTS/1200 distributed processing family:

☐ MARK·I
☐ MARK·II

Tell me more about some of the features shown on The Checklist. I'm especially interested in:

1. __________
2. __________
3. __________
4. __________

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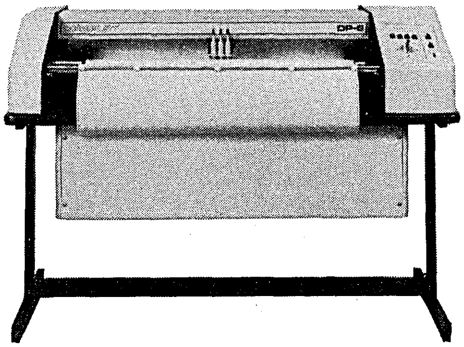

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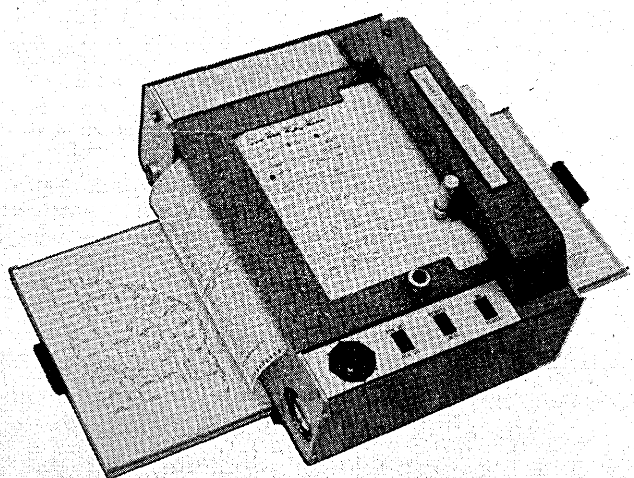

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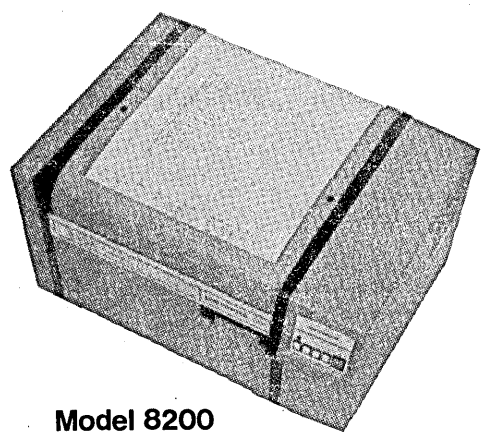

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letters

(Continued from page 32)

Communications of the ACM, the sort key at each stage was randomly chosen from the pile. It was noted later in the *Communications* that for already ordered data, it is better to use the central item (reducing the number of comparisons to the theoretical minimum for a random pile; of course, it is better not to sort at all or to use a merge sort). This trivial modification is referred to there as Quicker-sort. It would appear that this is what the student has discovered.

4. *The theoretic minimum is asymptotically attainable.* If one could select the median value as the sort key at each

stage, then the theoretical minimum would be attained for randomly mixed data. It has been noted many times that one may easily find a much better sort key than simply picking the central item. For example, if at each stage one selects the mid-most of three items (one central and two random), then it is easy to show that the sort is only 20% above the minimum. For large piles one should pick the median of a subsample of $4\sqrt{m/4}$ items (assuming an inefficient bubble subsort) to minimize the sum of the additional work of the sub-sort plus the work of the mainsort. For arrays of 10,000 the deviation from the theoretical minimum is imperceptible.

Since no theory was presented in the article, and since the timing results stated cannot be considered meaningful (at least the Quicksort used was a very poor implementation), my conjectures about the new algorithm may be entirely wrong.

DR. PAUL R. SPARKS
Bellaire, Texas

(Continued on page 321)

letters

(Continued from page 319)

March, p. 184). His litany of supervisors (engineers, astronomers, physicists) is enough to make the most seasoned veteran cringe.

My ten years of experience in the manufacturing world have uncovered a knight/squire syndrome there as well, but one which has worked to the advantage of data processing professionals.

In the beginning the knights were those who had earned their stripes in the company and who were encouraged to direct their creative abilities in the solution of business-oriented problems. Their squires were the young, eager, college-educated whippersnappers whose knowledge came from books, whose minds were uncluttered with prejudices against change and whose only fault was lack of experience in dealing with the business world. In the past ten years the squires have matured and wisened, many of them becoming knights and lords. Many of the former knights are now polishing armor in the various maintenance shops throughout the kingdom.

Raids you say, Mr. Delaney? If a squire was snatched, it was because he was ready for knighthood ahead of his peers. Look around you, sir. The squires of the world have risen and are in power. The old knights are dead, long live the knights!

PAUL GOLDAK
Manager, Systems
Angelica Corp.
St. Louis, Missouri

Webster's revisited

I read with interest the Editor's Readout entitled "Just What is a Baud, Anyway? And Why is it Spelled Funny?" (February, p. 77). I would like to point out that while the piece clearly and concisely told an abbreviated version of "where it's at" in data communications, nowhere were the answers to the two questions in the title to be found.

A.E. LOEBEL
Director, MIS
Bostitch Textron
East Greenwich, Rhode Island

Our editor replies: By checking our Webster's New World Dictionary we discovered that the original Middle English spelling was baude; but how it evolved into bawd and then to the present day baud we have not a clue. As to its definition, during the Interface show in Las Vegas we sent one of our hardier editors to the Palomino Club to do some field research. He still hasn't been heard from.

Change and more change

Being a systems analyst myself, I read with great interest your article "The Systems Analyst as Change Agent," (November 1977, p. 85).

While the authors wrote only about change in the firm's system, my experience has taught me that the analyst

must also be alert to changes in the firm and its environment and in himself and his staff.

A proper systems analyst is in a constant state of learning, theories and practices on the one hand, and systems and changes that systems create on the other. This learning must be evaluated and introduced into the system as soon as possible. We may surely say that the profession asks for an unconventional dynamic change agent who must act as a conductor of multiple changes, applying them in proper time and place in accordance with needs as to the best of his knowledge and intuition.

ALEXANDER SCHEY
Ramat Gam, Israel

Management in transition

I enjoyed Mr. Gilbert's skillfully written article in the March issue ("Can Today's MIS Managers Make the Transition?" page 141), and see the situation pretty much as he does. I am glad that he has added his voice to the growing chorus of MIS professionals who feel that our entire discipline is undergoing a rapid transformation with regard to its responsibilities for managing the totality of information.

PAUL A. STRASSMANN
Vice President
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The Many Faces of the Machine

In the quarter of a century or so that computers have been used in business, education, and government, much has been written about their sociological impact. Studies on the growing alienation of man from his impersonal, machine-oriented culture seem to settle on computers as the bringer of frustration and fear—the computer is cited as an arch example of psychological "fallout" from the age of automation. A kind of Kafkaesque picture emerges of a future in which police, government, and credit files contain information dooming an individual to jail, duplicate taxes, lack of credit, etc.

The computer's side in all of this is ignored. It's misunderstood and often misused. Therefore, it is past time someone came to the defense of the computer. The computer's image, as we shall see, has gone from bad to worse as it has become a common part of our everyday world.

One of the major obstacles to putting the computer into its proper perspective vis-a-vis mankind is that the very people who should not do so, computer professionals, are the ones who seem to develop the worst anthropomorphisms. I have worked with computers for about a quarter of a century, and have been alternately amused and appalled at the attitudes manifested toward them by my fellow programmers, analysts, etc.

My earliest experience of man's inhumanity to the computer was the climate of fear and resentment found among staff in computer installations. At first, I was taken aback by what I observed, and mistakenly ascribed it to resentment of me as an outsider, since I work as a consultant. However, it didn't take me long to realize my mistake and to understand that what was feared was the machine—as a potential replacement for the people who used it, and, therefore, a threat to their security and future. If any of you remember what computers were like twenty-odd years ago and just how tedious it was to spoonfeed them in machine language or those cryptic symbolic assembly languages, and how poor the cost-performance ratios of available systems were, you may well wonder how this notion ever got started. But there it was.

Competitor or anti-Christ?

The first consequence of this feeling of fear and resentment was a spirit of competition on the part of the user of the computer. What happened was that everyone tried to be superhumanly—or supermechanically, if you will—efficient and accurate, to out-machine the machine. Turning in an assembly that had clerical errors was cause for disgrace. Wasting precious machine time by clumsy handling of cards and tapes was regarded as sinful (you must remember that at the time I am talking about, some twenty-plus years ago, certain quaint concepts like sin were still in vogue.)

In group efforts, the unfortunate programmer who committed one of these sins was regarded by teammates as a minor saboteur. And, of course, the machine had the last laugh. It snapped tapes gaily at two and three in the morning, ruining hours of work. Thus, it contributed to unfounded suspicion of slacking on the part of that programmer, and to resentment of his apparent incompetence.

It didn't take too long for everyone who had some contact with the then-new computers to realize that computers weren't going to take away jobs, but rather to create new ones. The more savvy programmers also realized that there would be possibilities opening up for advancement, as evolving computer departments grew, and thus a second level of competition began. This was, naturally, for recognition as the best person to take over responsibility for programming, running the center, heading a newly automated department, etc.

The poor office manager or head accountant or whoever had been responsible for the application when it was done manually or on electromechanical equipment found himself in a bad spot. He got misleading information or none at all, as programmers tried to show that he wasn't up to the new techniques and to ease into his place in the new set up.

One of these unfortunate department heads, a woman, who thus had the added misfortune of being unacceptable as boss to the newly emerging breed of young-programmer-on-his-way-up, was quite distressed by the changes that took place in her once peaceful working environment. She had worked for many years in a large, paternalistic, service-oriented firm and had had a pleasant and tranquil working life before the advent of the machine. Prior to the automation she had risen to a position of some responsibility, had a number of bright young women working for her, and managed to get her job done effectively and almost effortlessly.

Then the computer arrived, and with it a number of ambitious young men. They told her one thing on Tuesday, two contradictory ones on Thursday and blamed their problems on her explanations. Watching her department fall to pieces around her, sensing the hostility among her staff and toward herself, and not understanding where it all stemmed from, she got to reasoning out her own explanation. She asked me if, given the psychological climate I had found in my varied experience in different installations, I didn't think the computer might be the "anti-Christ" of certain religious traditions. It certainly had some of the qualifications: it pitted people against each other and, even then, had its devoted slaves among the technical staff.

Corporal, psychoanalyst?

I reassured her as best I could by pointing out that the anti-Christ must certainly, by definition, be more intelligent than the computer. Her idea, however, struck me as quite original and, I thought, the most bizarre view of the computer I would be likely to encounter. My next assignment proved me completely wrong.

I was put to studying some proposals for the use of computers by the U.S. government. There was a suggestion that they be installed in field positions in time of war to process information about positions, reserves, troop moves, enemy strength and whereabouts, food supplies, and the like and to come up with decisions that would be translated into orders.

There was much soul-searching on the part of the specifiers with respect to the rank to be held by these computers. Believe it or not, the choice finally fell on corporal. A private could hardly be trusted with all that information and responsibility, but a computer couldn't, of course, be an officer. I thought it was funny at the time—may heaven forgive my levity—for I knew not what depths there are to the fantasy of mankind when confronted by something he doesn't quite understand. I have lived to hear even stranger views of the role of the computer.

Among these is the recent attempt to make the computer a sort of poor man's psychoanalyst. The computer can't psychoanalyze, of course, but properly programmed it can carry on a sort of dialogue that permits a "patient" to air his woes and gives him the feeling that someone cares. It is this "someone" that's the rub. Now that programs have gotten more sophisticated, the basic stupidity of the machine is almost forgotten. And the unwary layman begins to ascribe human qualities to the machine.

Sex symbol or drudge?

I had thought I was fairly well inured to the flights of fancy of my fellow technicians, but a recent one really got to me. A friend who works in a large and sophisticated computing center (they're into distributed processing) was telling me about the latest philosophical introspections of his fellow programmers. He is, incidentally, not a programmer but the manager of an extensive technical project.

Like so many people who have come to similar positions

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through a technical career, he has a completely distorted view of the value and role of the technician. He longs to program, preferably in assembler (you feel closer to the machine; you have more control), and to use ever newer, bigger and more powerful machines. So he programs. He moonlights doing contract programming for other firms, more for the fun of it than for what they pay him.

He and some of his staff have finally worked out the real motive for their love of their work. According to him, their efforts to "dominate" the machine, by writing programs that make it do what they want even when, sometimes, the rules of the compilers and operating systems they are using should prevent their doing so, are simply sublimations of the desire to dominate and possess "women," or "woman," symbolically speaking. Thus, their work is all tied up with their sex drives and the computer is nothing more than a sex symbol. They feel they have discovered a universal truth, although they are a bit nonplussed about where the "lady hacks" fit.

This sex symbol development bothers me a bit. It seems to presage a bleak and dreary future for the computer. Considering the recent programming of computers to select menus and turn on ovens—the thin edge of the wedge for introducing them as general household help—and the spread of computer games playing, what more natural next phase in the marriage of man and machine than that the bloom should fade from the sex symbol and the computer be relegated to household drudge and baby-sitter?

Dorothy A. Walsh

Ms. Walsh is a dp consultant currently working out of Rome, where she is professor of computer science at John Cabot International College.

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