DATAMATION®

70

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Varian Data Machines, a Varian subsidiary, 2722 Michelson Dr., Irvine, Calif. 92664. Telephone 714/833-2400.

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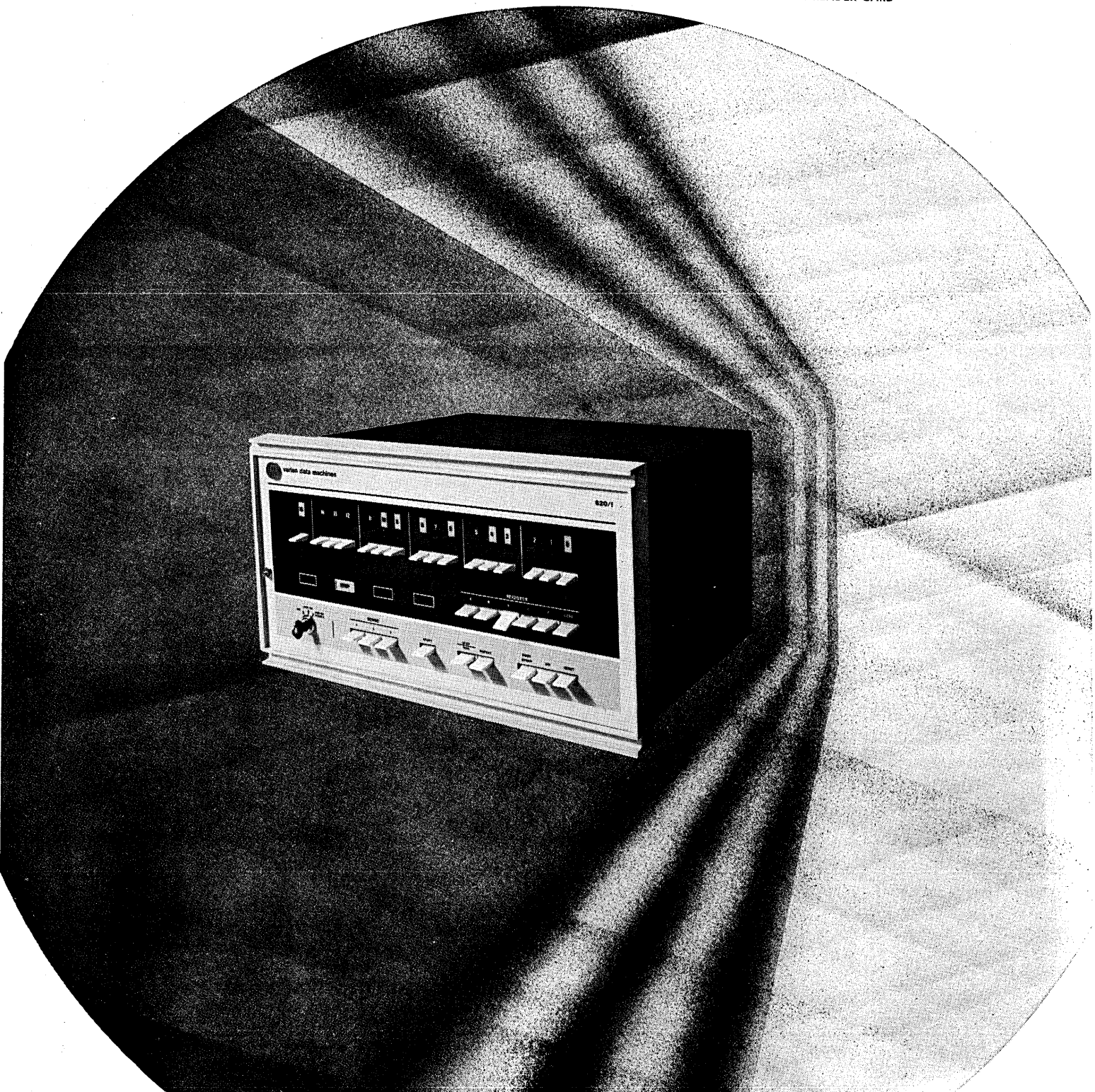
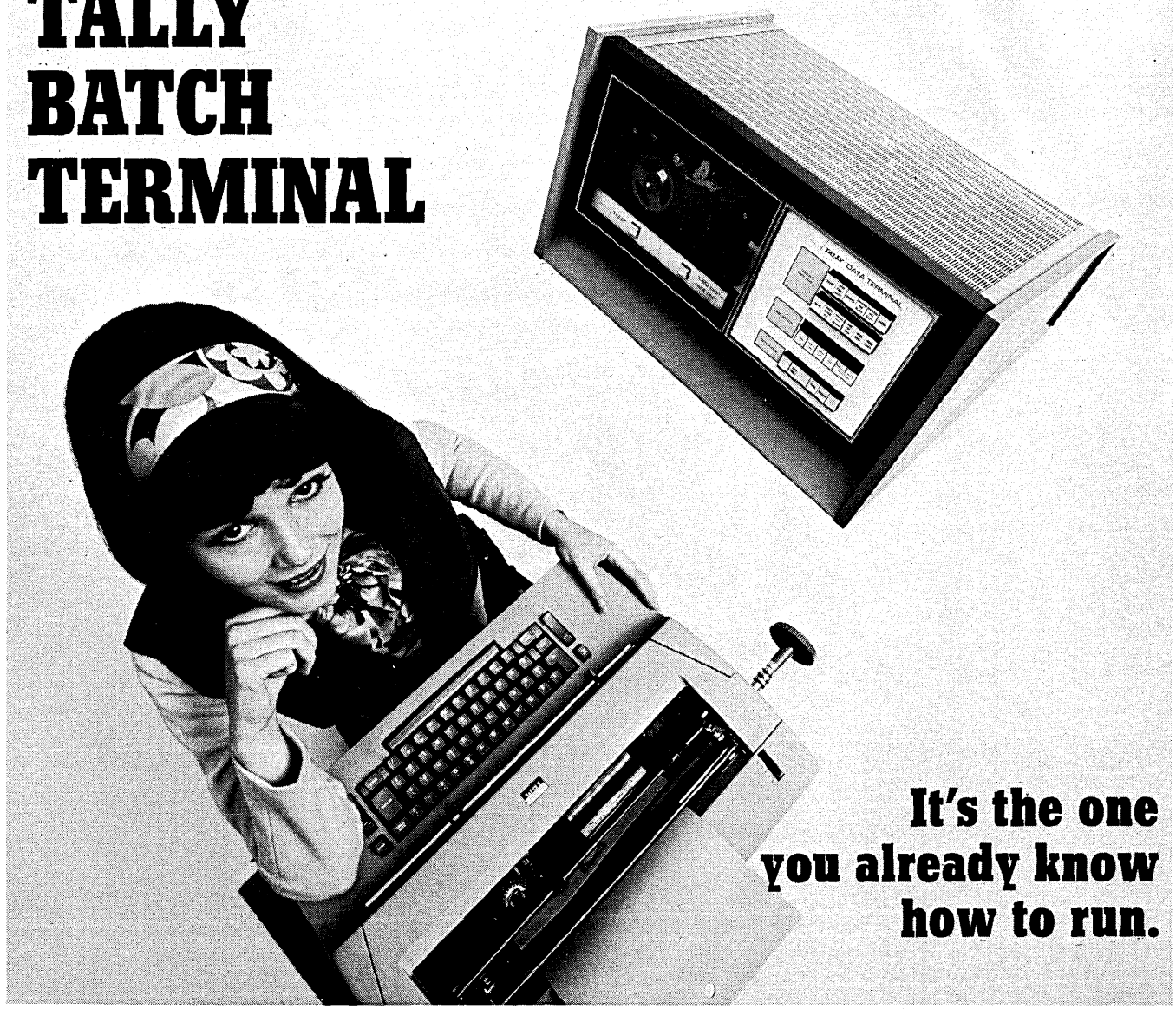
CIRCLE 1 ON READER CARD



PRESENTING THE TALLY BATCH TERMINAL



Everybody who types already knows how to run the fastest batch terminal on the market. As a non-labor byproduct of your regular office typing routines, data is entered on the Tally 1021 Batch Terminal.

At the end of the day or any other convenient time, you can transmit at 1200 words per minute to any size computer. The Tally 1021 Batch Terminal gives you full error control, variable record length, reusable media, two way communication, code flexibility, simplicity of operation, proven reliability, and operating economies. Options include computer interface, paper tape reader, cardreader, and computer compatible mag tape recorder.

Your Tally Batch Terminal comes with the works, all tape formatting, parity checking, switching, and tape control functions. As a matter of fact, all you add is the girl.

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For complete information, please write or call Tally Corporation, 8301 South 180th Street, Kent, WA 98031. Phone (206) 251-5500. TWX 910-423-0895. Or contact one of the regional offices: New York: 45 N. Village, Rockville Centre, NY 516-678-4220. Chicago: 33 N. Addison Rd., Addison, IL 312-279-9200. Seattle: 8301 South 180th St., Kent, WA 206-251-5500. England: 6a George Street, Croydon, Surrey (01) 686-6836.

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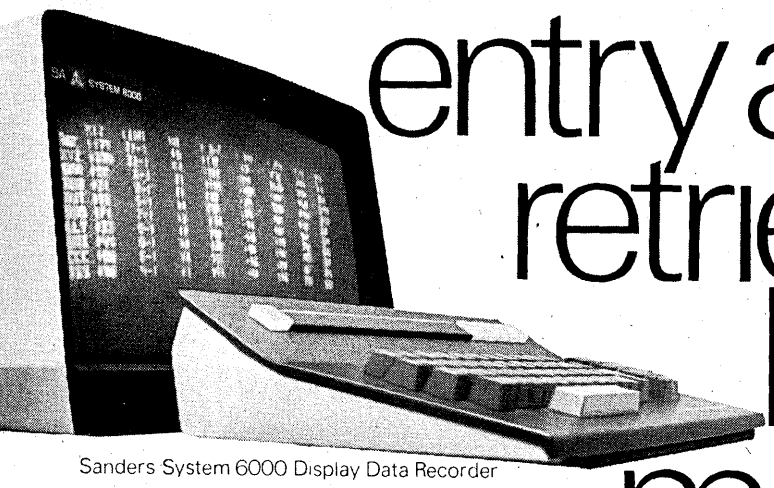
Who makes data display systems for off-line and on-line, stand-alone and multi-terminal, entry and retrieval, key to mag tape and key to



Sanders System 6000 Display Data Recorder

Sanders 720
Data Display System

Sanders, Sanders, Sanc

Sanders makes data display systems for application after application. And there's actually something special about every Sanders system.

Multi-terminal? The 720® Data Display System answers that need. And more. With its unique edit capabilities you can easily add or delete data at any point in the displayed text.

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Find out more. Write Marketing Manager, Data Systems Division, Sanders Associates, Inc., Daniel Webster Highway S., Nashua, N.H. 03060. Or call (603) 885-4220.

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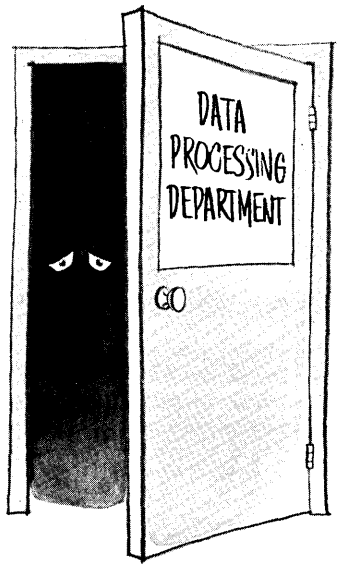

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CIRCLE 187 ON READER CARD

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COMPUTERS · MODULES

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From CRT display to hardcopy printout. In seconds!

A plotter takes 30 minutes. A dry-silver photographic process makes muddy copies. But at Adage, Inc. the Gould 4800 Electrostatic Printer puts out clean hard copy in seconds. No wait.

No wonder the 4800 is now a catalogued item for Adage Inc.'s award-winning Graphics Terminal.

The Graphics Terminal is a CRT display computer system with infinite potential for interractive graphics applications in science and engineering. To name a few, cockpit design, mathematical equations and printed circuit cards.

Having the 4800 Electrostatic Printer on line the user can alter his design equation with a light pen and have clean hard copy of any stage within seconds.

Adage officials say their system is further enhanced by the economy of the 4800. It doubles as a printer by putting out both alphanumerics and graphics. It has fewer moving parts to maintain than conventional equipment. And Adage interfaced the 4800 in a matter of days . . . at surprisingly low cost.

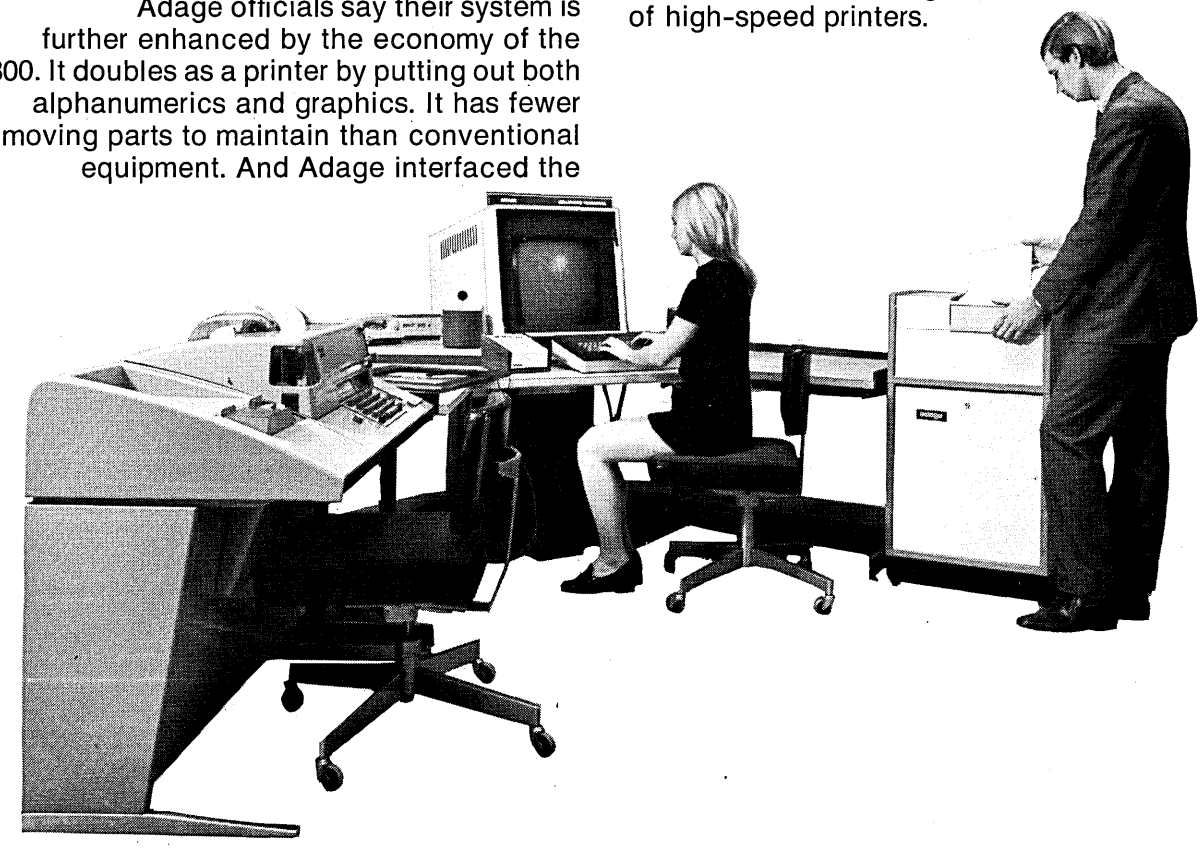
More 4800 facts:

At 412,000 characters per minute, the Gould 4800 breaks the old printout bottleneck on your computer. It reproduces signals from any source of digital input or data transmission by telemetry, radio microwave and/or land line, quickly, quietly, accurately and economically.

4800 can probably recap the same benefits for your system as it does for Adage's Graphics Terminal. Write us to see. Don't wait. Graphics Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

GOULD CLEVITE

Gould 4800. The next generation of high-speed printers.



Keypunches are here to stay.

Punch card input is wasting the time of today's computers. Computers capable of processing over 500,000 characters of information every second.

Card-handling is wasting operator time.

We solved these problems with the KeyProcessing System. It eliminates cards and card-handling forever. And is far superior to key-to-tape systems.

This totally new concept in data processing, a computer-controlled keyboard input system, isn't just a gleam in an engineer's eye. Our systems have been out in the field and working for almost a year. Former keypunch and key-to-tape users are getting a lot more productivity for the same money. Or the same productivity for a lot less money.

And they all feel the same way: the KeyProcessing System is here to stay.

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CIRCLE 14 ON READER CARD

Moore New Ideas for Data Processing

Increase legibility of source documents

The more copies of a document you need, the more likely that some will be blurred and virtually illegible. Moore has a system that gets around the problem. Instead of requiring your automatic printer to hammer out seven carbons, Moore designed a system that uses two sets of four copies. Everyone gets legible copies, mistakes are averted, better utilization is made of print-out capability. Ask about Idea #351.

Easy way to make sure leases don't lapse

If your company issues many leases, you know that record keeping can be complicated. With large numbers of leases requiring renewal at different times it is difficult to be certain that each lease has in fact been renewed. Moore has a special system that gives lessors the control they need. It makes sure lease payments are deposited and that each detail of the transaction is recorded. Ask about Idea #352.

Decollating Time saver

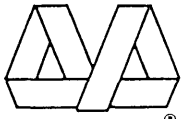
ADP equipment is no more efficient than the total system it is part of. If you still use manual decollating, you're paying a needless premium in wasted time. A Moore Multiweb Decollator can strip carbons from as many as eight parts in a single pass-remove margins and refold for subsequent operations. Ask about Idea #353.

Your data processing system could be costing you

It isn't unusual for companies to discover that a new data processing system isn't delivering what was expected of it. Unless the paperwork is as advanced as the equipment, all you get out of it is inadequacy produced at high speed. A Moore specialist, working with your computer manufacturer, can make sure that your system is as good as the equipment. Call your Moore man when you first consider EDP installations.

What's an idea worth

Unless it works for you, an idea has little value. Moore ideas work. Each of them is in use... saving time, saving money, eliminating waste, improving control, or contributing in some other way to the well-being of a business. Moore sales people have been trained to detect the need for better ideas and then contribute the right one. One Moore idea may be what you need.



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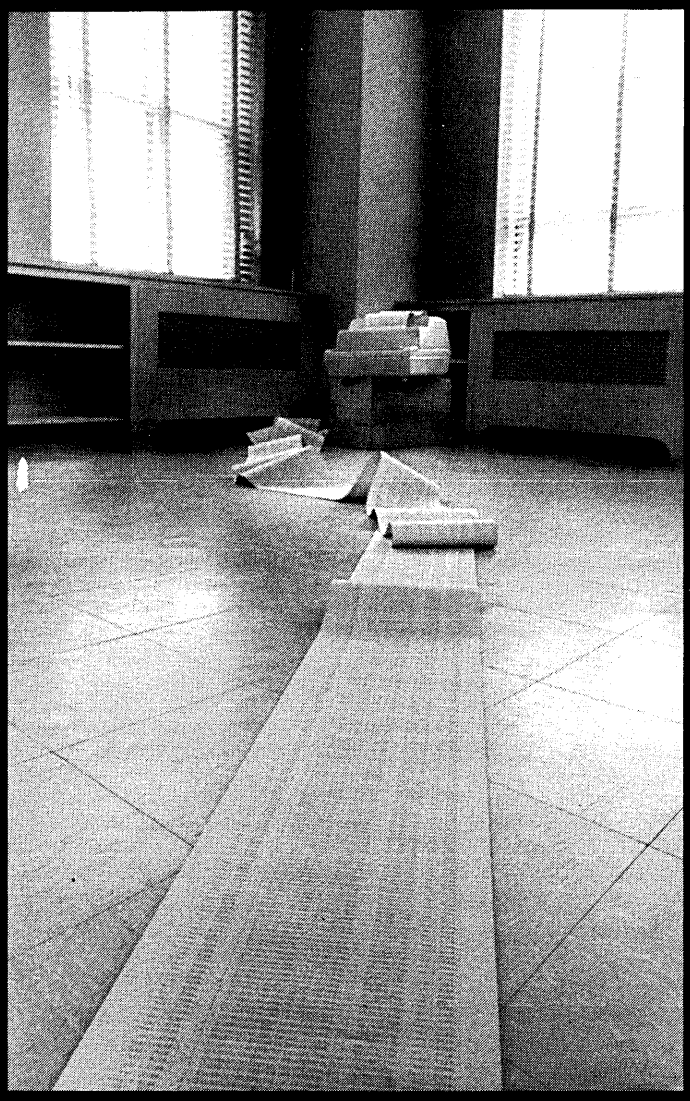

We want you to hear our high-speed teleprinter at work.

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The new Motorola MTP teleprinter may be the quietest machine on the market.

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No ink. No toner. No ribbon.

The MTP employs a patented electrographic printing process. Characters are formed by continuously-moving print heads in contact with continuously-moving, current-sensitive paper. The printout is clean, dry, permanent.

The continuous-motion print action gives the MTP extraordinary reliability. The idea seems contradictory, at first. But when you think about the wear and tear of start-stop mechanisms, the logic emerges. Visualize the pounding of a piston aircraft engine as opposed to the smooth spin of a jet. You've got the picture.

A communicative machine.

The MTP can be interfaced to a computer or communications network in any of several ways, all of them quite uncomplicated. The basic model accepts a dot-matrix input, either directly from a processor or through an USASCII-to-dot-matrix IC chip. If you'd prefer direct 7-bit USASCII input, we'll supply the printer with a built-in 2-character buffer and ready-strobe interface. For dedicated communications service, we've got a model with a 200-character buffer and interface for a 202C data set or equivalent.

It's worth noting that the printer employs Motorola High Threshold Logic. MHTL provides extremely effective noise rejection, which is nice to have under any circumstances, and absolutely essential in most industrial environments.

Symbols. And Urdu, too.

In the USASCII mode, the MTP produces 63 printable characters. Characters are structured on a 7 x 5 dot matrix, which gives a character size equivalent to 10-point type. With appropriate computer software, you can have the dots form esoteric symbols, Japanese ideograms—or the Arabic alphabet of the Urdu language, for that matter. Practically anything is possible.

The printout, 8½ inches wide, duplicates beautifully on any conventional office copier or blueline machine. Page length can be any dimension up to the full capacity of the supply roll—400 feet.

Small package. Modest price.

The MTP is about the size of an office typewriter. It can be installed any place where the temperature is between 40° and 100°F, the relative humidity between 0 and 90 percent. In other words, no coddling necessary.

The machine can operate unattended. An automatic paper advance takes care of spacing between messages (you can switch this off, if you like, to eliminate message separation).

The MTP's price varies with the model and the quantity you order. The basic machine costs less than $4000, which ranks it as one of the great bargains of the moment.

At least that's the way we see it. You, of course, will want to make your own evaluation. Our MTP brochure will help. Or perhaps you'd like a demonstration. Either way, drop us a line. Motorola Instrumentation and Control Inc., a Subsidiary of Motorola Inc., P.O. Box 5409, Phoenix, Arizona 85010.

A note to OEM's. We're more than casually interested in working with you. Special packaging, chassis-only construction, private labeling, or any other options you may have in mind certainly merit discussion. Contact our OEM Sales Department.

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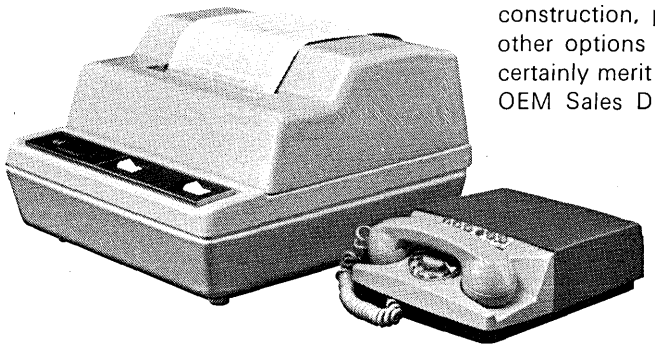

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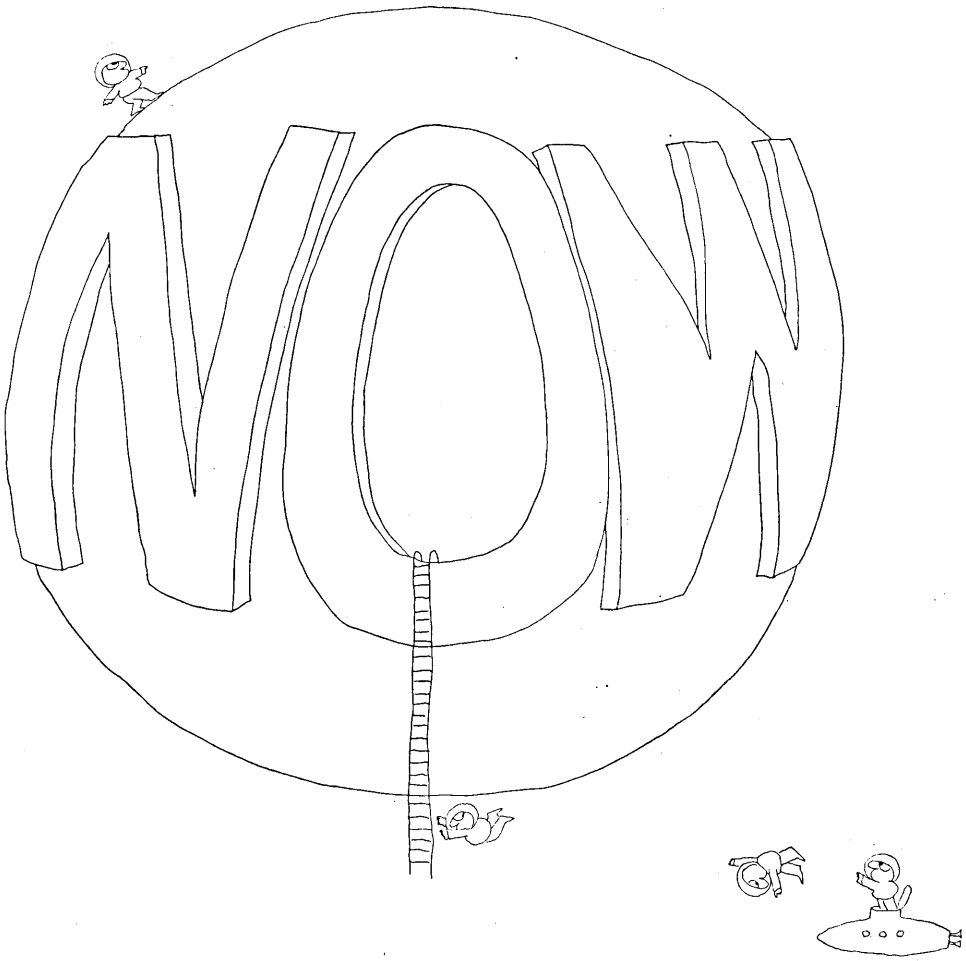

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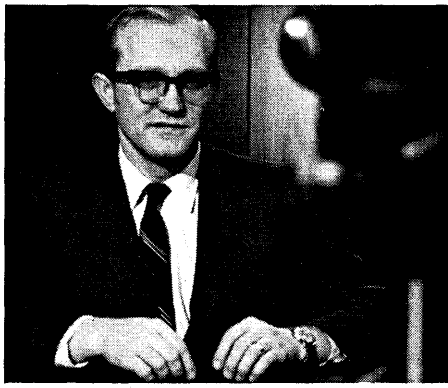

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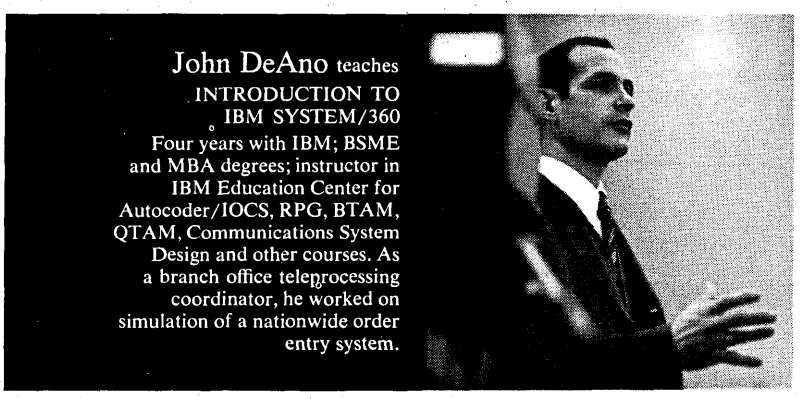

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With IBM 12 years; staff instructor, IBM Management Computer Concepts Course; helped develop award-winning IBM course for DP Managers; Senior Instructor, IBM Customer Executive Training Program in England; Graduate, IBM Systems Research Institute; twice chosen for IBM Systems Engineering Symposium for Outstanding Accomplishments.

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Rohit Patel teaches
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An Operations Research Specialist with Clark Equipment Co. and Hoffman-LaRoche who, for 5 years, made practical application of OR to sales forecasting, communications network design, investment analysis, product scheduling, and distribution management simulation. Holds BS, Electrical Engineering; BS and MS, Mechanical Engineering; MBA.

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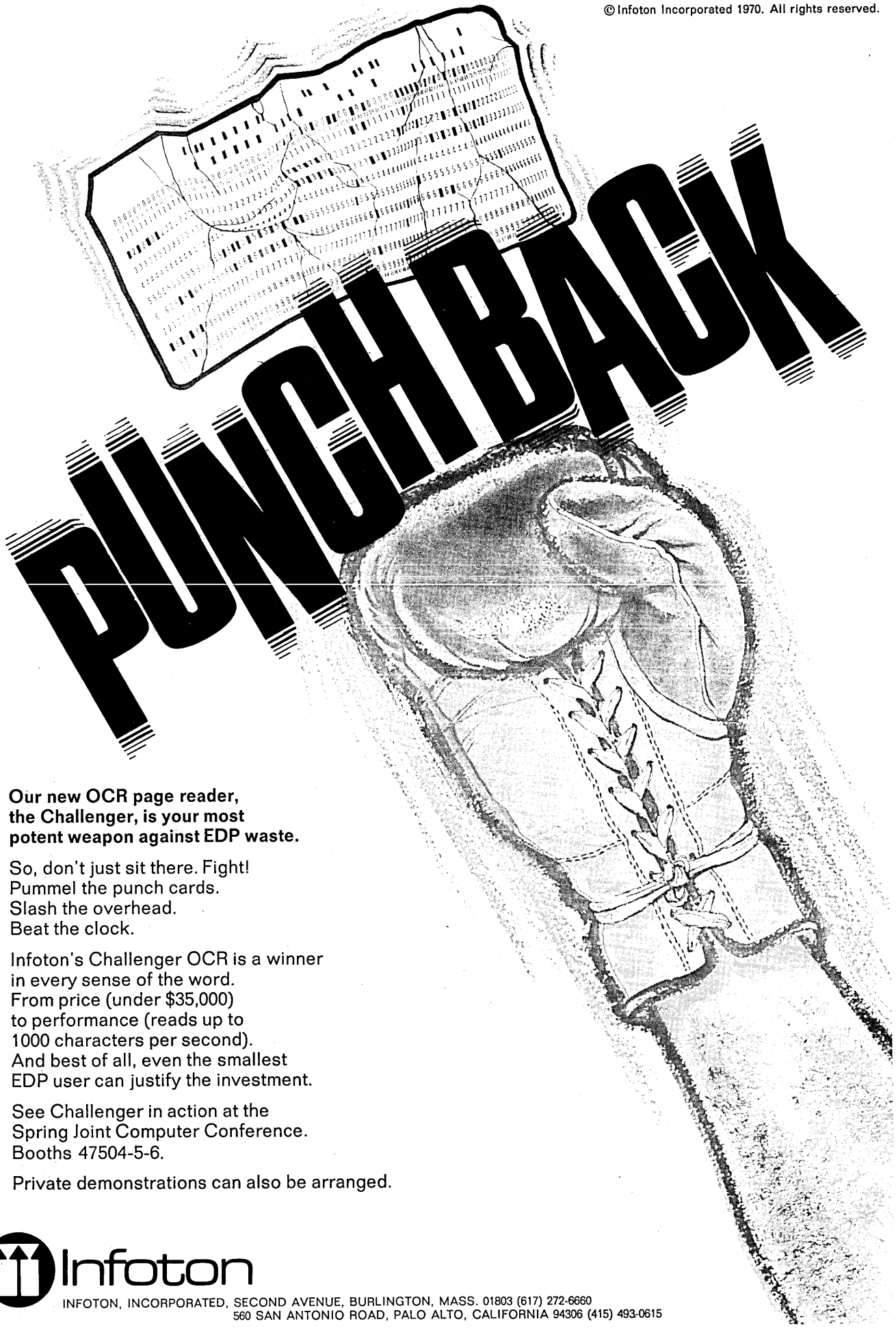


Our new OCR page reader, the Challenger, is your most potent weapon against EDP waste.

So, don't just sit there. Fight!
Pummel the punch cards.
Slash the overhead.
Beat the clock.

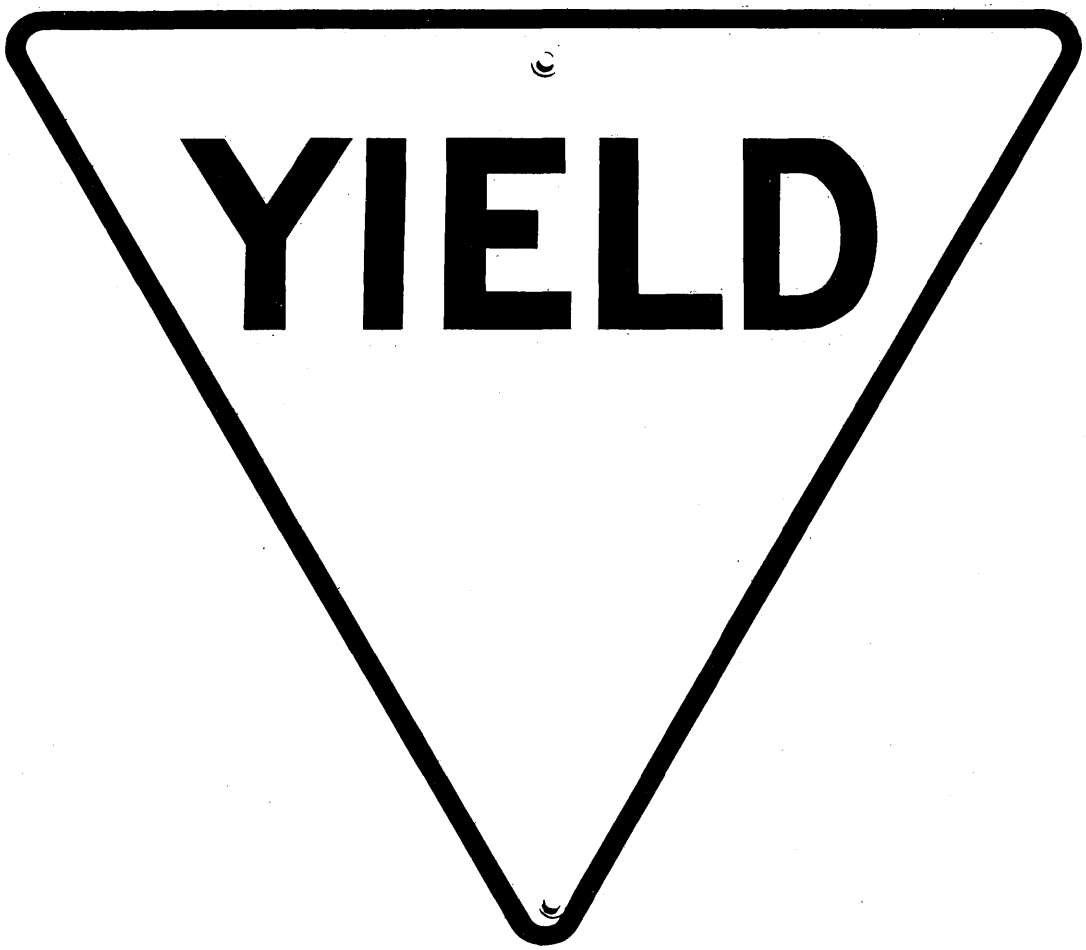
Infoton's Challenger OCR is a winner in every sense of the word. From price (under $35,000) to performance (reads up to 1000 characters per second). And best of all, even the smallest EDP user can justify the investment.

See Challenger in action at the Spring Joint Computer Conference. Booths 47504-5-6.

Private demonstrations can also be arranged.

Infoton

INFOTON, INCORPORATED, SECOND AVENUE, BURLINGTON, MASS. 01803 (617) 272-6660
560 SAN ANTONIO ROAD, PALO ALTO, CALIFORNIA 94306 (415) 493-0615



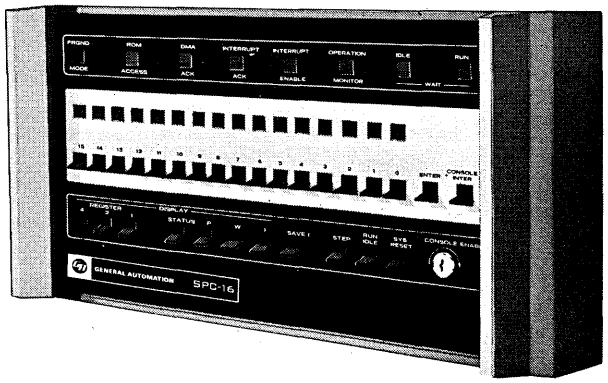
You can increase product yield today... ask about the performance of the SPC-16 industrial automation computer.

SPC-16 gives you big computing power, accuracy, reliability and programming simplicity . . . It's specially designed to work in industrial environments.

You can reduce your operating costs, increase the yield of better quality products . . . you can get your products to the market faster. And you can serve more markets with new levels of reliability.

And the SPC-16 is supported by expert consultation, systems engineering, programming and customer training services.

If you make, move, test or count, SPC-16 is your automation worker . . . ask about its performance today.



Ask about other low-cost computers in the GA family. The SPC-12 for less than $5000. System 18/30 for under $20,000.

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Automation Products Division
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Houston, (713) 774-8716

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MARYLAND
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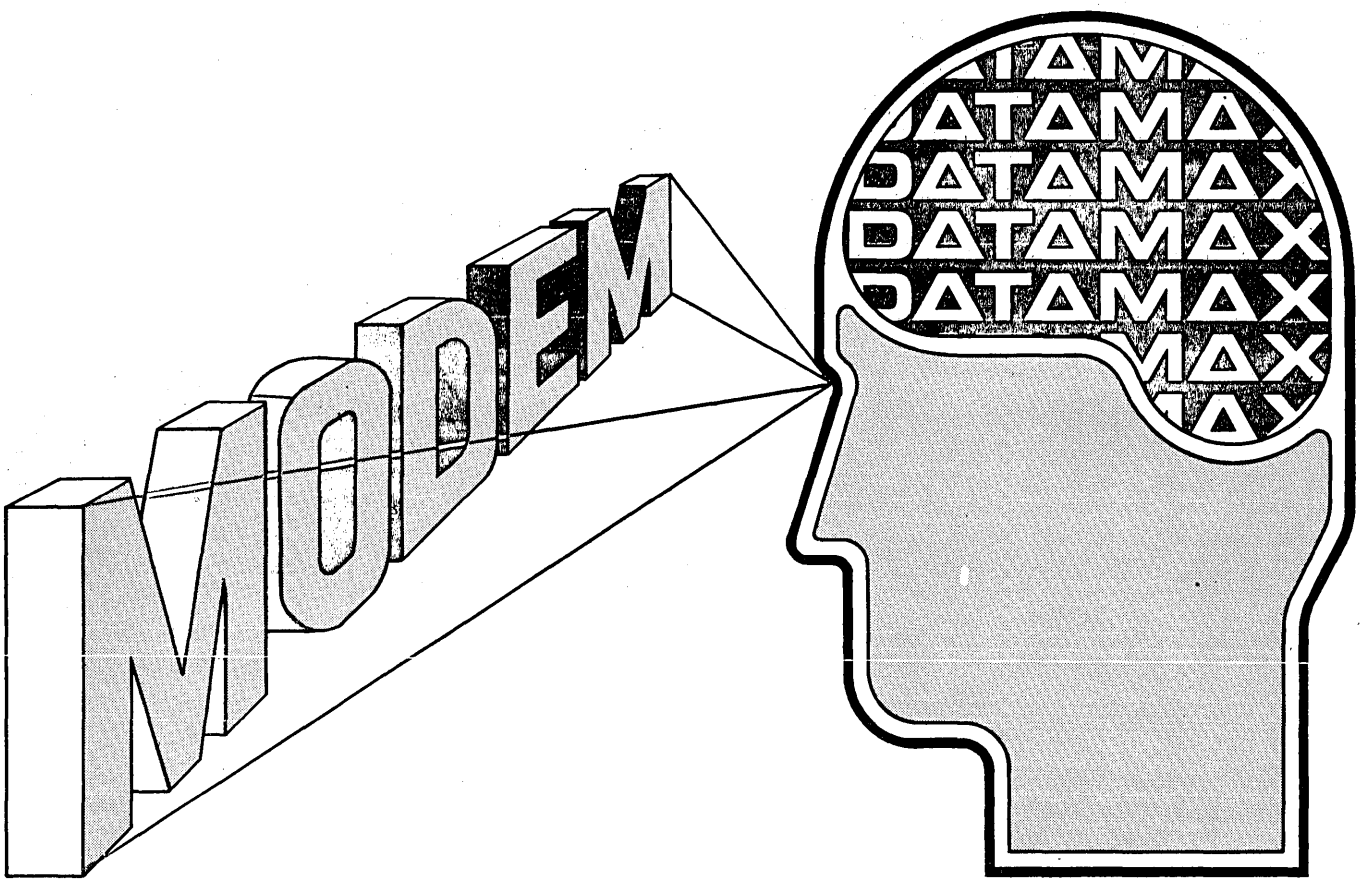
G. A. I.
24 Bvld. de l'Empereur
Bruxelles, Belgium

G. A. Ltd.
Wren House, Portsmouth Rd.
Esher, Surrey, Esher 65764



Look at it this way...

You need a DATAMAX MODEM to achieve MAXIMUM DATA THROUGHPUT. DATAMAX has coupled FORWARD ERROR CORRECTION with AUTOMATIC and ADAPTIVE LINE EQUALIZATION to assure accurate data transmission at 4800 and 2400 bits per second. If you missed us at the S.J.C.C. and the Telecommunications Exposition, write or call . . .

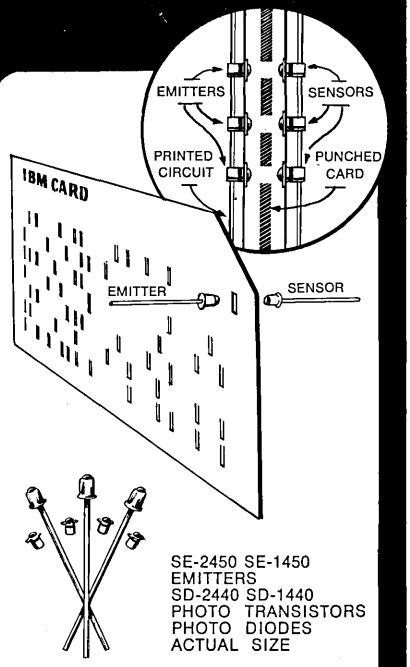
DATAMAX CORPORATION
3941 Research Park Drive
Ann Arbor, Michigan 48104
313/769-0900

Where better modems are built

calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
May 26-28	11th Annual Information Display Symp.	New York City	SID/W. M. Hornish Western Union 82 McKee Drive, Mahway, N.J. 07430
June 1-3	Info Processing & Operations Research Joint Conference	Vancouver, B.C.	IPS, CORS/Session 70 1177 W. Hastings St., Vancouver, B.C., Canada
June 7-9	8th Annual Computer Applications Colloq., Geostatistics	Lawrence, Kan.	Kan. Geo. Survey/D. Merriam Univ. of Kansas, Lawrence, Kan. 66044
June 8-11	46th Annual Convention	Chicago	EIA 2001 Eye St., N.W., Washington, D.C. 20006
June 10-12	Computer Simulation Conference	Denver, Colo.	SCi, ACM, IEEE/O. Hall Jr. TRW, 1 Space Park, Redondo Beach, Calif. 90278
June 16-18	Computer Group Conference	Washington, D.C.	IEEE/D. L. Doll IBM, 18100 Frederick Pike, Gaithersburg, Md. 20760
June 16-18	Computers in Undergrad Curricula Conference	Iowa City	Iowa U/Brooks Booker Iowa U. Conference Center, Iowa City, Ia. 52240
June 18-19	Management & Time-Sharing Conference	Washington, D.C.	ADAPSO 551 Fifth Ave., New York, N.Y. 10017
June 22-23	8th Annual Personnel Research Conference	College Park, Md.	SIG-ACM/R.A. Dickmann APL/JHU, 8621 Georgia Ave., Silver Spring, Md. 20910
June 22-26	11th Joint Automatic Control Conference	Atlanta, Ga.	ISA, ASME 345 E. 47th St., New York, N.Y. 10017
June 22-24	Spring General Meeting	Seattle, Wash.	DPSA P.O. Box 1333, Stamford, Conn. 06904
June 23-26	Annual DP Conference	Seattle, Wash.	DPMA 505 Busse Highway, Park Ridge, Ill. 60068
August 24-28	World Conference Computer Education	Amsterdam, Netherlands	IFIP, IAG/A. Veenhuis 6, Stadhouderskade Amsterdam 13, Neth.
August 25-28	Western Electronic Show & Convention	Los Angeles	WESCON/Don Larson 3600 Wilshire Blvd., Los Angeles, Calif. 90005

HIGH SPEED CARD/TAPE READERS



SE-2450 SE-1450 EMITTERS
SD-2440 SD-1440 PHOTO TRANSISTORS
PHOTO DIODES
ACTUAL SIZE

- MATCHED PAIRS EMITTER/DETECTORS
- SOLID STATE RELIABILITY
- SPACE SAVING COMPACTNESS
- IDEAL FOR ALL PUNCHED MEDIUMS
- AVAILABLE FOR IMMEDIATE DELIVERY

Designed for mounting in printed circuit cards, these miniature emitters and detectors provide the perfect solution to designing extremely reliable, compact high speed reader assemblies for data processing and computer applications.

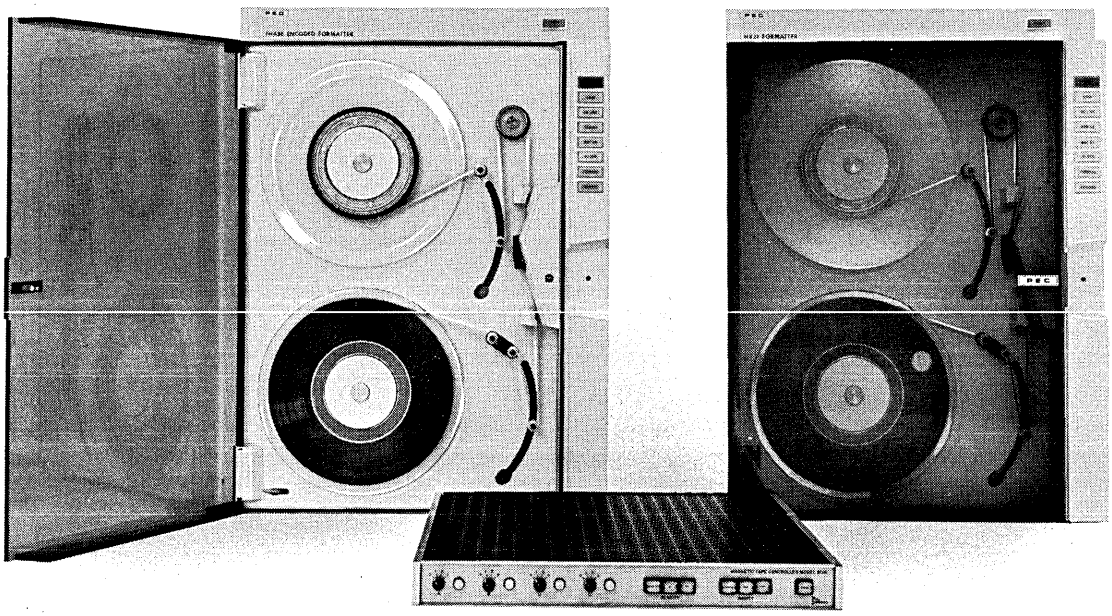
For more information and technical data, contact Spectronics, Inc.

Spectronics INCORPORATED

541 STERLING DRIVE
RICHARDSON, TEXAS 75080
AREA 214 231-9381

CIRCLE 180 ON READER CARD

PEC's new 1600cpi and 800cpi tape units work beautifully with the same controller.



Now you can use the same magnetic tape controller for 800cpi and 1600cpi. Without redesigning the controller. And for less cost.

We've taken the formatting electronics out of our transports, included data timing functions which you normally have to provide in your tape controller and packaged the whole works in two new data formatters.

So now with a PEC formatter, your controller can handle 7 and 9-track, 800cpi NRZI and the new 9-track, 1600cpi phase-encoded ASCII and IBM compatible formats. And each of our formatters handle up to four PEC tape transports. So you don't have to pay for formatting each time you buy a tape transport.

The real bonus of course is 1600cpi capability for your system. And we offer that in our new 6600 Series tape transports — ideal for data entry systems, data communications terminals, and minicomputers. The 6600 Series has all the features such as a read-after-write, dual-stack head, a 9-track phase-encoded IBM compatible recording mode, and tape speeds from 37.5 to 12.5ips with data transfer rates to 60KHz.

And like all PEC models, our 6600 Series has a single capstan drive which minimizes tape skew for increased data reliability and longer tape life.

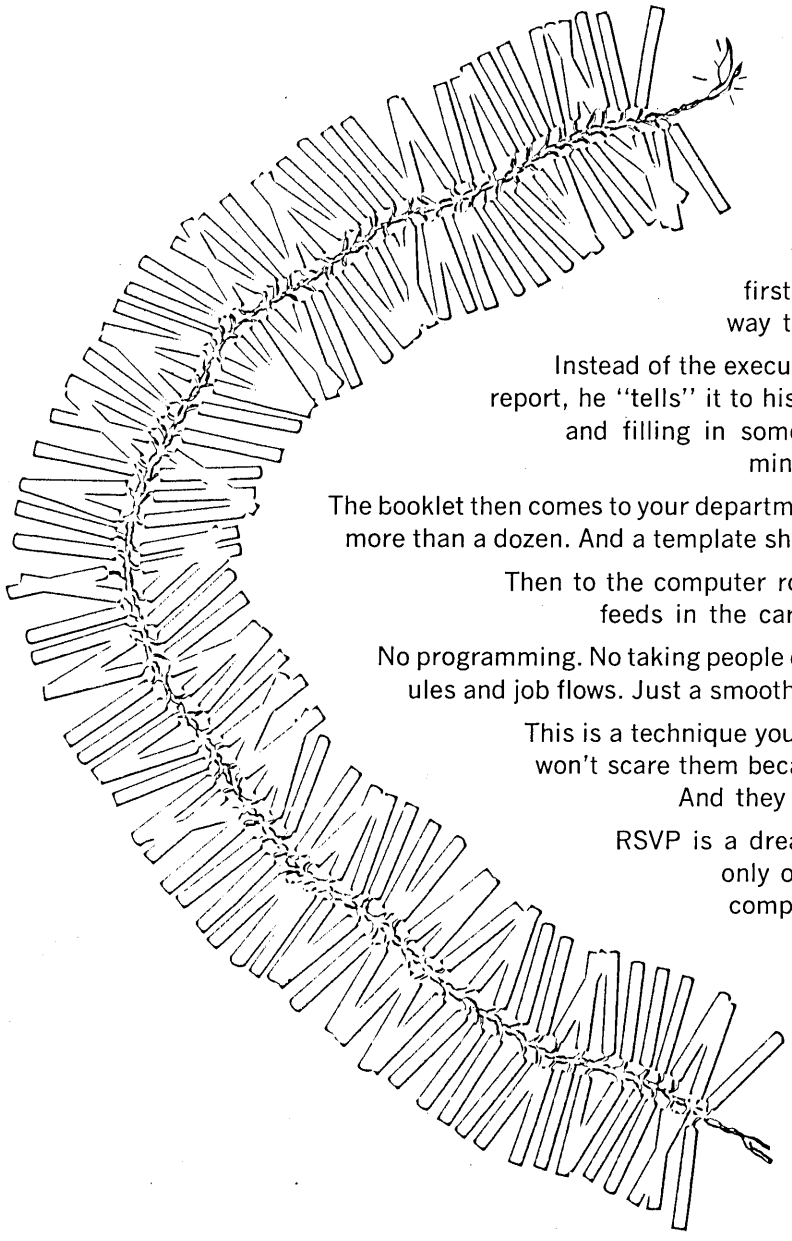
PEC offers the industry's most complete line of low-cost synchronous and incremental digital magnetic tape transports — all IBM compatible — with dozens of models in three reel sizes. All available from our big new plant. And sales and service centers across the U.S. and abroad.

For more information on our 800cpi and 1600cpi tape units, plug-to-plug compatible with the same controller, just write Peripheral Equipment Corporation, 9600 Irondale Avenue, Chatsworth, California 91311. (213) 882-0030

PEC

PERIPHERAL EQUIPMENT CORPORATION

RSVP is about to explode on the information scene



The principle is so obvious . . . and the method is so quick, so simple and so effortless . . . that you will wonder why no one ever handled computer reports this way before.

We designed the Report Request booklet first. We made it the way people think. The way they talk. Then we designed the system.

Instead of the executive telling **you** what he wants in a special report, he "tells" it to his RSVP booklet. By checking a few boxes and filling in some blanks. The booklet usually takes 15 minutes or so to complete for each request.

The booklet then comes to your department where a few cards are punched. Rarely more than a dozen. And a template shows what to punch and where to punch it.

Then to the computer room. The operator hangs a tape or disk, feeds in the cards and the report comes bouncing out.

No programming. No taking people off other jobs. No interrupting work schedules and job flows. Just a smooth, quiet, effective and very simple system.

This is a technique you give to management and forget it. RSVP won't scare them because they will understand it immediately. And they won't come back to you with questions.

RSVP is a dream to install. You define a file to RSVP only once. An efficient customized program is compiled that services any inquiry against that file. From then on, it's just load-and-go.

Get rid of the special report nuisance once and for all. Write now for more information on RSVP.

NCI

NATIONAL COMPUTING INDUSTRIES
3003 NORTH CENTRAL AVENUE
PHOENIX, ARIZONA 85012
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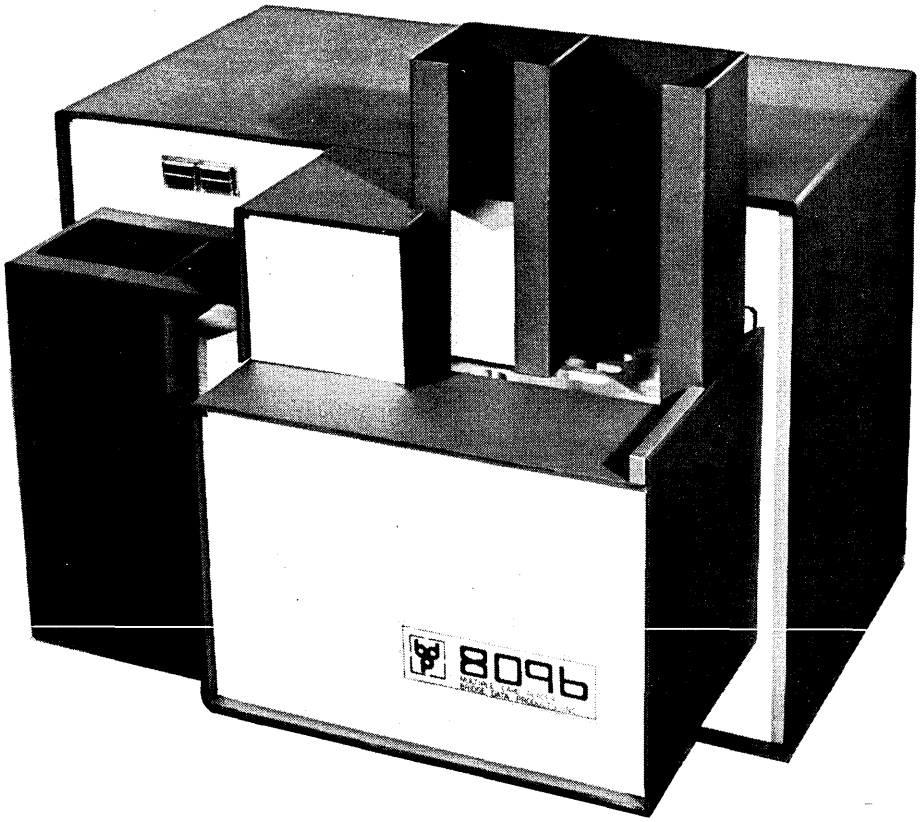
Subsidiary of CONTINENTAL TELEPHONE CORPORATION

An Equal Opportunity Employer

New: 80/96 multiple-card card reader



makes obsolescence obsolete.

Feeds, reads, and stacks the 96 column IBM System/3 card, and the 80 column card and its stub varieties.

Handles 96 column card at 500 CPM, 80 column at 300 CPM and its stub varieties at over 400 CPM.

Reads character serial. Reading is photoelectric with phototransistors and unique fiberoptic light distribution and collection package.

Reader adjusts automatically to card size when operator inserts appropriate hopper and stacker magazines.

Hopper and stacker capacity is 1000 cards. Cards are fed from input hopper to transport rollers by simple clutchless feed mechanism. Each card is driven into the stacker; last card visible and accessible to operator.

Control electronics, transport mechanism, and power supply are included in unit. Electronics consist of silicon discrete components and DTL integrated circuits. I.C. interface is +5 volts and 0 volts.

High read reliability is achieved through electronic resynchronization.

Primary power is nominally 117 volts AC and 60 HZ.

Desk-mountable unit measures less than 24″ high, 24″ deep and 26″ wide, weighs less than 50 lbs.

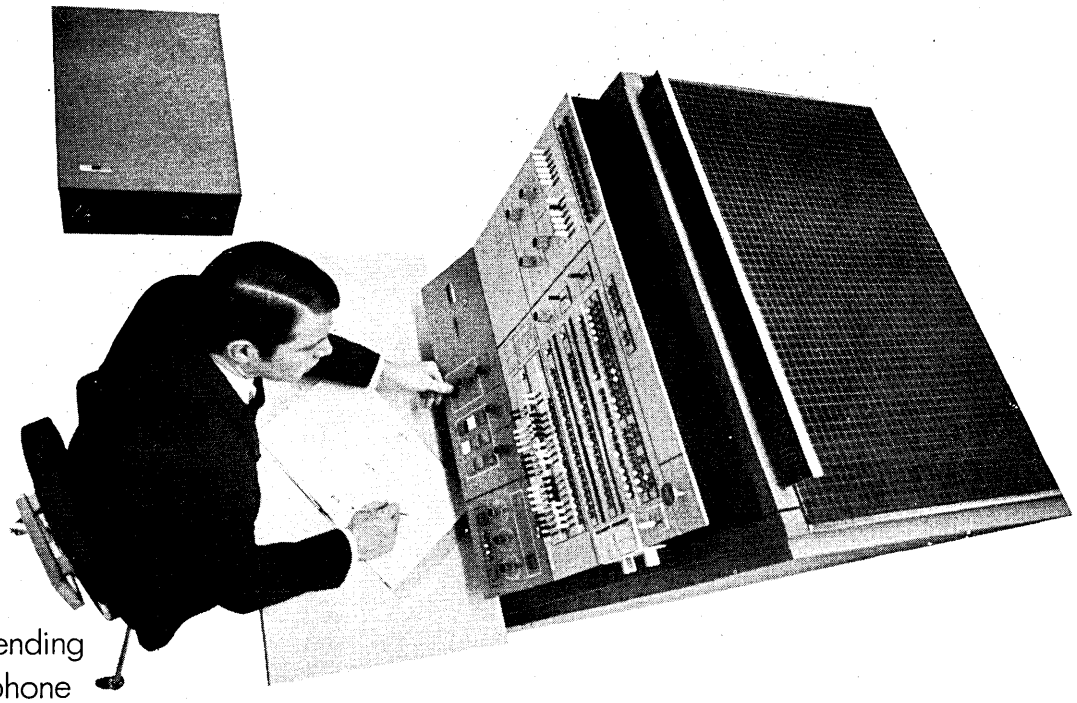
Unit is also offered in single capability versions for 96 column cards, 80 column cards, and stub varieties.

Quantity prices in range of $1500 for multiple-card unit, and in $1200 range for single capability versions. Prices vary with options and quantity.

Bridge Data Products, Inc., 738 S. 42nd Street, Philadelphia, Pa. 19104, (215) 382-8700.

BRIDGE data products

The IBM Modem. Only the price will surprise you.



If you're sending data over telephone lines, our new modem can give you speed and reliability. And a new low cost.

The IBM 4872 Modem is a 4800 bps data set which operates over C2-conditioned telephone lines.

And which not only gives you built-in test equipment.

But also gives you manual equalization so you can easily adjust it to line characteristics.

The economy of multipoint capability.

And the same kind of dependable maintenance that's available with any of our IBM products.

And the purchase price will surprise you. $4460 for point-to-point. And $4850 for multipoint.

And for another pleasant surprise call your nearest IBM representative about our fast delivery schedule.

Or mail the coupon below.

IBM Marketing Information, 18100 Frederick Pike, Gaithersburg, Maryland 20760

☐ Please rush me more facts about the IBM 4872 modem.

☐ Please have a marketing representative call on me.

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J201206

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RCA's Octobundle

Computers and systems support priced separately or as a package. Only RCA offers you a choice.

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That is your option.
Only at RCA. On all our newer computers being installed now and in the future. No other major computer maker lets you choose.
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Some computer makers still sell their machines that way.
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At RCA you get what you need, the way it's best for you.
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Whichever way you go, you get complete, in-depth service.
Our systems support, service and education are known as some of the best in the business. Just ask our customers.
Bundle or unbundle. Whatever is better for you.
The Octoputers are the easiest computers to use. Now you have easier ways to get them.
At RCA, doing business is easy—for you.

RCA
COMPUTERS

CIRCLE 93 ON READER CARD

Now, Strength and Precision in Steel or Aluminum Floating Floors Panels

New Steel Floating Floors® Panels have a top plate of 13 gauge hot-rolled steel continuous bonded to a uniform support grid.
These panels will support a concentrated load of 1,000 lb. on one square inch with a maximum deflection of only .080" or a uniform live load of 250 lb. per square foot without damage. They are factory finished with a rust inhibiting paint.

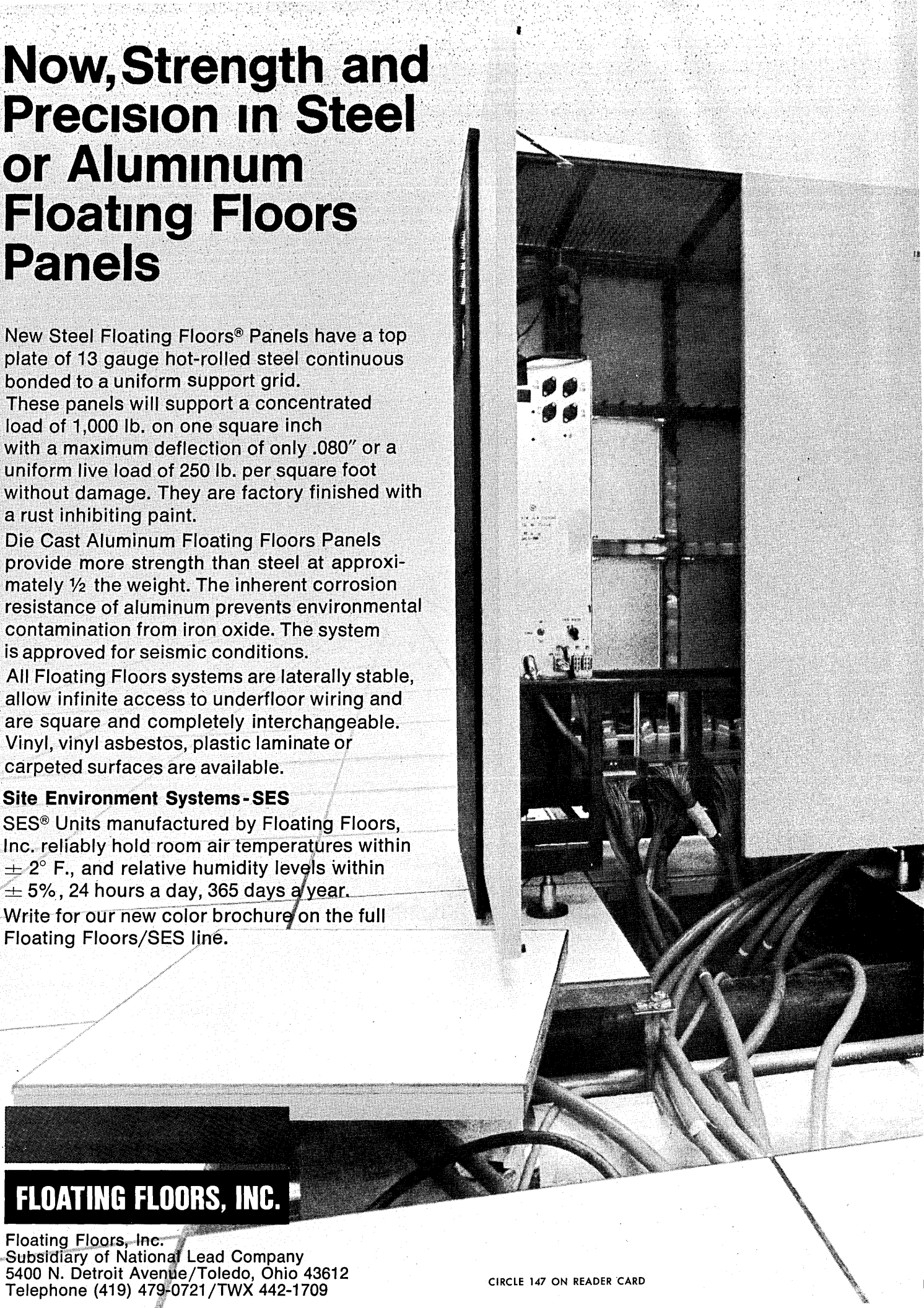
Die Cast Aluminum Floating Floors Panels provide more strength than steel at approximately ½ the weight. The inherent corrosion resistance of aluminum prevents environmental contamination from iron oxide. The system is approved for seismic conditions.

All Floating Floors systems are laterally stable, allow infinite access to underfloor wiring and are square and completely interchangeable. Vinyl, vinyl asbestos, plastic laminate or carpeted surfaces are available.

Site Environment Systems - SES

SES® Units manufactured by Floating Floors, Inc. reliably hold room air temperatures within ± 2° F., and relative humidity levels within ± 5%, 24 hours a day, 365 days a year.

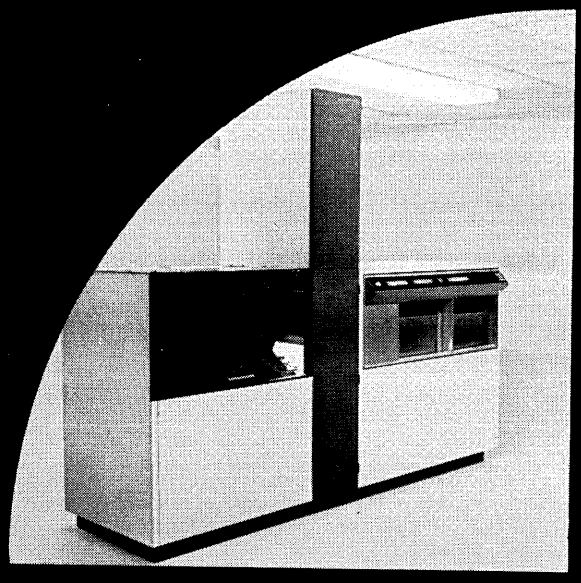
Write for our new color brochure on the full Floating Floors/SES line.



FLOATING FLOORS, INC.

Floating Floors, Inc.
Subsidiary of National Lead Company
5400 N. Detroit Avenue/Toledo, Ohio 43612
Telephone (419) 479-0721/TWX 442-1709

CIRCLE 147 ON READER CARD



A new name makes the OCR scene

Scan-Optics. Remember it. You'll be hearing it again. An exciting new company. An experienced, progressive management. And an innovative new product. It's called the Scan-Optics 20/20. It directly converts data into computer usable form. It's the first and only Optical Character Reader handling both pages and documents. Like getting two Readers for the price of one. Higher thruput than any page reader available. For demonstration, or information, call or write:

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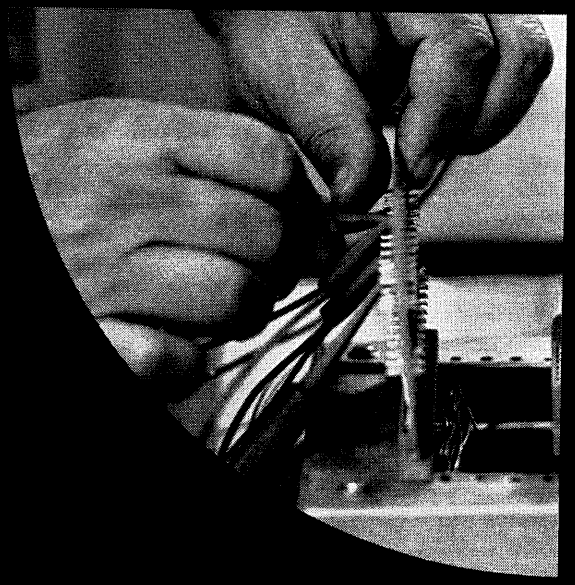
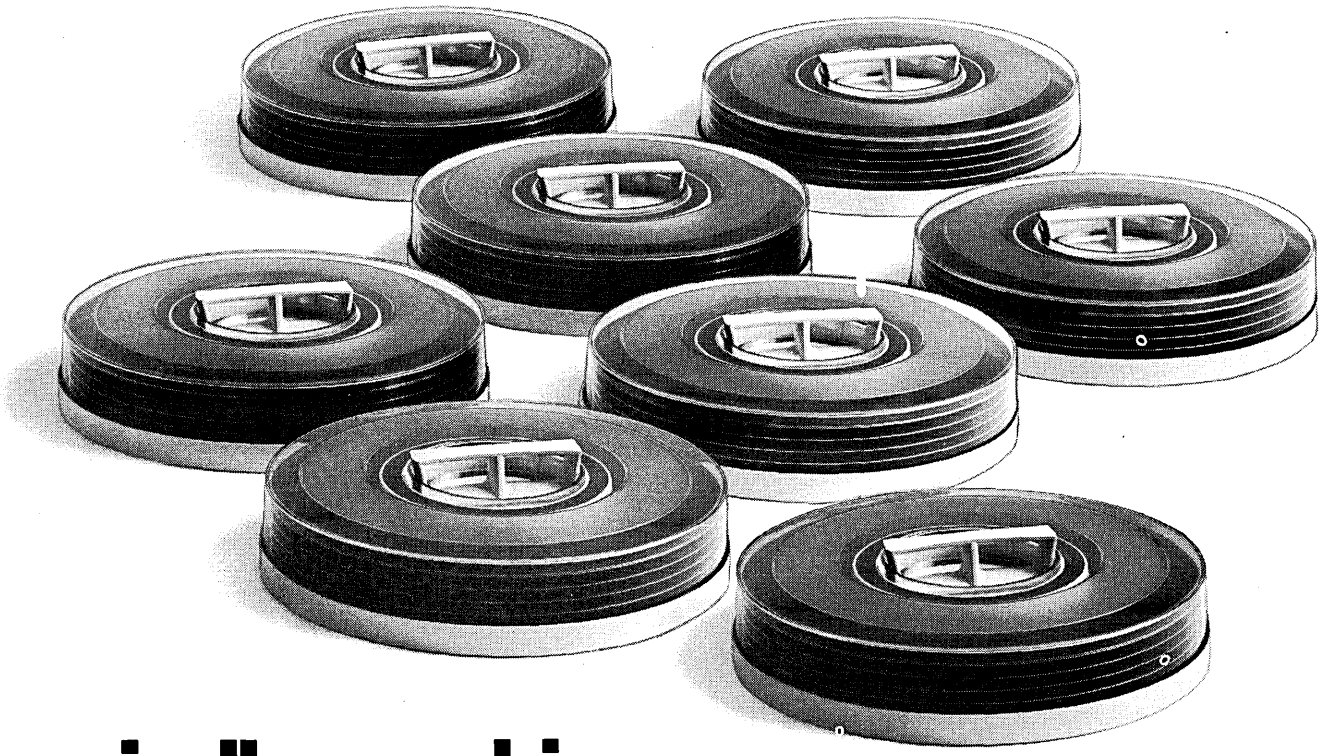
Phone: 203 289-6001.

Scan-Optics Inc.



CIRCLE 177 ON READER CARD



Logically speaking... Everybody loves our KeyDisc system. It's so compatible.

It goes together so well with the IBM System/360 and all other major computer systems. Including the RCA Spectra 70, and the Univac 9000 series.

100% compatible . . . that's Logic's LC-720 KeyDisc Data Input System.

The LC-720's magnetic disc drive is an IBM 2311 compatible unit. Its disc pack is an IBM 1316 that is removable, directly interchangeable and guaranteed readable by your computer system. Output formats include the disc pack and industry-compatible 7 or 9 track magnetic tape.

And where high-speed input is required, the LC-720 will interface directly with your computer system.

But there are other lovable things about the LC-720 that you'll find completely compatible with your day-to-day operations. For instance, it minimizes errors with point-of-entry editing and correction.

And it offers you total security and high-speed random access of data. However, the thing you'll love most is that it keeps your computer working all the time.

At Logic we think about compatibility a lot. And what a difference it can make to your data collecting.

Lewis Barr at Logic would be happy to show you how. Give him a call. 609-424-3150.

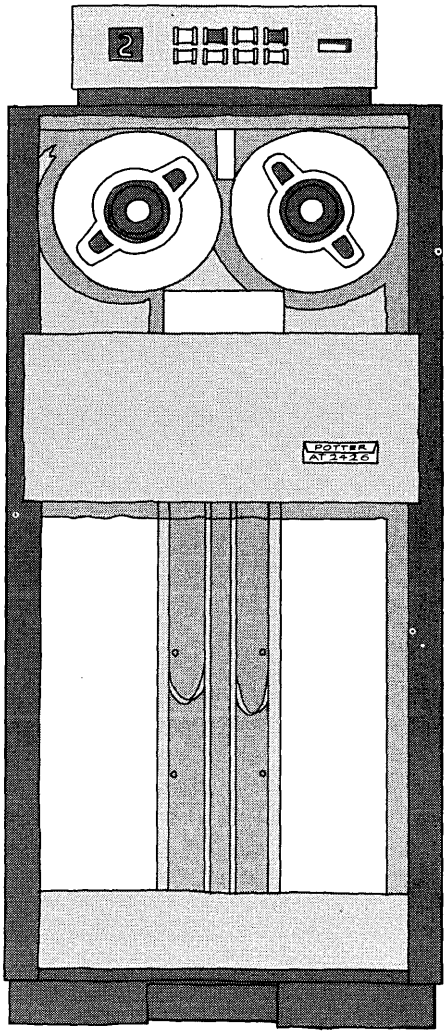
It's the *logic*al thing to do.

LC-720 KeyDisc System

LOGIC CORPORATION

21 Olney Avenue • Cherry Hill Industrial Park • Cherry Hill, N.J. 08034 • (609) 424-3150

This Potter Tape Unit can increase your S/360 transfer rate up to 300%.



if you have IBM model number:	. . . the Potter AT 2426 gives you this increase in transfer rate:
2401 Mod. 2	300%
2401 Mod. 3	167%
2401 Mod. 5	100%
2401 Mod. 6	33%
2420 Mod. 5	50%

Potter's new AT 2426 can give you a substantial increase in data transfer rate over your present IBM 360 system. With this plug-in compatible Potter tape unit in combination with Potter's new tape control, you can increase your rate (as the chart shows you) from 33% to 300%.

And it can cost you considerably less. No modification of software or space. Just unplug your present IBM unit and plug in Potter.

Potter gives you automatic tape threading too. Put it on the reel, push a button and in just 8 seconds you're ready to go.

The AT 2426 is the latest addition to Potter's well-known line of single-capstan tape units, thousands of which are in use on IBM systems. As well as reliable products, Potter provides dependable field service. And Potter's 25-year quality record backs it up.

If you can use higher transfer rate, we'd like a few moments with you to tell you about the advantages of switching to Potter. Your accounting department may later refer to them happily as golden moments. Call us.

Potter Instrument Company, Inc., East Bethpage Road, Plainview, N.Y. 11803. Tel. 516-694-9000.

Potter.
A lot more than less expensive.

How to lose an $8000 bet

Sykes cassette-loaded COMPU/CORDER™ 100. A high-speed, direct access magnetic tape transport system for mini-computers.

Bet that the Sykes COMPU/CORDER™ system does not include complete software and interface for $2950, and does not put you on the air in 30 minutes.

It's easy to disbelieve these capabilities. And lose by buying another unit for about $5000, plus some $1400 for interfacing, plus $4000 to $6000 more for software, plus months of waiting and doubt.

But it's true.

The unique Sykes COMPU/CORDER system *does include* the software and interface for your mini-computer. It's all in the one price: $2950.

Complete Software Package

The software manuals prepared by Sykes make it possible for any programmer to easily perform these operations immediately after the COMPU/CORDER is installed:

A. BASIC: Set of read/write sub-routines in both object and source form to allow processing data in a traditional sequential manner. 37-page manual.

B. DABAR: Read/write sub-routines in both object and source form that utilize an address track to permit direct access to data anywhere along 100 feet of tape within 4 seconds. 27-page manual.

C. UCHEK: Checkout program in object form to assess system performance and operation. 30-page manual.

Typical Sub-Routines

Want proof of our complete software control sub-routines? Here's a sample from our Direct Access Dabar Manual.

To write a block of data, at say tape address 1240, the programmer simply loads the value 1240 into the first word of his I/O area and includes the following calling sequence in his program:

PDP	VARIAN	NOVA
TAD DRIV /DRIV NO	,LDA,DRVO C/C NO.	LDA 0,IO ;I/O AREA
JMS I WRIT	,LDBI,ERR ERR ADR	LDA 1,ERR ;ERR ADR
AREA /I-O AREA	, LDXI,IO I/O ADR	LDA 2,DEV ;C/C NO.
ERR /ERR EXIT	,JMPM,WRIT	JSR@ WRITE
ION /ENABLE INT	,EXC,0160 INT. ON	INTEN

The Sykes Dabar sub-routines will initiate the write operation and transfer control back to the user's program, which is then able to perform other tasks while the writing is taking place.

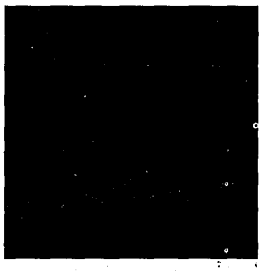
Sykes software will support up to six COMPU/CORDER units simultaneously writing and/or reading from different I/O areas.

Interface Kits

We include standard interfacing and plug-to-plug compatibility for the Varian 620i, Data General Nova, PDP-8, PDP-8/L, PDP-8i and PDP-12. The *Interface Kit* supplied with each Sykes COMPU/CORDER system includes: Interface board, interface harness and connector assembly, 5 ft. cables, Use & Care manual, installation manual, software manuals, one pre-recorded cassette, two Write Enable plugs.

Free Software Manual

Get a free copy of our "Dabar" Software Manual, plus full details on the Sykes COMPU/CORDER. Write today on your letterhead.



SYKES™

SYKES DATATRONICS INC.
375 ORCHARD STREET
ROCHESTER, NEW YORK 14606

While your computer is remembering Louie's name, our 410 is placing his face.

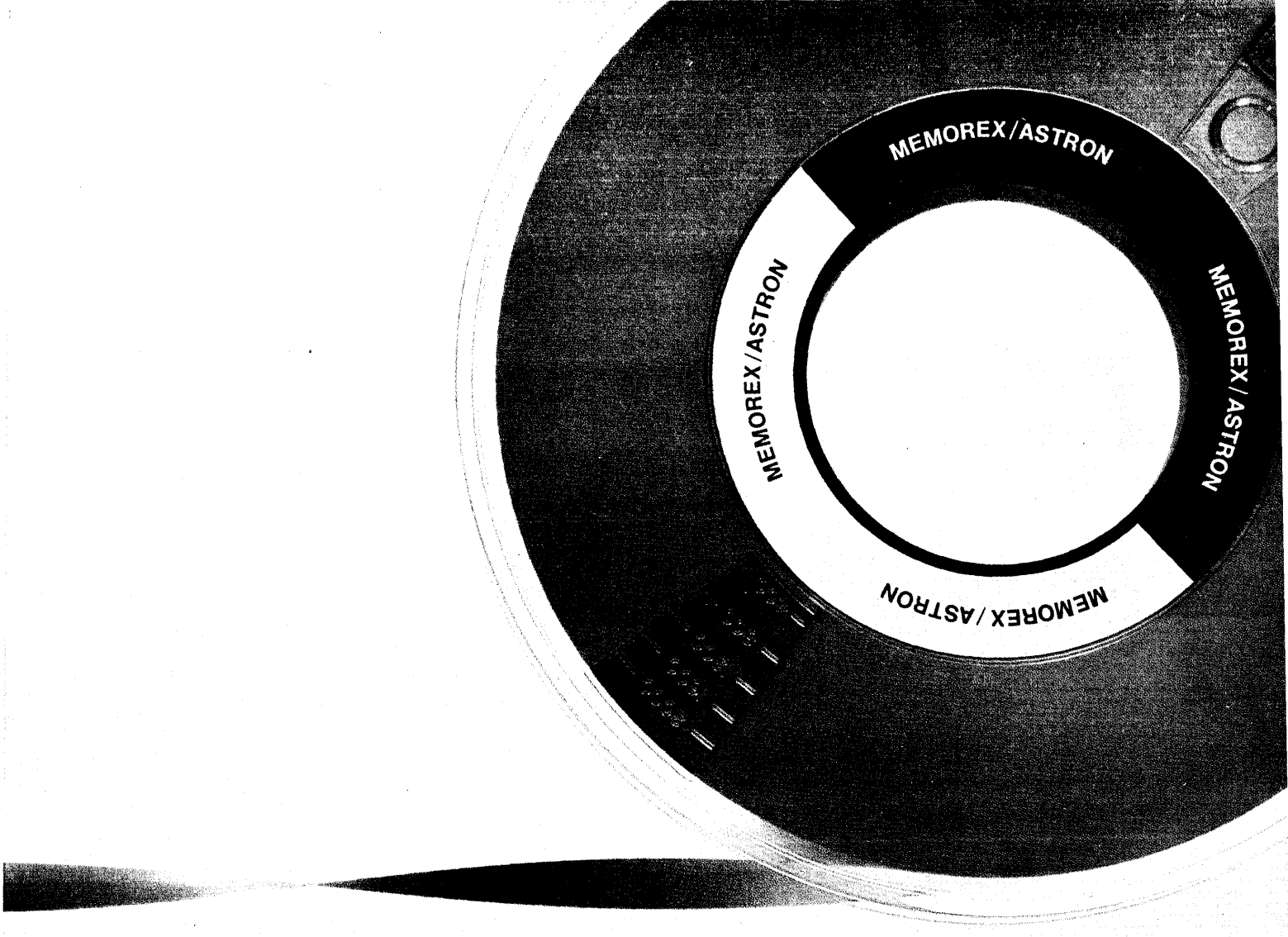
We think computers are great. But let's face it; they can't make a face. Our 410 can. And when it's interfaced with your computer, you see a picture with the data. That's pretty important when you need to identify someone.

While your computer is coming up with a suspect's name, our 410 is coming up with a face, fingerprints and history of arrests and convictions.

A computer can tell you a lot but it can't show you anything graphic quickly or economically. Our 410 can show you anything in its files in a matter of seconds. And if you want a copy of what you're looking at, you can have it in a few more seconds. It all happens at your desk, via a TV screen.

We don't claim that a picture is worth a thousand words. We do claim, however, that the 410 can save you time, eliminate errors, minimize your active filing space, and free your computer to do things it does best. For information, write to Mosler, Dept.D-5, Information Systems Div., Hamilton, Ohio 45012.

Mosler
An American-Standard Company



Astron:

the forgotten side isn't forgotten anymore.

Memorex has improved computer tape. Again. This time by turning to the forgotten side. And developing Astron.

Astron's unique, new back coating is scratch-resistant and anti-static. It eliminates two of the most common causes of tape error in high-activity applications: base film debris and foreign matter attracted by static charge.

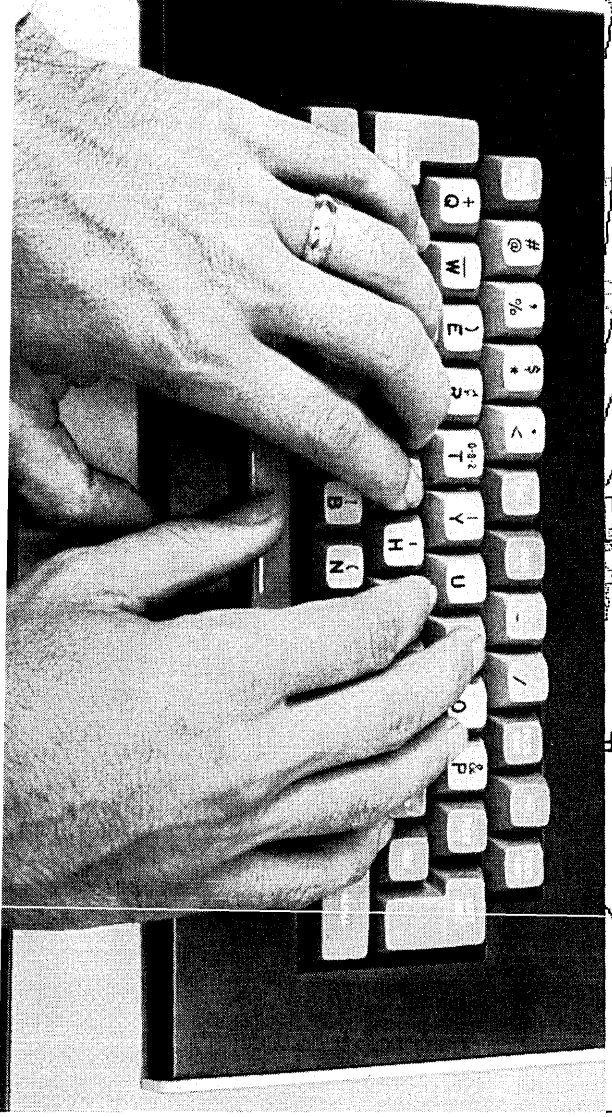
The new back coating also minimizes permanent tape damage. It eliminates cinching that's caused by layer-to-layer slippage in tape packs. Also offsetting of individual tape layers during fast rewind — a common damage-producer when reels are handled by operators.

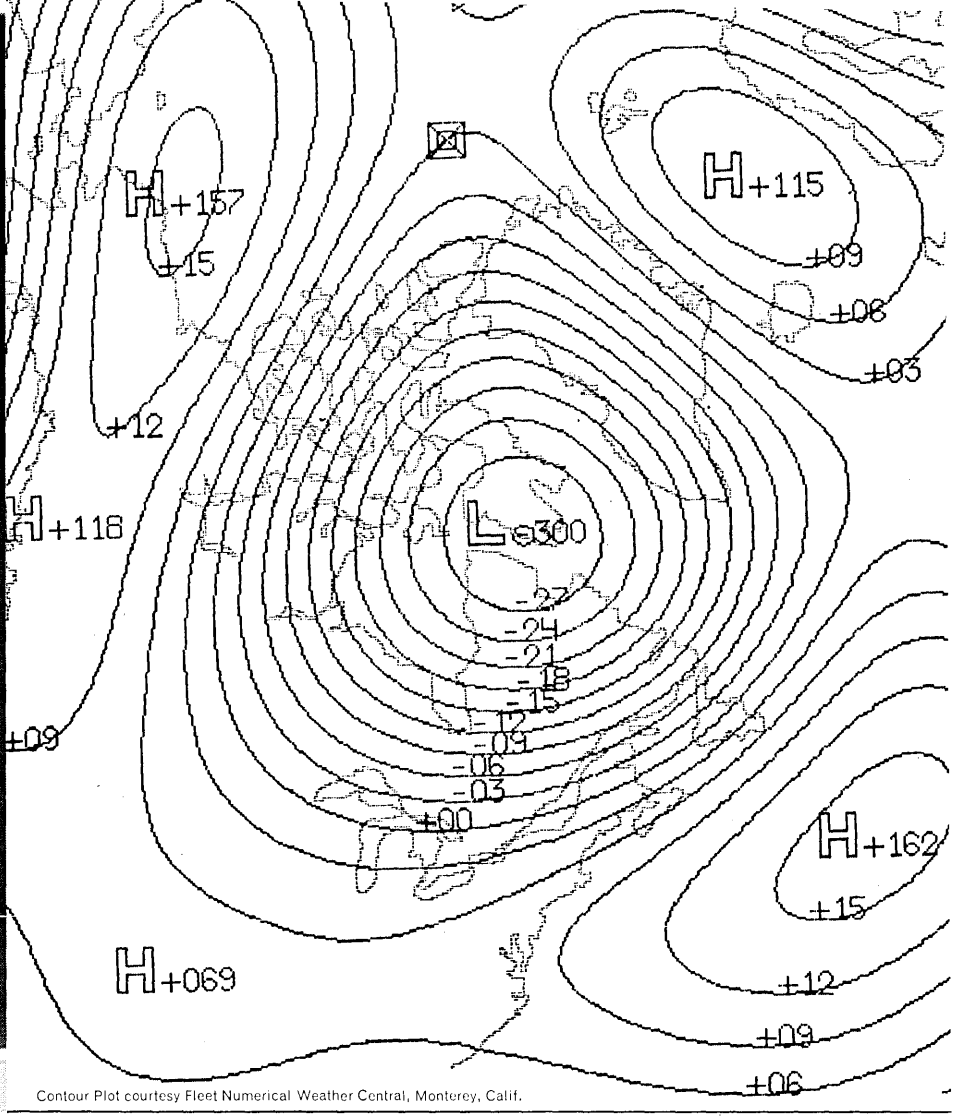
What's the combined effect of Astron's high-durability oxide coating and our new back coating? Unparalleled tape drive operational efficiency. And longer tape life.

Ask your man from Memorex about Astron. Or write for our Astron brochure. Memorex Corporation, Memorex Park, Santa Clara, California 95050.

MEMOREX

CIRCLE 57 ON READER CARD





Contour Plot courtesy Fleet Numerical Weather Central, Monterey, Calif.

Go from data to plot in 1/5 the time.

Compared with conventional plotters, Statos 5 needs less CPU time. Because our digital printer/plotter requires less sorting and connecting. The job gets done with 20 per cent less core, since the memory isn't forced to hold the whole plot to start plotting. And Statos produces the plot 10 to 15 times faster too.

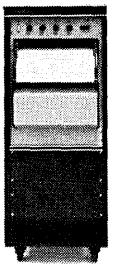
Another time saver. The hardware character generator. If you want a capital H, oriented sideways, just give the plotter 3 commands. The generator does the rest. Or print descriptive text at 30 lines per second.

Complex plots show off our ability. One way: the plotting time is the same for any given size plot regardless of contour density or total line length. Including any number of double width lines.

One more pertinent item. The world isn't all black and white. Depending on individual needs, Statos 5 can deliver gray with a variable dot density that produces up to five shades or an optional Z-axis intensity modulator that delivers up to eight shades of gray. All in precise registration.

Software? No problem. Choose from several complete packages. In short, any way you program the facts, Statos 5 will save you time.

For the full story on the Statos 5 electrostatic printer/plotter, call or write: 611 Hansen Way, Palo Alto, Calif. 94303. Phone (415) 326-4000.



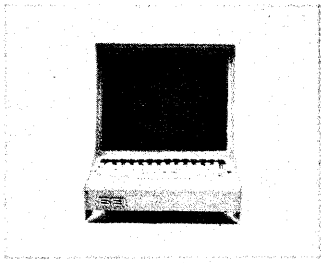
Statos 5— a great idea whose time has come

varian graphics and data systems division

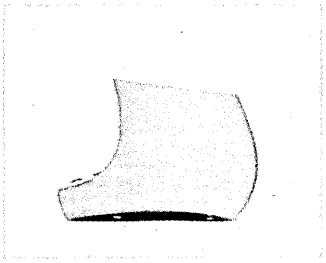
CIRCLE 39 ON READER CARD

From any angle... the Top Time-Sharing Terminal

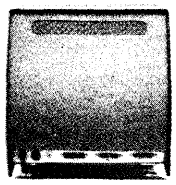
Let's Face It
Beehive has the slenderest CRT terminal of all—a classy stand alone unit measuring just 12" wide, 14" high and 20" deep. Alpha-103, with an 800 character display is TTY interchangeable. Alpha-105, with 80 char/line 20 line capacity is a direct TTY replacement.

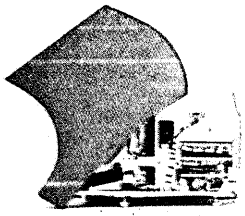


Aside From That
This terminal is smartly functional with a contoured design which will enhance the looks of any modern office. The curved case bottom makes it easy to lift the 30 pound lightweight which is available in green, blue, yellow, brown and buff—plus dozens of special decorator colors.

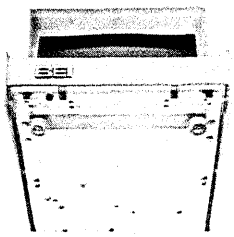


A Little Back Talk
Shows a clean rear panel which makes this Beehive terminal attractive from any angle. All connectors and the AC power cord are hidden beneath the unit, including a BNC to directly connect low cost, large screen TV monitors. You see, all Beehive CRT terminals are EIA Television compatible.

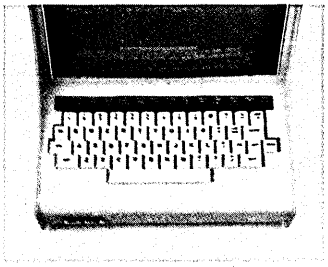




The Inside Story
Concerns the five modular printed circuit boards, easily reached by lifting the hinged case. Beehive CRT terminals use MOS integrated circuits for both memory and for character generation. The use of MOS results in smaller size, higher speed, lower power consumption and better reliability.



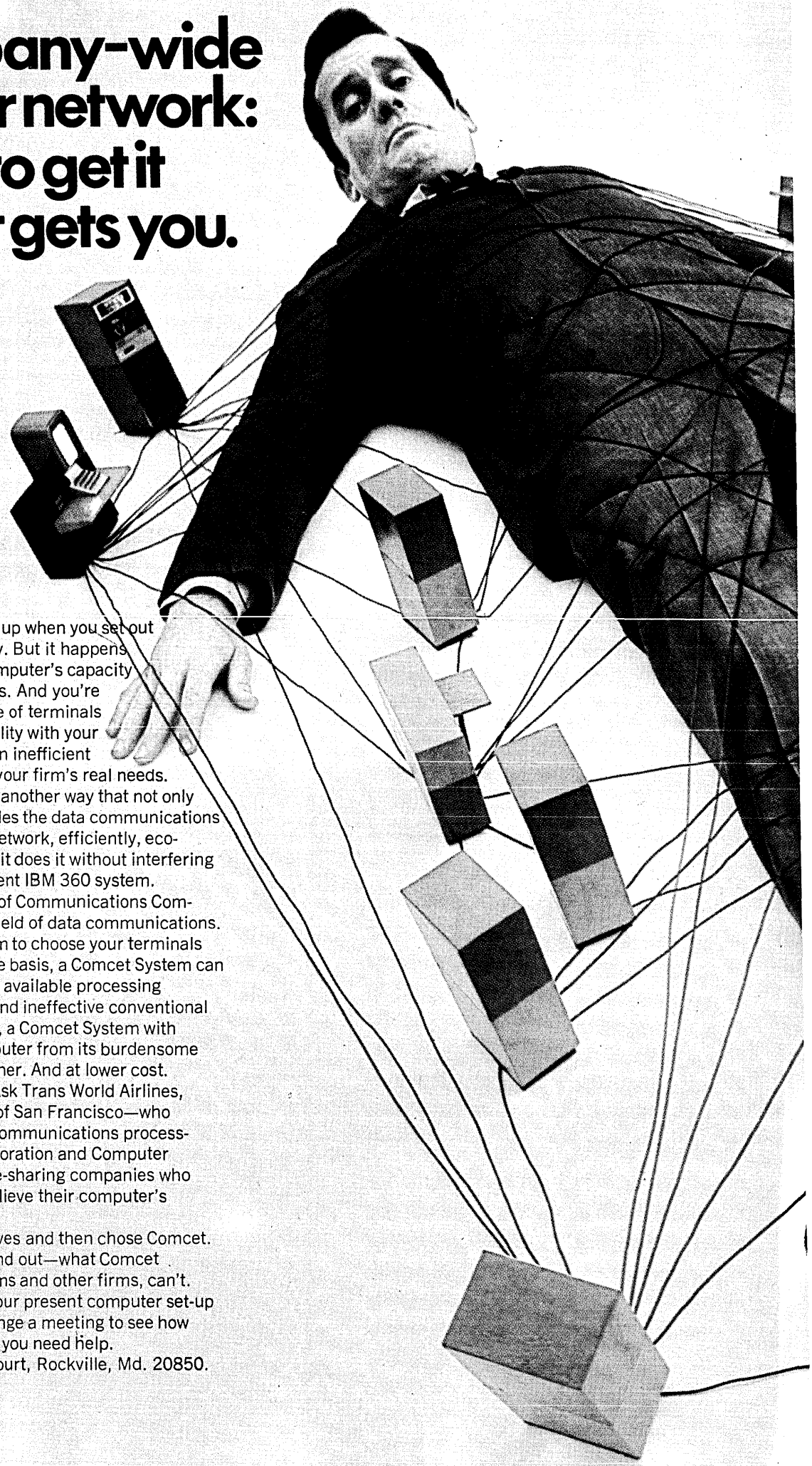
Underneath It All
Are the cleverly concealed controls for On/Off, Brightness, Contrast, System Reset, and a very important Local/Half/Full Duplex switch. This makes it possible to type and edit text under Local control, and then switch to Half Duplex for high speed transmission of the entire message to the computer.



The Closer You Get
The more you'll appreciate the flexibility of Beehive's CRT terminals. Note the Teletype keyboard. Plus the 14 optional black control keys for tabbing, 4-way cursor control, text editing and interface with printers, tape cassettes and, of course, the computer.

Beehive Electrotech, Inc.,
1473 South 6th West,
Salt Lake City, Utah 84104
(801) 487-0741

The company-wide computer network: How to get it before it gets you.



You didn't expect to get all tied up when you set out to computer-link your company. But it happens too often. Too much of your computer's capacity gets tied up in communications. And you're still locked into a particular line of terminals based solely on their compatibility with your main computer. The result is an inefficient system that's unresponsive to your firm's real needs.

We'll tell you right now, there's another way that not only costs less but completely handles the data communications of a company-wide computer network, efficiently, economically and inventively. And it does it without interfering with the operation of your present IBM 360 system.

It's through the Comcet family of Communications Computers, a breakthrough in the field of data communications. Besides giving you new freedom to choose your terminals on a sensible cost/performance basis, a Comcet System can almost double your computer's available processing capacity and eliminate costly and ineffective conventional termination equipment. In fact, a Comcet System with peripherals can free your computer from its burdensome communications tasks, altogether. And at lower cost.

But don't take our word for it. Ask Trans World Airlines, Alcoa and the City and County of San Francisco—who chose Comcet to handle their communications processing. Or Wabash Computer Corporation and Computer Network Corporation—two time-sharing companies who installed Comcet Systems to relieve their computer's communications overload.

They checked out the alternatives and then chose Comcet. Why not find out what they found out—what Comcet can do for you that other systems and other firms, can't. Call or write us. Tell us about your present computer set-up and your goals. Then we'll arrange a meeting to see how Comcet can help you wherever you need help.

Comcet, Inc., Two Research Court, Rockville, Md. 20850. Phone (301) 948-8700.

COMCET

Or call us in the city nearest you—Minneapolis-St. Paul (612) 633-8130. Boston (617) 232-3570. Los Angeles (213) 641-3655. New York (212) 594-9080. Chicago (312) 298-6180. San Francisco (415) 392-7741. Dallas (214) 357-6557. Houston (713) 626-3225. Detroit (313) 354-4033. Pittsburgh (412) 232-0223.

CIRCLE 155 ON READER CARD

PI announces
200 New Digital Tape Recorders

SERIES 1217/19

The new PI 1217/19 series of block read/write digital tape recorders are designed for versatility.

THE SECRET . . . Modular construction.

THE FORMULA . . . Pre-engineered, off-the-shelf components.

THE METHOD . . . Mass produced modules insuring economy and fast delivery.

THE RESULT . . . Recorders to meet your unique applications. No costly unwanted and unneeded features. Performance is certified to your application and a copy of each recorder's final acceptance test data is included with the machine.

Write today, on your letterhead, for our DIGITAL RECORDER DESIGNER'S KIT. With this kit you can quickly, easily design the exact recorder you need.

PRECISION INSTRUMENT COMPANY

3170 Porter Drive, Palo Alto, California 94304 • Phone (415) 321-5615 • TWX No. 910-373-1752

CIRCLE 173 ON READER CARD

Interactive Graphics

for the Tektronix T4002 Graphic Computer Terminal

With the introduction of the 4901 Interactive Graphic Unit and Joystick accessory, graphic input capability is now available for the Tektronix T4002 Computer Terminal. The Interactive Graphic Unit is a valuable aid wherever graphic analysis of statistical data is fundamental to: thorough scientific investigation—effective computer-aided instruction—informed decision making.

The 4901 and optional Joystick are *software* supported. The software permits coordinate identification, display rotation and overlaying, menu picking and other frequently repeated functions in graphic formatting.

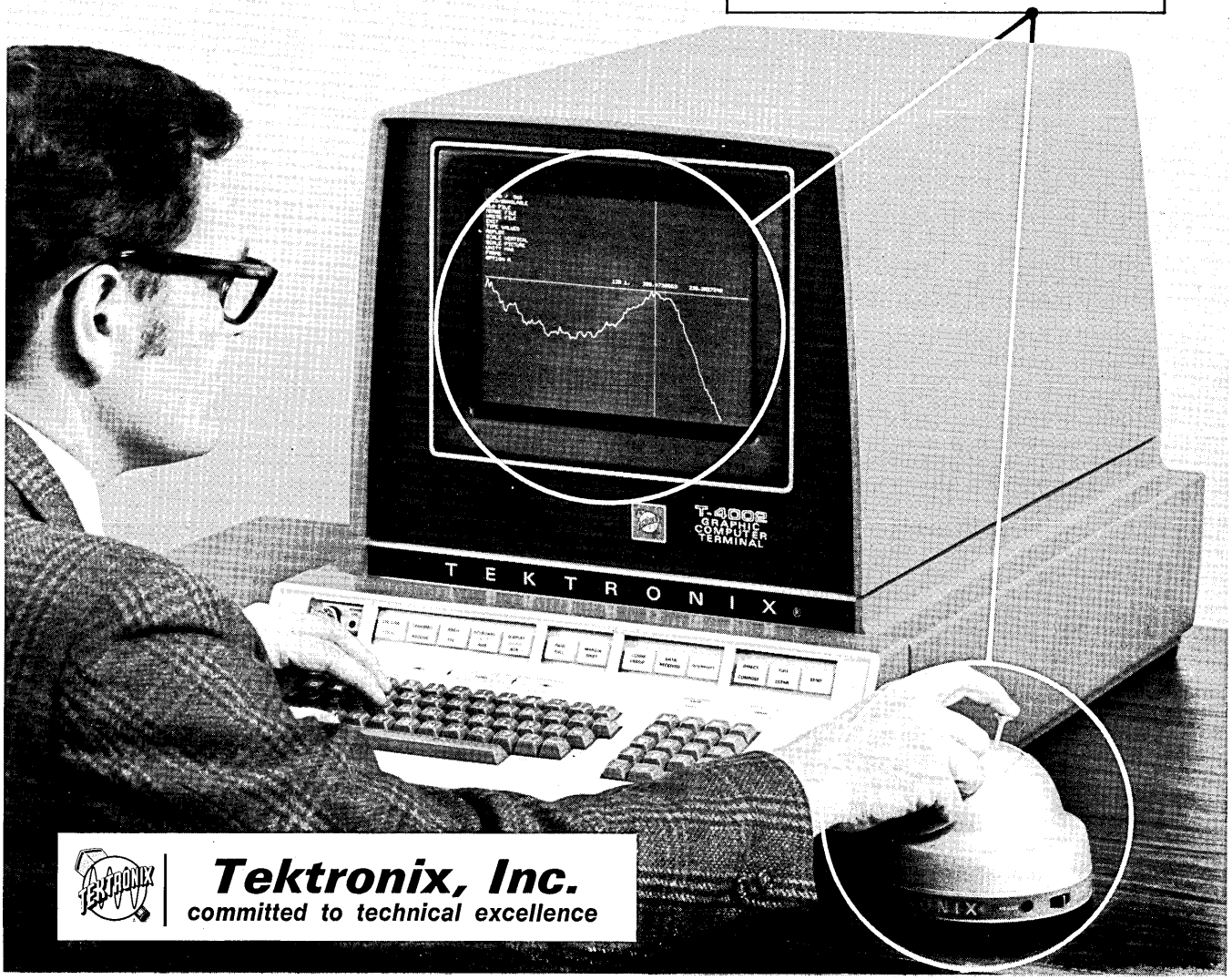
The new 4901 generates a bright, no parallax, orthogonal crosshair cursor. The cursor is easily and accurately positioned with the desk-top Joystick. You enter data points and instructions through the T4002 keyboard. This means complete graphic interface without removing your hand from the Joystick.

Tektronix Application Engineers, especially trained in the capabilities of Tektronix Information Display Products, will discuss with you the full versatility of the T4002 Graphic Computer Terminal. A T4002 demonstration provides an excellent opportunity to discuss software support, machine compatibility, interface options and maintenance. Contact your Application Engineer through any Tektronix office (57 domestic—48 foreign) or directly by calling (301) 825-9000 Baltimore; (617) 894-4550 Boston; (415) 326-8500 Palo Alto. Or write Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

T4002 Graphic Computer Terminal	$8,800
4901 Interactive Graphic Unit	$ 450
Optional Joystick (015-0175-00)	$ 250

U.S. Sales Prices FOB Beaverton, Oregon

The new, no parallax crosshair cursor is positioned with the desk-top Joystick.



Tektronix, Inc.
committed to technical excellence

Welcome to the Graphic Generation

The new GRAPHIC-15 Display System contains a programmable processor and display console with built-in vector generator, character generator, and function box. Mated to the PDP-15 computer, it becomes a graphic system that is highly interactive – yet is but half the price of its nearest competitor.

Field expandable. Fast (¼ inch of vector every μsec). 4,000 flicker-free characters. 8,000 inches of flicker-free vectors. Remotable display. Software ported. Full line of options. And made by the computer company that knows more about big needs and small budgets than anyone.

A work of art. Write.

digital
COMPUTERS · MODULES

Digital Equipment Corporation
Maynard, Mass. (617) 897-5111

CIRCLE 21 ON READER CARD

letters

see the cpu run

Sir:

The new series of self teaching manuals that IBM Corporation has published would appear to be oversimplified. It is true that an operator is not required or expected to be a college graduate, and the degree of highly technical material that he would need to absorb is limited. Nevertheless, this latest series of educational material IBM has published is an insult to the intelligence of the average operator.

When questioned on this matter, an IBM sales representative indicated that educational material, as with television, has to be aimed at the broadest spectrum of participating individuals, and this presents an average level of a 5th grade student.

The following commentary was mailed to IBM Corporation in mild protest to the oversimplification of their current educational material.

COMMENTS

MY NAME IS PAUL.
THE NAME OF THIS BOOK IS . . . . TOO HARD TO SAY.
I CAN READ.
I READ THIS BOOK.
THE COMPUTER IS NICE.
THE COMPUTER CAN WORK HARD.
THE COMPUTER IS ALSO VERY PRETTY.
PRETTY COMPUTERS MAKE ME FEEL GOOD.
(NOTICE HOW THE SENTENCES ARE GETTING LARGER)
I CAN PUT CARDS IN THE LARGE BOX.
THE LARGE BOX IS CALLED A CARD READER.
THE CARD READER CAN ALSO PUNCH CARDS.
THE BIGGER BOX IS A THINKING MACHINE.
THE THINKING MACHINE IS CALLED A CENTRAL PROCESSING UNIT.
THE INITIALS OF CENTRAL PROCESSING UNIT IS CPU.
THE CARDS TELL THE CPU WHAT TO DO.
THE CPU CAN ADD AND SUBTRACT.
THE CPU CAN MULTIPLY AND DIVIDE.
AFTER THINKING THE RIGHT ANSWER, THE CPU WILL TELL THE PRINTER TO WRITE THE ANSWER ON A SHEET OF PAPER. (SENTENCE TOO WORDY BUT IT PUTS THE POINT ACROSS.)
SOMETIMES THE CPU WILL TELL THE CARD READER TO PUNCH THE ANSWER IN A CARD.
NOW I CAN OPERATE A COMPUTER.
NOW I CAN MAKE PRINTED LISTINGS.
NOW I CAN SEE THE TAPES SPIN.
NOW I AM HAPPY!
OH HAPPY DAY!
I AM AN OPERATOR.
IF I AM GOOD, I MAY BE ALLOWED TO WRITE A COMPUTER PROGRAM. (PROGRESSION TO A COMPOUND-COMPLEX SENTENCE STRUCTURE.)
THANK YOU, IBM, FOR NOW THE COMPUTER IS MY FRIEND.

PAUL E. THOMAS
University Hospital Computing Center
Oklahoma City, Oklahoma

A representative of IBM states: This manual is one of our most popular self-study courses offered by IBM. Reader comments have been consistently favorable. For students with more advanced needs, IBM has available a DOS/360 operator's guide (GC24-5022) obtainable through IBM local sales offices.

an oscar performance

Sir:

The computer business has a habit, like others, of attaching people's names to Laws and Principles (capitalization intended). Therefore I would like to get a specific name on record before someone preempts the privilege. After all, I have seen at least three different usages of XTRAN since I first attached it to the work that was a predecessor of ALGOL 58.

Lockheed Missiles and Space Company started in Van Nuys, California, not in Sunnyvale as at present. One of the group of excellent programmers I had there in 1954 was one Oscar Firschein. Our early equipment was the IBM 650, which can be remembered as a drum store machine which ran faster if you spaced the instructions and data on the drum just right, and there were programs to do this optimization.

Oscar found that he did not like to give up his turn when he had a malfunction in his program. So he developed a holding routine which, after taking a store dump, was loaded immediately to keep the lights flashing long enough for Oscar to get back to his desk, find the mistake, correct it, and get back on the machine.

As one can imagine, his success prompted the other programmers to wonder how he did it, and of course they caught him one day. To their indignant queries of "Aren't you ashamed to use that holding routine?", he replied "Hell, no—it's optimized!"

There you have it, young-timers, the *Firschein Phenomenon*. And you software management types had better take heed. It says that the good programmer is going to be wasted if he has to wait several hours for his next shot on the machine. And when he is wasted, his production goes down so that you have to hire more programmers to get the job done. But most of these will *not* be good programmers, so you have complicated the job, created less efficient programs and wasted your machine capacity. This is strictly a horseshoe nail to lost battle sequence.

Any further arguments needed for online software development?

ROBERT W. BEMER
Phoenix, Arizona

and another

Sir:

As a follow-up on Bob Bemer's report on the Firschein Phenomenon, you might be interested in the Fischler Foreground Finisher, which brings the former approach up-to-date.

We run pattern recognition experiments in background on the IBM 360/40 using DOS 21.1. It turns out that the software for the experimental system, designed by Dr. M. A. Fischler of our labs, locks up foreground if an attempt is made to cancel our background operation. The Fischler Foreground Finisher conveys a certain amount of power to a background user, and he is treated with both awe and respect by the usually dominant foreground users.

OSCAR FIRSCHEIN
Lockheed Research Laboratory
Palo Alto, California

readout reaction

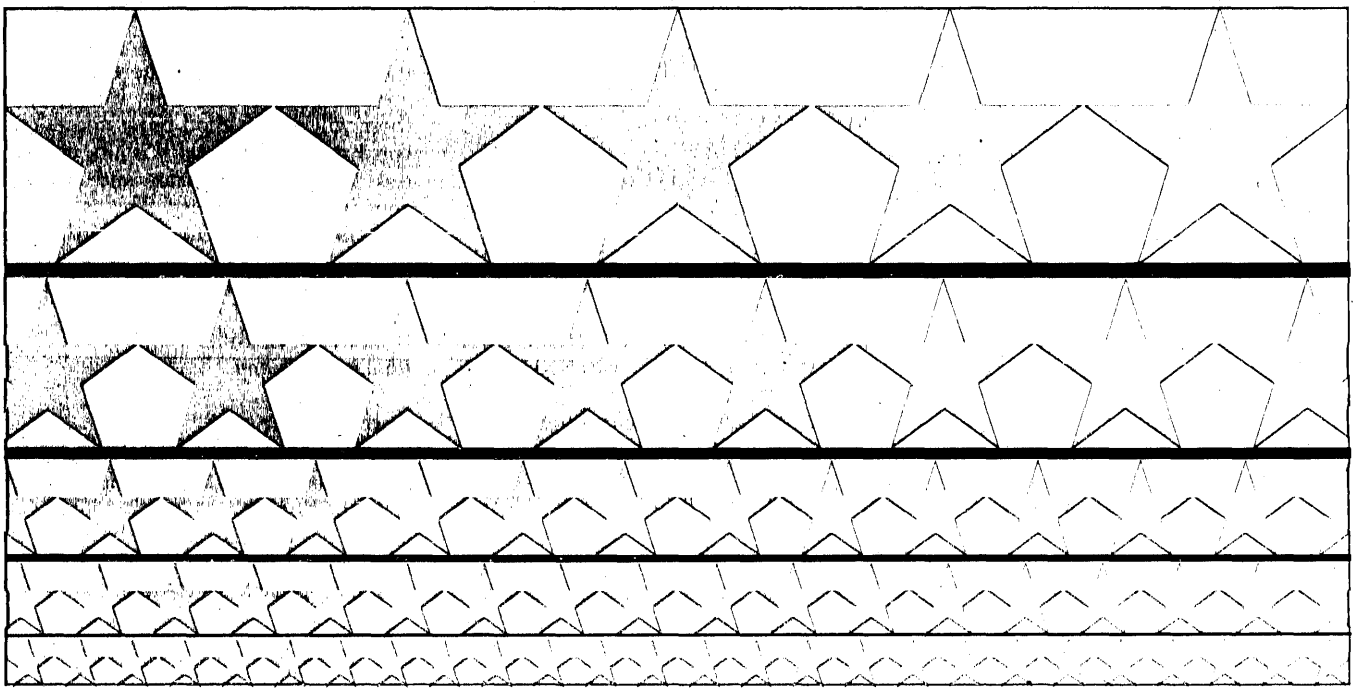
Sir:

I was shocked the other day to read in DATAMATION (March Readout, p. 51) that you "were shocked the other day to hear the President of the United States say it was wrong for a minority to impose its will on the majority." Does this mean that you would not be shocked if the President had said that it is right for the minority to impose its will on the majority? If not, why not? I'm only kidding; I wasn't really shocked.

You say that "Progress . . . comes from . . . dissent and debate. The other way lies conformity, apathy . . . and ultimate disaster." Wrong. Progress is the ultimate disaster. The only effective countermeasure is apathy. If

There's a computer system that can take on 1,000 simultaneous users.

That's an astronomical impossibility.



Impossible...no. Astronomical...of course.

But then it's the Gemini Computer.

The Gemini Generation is here.

COMPUTER OPERATIONS, INC.
3161 RED HILL AVENUE, COSTA MESA
CALIFORNIA 92627 • AREA 714/549-3051

CIRCLE 160 ON READER CARD

everyone will just mind his own business and shrug off all the people who keep imploring us to do this or to do that, then all will be well. Are you a Gnostic?

The reason that nobody writes to you is that DATAMATION is unbelievably boring. So is data processing. That is why I couldn't work up the interest to write this. My slogan for the 70's? *Settle for less.*

L. G. HUDGENS
St. Louis, Missouri

The editor replies: Hmmm, Mr. Hudgens may have something here. On the other hand, our industry has been settling for less for some 20 years now.

reading him off

Sir:

In reference to the March Editor's Readout, lack of involvement is a sickness in this country among the so-called "silent majority," because today involvement is something negative. You yourself show it is negative by a statement like "Complain when a program is lousy;" you never say, "Praise and compliment when a program is good."

Perhaps when people look for the good in something, rather than the bad, and when people can understand the rational good as opposed to the emotional good, there will exist no silent majority—only because there will be no discontent minority.

LT. SEBASTIAN A. SORA
Rockville, Maryland

The editor replies again (not unusual for him): By golly, you're right—my approach was negative. I guess I assume that assent is silent, but it shouldn't be. I think your conclusion is a bit idealistic, but am glad to know there are some idealists left.

generation veneration

Sir:

The quandary of J. Czarnuszewicz and associates concerning "generations of computers" (Feb. pp. 41-42) seems to be shared by many others.

The written material he desires does exist in the technical literature, and in two books published last year. Chapter 12 of C. A. Harper's *Handbook of Electronic Packaging* (McGraw-Hill 1969) defines four generations of computers, documented with references and exemplified by a table of representative computers and their distinguishing features. The references are to Norman Nisenoff in the IEEE Proceedings for December, 1966, to R. L. Petritz in the AFIPS Proceedings of the 1966 FJCC, and to Gene and Lowell Amdahl in DATAMATION for January 1967. These citations support the idea stated by Czarnuszewicz, and are aimed at hardware engineers, specifically in circuits and packaging.

The other book mentioned is *Computers, Office Machines, and the New Information Technology* by Carl Heyel (Macmillan 1969). In it, a section on "The 'Generations' of Computers" starting on page 78 discusses at some length the definitive attributes of three generations, including circuit features, storage, software, and peripherals. Its contents are consonant with the other references previously listed.

Although there has been some one-upmanship in promoting and advertising new computers, the technical community appears to be in agreement on definitions of generations, as the foregoing published material indicates.

I am the author of the Chapter 12 cited above.

ROBERT M. KALB
Minneapolis, Minnesota

fatty issue

Sir:

So you want a complaint? I got a complaint! Used to be DATAMATION was a nice little newsy sheet, and I took time to read it; now it is ½ inch thick and fat! fat! fat! You are hanging out over your belt! Fine thing! you say, complaining about too much of a free thing. Well, the message is the medium, someone said. Maybe this is what I am trying to say.

No hard feelings, I still read about one out of three.

JOEL W. MAXEY
Dearborn, Michigan

getting laid off

Sir:

Your March 1970 issue made reference to ARIES Corporation letting "approximately half of its Washington staff go" (News Briefs, p. 171). In the interest of fairness, I wish to point out that a total of fourteen persons were laid off. Only six of these were members of the technical staff. The remaining eight were in various support capacities. This is nowhere close to "half of the Washington staff," as we still have in excess of 100 personnel at this site.

JAMES H. DINWIDDIE
Aries Corporation
McLean, Virginia

real parent stands up

Sir:

I was quite pleased to see the article, "You Pay Us, We Pay Your Bills," concerning Unibudget in the Look Ahead section (March '70, p. 41); however, I found two inaccuracies in the article. First of all, Tax Corporation of America is not ARIES Corporation's parent company. Automation Technology (Autotech), based in Santa Barbara, is the parent company of both TCA and ARIES, making them *affiliated* companies. Secondly, Unibudget will be marketed by TCA for five dollars a month plus 15¢ a check rather than for $15 a month.

PETER R. COWGER
Automotion Technology, Inc.
Santa Barbara, California

cosmetic factors

Sir:

Although Frederic C. Withington, in his article "Cosmetic Programming" (Mar. '70, p. 91), advocates making the computer more acceptable to its user, the title itself reflects the demeaning of the importance of the user. The word "cosmetic" implies a superficial prettying-up, rather than a professional one. We don't need cosmetics, we need system design that does not merely make a computer work, but optimizes the functioning of a man-machine system.

Human factors specialists have for many years been addressing themselves to problems of interfacing humans and hardware. Recent issues of such journals as *Human Factors, Ergonomics,* and *IEEE Transactions on Man-Machine Systems* contain a good deal of material relevant to the design of systems containing computers. Appropriate use of human factors professionals on the design team together with hardware and software specialists is the only effective way of assuring optimal allocation of system functions to the computer complex and to man, and designing the man-machine interface to optimize total system functioning.

EDWIN COHEN
Binghamton, New York

zero in

Sir:

In the "New Products" section of the March, 1970, issue (p. 183), you describe our new Medical Lab System "MED-LIS." The test processing capability of the small MED-LIS configuration is 2,000 tests per day as against the 200 tests per day stated in the description.

DR. S. B. JEFFRIES
Comprehensive Computer Systems, Inc.
Englewood Cliffs, New Jersey

european alias

Sir:

With reference to World Report of February, System CII 10070 is the name given by Compagnie Internationale pour l'Informatique to the Sigma 7 computer. Apparently, in the news reported, a different name should

(Continued on p. 263)

Hit the Nail Right on the Head in Florida.

Our Competitive Advantages For Industry Are Tailored To Meet Your Needs When you look toward Florida for a plant site, you are putting your efforts where they'll do the most good.

We have a great deal for you in this booming, business-oriented state. We have a built-in competitive edge for you that just can't be ignored. This factor is being recognized by more and more firms with an eye on the future: A tremendous variety of sites, a recruitment and training program (free to you) which has your labor force ready for you when the doors open . . . new laws concerning revenue bond financing for construction and improvement.

There's a lot more to your competitive edge in Florida. Let us tell you about it in confidence. Phone (904) 224-1215, or send for coupon.

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107 WEST GAINES STREET
TALLAHASSEE, FLORIDA 32304

HANDY COUPON FOR YOUR CONVENIENCE!

Florida Department of Commerce / 107 West Gaines St. Tallahassee, Florida 32304 / Att.: Dept. "F-3"

I'm interested in a business or industrial future in Florida. Please send me more information.

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Title or Position .....

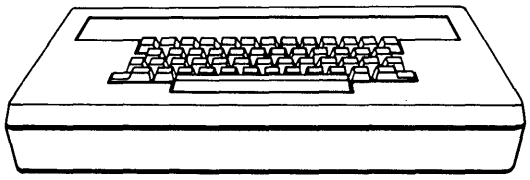
Company .....

Street .....

City ..... State ..... Zip.....

We've formed a small movement to eliminate keyboard downtime.

The only moving mechanical parts of our new keyboard are the plungers. And they barely travel 3/16 of an inch.



Everything else is all solid state. So there's no need for mechanical linkages, electromechanical parts, contacts or any of the moving parts that normally wear out and result in expensive downtime.

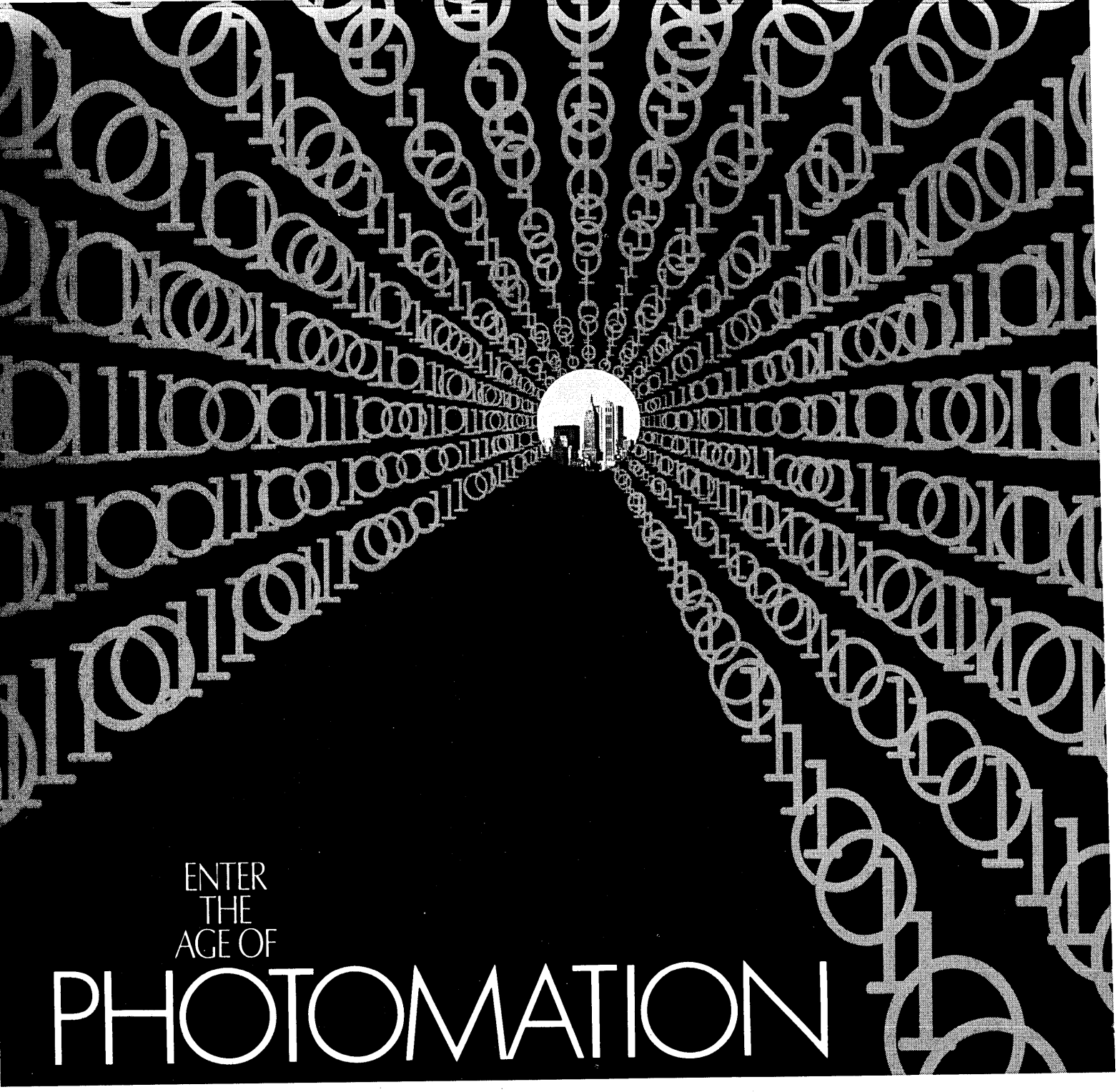
The reliability of our all solid state keyboards will play an important role in helping you beat the economics of downtime. Especially during critical operating periods.

But if you ever do need application assistance, experienced MICRO SWITCH field engineers are standing by to provide the back-up help you'll need to solve your individual problems.

MICRO SWITCH can supply all standard and custom key arrays. Each with the same touch and spacing as a regular keyboard.

Let's get together and discuss keyboard reliability or any other part of the business you consider important. Dollars. Technology. Compatibility. Delivery. They're all important to us. Call or write us and see.

MICRO SWITCH
FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL



Consider all that the digital computer has accomplished in the automation of words, numbers and lines. Now it's possible for pictures.

Photomation is the automation of halftone photographic images for transmission over telephone lines. Or for computer enhancing a reproduction to better quality than the original picture. Or for storage and retrieval.

The DICOMED 30 Image Display makes photomation possible. And practical.

It's a direct view CRT with a resolution of over one million points, each with 64 intensity levels.

This is *not* television. It's much more.

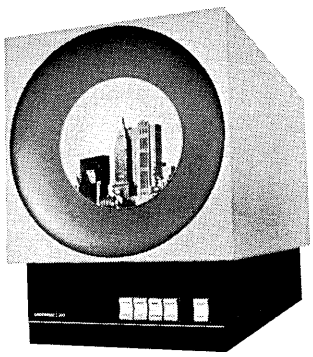
The DICOMED 30 needs no refreshing. It doesn't fade or flicker. Your picture stays solid as a print until you erase it.

This is *not* a film device. Digital film output takes most of a 24-hour day. The DICOMED 30 displays your picture immediately.

Photomation offers the advantages of TV and film without the drawbacks. And it costs far less than either.

Reproduce accurate pictures when and where you want them.

Write, or call (612) 920-8980.



BIRTH OF AN INDUSTRY

DICOMED

DICOMED CORPORATION Dept. D105 4600 W. 77th St./Minneapolis, Minn. 55435

CIRCLE 132 ON READER CARD

AIRLINE EDP MANAGER SHORT CIRCUITS UTILITY COMPANY INPUT PROBLEM.

THE INPUT UNDERGROUND IS WORKING.

Mr. A., EDP manager for one of the major airlines, has applied his company's remedy to another company's headache.

"I joined the Underground because I believe the success my company has had with optical readers should be shared with companies still living in the data processing dark ages," Mr. A. told IU Headquarters. "I immediately began looking for someone to help. Preferably someone who was still keypunching."

Mr. A. didn't have to look farther than his mailbox. There, in living holes, was a utility company bill.

"I couldn't understand how utility companies, with all their volume, could keep plugging along with outmoded input methods."

According to reliable sources, most utility companies use a combination mark sense/keypunch billing system. Meter readers fill out mark sense forms in the field. The forms are fed to optical scanners which drive automatic keypunch machines. The resulting cards go to the computer to update billing records. Computer-operated line printers prepare statements. Before they're mailed, statements are keypunched with account numbers.

I.U. FLASH BULLETIN:
Just in from Recognition Equipment: Major new input products to support underground movement now under development. Watch this page for announcements.

When statement stubs are returned with payment, clerks have to open each envelope to make sure the payment equals the amount due. Any partial payment has to be keypunched into the stub before it goes to the computer for processing.

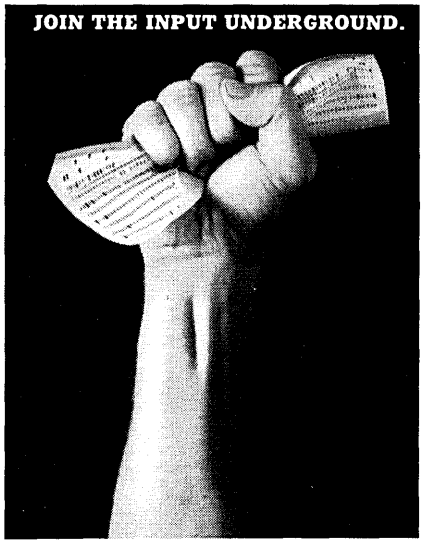
"That's a lot of keypunching and a lot of room for errors," Mr. A stated. "I was determined to find a better way. I started with the people my company got its reading system from. Recognition Equipment Incorporated. I figured that any company that could build a system to read and sort flimsy airline tickets should be able to handle anything.

"I was right. Recognition Equipment has a system called INPUT 2. It's just what the utility companies need. Reads handprinting and machine printing. Records the data on magnetic tape in computer language so it can be fed directly into the computer.

"I figure the utility companies can use it something like this: Information handprinted by meter readers can be read by INPUT 2 and fed directly into the computer. Statements don't have to be keypunched because INPUT 2 will read information printed by the line printer. And, since there's no need for keypunching, there's no need for card stock. Statements can go out on plain paper.

"Partial payment information can be handprinted by clerks and sent directly to the reader for processing. And I'll bet the utilities have a lot of other forms they can read with INPUT 2."

Thanks to the joint efforts of Mr. A. and Recognition Equipment, IU Headquarters can supply detailed information to any utility company seeking a solution to input fatigue. Send all requests to Input Underground, P.O. Box 5274, Dallas, Texas 75222.



PUBLISHED AS A PUBLIC SERVICE BY RECOGNITION EQUIPMENT INCORPORATED

Burroughs announces the B 4500 data processing system, an important addition to its expanding '500 Systems' family.

The B 4500 is a totally new computer. It employs the latest electronics technology, including both a new generation of high-speed CTL integrated circuits and MSI devices. Faster speeds and improved performance result from applying this technology to processor logic and multi-level memories. Operations are measured in billionths of a second.

The B 4500 combines this exceptional performance with Burroughs commitment to responsiveness. Responsiveness to current users through B 2500/B 3500 object code compatibility. Responsiveness to new users through the standard compiler languages: COBOL, FORTRAN and BASIC. Responsiveness to on-the-job production through Burroughs unique Master Control Program (MCP), an operating system concept that has made the popular B 3500 highly efficient and easy to use.

Proven performance and field-experienced software mark the evolution of Burroughs '500 Systems'. The new B 4500 is the latest step in that evolution.

Burroughs

look ahead

THE BUYER AWAKES, LET THE SELLER BEWARE

Are computer users coming of age? Good sources delightedly relate that there's a new fad afoot: more and more customers are writing their own contracts on equipment and services -- and letting the vendor do the stewing for a change. IBM's not the only mainframer involved in the rebellion, we're told; "the whole idea of the rigid standard contract is being attacked." There's no word yet, though, on whether the vendors are signing the dotted line . . .

WESTINGHOUSE TO ENTER BOOMING MINI MART

Westinghouse this month is expected to announce its entry in the minicomputer market, starting with the 16-bit machine in its P-2000 process control system announced last May. Fifty of those have been delivered. The business, say happy minimarketeers, is "ahead of projections" for 1970. DEC and Data General, both profitable, are said to be among those taking more orders than expected. DG installed its 500th system before May 1.

Negative rumors on Honeywell's DDP-316 (heavily inventoried, we hear, many customers but difficulty in configuring) have led some to say Honeywell may be out of the race for the number 2 mini spot. But the Big H says it is on target and that it has orders "far in excess" of $33 million (figure that was rumored to be in inventory) for the popular 316, and no delivery problems at all.

This booming market has drawn many would-be manufacturers. A company that never made it with even a breadboard, that spent $400K, failed in its effort to go public, and is now liquidating was Quantum Computing Corp., Needham, Mass. The 26-man firm was formed a year ago by ex-Honeywell people who planned a 16-bit mini for the industrial distribution market. An ex-employee says they thought they could save money by making rather than buying the computer.

GE-PHOENIX GIVES TOSHIBA THE BIRD

Interesting story told is that GE and Toshiba were cooperating on development of a microprogrammed multiprocessing system using T_2L circuitry -- a project started under the late John Haanstra. The machine, called the Pi, was to be three times faster than the 435 and as fast as the 635 but less expensive. With the changing of the guard at GE, the project was reconsidered because of its potential impact on the 600 line--and dropped.

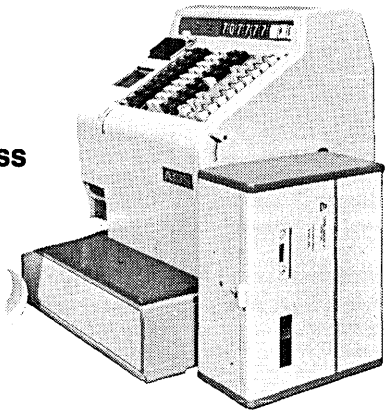
The bewildered Toshiba, which has manufacturing rights to the 635 and 655, was said to be ready to go into production on the Pi for GE. Now it's uncertain whether to go ahead on its own. The Japanese government

(Continued on page 51)

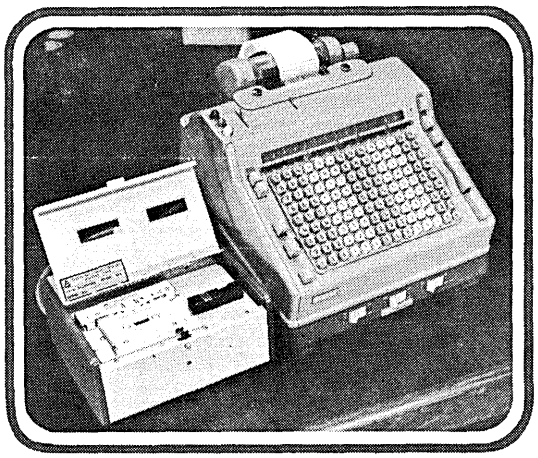
data-kap® 882

BUSINESS MACHINE-SOURCE DIGITAL RECORDER

The new, easy-to-use, silent recorder that captures numeric source data directly from business machines on standard cassette magnetic tape.



- **Captures data directly from adding machines, cash register, accounting machines or other office business machines, equipped with an electro-mechanical matrix.**
- **Quiet, fast, economical replacement for punched paper tape or cards.**
- **Interlock prevents inserting cassette incorrectly. Sensor stops machine at end of tape.**
- **Variable word length. Characters recorded in BCD, ASCII, or EBCDIC on tape.**
- **Fully Automatic.**
- **Error check locks machine requiring operator intervention to continue.**



The data-kap® 882 provides direct, reliable data capture in retail and wholesale operations, banks and other financial or accounting institutions, industrial plants, or wherever data is generated or handled on regular business machines. The Model 882 recorder may be used free-standing or mounted directly to machines. Data is recorded on standard computer-grade magnetic tape cassettes (up to 200,000 character numeric capacity).

Write for details on the Model 882 Machine Source Recorder . . . part of the use-proven ready-for-delivery data-kap® system, a system which permits you to reach your computer in the fastest possible time. Attn: Vice President, Marketing

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is unhappy because it okayed the outflow of currency to GE for the 600 manufacturing rights with the understanding that Pi also would be manufactured there. Since GE was to market the unit in the U.S., dollars, of course, would have flowed back to Japan.

A strange twist to this unconfirmed story is that GE may be building a "cut and paste" copy of the Pi in Phoenix. As this is being written, Toshiba people were reportedly in Phoenix, trying to unravel the snarled threads.

Other reports are that GE, fast at work on its next product line, has dropped consideration of two architects: microprograms and the B-5500-type stack. Some observers think they'll "make a mistake" and stick with the GE 600 architecture.

DEALERS GO CRAZY OVER VIATRON'S SELL CRAZE

The Viatron sell push may turn into a putsch. A delivery policy placing priority on purchased or long-term-lease units has dealers grumbling and prospective users thinking twice.

Dealers made an irresolute stand against the policy at a recent get-together but Viatron, strong in its need for money, persevered. It also took the opportunity to announce that production of the 2101 (remember the original $39/mo. unit?) was being discontinued and that delivery of the computers was slipping from autumn to winter.

Production efficiency and economy were given as reasons for the end of the 2101. Viatron's standard bearer will be the 2111 at $55/month, with twice the memory.

Meanwhile, Viatron continues to throw up new gadgets for System 21. Customers continue to be interested in testing. "There's no inducement to buy--not in price, proven reliability or data entry economy --and data entry development is too dynamic." And dealers try to reconcile their situation.

One dealer is buying units and leasing them to rental customers. North American Computer Corp. says it is getting the hardware in 2 to 3 days. This is much better than the 10 to 12-month ARO Viatron quotes for rentals and even the 3 to 4 months delivery it professes for sales.

1110 SPORTS PERFORMANCE IMPROVEMENTS "BUSINESS" FEATURE

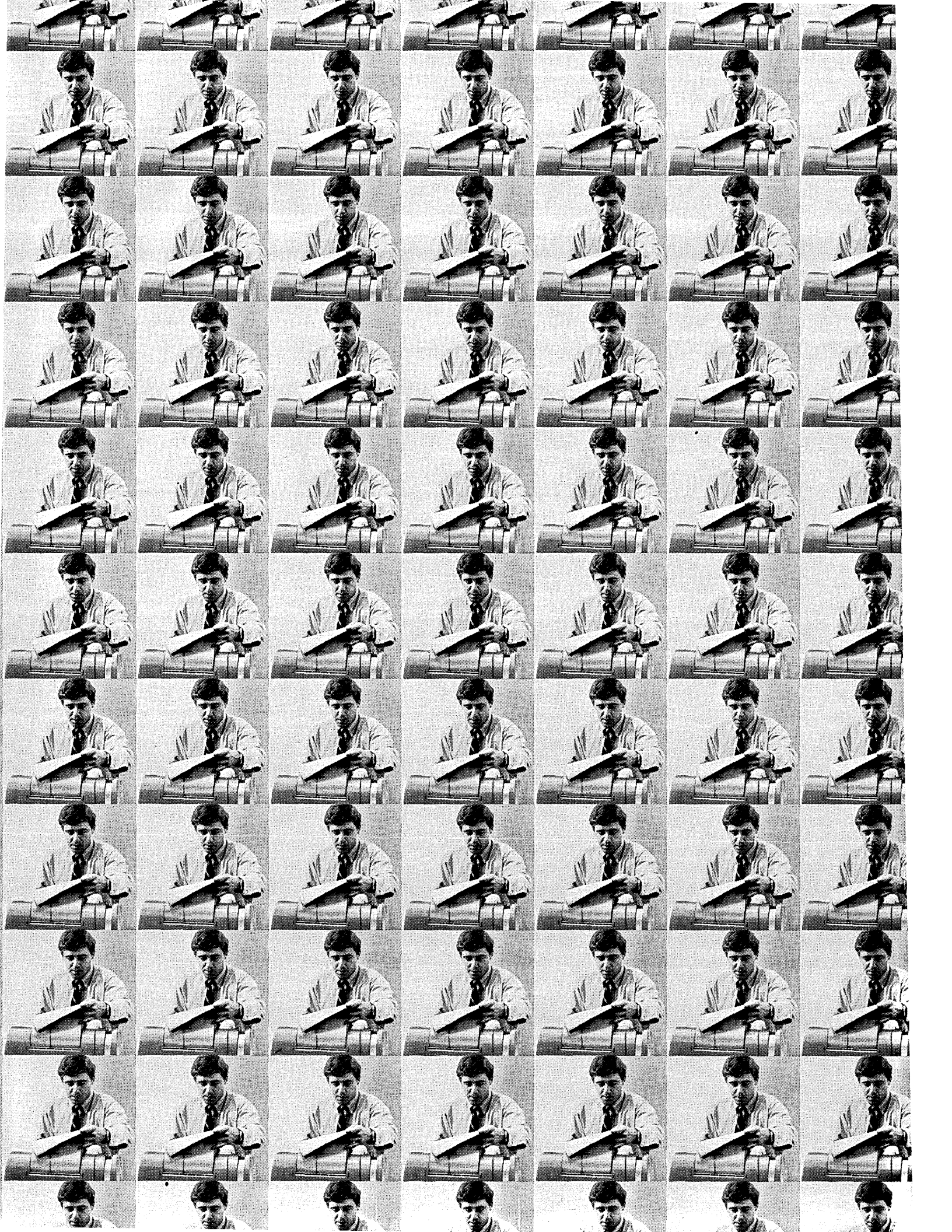
Deadline news on the long-awaited Univac 1110: Its processor speed is 1.8 times that of the 1108, and you can run 1108 programs unchanged at probably more than 2.8 times the 1108 speed. The reasons are a 300 nsec read/500 nsec write plated-wire memory of up to 256K, directly addressable extended core storage of 16 megawords with a 1.5 usec cycle, memory access through at 24-bit address register (bypassing regular I/O channels), and execution speeds of 1.8 million instructions/second.

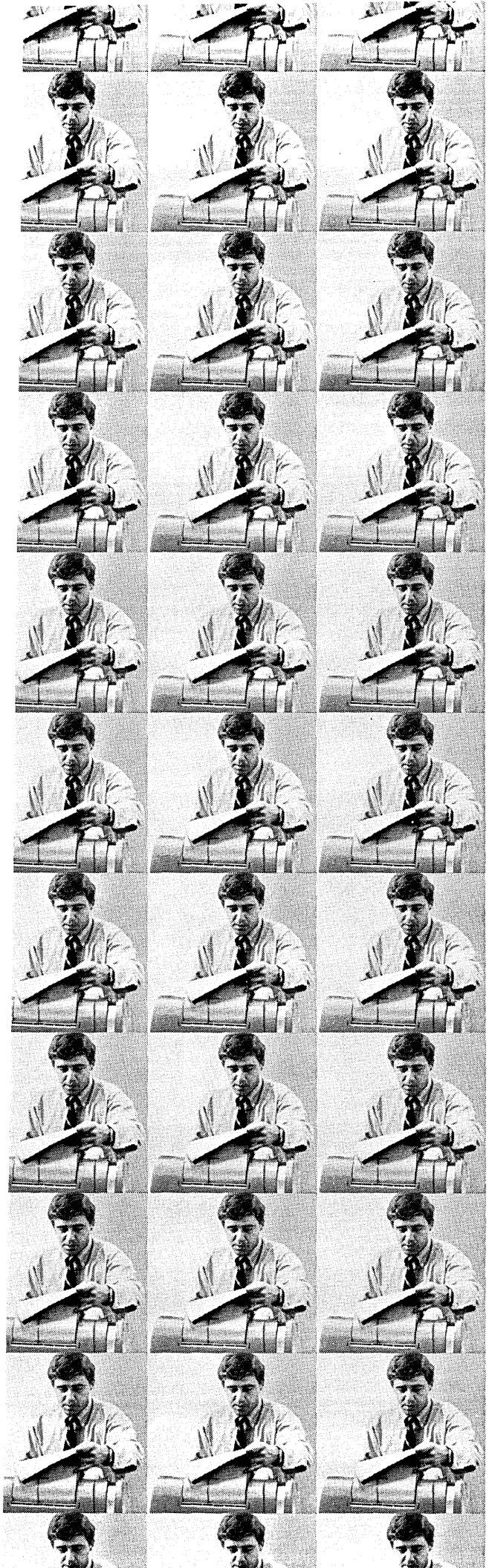
It's said to have three I/O modules, each with eight I/O channels and a transfer rate of four megawords/second. And it looks as though it will better accommodate business-oriented jobs because of the addition of character-manipulation capability in 6, 9, 12, or 18 bit bytes with hardware-controlled incrementation.

CONTROL DATA DISCOVERS COMMERCIAL COMPUTER MARKET

We hear the reorganization at Control Data, announced last month, includes some computers targeted for the business dp market. The firm has trimmed some people, juggled those who remain, and is preparing new cpu entries that fall somewhere between the largest 6600's and the smallest 7600's. But in addition to a new

(Continued on page 241)





UTS holds 128 conversations while it does its batch and real-time chores.

But it isn't the ultimate.

Some of our salesmen say UTS stands for the Ultimate Time-sharing System. Don't you believe it.

They cite as evidence the fact that UTS is the only system designed to handle time-sharing, batch and real-time on a Sigma-size computer.

And the fact that 128 on-line users can converse with the system simultaneously. That UTS handles both local and remote batch. And that all on-line processors are re-entrant and are shared by on-line and batch programs.

They'll tell you that UTS keeps track of what it's doing every moment, and will report to you on request. What's more it allows you to change the operating parameters to suit your conditions at any given time. For example, you can set limits on time-slices, or on the amount of core each user is allowed, or dictate the minimum batch thruput, right at the console while the system is running.

XDS
Xerox Data Systems
El Segundo, California

The facts are right. But our salesmen are wrong about the name. UTS stands for Universal Time-sharing System. The ultimate system it isn't.

It's only the ultimate system available this year.

CIRCLE 45 ON READER CARD

how to get an extra 28,000 lines per minute out of your computer

Use a 30,000 line-per-minute Micromation printer. Considering the limitations of your present impact printer (1100 or 1200 lpm), you're getting short-changed 28,000 lines every minute. That's not all. Compared to impact printing, Micromation is roughly 27 times faster, takes 1/18th the computer time, slashes the cost of paper supplies 87%, and reduces storage 99%. Factor these ratios out of your operating overhead and you'll achieve an annual savings running into 6 figures or higher.

Unequalled speed brings fresher information to decision makers. Using a corporate-wide retention and retrieval system which accesses any of thousands of pages in seconds. And the first practical means of immediately communicating computer generated data anywhere. For external distribution, paper copies can be produced from data film at 5,200 pages per hour. In just one hour, you can get out 20,000 bank statements, 200,000 labels, or 5,200 direct mail pieces on preprinted, multi-colored forms.

Only one company offers the complete family of machine systems; service centers; Kalvar dry film processing; all associated supplies; systems and software support; worldwide maintenance. Discover what Micromation can do for you. Contact our local office or National Sales Manager, James P. Whitfield.

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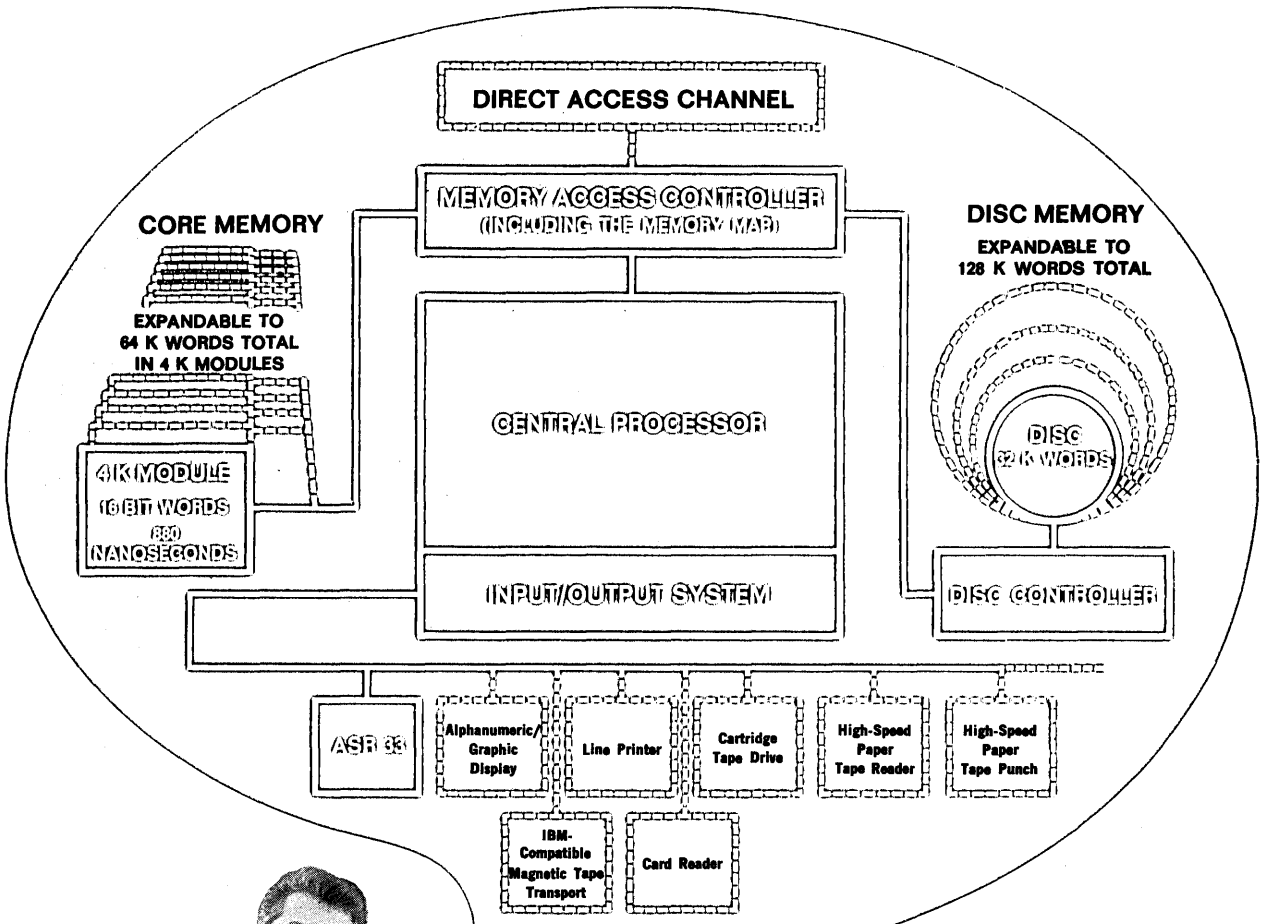
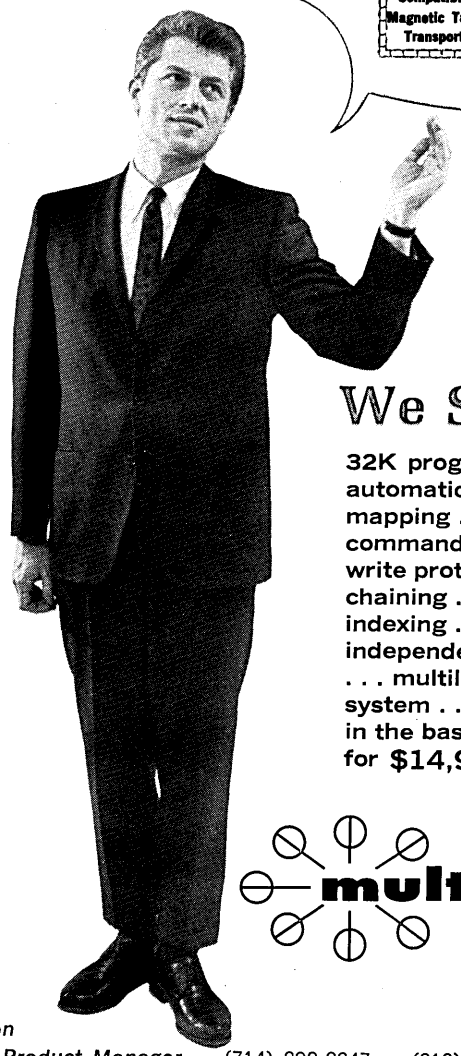
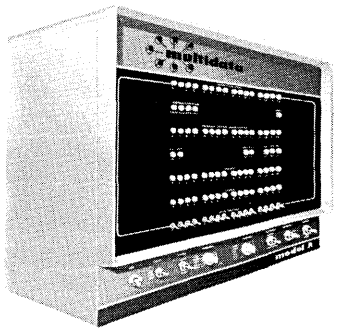
CIRCLE 200 ON READER CARD





We Speak your language...

32K programs . . . privileged instructions . . . automatic program fragmentation . . . memory mapping . . . dynamic program relocation. . . command chaining . . . double indexing . . . memory write protection . . . rapid context switching . . . data chaining . . . displacement indexing . . . device independent input/output . . . multilevel interrupt system . . . and all of this in the basic configuration for $14,995!

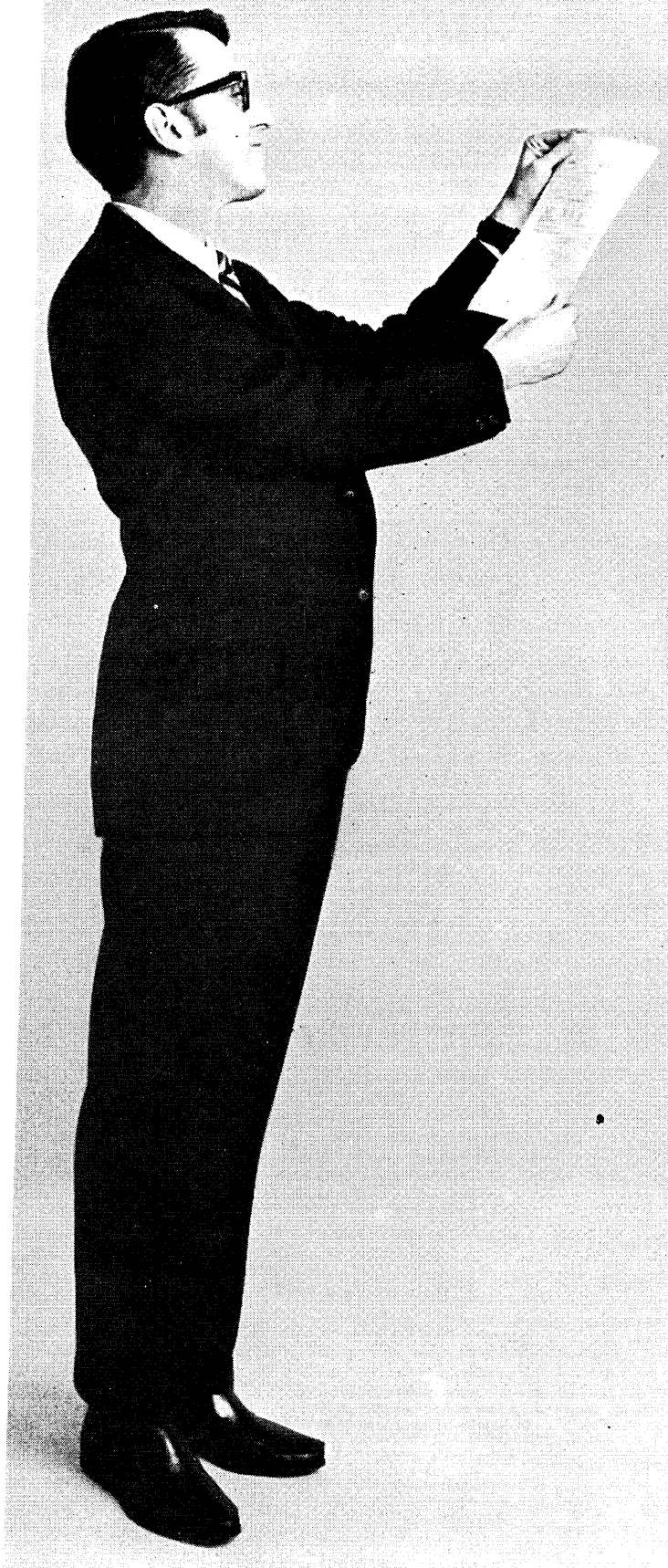


multidata

For information call Gene Olson / Product Manager (714) 892-8347 or (213) 598-1377. *7300 Bolsa Avenue Westminster, Calif. 92683*

Now we give you dry, flat COM printout...

any way you look at it.



Sometimes you want COM printout by the page, at point of need.

Other times you want it in quantity, foot after foot.

Either way there's a Xerox machine that can take your electronically-generated microfilm and give you printout the way it's most useful. Dry and flat. And fast.

For selective printout there's the Xerox microprinter. In 10 seconds it gives you enlargements on plain, untreated paper that you can use and mark up the instant they're made.

You simply select the frame, push a button, and out come your blowups. From any size or kind of microfilm. In magnification ratios of 12x, 16x, 20x or 24x.

The other way we give you printout is the Copyflo II Continuous Printer. It makes sharp, dry positive enlargements at 50 to 60 pages per minute. On ordinary, unsensitized paper, translucent intermediates, or offset master material.

The microprinter and the Copyflo II. Any way you look at it, they're worth looking into.

For more information, write Xerox, Dept. MP, Xerox Square, Rochester, New York 14603.

And we'll have one of our product specialists call on you.

XEROX

CIRCLE 98 ON READER CARD

Your computer is calling!

Not unusual nowadays.

Because the voice of most computers comes from Cognitronics' Speechmaker® audio response systems.

You can hear it in banking, credit checking, inventory and production control, education, voice warning and alarm systems, and many more. Wherever information is needed immediately. And with the lowest-cost terminal possible — a telephone.

Now Cognitronics has a free-standing Multiplexed Audio Response System, too. We call it MARS. It couples our famous voice with mini-computers, completely interfaced.

Listen how voice reply can apply to your business by simply adding a Speechmaker, or with our new MARS system.

Just give us a call.

If a computer answers, don't hang up.

SPEECHMAKER® DIVISION
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CIRCLE 63 ON READER CARD

editor's readout

IT'S UP TO YOU

A few weeks ago I found in my door as I returned home a form from a directory publishing firm. They asked me to fill it out and mail it to them. I threw it away.

A few days later a boy came to the door and asked if I wanted to subscribe to the paper. "Which one?" I asked. He gave me the name of a newspaper, and I said sure, and gave him my name, with initials only. He asked for my full first name, and I gave it to him. He disappeared and I never have seen a copy of the paper. I wonder if he really works for the directory publishing house.

Recently I applied for a renewal of my driver's license. I was surprised to note they wanted to know if I was single, married, divorced or separated. But I was in a hurry, so I told them. Later I wondered why they needed to know, or why I should tell them. A few weeks later *The Los Angeles Times* carried a series of stories about how the California Department of Motor Vehicles was selling data about car owners and drivers, as well as the DMV driver lists to private companies for marketing studies and mail order campaigns.

A friend of mine recently wrote a letter to a publication complaining that his name had been sold to a "junk mail" house. A slight variation on his name—used only for this publication—proved they were the source of the solicitation he had received. He told them he hadn't given them the right to sell his name, considered this an invasion of his privacy, and demanded that they knock it off pronto.

Last month a California senate committee buried a proposed bill to prohibit the state Department of Motor Vehicles from selling driver license application information. A department spokesman told the committee that the information was of value to "private enterprise."

Other articles in this issue examine many facets of the topic of security of information as well as its flip side, privacy. But they are concerned primarily with technical and legislative and system aspects of the question.

We're not trying to minimize the importance of these aspects of security/privacy, but we believe that an important responsibility for protecting his own privacy resides with each individual. It's up to you to question the right of the people to whom you are supplying information about yourself to ask certain questions. In the case of private organizations, you can refuse. You can also do what our angry friend did when he coded his name and wrote to the publication selling his name. And you can work to support legislation that will protect your rights.

Citizen Grosch believes that people aren't really interested in their own privacy. "Given the alternatives of privacy or easy credit, they'll opt for the latter," he says (Dec. '69, p. 194).

We hope he's wrong. —R.B.F.

beware 0001

SECURITY OF COMPUTER-BASED INFORMATION SYSTEMS

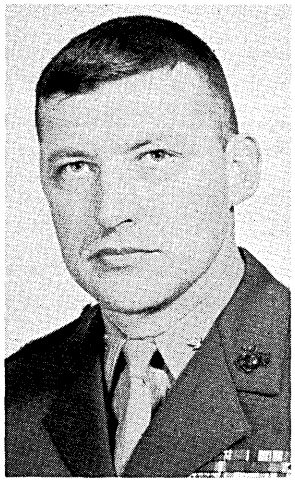
by William S. Bates

Imagine that you are the vice-president for information of a medium-sized manufacturer whose information files have been computerized under your direction. Early one morning, while you sleep, a major explosion and fire totally destroys the building in which your computer installation is housed. Is your reaction one of panic as you envision the resultant chaotic conditions in your company caused by destroyed files and processing equipment, or are you able to feel the relief of being able to activate established backup files and contingency plans? This hypothetical case is not far removed from reality. Degrees of damage or destruction of files or the required supporting processing equipment can and do happen accidentally and maliciously.

During the past months it has become obvious to even the casual computer oriented observer that there appears to be a lack of good security of computer systems and their related data bases. This point has been underscored by a series of articles and news items in recent periodicals and newspapers. These articles report accidental and malicious damage or destruction of files and/or equipment as well as theft cases involving program manipulation.

The purpose of this article is to acquaint business and data processing managers with areas of vulnerability of information systems and to present a security system framework upon which an organization may build and develop to suit its individual needs.

During a recent survey conducted by the author, the following provocative hypothesis was offered to top management of the surveyed organizations for their consideration. "Management cannot depend upon electronic data processing (edp) operations at the present level of the state of the art to ensure the security of data bases and assets accounted for by the system." If the top management of your organization subscribed to that hypothesis, could your data processing or information systems department be given



Major Bates has been with the Marine Corps since 1952, and is presently head of the Management Systems Instruction Group, Marine Corps' Computer Science School, Quantico, Va. He is also a lecturer at American University. He has a BS from the University of Maryland and an MA from American University. The research paper on which this article is based was done as part of the MA program.

Security of information is of increasing concern to the public and we consider it this month from the computer professional's point of view. After this overview article by William S. Bates, Phil Hirsch shows some of the weak points in the Census Bureau's security system and the following article by Miller and Hoffman describes a method for extracting a personal dossier from a statistical data bank. Two more articles examine the Los Angeles County vote-counting system, analyzing its problems and suggesting some solutions, while the concluding article by Roy H. Lauren focuses on data base security.

a clean bill of health by an audit which included the following questions?

1. What would the estimated cost of replacement be if your current data base and/or documentation were destroyed or damaged?

2. Are the funds and/or assets accounted for by your data processing system unquestionably safe from theft and fraud through program manipulation? If so, briefly describe your controls.

3. Do you maintain any type of duplicate or backup file separate from your primary file library? If so:

How current is the duplicate file?

Is the duplicate file located in the same physical location as your primary file? If so, why?

What access time would you require from the duplicate file in case of damage or destruction of your primary file?

4. Is there an "in being" security system to protect your program documentation and various data processing files from:

Malicious or inadvertent destruction or manipulation;

Overt corporate raiding; or

Purposeful or malicious mismanagement of data to mislead management? If so, describe the system.

5. Do you have contingency plans for use of other computer equipment in case of damage or destruction of your equipment? If so, has it been tested under current conditions?

6. What long and short term effects would the loss of your files without backup files have upon your organization?

During the course of this discussion, I will review the vulnerable areas of computer-based information systems. Special emphasis will be directed to those systems which are communications oriented, since they are probably the systems of the future. Finally, I will present a framework for a security system, for the reader's consideration, as a possible answer to the many vulnerabilities of his information systems.

The problem of security of information systems with their related equipment and assorted data is not new; however, it is one which until recently has received minimal interest from commercial users of these systems in general. In part, this stems from the way American industry and government rushed into the computer era. It can be said, in general, that the Department of Defense and other similar security-conscious agencies are well advanced in the area of systems security as compared to private industry. As will be shown later, there are a few bright exceptions to the above generalizations.

There are two classes of security vulnerabilities to be considered. First, there are those common to all computer-based information systems and then there are those which are peculiar to systems utilizing remote access devices and/or multiprogramming. The vulnerabilities common to all information systems are:

1. Accidental or inadvertent damage or destruction of software, hardware, or stored data.

2. Malicious damage or destruction of software, hard-

ware, or stored data.

3. Theft or fraud which deprives an organization of assets other than private or classified information.

4. Theft of private or classified information.

In general, the threat which is of greatest concern to computer centers is the threat of accidental or inadvertent damage to hardware or files. An information system is vulnerable to this threat from several directions. The most obvious and critical of these are environmental dangers to the physical plant; i.e., fire, flood, storm, power failure, etc. Many of these incidents are described by Brandt Allen in the *Harvard Business Review*, November-December, 1968. There are recorded incidents of fire destroying computer installations or stored data banks. In a recent case, a fireproofed computer center located on the second floor of a building was destroyed when a first-floor fire caused the second floor to collapse. In August, 1966, a gas leak caused an explosion at Phelps-Dodge Copper in Fort Wayne, Indiana, which completely destroyed a $290,000 Honeywell H-200 leased system and other associated equipment. Only foresight on the part of edp management in this case prevented a real administrative disaster, since duplicate files were stored in a fireproof safe.

Mechanical failure of all or some portion of the supporting computer system or its environmental support equipment, such as air conditioning, also has disaster potential for large, centralized, automated information systems. Of course, a major failure which is noticeable can be acted upon to possibly avert this problem and place the organization back in operation before extensive damage is done. However, the small, undetected, but critical failure presents potentially expensive error possibilities for the system.

Inexperienced or inattentive computer operators can, without proper supervision, inadvertently erase or alter tapes or other storage devices. It is conceivable that, by incorrectly learned routines, an inexperienced operator could alter or erase an entire set of master file generation tapes. This type of experience occurred in a large New England manufacturing company, whose customer file containing billing information and inventory records data was nearly destroyed. Only a change in operating schedule caused a more experienced operator to spot the error just before the last tape of a three-generation tape file was erased. Estimates of the potential loss to the company ran into the millions.

Willful damage falls into a completely different category and is one where direct preventive steps can usually be taken. Types of malicious damage run the spectrum from the damage caused by war to that caused by the disgruntled employee. Probably the weakest security link of this category would be the disgruntled employee. Allen cites a case where an employee destroyed almost every file and program of his company using magnets. Auditors were not sure they could reconstruct enough information to ensure the company's continued operation. This could well have been fatal to the company.

Much in the news during the past eight to nine months has been the threat to university computer systems by radical students. Since the beginning of 1969, there have been at least three reported cases of actual damage to computer systems by students. In January, 1969, students used a threat against a $200,000 IBM 1130 installation at Brandeis University in their bargaining with school officials after the students had taken over the school's computer and communications center. On February 11, 1969, rioting students at Sir George Williams University in Montreal completely destroyed computer equipment and files valued at $1.6 million. School officials felt it would take at least eight months to restore normal operations. Fortunately, the University had duplicate files in remote locations. In March, 1969, vandals at Boston University damaged an IBM 360/40 using wire cutters and acid. They cut connecting wires inside the cpu and threw acid into the printed circuits of the computer.

Whether faced with a disgruntled employee, a radical student, or a foreign saboteur, a computer system is a highly vulnerable target that only the tightest of security arrangements can protect.

profit and politics

Because of a general lack of understanding of computer operation by the public as well as by management, public and corporate assets have become ripe targets for the unscrupulous. The only really surprising thing is that there has not been more theft and fraud reported. Banks, credit organizations, loan companies, and investment firms would seem to be the most vulnerable within this category. Not included within this category is the theft of information.

Allen cites two cases of this type of theft. The first is the case of a programmer in a bank who allowed his accounts to be bypassed when an overdraft should have been reported. He was able to steal large amounts of money before being caught. The second case involved a group of industrious but larcenous individuals with an investment firm who raided customer accounts and then claimed "computer error," which their gullible public believed for some time.

In February, 1969, a California service bureau owner received one to ten years for grand theft and forgery. In this case, an accountant had embezzled more than a million dollars over a four to five year period from a fruit and vegetable shipping firm through his computer service bureau. In the end, he was not caught by the customer firm, but by a suspicious bank official.

The infiltration of information systems and the resultant theft or compromise of information is the second largest area of concern to computer-based information systems in general. Certainly, to governmental agencies such as the Defense Department and CIA, as well as defense-related industries, this can become the overriding and primary consideration.

There are two subcategories of threat within this area. They are generally applicable whether we are discussing international espionage, corporate raiding, or just plain snooping through an organization's files. H. E. Petersen and R. Turn, in the *AFIPS Conference Proceedings; Spring Joint Computer Conference*, Volume 30, 1967, classify these as "passive infiltration" and "active infiltration." Passive infiltration consists of covert efforts aimed primarily at communications traffic within the information system by such means as wiretapping. This type of threat will be more fully discussed later. Active infiltration consists of overt efforts to penetrate both the computer center and the communication channels. Active infiltration can be conducted by company employees working in the computer center as well as by outsiders.

Active infiltration is not just the worry of industry or government. In my recent survey, a major university reports an incident in which a university employee with computer experience, who was not a member of the computer center staff, was able to steal data. He entered the computer center while a confidential file was sitting by a computer awaiting an operation, processed the file, copied the information, and walked out.

By the nature of the operations performed, multipro-

gramming systems, and systems utilizing remote access, present special security vulnerabilities beyond those of other information systems. In most cases of remote-access systems, multiprogramming is also involved. The importance of discussing these special vulnerabilities is self-evident when one considers that most large third-generation computer systems are designed to operate in a multiprogramming mode, and that the rapid rise of private and public time-sharing systems is probably the trend of the future.

For purposes of this article I will discuss the problem in the context of a system that encompasses both techniques —multiprogramming and remote access. For any particular system the reader need only relate those problem areas which apply to that system. For the system with multiprogramming and remote access there are two general areas of vulnerability to be considered. The first of these is the computer hardware and software systems which together provide the computing power of the system. The second would be the communications system which would include the remote-access terminals, the connecting communication channels, and any communications switching equipment.

Within the computing center there are several vulnerable areas to be considered. The most significant are file access control, hardware and/or software failures, mistaken or deliberate penetration by employees, and electromagnetic radiation from the hardware. Since acts by employees were discussed in the previous section, they will not be further explored here. Electromagnetic radiation is essentially a hardware vulnerability which could conceivably provide a passive listening device with sensitive information.

hardware or software failure

Hardware or software failure within a system provide the greatest vulnerability within the computing center itself. The areas which are particularly vulnerable in the hardware are the circuits which provide protection for privileged modes, bounds registers, or memory read-write. A failure of software might lead to improper file access, crossing of memory partitions, or improper information routing within the system. Any of these failures could lead to the loss of critical information either accidentally, or if a potential infiltrator were aware of the weakness, to a deliberate penetration of the system. This is described in detail by Willis H. Ware in the 1967 AFIPS *Conference Proceedings.*

The greatest vulnerability to the over-all system is contained within the communications subsystem, the communications channels. The passive infiltrator can work with relative ease and safety with small probability of discovery if he is clever. Most commercial time-sharing systems, whether private or public, utilize public communications lines. Here the detection or wiretapping becomes virtually impossible. At best, on private channels passive wiretapping or electromagnetic radiation listening devices are difficult to detect. Crosstalk between the channels can accidentally leak information. Active penetration attempts can be made by unauthorized persons who have illegally gained legitimate passwords to the system. Once the proper passwords are available, the unauthorized person could access the system utilizing his own terminal and masquerading as a legitimate user.

Other areas of threat within the communications subsystem are the remote terminals and any switching centers used. Both provide targets for applying electronic bugs to record information or detect electromagnetic radiation. By observing the terminals in operation or by collecting discarded printing ribbons, carbons, or printouts from a terminal, a person could gain the necessary passwords to allow him unauthorized access to the files and programs of all or part of the system. The switching center, by a failure in hardware, can also accidentally leak information via crosstalk or, if penetrated, may be wired to deliberately crosstalk.

a possible solution

Now that we have had a look at some of the vulnerabilities of an information system, I would like to offer my security system framework as a possible solution to this immense problem. Bernard Peters, in the 1967 AFIPS *Conference Proceedings,* said:

"Security cannot be attained in the absolute sense. Every security system seeks to attain a probability of loss which is commensurate with the value returned by the operation being secured. For each activity which exposes private, valuable or classified information to possible loss, it is necessary that reasonable steps be taken to reduce the probability of loss. Further, any loss which may occur must be detected."

There are, of course, answers to most of the threat areas presented above. The problem for management is to ensure that, within the bounds of their realistic needs and economic capability, these answers are thoroughly explored and drawn together into a compatible security system. The first step in a move towards a good system is an in-depth study of the organization's security needs, and the next is to determine to what extent the present information system is meeting those needs. From this study, the organization's management can develop a security doctrine, which would then become the hub of the information security system. Fig. 1 contains my concept of how this security system

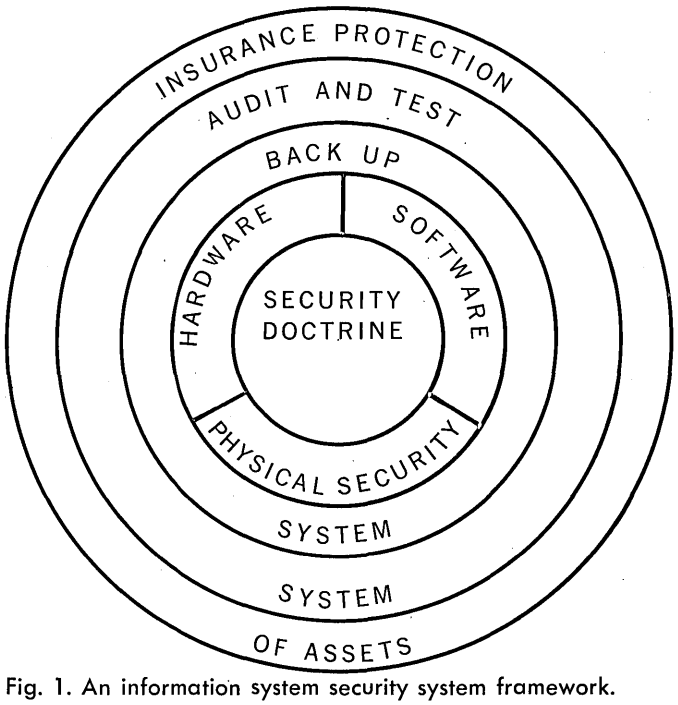


Fig. 1. An information system security system framework.

framework should be built around the system security doctrine.

Based on the security doctrine, a protection plan for the information system would be developed which would consist of the physical security of the computer center, with its allied or connecting locations, and necessary hardware and software configurations to protect information contained in

the hardware or files. A must within every system is a back-up capability to ensure that, within reason, the information system does not collapse if the supporting computer center becomes inoperative. Once the various operational subsystems listed above are established, management must ensure the continued adequacy of the system through a routine system of audits and tests. Finally, all system assets should be covered by a comprehensive insurance plan to ensure the organization's financial recovery capability in case of some disaster.

The security doctrine must set management's basic guiding policies, upon which the remaining subsystems of the security system can be built. These policies should provide answers to the many questions of the system designers. Management must ensure an explicit security doctrine, which is understood by all personnel concerned and strongly enforced. A well-conceived and strongly enforced doctrine should reap, hopefully, unseen and unheard benefits for the organization.

external protection

The primary protection of the system, based on the security doctrine, will come from an interlocking set of subsystems of physical security and hardware and software techniques used to protect files and equipment. Without adequate plant security to protect the computer center and its allied installations, most other measures taken to protect the system become sharply devalued. Physical security must include protection against environmental damage, inadvertent and malicious damage to the hardware and files, and infiltration of the system's files and data base. Physical security joins with hardware and software security precautions to become the first line of defense for the information system.

When considering environmental hazards, planning should include the proper location of the installation and protection against fire and storm. Normal protection against fire is probably not sufficient for computer systems because of the special electrical and air-conditioning problems associated with computers. Fireproof safes, especially designed for the storage of magnetic files, have been developed and placed in use. These are capable of withstanding high degrees of heat, and there is not the problem of steam, as found in conventional fireproof safes. In the previously mentioned explosion at Phelps-Dodge about 150 magnetic tape files were saved because they were stored in a fireproof safe. During an interview, the company's data processing manager, with a smile, said, "We bought that safe two years ago and thought it was a big white elephant."

Access control to the computer center is a key feature in the problem of unauthorized persons having access to the hardware and files. Good access control substantially reduces the threats of inadvertent damage by visitors, malicious damage by persons other than those authorized to be in the computer center, and infiltration of the files by unauthorized persons. Several of my survey answers indicated at least some top management awareness in this area. Excerpts of several are quoted.

"We . . . are in the process of completing construction and installation of a comprehensive security system . . . (to) include installation of man traps on the ground floor building entrances and those floors where television monitors are used as a means of surveillance of computer areas and emergency exit stairwells; equipment to monitor fire detection and intrusion into secured areas; and acquisition of a combined photo identification and card key electronic locking system to limit admittance to secured areas to authorized personnel only."

"The . . . Bank . . . has an underground computer center capable of withstanding a 20-megaton bomb dropped 10 miles away. . . . The entire structure is reinforced concrete with one main entrance and two emergency escape hatches. The main entrance consists of two sets of electrically operated blast doors. . . . Only one set of doors will open at a time under normal conditions. These doors are operated electrically with a limited number of keys or from the inside by a receptionist. No one is admitted unless known or by appointment . . . there is a closed circuit television to view visitors."

the inside job

Closely allied with the physical security subsystem will be a subsystem which will be built into the computer itself. This subsystem will be a combination of hardware and software techniques designed to prevent inadvertent leakage of private information, or overt penetration of the information system, to steal or alter private information. Together, the hardware and software techniques must provide effective countermeasures to various potential threats to the information system, which are not screened out by the physical security subsystem. Areas of concern for countermeasure planning are remote-terminal access, processing controls, cryptography, threat monitoring, system integrity, the communication subsystem, file control, and protection of the monitor program.

Techniques must be developed to manage remote-terminal access to the system. The techniques must include ways for users of the system to gain authorization to use the system, to identify a user when he attempts to use the system, and then to authenticate that identity as necessary. A good identification and authentication system can have as many authentication levels as is necessary to protect the information system.

Even the best access control can be circumvented by a sophisticated and determined infiltrator; hence the system must be protected from within also. Processing restrictions must be placed upon all sensitive files to ensure they are not read or altered by unauthorized persons. The degree of threat monitoring required by a system depends upon the criticalness of the information being processed.

As previously mentioned, the weakest link in our computer system is the communications link between the terminals and the processors. Here we must deal with not only the overt or active infiltrator, but also the covert or passive infiltrator, with his wiretapping methods or listening devices for electromagnetic radiation. An effective method of dealing with this threat, if not the most effective method at present, is cryptography. A good cryptographic system, properly installed and maintained, will substantially reduce the threat against the communications system.

Briefly, this cryptographic system should contain three basic elements. First, there must be a set of codes which are sufficiently difficult to interpret. The system should also contain a mechanism for encoding and decoding at each end of the communications channel. This mechanism may be either manual or automated, depending upon the needs of the user. Finally the cryptographic system must contain its own built-in security procedures to protect the code sets and the encoding/decoding mechanism.

A very probable target of a sophisticated infiltrator is the system monitor, since the monitor is usually the primary key to the correct operation of security measures. Since the primary threat to the monitor will come from system personnel, protection will rely on adequate physical and personnel integrity of the system. A suggested method is for the monitor to be housed in read-only memory which can only

be altered physically. Peters feels the monitor is "the key defense, the key security element in the (computer) system." Monitors in a remote-access and/or multiprogramming environment need a high degree of program and file integrity in addition to any security requirements. To operate in a secure mode the monitor must perform all input/output operations. This way, no user can access and print or alter a file without the monitor interceding. H. M. Jayne, in "The UNIVAC 1108 as a Secure Computer System," a paper read in Minneapolis in September, 1967, says the monitor must also possess the ability to roll out data without eradicating it, and that when a user finishes with a memory segment, that segment must be completely erased prior to reallocation to ensure that no stray data is inadvertently given to succeeding users. The monitor should maintain an adequate audit trail log to permit reconstruction of occurrences within the system. Finally, the monitor should provide adequate testing of the hardware's privileged instructions and memory-protect features to ensure proper functioning.

duplicate files

As previously noted, no system can be absolutely secure, especially against hardware failure or damage or loss of files. Hence, no information system protection plan would be complete without a thoroughly planned and tested contingency plan to keep the system in operation in case of a disaster. This contingency plan must fulfill two needs. First, it must provide for access to back up computer equipment for emergency operation of the system. It must also provide for the availability of all files, software, and problem programs which are vital to the operation of the information system.

The availability of a backup computer system is a definite problem for management. The backup system may be available within the organization or may be obtained through a cross-servicing agreement with a neighboring organization with compatible equipment. The arrangement for backup equipment must be more than just a paper plan. Critical programs and files must be processed on the backup equipment at the time of the cross-service agreement, and should be periodically retested as program modifications are implemented.

The key portion of the backup system is the maintenance of a set of duplicate files which contain the vital records of the organization. Before establishing its duplicate files, management must make basic decisions which will effect the way the file system is organized. First, a method must be devised for determining just what is a vital record. A careful balance between the cost of storage media and storage space and the desire to duplicate a large number of records must be met. Next, a determination of the storage location of the duplicate files must be made. Most authorities recommend a location that is sufficiently remote from the primary file that it does not become involved in any potential disaster. Utilizing remote storage, of course, adds another physical security problem, which can be provided for in the security plan.

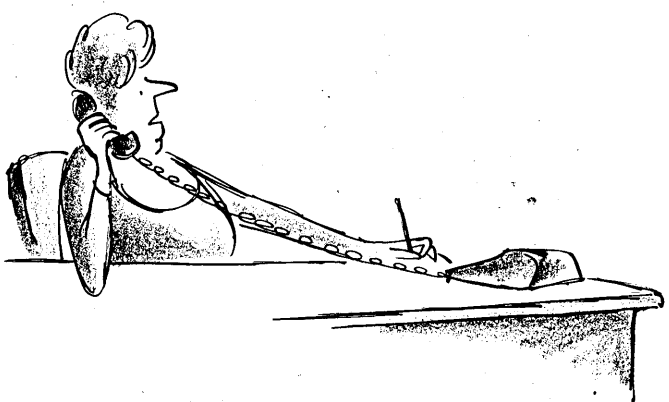
The duplicate file must be maintained as part of the overall file maintenance system of the organization. Most organizations use some type of generation system, which varies from three to five generations. When the generation system is used, the duplicate files are rotated as new generations are developed. In addition, management must ensure that modifications to production programs and critical utility programs for which duplicates are maintained are incorporated in the duplicates.

No accounting system is any better than its audit methods, and no security system is safer than its testing procedures. Since many of the computer-based information systems under consideration are used to account for organizational assets, there must be both audit and test procedures developed which oversee the system. System auditing and testing should be accomplished by some group separate from that responsible for the operation of the computer system. An internal audit and security group is suggested which would be composed of computer security specialists and accountants with edp experience. The mission of this group would be to protect the system and the assets accounted for by the system.

Once an organization has taken all reasonable steps to ensure the protection of their information system, they must still consider the financial loss possibilities they are liable to incur in the event of some type of disaster, despite their system protection and backup plans. There are four possible areas of financial loss that the organization should seriously consider buying insurance to cover. They are loss or damage of equipment, cost of reconstructing files and programs, other costs incurred in returning to normal operation, and any business losses incurred by disruption of normal business. The insurance industry has recognized the insurance needs of electronic data processing for several years and will provide coverage to organizations who will institute acceptable protection and backup procedures.

conclusion

The threats to computer-based information systems are numerous and can only be solved by the involvement of top management. My research has shown that the state of the art within the edp community is capable of providing adequate protection to computer-based information systems if management is willing to provide the necessary planning, resources, and supervision. Although I have uncovered no hard evidence that there is widespread management interest in the problem of information system's security, there does appear to be a growing awareness in some organizations' management that information system security is a critical area which requires their personal concern. Accidents, thefts, and/or malicious damage can happen to anyone, and the organization which has completely converted to a computer-based information system without adequate protection courts disaster. ■



"I'm sorry but Mr. Owen is in Aspen re-thinking his philosophy of self conduct in terms of the new computer-oriented business community." © DATAMATION ®

THE WORLD'S BIGGEST DATA BANK

by Phil Hirsch

In 1790, when the United States took its first decennial population census, each person was asked five questions and the statistical summaries for the whole country were printed on a total of 56 pages. This year, for the 19th decennial census of population and housing, there will be a total of 68 questions per person; the published tabulations will cover several thousand pages and contain more than 4 billion facts. A far greater volume of data—200% to 300% more than is published—will be distributed in machine-readable form.

The federal government was the sole user of the first census, but today the bureau's customers include virtually every governing body in the country as well as a substantial percentage of the business and university communities. The list probably will continue to grow rapidly.

Until now, most census statistics have been of only limited value to many users. A business firm, for example, has far less interest in the population and housing characteristics of a census tract than in the characteristics of its trading area. A municipal government wants data on school districts, wards, and precincts far more than on the city as a whole. For both groups, separate statistics covering very small areas, such as individual city blocks, are particularly valuable. The 1970 census is the first one likely to satisfy most of these needs. Also, the data may be available quicker, which would increase its value by an order of magnitude.

The improved utility of the census is due mainly to development of new software which can reformat and reaggregate census statistics in ways specifically desired by the end user. Also, census users, for the first time, now have a practical method of relating census statistics to a random list of individuals. A marketing manager, for example, can now estimate the incomes of customers or prospects from the aggregate data published in the census tables—largely automatically. All he has to know is each individual's address.

no invasion?

Census Bureau officials insist that this new capability doesn't violate anyone's privacy. Census data is an aggregation of figures supplied by all those living within a particular area; so, even if a list of addresses is concentrated within a single census tract, it represents only a small subset of the individuals contributing information to the corresponding tables. The output, in other words, provides an approximate idea of individual incomes, but it doesn't tell how much an individual or family earns.

The bureau's critics say it's possible to violate privacy anyway, because the invader frequently doesn't need to see individual records. His basic problem is to find an area containing a high concentration of people with specified demographic characteristics relating to such things as age, race, marital status, number of children, and income. He can do this easily with the help of census statistics.

Once his target area is defined, the publisher of, say, Better Homes and Gardens, or a publisher of pornographic literature, can develop a direct-mail advertising campaign and get the literature into the mailboxes of everyone living within the area regardless of whether they want to receive it. The names and addresses are easily obtainable from commercial sources, once the mailing area is defined. For example, reverse telephone directories are available that list subscribers by address.

The same census data could, if manipulated cleverly, help determine whether an individual is hired for a job, admitted to school, granted a loan or an insurance policy, the bureau's critics contend. (See the article by Miller and Hoffman in this issue.) Here again, there is no recourse. If the employer, admissions officer, loan manager, or insurance agent draws unwarranted conclusions from the census about an applicant, he can't prevent it. The individual can't even refuse to supply his share of the data that generates such conclusions. Failure to fill out a census form is a federal offense, punishable by fine and/or imprisonment.

Whether the collection and distribution of census statistics invades personal privacy, or is a legitimate use of public money and government effort to promote the general welfare, has been the subject of a bitter, protracted battle in Congress and among academicians for several years. A number of bills have been introduced in Congress aimed at restricting the number of census questions that must be answered. Virtually all of this legislation has died, quickly. Recently, an organization called "The Committee for a Voluntary Census" was formed in Philadelphia; it has been telling the public, through newspaper ads, not to answer some or all of the questions on the census form, or alternatively, to answer only under protest. The committee seems likely to have "all the impact of a snowflake falling on the broad bosom of the Potomac," to quote the late Everett McKinley Dirksen's immortal phrase.

The nerve center of the U.S. census operation is a huge

complex of buildings in Suitland, Md., near Washington. In the bowels of this complex are four Univac cpu's—two 1107's and two 1108's—which do most of the processing.

After census questionnaires have been answered by the individual respondent, they go to Jeffersonville, Ind., near Louisville, where 35 microfilm cameras convert each return to a ½ in. microfilm record. Two questionnaires are processed per second. This operation will generate about 50,000 reels of microfilm by the time the '70 census is completed.

The film is shipped to Suitland and feeds into a battery of six FOSDIC machines. The initials stand for Film Optical Sensing Device for Input to Computers.

Each FOSDIC is a kind of mark-sense reader. Answers to census questions are recorded initially by darkening, with a pencil or pen, appropriately coded circles on the census form. When the form is microfilmed, the black dots become white ones. FOSDIC detects each spot and then determines its position relative to an adjacent reference point. The variation in distance between the reference point and the possible answers to any question enables the circuitry to discriminate among them.

FOSDIC reduces each census return to a 120-character mag tape record, formatted in BCDXS-3. The entire 1970 population-housing enumeration will be stored on about 8,000 reels of such tapes.

Each goes directly into the Univac complex, where, after being edited and checked for consistency, the data gets processed into a "basic record tape." The BRT set will consist of about 210 reels. Successive passes of these 210 tapes through the Univac system generate the final census output. During each pass, separate counts are made of the answers to specific questions and, concurrently, the counts are aggregated to produce totals for the states, cities, census tracts, and other geographic areas represented in the published tables. The output is recorded on summary tapes which generate:

1. Bound volumes of statistical tables. A Linotron photocomposition machine at the Government Printing Office produces these tables by recording summary tape data on microfilm; then the microfilm image is burned into a photo-offset printing plate.
2. Public user summary tapes. These are sold to business firms, government agencies, and other statistics users who have access to computers, and wish to massage the data in additional ways. (Microfilm, microfiche, and punched card copies of census summary tapes are also available.) The tapes are offered in 7- and 9-track formats. The former are produced by the Univac equipment, the latter by a 360/40.

The 1107-08 complex at Suitland represents a big improvement in the bureau's dp efficiency. It has about five times the capacity of the 1105 equipment used to process the 1960 census. Each 1108 can do the work of about nine Univac I's.

if they're working . . .

This is the first decennial census in which most of the questionnaires are being mailed to and from each household. The bureau estimates that by using mailmen, it can get along with 24,000 fewer census takers. But overall costs are still expected to be greater than in 1960. Then, to count 180 million noses cost $125 million. This time, to count an estimated 215 million individuals, the bill is expected to be about $215 million.

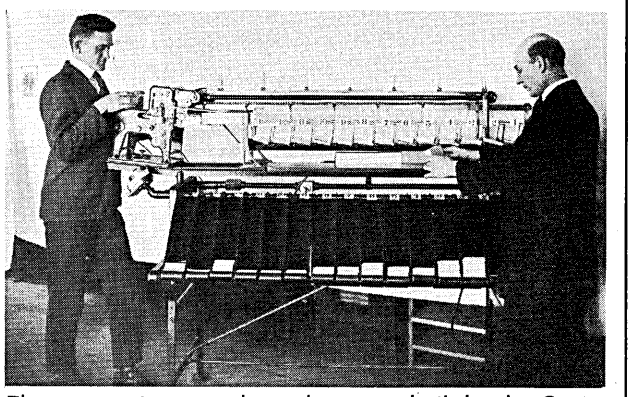
The "mail-out, mail-back" areas encompass about 60% of the population. Essentially, these are the people living within urban areas[1] who receive daily, house-to-house mail delivery service. The rest of the population will get census questionnaires by mail, but a census taker (the bureau prefers the term "enumerator") will come by several days later to collect the completed forms.

The biggest single improvement in the 1970 census is a vast increase in the quantity of machine-readable statistics. Some summary tapes were copied and sold to the public after the 1960 enumeration, but in 1970—for the first time—tapes containing data on all census questions will be available for all census tabulation areas.

This new capability is particularly important because much more data is released on tape than in the published tables. For example, the tables will display up to 256 separate statistics related to the population and housing characteristics of each census tract. The corresponding summary tapes will have up to 3,585.

Six sets of public use summary tapes will be generated from the 1970 census. The first set, containing data accumulated on the first pass of the basic record tapes through the Univac system, is scheduled for release between August and September of this year. Succeeding series will contain data accumulated on later passes—or "counts" as the bureau calls them. The final reel of the final count is scheduled for distribution in November '71.

The first three sets of public use tapes will reflect answers to 22 questions which every respondent was asked. The last three sets will be based on answers to 46 other questions put to a sample of the population—either 5, 15, or 20%, depending on the question.



The automatic sorter shown here was built by the Census Bureau in 1918.

The entire set of public use summary tapes, comprising 2,054 reels, will cost about $100K. Individual reels will sell for about $60. Test reels are also available, at the same price.

Tape orders have been accepted since the first of this year. They're being filled on a first-in, first-out basis. A minimum purchase, generally, consists of all the reels comprising "a complete file within a count for a particular state."

"Partial files will be prepared on a special order basis," the bureau adds. "However, this may involve some delay as well as additional expense."

The tapes are available in a 7-track version, coded in BCD at a density of 556 cpi, and in a 9-track, 800 cpi mode which employs EBCDIC format. The character set consists of 10 decimal digits, 26 alpha symbols, and six special characters plus a code for blank spaces. Each tape record consists

[1] For a definition of this and other census terms, see box on p. 73.

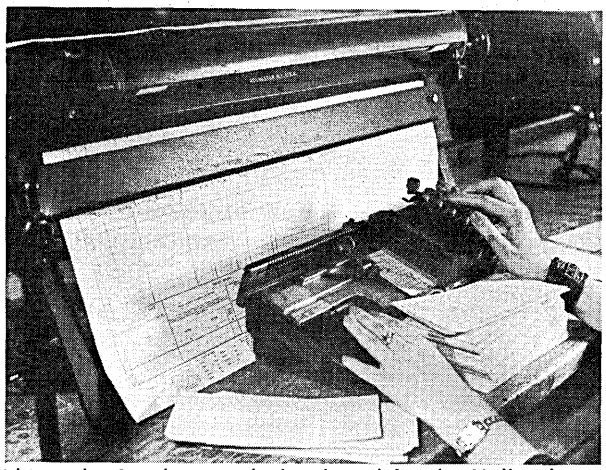
of a header block, containing geographic identifier codes, followed by one or more data blocks. The block is subdivided into 120-character segments and has a minimum of 720 characters and a maximum of 2040. Data fields within each block contain either six or eight characters apiece. Header and trailer labels conform to the July '69 proposed USASI standard.

Further details can be found in "Technical Conventions for 1970 Census Summary Tapes" and "Character Set for the 1970 Summary Tapes." Both publications are available from The Central Users Service, Bureau of the Census, Washington, D.C. 20233.

for do-it-yourselfers

The compleat census user's kit includes several other items besides data tapes.

A "metropolitan map series" covers the urban cores of all standard metropolitan statistical areas (SMSA). There are 200 map sets and a total of 3100 sheets. Place and county maps for outlying areas are also available. Each map shows the boundaries and identification codes for all subsidiary census tabulation areas. Final versions of the maps should



This is the first keypunch developed for the Hollerith system. It was used for the 1900 census and was still in operation during the 1930's.

be out late this year (preliminary versions are now on sale). They cost about 75 cents per sheet. For further information, see the bureau's "Data Access Description" for December '69.

Possibly the most useful census accessory is an "address coding guide." It lists all the streets within the central city portion of a metropolitan area on a block-by-block basis, plus the range of street addresses along each blockface. Each listing also contains codes identifying the various census enumeration areas in which the blockface is located —e.g., the census tract, zip code area, and enumeration district. Essentially, the ACG is a directory in which a group of addresses can be looked up to find the census tables covering the related area or areas. From these tables, the user can then extract, again by computer, demographic information related to the individuals whose addresses are included in his list.

The bureau has developed a computer program called Admatch for correlating an address list with an address coding guide. The program is written in 360 assembly language. It runs on a DOS or TOS system, requires a minimum 32K byte core, and four tape drives. When this article was written, bureau officials were planning to release Admatch to the public "shortly," for a price of "about $60-80."

Address coding guides have been developed for nearly all metropolitan areas, but they cover only those portions receiving regular house-to-house mail delivery service. Other areas will not be coded, says a Census Bureau official. The ACG's produced to date can be obtained as printed lists, or on 7- or 9-channel mag tape. Prices vary from around $32 to about $200, depending on the metro area selected. A complete description and price list are published in "1970 Census Summary Tape Users Memorandum No. 23," obtainable from William T. Fay, Chief, Geography Division, Bureau of the Census.

An updated address coding guide is now almost completed for all SMSA's. It will include areas overlooked in the first version, as well as recently annexed areas—provided, in both cases, that the residents get daily service from the Post Office foot patrol.

The census tract tables referenced by the address coding guide show the characteristics of all those living within a particular area; almost always, this is a far greater number of individuals than are represented by the addresses on the user's list. For a more refined analysis, he can give the Census Bureau his list. The agency will then perform a "matching study." This consists of going to the basic record tapes, extracting the census return of each addressee, and then summarizing—from just this data—the aggregate statistics desired by the customer.

a choice of correlations

The cost and value of matching studies depend largely on how fussy the user is. For most business-related applications, it is necessary to match only addresses; based on studies done a few years ago for a bank in New Haven, Conn., the cost would probably be less than 5 cents/match, and census data could be found for 80-90% of the addresses on the user's list. The bureau has done similar jobs—for such agencies as the National Institutes of Mental Health—which cost $1 or more per match and resulted in substantially lower correlation rates. But here it was necessary to match individual age, sex, and family relationship data, as well as the address, to each census record.

"Public use samples," consisting of individual census records which represent a 1% sample of the total U.S. population, are also offered by the bureau. All of these records are drawn from SMSA's having minimum populations of 250K. Individual names and addresses are not disclosed; all the customer knows is the names of the individual metropolitan areas. Public use samples enable researchers to make correlations and analyses of demographic data which are not included in the summary tape statistical program.

Another way of tailoring census data to specific user requirements involves manipulation of a "geographic base file." This is an address coding guide enhanced with a "Dual Independent Map Encoding (DIME) System." Essentially, DIME identifies the street intersections adjoining each blockface by code number and X-Y coordinates, and also specifies whether the blockface is on the left or right side of the street when a person faces in the direction of increasing house numbers.

When a list of addresses is passed against a geographic base file, the coordinate information is picked up along with the rest, permitting each address subsequently to be plotted on a computer-generated map. This latter operation utilizes a program called SYMAP, developed by Harvard's Laboratory for Computer Graphics. It's written in FORTRAN IV and runs on a 360/40 equipped with 128K core and four tape

drives. The lab is selling SYMAP to nonprofit organizations for $485, and to everyone else for $776. A follow-on program, called SYMVU, will be available shortly. It generates oblique maps. The user can specify any angle and azimuth.

Linking geographic base file codes to demographic records makes it possible to map those areas which have a specified statistical relationship to each other—for example, areas with the same average income. The base file also permits special-purpose areas to be mapped. One user would be a company that wanted to realign its sales territories. The new territories could be drawn on a plotter once the boundary streets and intersections were specified.

The bureau expects to have geographic base files, without X-Y coordinate data, available for public sale by mid-'71. These will cover the smaller SMSA's. By the end of next year, geographic base files with coordinates are scheduled to be completed for "most SMSA's." Prices haven't been established.

figure-sifting services

Census users who don't want to juggle the statistics themselves can hire the Census Bureau or an outside specialist.

The bureau can do some chores the outsiders can't—for example, matching studies. Also, Uncle Sam's prices for some jobs may be less. But the private firms generally offer faster turnaround time, work more closely with users, and have more sophisticated software.

More than 60 of these firms have been organized in the past 18 months—one barometer of the rising interest in census data. As of last March, 47 of them had been recognized by the bureau as "summary tape processing centers." Recognition doesn't connote government approval or control, but it does provide valuable advertising: the name and address of each center is listed in various bureau publications. (See Summary Tape User Memorandum #17C, Jan. 23, '70, for a recent listing of recognized centers.) Also, when the bureau is swamped, it refers summary tape processing inquiries to the centers.

Ex-Census Bureau personnel staff many of the centers. Dualabs, in Arlington, Va., was founded by John Beresford, who played a key role in organizing the present summary tape program. Morris Hansen, who used to be the agency's associate director for research and development, is a senior adviser at Westat Research, a summary tape center in Bethesda.

Westat's "Censtat" program typifies the kind of special software available. The program reportedly enables a user to select census tables for analysis on the basis of specified, easily-changeable criteria. Censtat also derives arithmetic products—such as means, median, subtotals, and percentages—from census summary tapes, and re-aggregates the data to show the characteristics of several different user-specified geographic areas.

A number of other dp companies are immersed in census-related activities. CDC has developed a file-manipulation package called CENTRACT, while System Sciences has another called SIAM. SDC has designed census-based information systems for a number of local governments. It is also involved in a census R&D effort that began last year in Los Angeles. Among the other participants are IBM, Informatics, TRW, and International Time Sharing Co. ITSC reportedly is exploring the possibility of getting into centralized census files through remote terminals.

None of the census-processing fraternity, inside or outside the government, will admit their activities may be harmful. Elsewhere, however, well-qualified observers have criticized the proliferation of census-type data. One critic is Arthur Ross, Commissioner of Labor Statistics in the Kennedy Administration. On June 30, 1968, he told the Washington Post that:

"The issues which come here (Washington) are vast, intricate, ambiguous, intractable. Statistics enable us to grasp and describe these many-sided problems at the cost of heroic over-simplification . . . No harm is done if a quantitative measure is seen for what it realiy is. But trouble sets in when the statistical abstraction is confused with the more complex underlying reality . . . Immeasurable aspects of the problem may be vastly more important than the measurable (and) the validity of a particular measure may have been undermined by economic and social changes. Meanwhile, bemused by the appearance of objectivity and precision, the policymaker keeps his eye fixed on charts and tables which are sadly incomplete, obsolescent, or both. Eventually, he comes to believe that poverty really is a condition of having less than $3300 income. . . . The ultimate hazard is not that officials fool the public but that they fool themselves.

In a 1965 paper entitled "Social Responsibility and Computers," Oliver G. Selfridge, of MIT's Project Mac team, said:

"Our privacy depends on the fact that the system has no efficient way of collating all the information (that is collected) and displaying it . . . (But) even though that information is not collated, it soon can be, with the aid of the technology that we are helping to develop . . . I asked before: Even if I have something to hide, why shouldn't I be able to hide it? The standard answer is that only the guilty have something to hide, and they shouldn't be allowed to do so. But what is a sin to one man, or the system, is not necessarily a sin to another . . . We should understand that as computerized information processing becomes more prevalent, as the data bases spread throughout society, as the processing becomes speedier and more accurate, it may become very difficult to keep a skeleton in the closet. I think the human race would be the worse for that."

guarding the data

The Census Bureau, according to its official pronouncements, takes numerous precautions to make sure that individual census records will be kept confidential. This includes requiring all employees to swear that they won't disclose census data on individuals to outsiders, and subjecting violators to stiff punishment. Another precaution consists of dropping names and addresses off each census record when the microfilm copy passes through FOSDIC. The original returns, after being microfilmed, are shredded and burned.

Elaborate software has been developed to prevent disclosure of information about individuals in the census tables. These routines are so elaborate and/or sensitive that bureau officials decline to discuss them in detail.

One official connected with this phase of the operation was asked whether "disclosure suppression" routines can do anything about a geographic area in which the range of a particular variable is extremely narrow. An example would be a block in which the monthly rent of the residents didn't vary more than 5 or 10%. In a situation like this, the aggregate statistics would tell, pretty accurately, how much each family was paying.

The disclosure suppression routine isn't designed to take care of such situations, said the official.

When asked about physical security, officials quickly

point out that no Census Bureau employee has ever been accused, let alone convicted, of stealing a census record. This is hardly convincing evidence, though. The same thing could be said even if employees were stealing, provided they weren't suspected.

An official was asked whether tapes ever get lost. He answered that *data* is never lost, permanently, because it can always be regenerated. But what about the tape itself? The official admitted that in such a large operation, loss of tape is "possible."

Census records and programs are stored on roughly 100,000 reels of tape, which the bureau keeps in a "secure area" near the Univac complex. Formerly, programmers from a variety of bureau divisions, as well as machine room supervisors, had direct access to these tapes. Now, their requests are processed through librarians. Also, a semi-automated system has recently been installed to keep track of the inventory.

Officials insist that unauthorized visitors have never been able to remain very long in the tape library without being detected because "our own people are there constantly, and they'll question anyone they don't know." This visitor, after taking a tour recently, isn't so sure that statement is correct. There were lots of census employees in the tape library when I was there, but they all seemed preoccupied. The tape reels are stored on open racks; it seemed to me that a dexterous thief could snatch any of them and hide the tape under his clothing in a few seconds. No guards are stationed at the entrances to the tape library, or at any of the nearby exits from the building.

Nevertheless, the bureau is probably right when it says that census data is physically secure. This is due more to the nature of the operation than to intentional planning. If someone did steal a tape, he'd have trouble using it unless he had the related program. The data is recorded in machine code, and so it can't be printed out and read directly, except perhaps by the programmer who wrote the routine. There are so many records and so many different census enumerations warehoused in the tape library that finding a particular record is virtually impossible, especially since names and addresses are missing.

Another reason unauthorized leaks aren't a serious threat to the privacy of census respondents is because so much can be learned from the statistics which are obtainable legally.

a personal example

R. H. Donnelley Co. has developed a computerized system for printing personalized promotional letters which illustrates some of the dangers inherent in aggregate statistics.

I received one of these letters last fall. It came from Jerome P. DuFour, Sr., a complete stranger; he began by saying:

"I'm amazed at the number of my friends who have dramatically increased their incomes in just the past few months." Then Mr. DuFour identified three people in my area who had allegedly increased their incomes by going into businesses of their own. He included their present and former incomes, as well as the names of their previous employers.

Most people who grow rich "started out with no more money than the few hundred dollars you have in the bank right now," the letter continued. "Few of them had two cars like the Hirschs do. Usually, they had a car less desirable

The swingy keypunch girls at the Census Bureau tabulating shop during the 1920's.

than your '65. . . . After making a careful household-by-household study of Washington residents with incomes in the critical $12,500-19,500 range, I have selected you and Mrs. Hirsch as possibly being among the few who will take positive action if given the opportunity."

To find out what this "opportunity" was, my wife and I had to attend a meeting at a nearby motel, where, according to the letter, we would see "a fascinating portrayal of the techniques that led to the successes mentioned above."

This promotion piece is part of a direct-mail campaign launched in seven major metropolitan areas so far; it will be extended to several others in coming months. More than 70,000 letters have been sent out to date. They're designed to attract new distributors for "Holiday Magic," a line of cosmetics sold door-to-door. Dan Harding, the Donnelley account exec who developed the idea, says the letter has been "5-10 times more successful than conventional direct-mail efforts of this type."

The 1960 census, plus a private data base, provide the personal information that goes into each Holiday Magic letter, explains Harding. The first step is to analyze census tract data in a metropolitan area selected for a promotional mailing, and locate those neighborhoods having the highest percentages of residents with specified income, education, family size, and home ownership characteristics. Next, Donnelley consults its own data base. These records, drawn from state vehicle registrations and telephone directory listings, are also classified by census tract. They contain specific name and address information, plus additional facts indicating whether a particular individual is likely to be a good prospect for direct-mail advertising.

"You can learn a great deal about a person, just by knowing whether he has a telephone and/or a car," says Harding. Those who have neither are generally too poor to qualify as prospects, he explains. Telephone owners who don't own cars tend to be older individuals; car owners who lack phones are usually young people. Those with phones *and* cars consume far more, proportionately, than the other groups, and thus tend to be prime prospects.

The name and address information needed for each Holiday Magic mailing comes from Donnelley's telephone list—"it's the most up-to-date source," says Harding. The automobile file tells the kind, age, and number of cars owned by each individual—data that can generate additional inferences. For example, if the record lists a six-passenger car, the family almost certainly includes young children. The age of a car is a tipoff to how well the family is managing on its present income.

The telephone and auto registry lists are both recorded in machine-readable form, so selecting the desired prospects is essentially a sorting job. Next, the letters are generated by a program that reads the census tract code attached to each census and the auto registry list, and inserts this data in the text of the letter. The "success stories" are obtained from existing Holiday Magic distributors; they're accessed in basically the same way.

who are they fooling?

One reason for objecting to the Donnelley letter was suggested recently by the Medford, Ore., Mail-Tribune: "We resent the implication that we are a simple-minded moron to be fooled by the versatility of an electronic gadget into thinking we're getting a 'personal' letter when we're not." But much more than deception is involved.

Although Donnelley learns a great deal about each Holiday Magic prospect, it doesn't really learn enough. For example, it doesn't know, ahead of time, whether the prospect has been involved in an auto collision that caused death or injury. Nor can Donnelley be sure that the couple receiving the letter haven't divorced each other, or haven't lost the homes or the jobs that qualified them as prospects. These are experiences which most people prefer not to be reminded of, especially by complete strangers who are obviously selling something.

Holiday Magic letters may not affront many people, but what is the justification for affronting anyone? Possibly, no one has been affronted yet. If the letter is as effective as Harding claims, though, Donnelley will soon be blanketing the entire country with these promotion pieces, and the statistical chance of upsetting people will grow accordingly. Does this prospect represent a threat to personal privacy?

Samuel D. Warren and Louis Brandeis (who later became a Surpeme Court Justice) answered that question in 1890, when they wrote one of the first articles on the subject. They said the individual has a "right to be let alone" which he should be able to assert directly. In 1967, the President's Office of Science and Technology added that "The right to privacy is the right of the individual to decide for himself how much he will share with others his thoughts, his feelings, and the facts of his personal life. It is a right that is essential to insure dignity and freedom of self-determination."

If the Holiday Magic letter were based completely on voluntary survey data, there would be less to complain about. Individuals who answer such surveys presumably are aware of what they're letting themselves in for, and have a way out if they want to take it. Telephone and auto registrations are less voluntary, but the individual who really wants to keep privacy inviolate still has at least a theoretical choice; he can give up owning an automobile and telephone. But the census questionnaire offers no choice to the individual who wants to stay within the law; he *must* answer the questions.

Donnelley's system, at present, is restricted to isolating good prospects, but the same basic statistical divining rod can be used to find good customers. This application could create additional threats to privacy.

Among the possible users of customer-qualification systems are insurance companies, banks, and loan companies. Each operates in a seller's market, where the cream of the prospects can be skimmed off, and the remainder ignored. Census-based statistical analyses can be a very effective cream-skimming tool.

A bank or an insurance company, for example, could correlate its "good" customers' addresses to the census tables, find the common demographic characteristics, and then accept new business only from applicants possessing these same characteristics. Or, the company could start with the poor risks and exclude applicants with similar characteristics.

Banks seem to be moving in this direction already.

Several months ago, a bank in Southern California opened a new branch; to generate business, it offered free checking accounts to a selected group of prospects. Before the promotional announcement was mailed, an L. A. service center, American Computer Resources, then known as Data Tab, was hired to analyze 1960 census tract data for the area surrounding the bank's branch. Data Tab found the areas with the highest concentrations of certain demographic characteristics. The company has done similar work for at least one other California bank. And the Census Bureau has done such work for a Michigan bank.

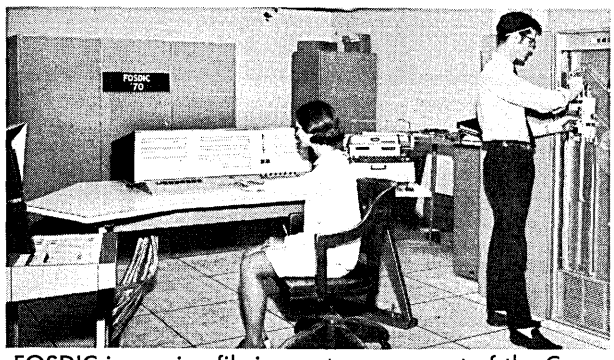
The most ambitious application of census data by a business firm involved David Birch, an assistant professor at Harvard's business school, and a large New Haven bank.

(Continued on p. 72)

Birch was one of the researchers who participated in the New Haven Census Use study that began about three years ago. He matched various groups of bank customers with census data collected from all New Haven residents in 1967, during a pre-test of the enumeration procedures being used this year throughout the country. The matching operation generated demographic profiles showing the kinds of people most likely to be interested in auto loans, home mortgages, credit cards, and other bank services. Birch also determined the demographic differences between delinquent customers and those who paid their loans on time each month. Another output consisted of projections showing future growth, and geographic locations, of the bank's likeliest prospects for specified services. Most of these outputs were displayed on computer-generated maps, besides being tabulated.

Insurance companies are also potential users of demographic profiles.

Three years ago, the House Judiciary Committee found that insurance policies are often canceled for reasons beyond the policyholder's control. One case involved a motorist who had been driving for 35 years without an accident. He was dropped because of a war-induced physical handicap. Another motorist was involved in two accidents; the company admitted that he wasn't at fault but canceled anyway because "our statistics indicate that drivers involved in accidents have a greater tendency to be involved in future



FOSDIC is a microfilming system now part of the Census Bureau's computer complex.

accidents. This has applied to drivers . . . involved both in fault and non-fault accidents."

If the last statement reflects an industry-wide attitude, and the House committee's investigation suggests that it does, 1970 census information could be invaluable to insurance companies. They could correlate vehicle accident records, easily obtained from the police, with census data, and determine where "accident prone" drivers are concentrated. The companies could then raise the rates of people living in these "high-risk" areas.

Insurance companies already classify their customers into risk categories, of course. Motorists who live in cities pay more than those who live in rural areas. A teenage driver in the family escalates the premium substantially. But these rate differentials are based on data the companies collect *themselves*. Use of census data would change things drastically. The individual would be forced to give the government information about himself which could then be used arbitrarily by an insurance company to raise that individual's rates, limit his coverage, or deny him a policy altogether.

The Fifth Amendment protects individual citizens against self-incrimination, provided the government is both the extractor and user of the information. An insurance company or bank that uses census data to qualify customers is presently outside the scope of the amendment, yet these firms also have power to affect each citizen's "life, liberty, and pursuit of happiness."

Even if such companies don't use census statistics, they'll still be in a position to use the bureau's new coding schemes, mapping techniques, and software, not to mention the new tools being developed by commercial firms with the bureau's encouragement. For this technology can be applied to any large set of geographically based records. It simplifies the job of combining separate files. Quite possibly, businessmen will be motivated to develop more files on their customers, prospects, and employees, which would further increase the danger of self-incrimination.

Anyone who argues that census statistics invade privacy is quickly told that the census does many good social works which would not happen if the answers to census questions were made voluntary and distribution of the data was restricted. In New Haven, for example, Prof. Birch found that Negro instalment loan customers tend to have no greater delinquency than whites. The bank subsequently began accepting more loan applications from Negroes. On the strength of this and other findings, it has opened three branches in the New Haven ghetto, and has been in the forefront of efforts to finance new Negro-owned businesses.

"Every loan officer has 'red-line' areas," explains Birch, "representing specific kinds of people he won't consider for loans. What we've done, basically, is to show that some of these poeple aren't really the poor risks the loan officer may have thought they were. So now he can evaluate loan applications with greater objectivity and less prejudice."

While all of this is undoubtedly true, it doesn't necessarily follow that computerized demographic analysis is always, or even usually, better than human evaluation. A computer can be programmed to leave out human bias, but the statistics the computer works with contain a built-in bias of another sort.

As former Labor Commissioner Ross pointed out above, even when a statistically valid relationship can be established between a group's characteristics and the performance of individuals within that group, it's dangerous to jump to conclusions because of other factors that haven't been measured, or can't be.

The big advantage of manual evaluation is that the evaluator has a chance to measure these intangibles and be influenced by them.

The Census Bureau apparently realizes that aggregate statistics are capable of being misused because the following statement appears in a number of the agency's publications:

"If for any reason the Bureau feels that the purchaser of a special tabulation is making unfair or improper use of the information furnished, it may take such action as is deemed appropriate to protect the public interest."

But nowhere does the bureau say what it means by "unfair or improper use," nor does it specify what constitutes appropriate action.

Actually, it's impossible for the agency to do what it says.

Census officials ask each special tab purchaser how the data is to be used, but he can get around that question easily by saying the application is confidential; he'll still get his job processed. Or the customer can simply lie. The bureau doesn't investigate.

The growth of outside summary tape processing centers makes a bad situation considerably worse because now the

bureau will have even less chance of determining how special tabulations are being used.

A company can be recognized as a summary tape center by filling out a simple questionnaire. "If the answers look bona fide," says a bureau official, "we recognize the company." Asked what he meant by "bona fide," the official said "no one has ever really figured that one out." But he didn't seem particularly worried. "The centers are entirely on their own," he pointed out. "We take no responsibility for their work."

Just possibly, the Census Bureau is right when it says people don't endanger their privacy by answering census questions. But, in view of the rather informal procedures used to monitor summary tape applications and summary tape centers, no one really knows. Even if no one's privacy has been violated so far, the danger of misuse would appear to be growing because of the recent proliferation of census statistics, applications, and software, and the virtual certainty that more proliferation is coming. The pace of change is suggested by the fact that, in 1960, the bureau's "public use samples consisted of individual census records representing a 1/1000th sample of the U.S. population. Names, addresses and geographic areas were not disclosed. In 1970, the bureau is offering a 1/100th sample, identifying the SMSA's they are drawn from, and providing the user with a demographic profile of each community so he can determine how representative the related portion of the sample is. The next logical step would be to increase the size of the sample further and offer a set of tapes, each one covering a different SMSA or region (the current public use sample is recorded on a single reel). Users still couldn't identify any individual but they'd be able to make more refined statistical analyses, thereby increasing the appeal of customer-qualification and direct-mail targeting systems.

Since the cost of direct-mail advertising continues to go up, the appeal of computerized techniques for prequalifying each mailing list is clearly growing. Meanwhile, program budgeting and other system analysis techniques are becoming more popular. It may not be long until just about every business decisionmaker has jumped aboard the bandwagon. With this kind of conditioning, they are apt to be much more receptive to "people-qualification" systems based directly or indirectly on census information.

Political support for using such techniques is also bound to grow, as the user market increases. This implies more pressure on Congress to authorize more questions and more-frequent enumerations. A bill authorizing a mid-decade population and housing count was passed in the last Congress by the House but not the Senate. The same bill has been introduced in the current Congress.

Possibly the most effective method of arresting these trends would be to establish an independent federal commission, authorize it to license summary tape processing centers and review copies of all data tabulated from census statistics. Along with the data, the user would have to submit a complete documentation trail showing how he traveled from initial input to final output. If the commission found that a tabulation violated individual privacy, it would have the power to bar use of the statistics by issuing an administrative order. Users who felt victimized would be free to take their complaints to court.

The commission could be financed by users of census statistics. They are now getting statistics from the bureau for a small fraction of what it would cost them to get the same data on their own, so higher prices and additional control are logical.

Regulatory commissions admittedly have a tendency to be taken over by those whom they regulate. But there are ways of coping with that problem, too.

One is to staff the commission with people of different viewpoints. In this case, the number of civil libertarians and constitutional lawyers should at least equal the number of statisticians and marketing types. Hopefully, the commission would also include at least some individuals familiar with the inner workings of computer hardware and software.

One area the commission could profitably explore is the advisability of making some census data available to a restricted group of users. There can be little argument, for example, that government officials need family income data to plan health, welfare, and similar social betterment programs. But it isn't necessarily true that the same information, aggregated to the same geographic levels, should also be distributed to direct-mail houses.

The commission might also study the kinds of problems that do, and do not, lend themselves to census-based statistical analysis. Projecting population growth is almost certainly more reliable than evaluating alternative birth control programs on the basis of demographic correlations.

The commission idea has already been suggested by Alan Westin, who is possibly the nation's leading authority on privacy. He and a group of associates recently received a $149,500 grant from the Russell Sage Foundation to look into this and related matters.

Meanwhile, Congressman Cornelius Gallagher of New Jersey has announced plans to introduce legislation establishing a "federal data processing commission."

But neither Westin nor Gallagher has worried very much about the threat to privacy posed by census data. The bureau's chief critics have been Rep. Jackson Betts of Ohio and Sen. Sam Ervin of North Carolina. Both legislators have tried—so far without success—to limit the number of mandatory census questions.

No one will be exactly surprised if Congress continues to let the Census Bureau operate more-or-less as it pleases. ■

An URBANIZED AREA consists of a central city or cities plus an urban fringe. At least one of the cities must have a minimum population of 50,000. The fringe area includes incorporated places with 2500 inhabitants or more, and "closely-settled" areas of 100 housing units or more.

A STANDARD METROPOLITAN STATISTICAL AREA (SMSA) must have one city with 50,000 residents or more, or two cities with contiguous boundaries and "constituting, for general economic and social purposes, a single community." The smaller of these two cities must have at least 15,000 residents, and the two, together, a total population of at least 50,000. SMSA's must also meet a number of lesser qualifications. Urbanized areas generally comprise the thickly-settled portions of Standard Metropolitan Statistical Areas.

MINOR CIVIL DIVISIONS (MCD's) include election districts, towns, townships, and in some areas, entities known as "beats" and "gores." Census county "divisions" are another kind of MCD. They are county subdivisions, akin to townships.

CENSUS TRACTS are MCD's within, and adjacent to, large cities and SMSA's, generally having about 4,000 residents apiece.

An ENUMERATION DISTRICT (ED) originally represented the territory that could be covered by a single census enumerator. Where enumerators are being used for the 1970 census, each ED contains about 750 people. In the areas where forms were mailed to each respondent and mailed back, the ED encompasses about 1500 individuals.

beware

GETTING A PERSONAL DOSSIER FROM A STATISTICAL DATA BANK

by Lance J. Hoffman and W. F. Miller

With enough work it is possible to obtain a personal dossier from a statistical data bank. A privacy safeguard sometimes proposed[1] is the restriction on the access procedures to permit read-out of only statistical summaries. (In the extreme one could remove from the file such identifying information as name, address, Social Security number, etc.) Data banks which return only summary tables of numbers of persons with given characteristics such as age, education level, etc., are referred to as "statistical" data banks. Data banks which return an individual's identifying information are referred to as "dossier" data banks. It has been pointed out that this distinction is largely illusory[2]. We present here an algorithm which, with enough work and sufficient additional information, can be used to identify individuals in a statistical data bank. We propose "threat monitoring"[3] as a procedure which, while not foolproof, gives substantial additional protection of privacy in statistical data banks.

deducing a salary range

Suppose that we wish to determine whether John Doe earns over $50,000 per year and we know that his data is stored in a statistical data bank. Suppose also that we already know that he is a 39-year-old lawyer with an LLB degree, has four children, has been married twice, and lives in New York City. When we ask our data bank the question, "How many people are in the data bank with the following properties:

age 39
education level is LLB
male
has 4 children
lives in New York City
profession is lawyer
has been married twice?"

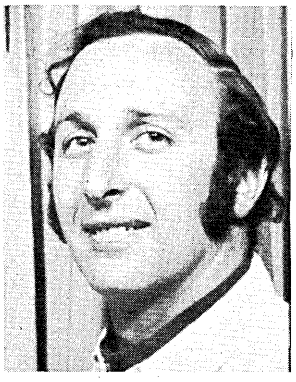
let us say that we get back the answer "57 people." If we then ask, "How many people are in the data bank with the following properties:

age 39
education level is LLB
male
has 4 children
lives in New York City
profession is lawyer
has been married twice
salary exceeds $50,000 year?"

and the data bank returns "57 people" again, we have discovered from our "statistical" data bank the "intelligence" that John Doe's salary exceeds $50,000 per year. We have obtained information on a specific individual even though the query algorithm we used returned only counts of instances, and did not return names. We would have been able to do this even if specific identifying information such as name had not been stored in the data bank.

Suppose we know that data on Richard Roe is contained

[1] Dunn, E. S., Jr. Statement in [8], pp. 92-95.
[2] Baran, P. Statement in [8], pp. 119-135.
[3] Petersen, H. E., and Turn, R. System implications of information privacy. Proc. AFIPS, 1967 Spring Joint Comput. Conf., Vol. 30, Thompson Book Co., Washington, D.C., pp. 291-300. (Also available as Doc. P-3504, RAND Corp., Santa Monica, Calif. April 1967)



Mr. Hoffman is a research assistant in the Computer Science Department of Stanford University. He was previously with Systems Development Corp., Control Data Corp., and Bolt Beranek and Newman, Inc. He has a BS in math from Carnegie Institute of Technology, an MS in computer science from Stanford, and is working towards his PhD in computer science at Stanford.

in a statistical data bank. Let us take some nonsensitive information we know about Richard and use it to form a question for our data bank system. "How many people are in the data bank with the following properties:

age 39
education level is LLB
male
has 4 children
lives in New York City
profession is lawyer
has been married twice
received MS degree from MIT in 1950
graduated from Harvard in 1948?"

If the answer is "1 person," we've hit the jackpot! For we can now extract *all* the information about Richard Roe in the data bank by simply adding more conditions, one by one, to our question. For example: "How many people are in the data bank with the following properties:

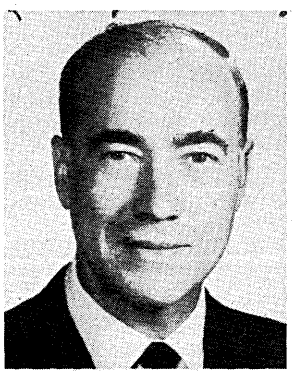
age 39
education level is LLB
male
has 4 children
lives in New York City
profession is lawyer
has been married twice
received MS degree from MIT in 1950
graduated from Harvard in 1948
has been convicted of a felony?"

If the answer to this question is "1 person," then Richard Roe has been convicted of a felony; if it is "0 people," he has not. Again, we have obtained personal information from a "statistical" data bank which does not return names or other identifying information directly.

the general algorithm

We now present the general algorithm for compiling a dossier from a "statistical" data bank. First, let us state our assumptions:

1. We assume that the data bank query algorithm will return to the inquirer $\#(P_1)$, the number of instances (people) with given property P_i but it will not return the names or other identifying information about the people included in this count. That is, the algorithm permits one to get aggregate data in the form of the count of the number of instances of a certain type, but it does not return anything other than the count.



Dr. Miller is currently vice-president for research at Stanford University where he has previously been associate provost for computing and professor of computing science. Prior to this, he was with the Argonne National Laboratory for nine years. He is a member of the Computer Science and Engineering Board of the National Academy of Sciences and is listed in Who's Who in America. He holds a BS, MS, and PhD from Purdue University in physics and mathematics.

2. The query algorithm will permit requests not only for a count of the instances of a given property, but also for a count of the instances of a conjunction of properties. For example, one might ask for the number of people with property P_1 (age greater than 30) *and* property P_2 (female) *and* property P_3 (not living in New York City), i.e., $\#(P_1 \& P_2 \& P_3)$.

Now, if we denote the number of people with properties $P_1, P_2, \ldots, P_m$ in common by $\#(P_1 \& P_2 \& \ldots P_m)$, the following algorithm determines whether a person (called Mr. X) has property P_0 (given that we *a priori* know a number of his other properties $P_1, P_2 \ldots, P_N$): Use the search algorithm to determine whether $\#(P_1 \& P_2 \& \ldots P_N) = 1$. If so, then if $\#(P_1 \& P_2 \& \ldots P_N \& P_0) = 1$, Mr. X has property P_0. Otherwise Mr. X does not have property P_0. (We used this method to determine that Richard Roe had been convicted of a felony.)

The scheme will fail if we do not know enough about Mr. X to identify him through his properties $P_1, P_2, \ldots, P_N$, i.e. if $\#(P_1 \& P_2 \& \ldots P_N) > 1$.

There is a variation of this scheme, which we used to deduce John Doe's salary range. Suppose we know that Mr. X is included in the count of people who have properties $P_1, P_2, P_3, \ldots, P_N$ in common. If the count of people with properties $P_1, P_2, P_3, \ldots, P_N, P_0$ in common is the same, i.e., if $\#(P_1 \& P_2 \& P_3 \& \ldots \& P_N) = \#(P_1 \& P_2 \& P_3 \& \ldots \& P_N \& P_0)$, then we know that Mr. X has property P_0. For this variation of the scheme to work in practice, the count will have to be small in order that one can expect all members in the count to also have P_0. If

$$\#(P_1 \& P_2 \& \ldots \& P_N) \neq \#(P_1 \& P_2 \& \ldots \& P_N \& P_0)$$

we cannot determine whether Mr X has property P_0 unless we have the earlier case where

$$\#(P_1 \& P_2 \& \ldots P_N) = 1.$$

The problem we are illustrating is well known to census bureaus and other agencies charged with publishing statistical summaries and at the same time protecting the privacy of individuals. Their policy is to avoid publishing summaries with small counts which might permit identification.

One way of protecting against the type of search we have illustrated is to use threat monitoring. Threat monitoring control programs monitor all requests to the system and keep audit trails. It can be used to detect excessively active periods of use of the data base, too many successive questions which are quite similar or which result in small counts as answers (therefore raising the possibility that a dossier extraction, such as in the examples above, is being carried out), etc. Even with threat monitoring, if the extraction procedure is concealed among legitimate request traffic, it will be quite hard to detect. This should serve to remind the proponents and builders of "statistical" data banks to very seriously consider the problems of privacy. Only a few[4] have really taken advantage of various methods of access control developed to date[5,6,7]. ■

[4] Hanlon, Joseph. Precautions Preclude Misuse of Student Data. *Computerworld*, 4 March 1970.

[5] Hoffman, Lance J. Computers and Privacy: A Survey. *Computing Surveys 1*, 2 (June 1969), 85-103.

[6] Weissman, Clark. Security Controls in the ADEPT-50 Time-Sharing System. Proc. AFIPS 1969 Fall Joint Computer Conference, 119-133.

[7] Hoffman, Lance J. The formulary model for Access Control and Privacy in Computer Systems. Ph.D. Dissertation, Stanford University, Stanford, Calif., 1970.

[9] U.S. Congress. The computer and the invasion of privacy—hearings before a subcommittee of the Committee on Government Operations, House of Representatives, 89th Congress, Second Session (Gallagher Report), U.S. Government Printing Office, Washington, D.C., 26-28 July 1966.

a possibility

CHEATING THE VOTE-COUNT SYSTEMS

by James Farmer, Colby Springer and Michael J. Strumwasser

In June of 1969 the authors made public the results of a feasibility study on the vulnerability of computer vote-counting systems to deliberate software modification—in other words, on the possibility of deliberate fraud. Because of the special sensitivity of this area, we soon found ourselves in the middle of a quite public—and, upon occasion, quite heated—discussion of the reliability of the new electronic vote tabulation systems.

The authors became involved in this controversy through a general interest in security problems posed by computer operations. There have been several published descriptions of the problems of auditing a computer-based accounting system, and some research done on security of terminal access systems,[1] but surprisingly little has been written on the possibility of unauthorized software modification. Although we had often discussed the problem, it was only after the recent Los Angeles mayoral election, in which we had acted as observers, that a specific system presented itself for study. We had been struck by both the complexity of the counting operation, and by the difficulty of monitoring it. Although no one suspected that a miscount had actually taken place, we were by no means certain that this was not a possibility.

Of all the areas where computer operations have taken prominence in the past decade, the vote-counting systems appeared to offer the most urgent need for study. Here, where the stakes are spectacularly high, seemed to lie the greatest attraction to a would-be criminal. And if system rigging were a real possibility, the threat would be twofold: not only could public confidence in the ballot, and therefore in the democratic process, be severely damaged, but the resultant impact on the computer industry could be crippling. In every respect, it seems important to resolve the issue immediately.

Since our group was divided in opinion as to whether or not computer vote fraud was a real possibility, we settled on a modified "war-game" technique for the first feasibility study. The Department of Defense uses this approach to enumerate possible contingencies in a given military situation. Under what might be called the "adversary technique," we divided into two teams: Red for offense, Blue for defense. The Red team operated as potential system riggers, developing techniques of cheating the system through software modification. The Blue team attempted to find adequate safeguards for each.

The Blue team was unable to find adequate safeguards for all of the Red-offered challenges, and the teams concluded that program modification was indeed a technically

Mr. Farmer was one of the founders of Systems Research Inc., where he is now a consultant, and has participated in the development of a national election model used in recent campaigns. He was previously involved with computing at the California State Colleges and San Fernando Valley State College, and was a member of the staff at RAND. He has a BS in mathematics from the University of Oklahoma, an SM in applied math from Harvard, and an MBA in operations analysis for UCLA.

[1] Ware, W. H., "Security and Privacy: Similarities and Differences," *AFIPS*, vol. 30, Proc. SJCC, Thompson Books, Washington, D.C., 1967.

feasible method of vote fraud. Their conclusions were:

1. The operating system is vulnerable to modification and would permit changes without access to the user vote-count system.
2. A vote bias routine—a program modification which would change the ballot image—would be difficult to detect during the counting process without destroying the results, and such a routine could be written without altering the length of the program.
3. A valid "logic and accuracy" test would require either a sophisticated computer program or prohibitive amounts of computer time—several times the amount required for the actual count itself.
4. Many techniques of computer vote fraud require the access of only one person and, at most, an operator and a programmer.
5. None of the techniques would be detected by a casual observer, even if he had extensive data processing background.

Although this first study determined several alternatives for computer vote fraud, the results were unconvincing to the computer professional and confusing to the layman. They showed *how* a program modification could work to alter election results, but did not demonstrate *whether* such alteration could be performed on the systems commonly in use, or how much effort would be required.

Obviously, the results called for further investigation. The next step was to develop a model vote-counting system, and to apply rigging techniques to it. A grant from Intellectron International, Inc., enabled this research to be carried out.

typical systems

Most vote-count systems have three functions: media conversion, counting, and reporting. The Votomatic™ system employed by Los Angeles County (the largest such system in use) reads from card ballots. The cards are punched by voters who press a stylus through a template—the resulting ballot can be read by computer or counted by mechanical sorters.

Since most systems use either punched cards or paper ballots, media conversion programs are employed to reproduce the ballot image in another medium—typically magnetic tape. Since most computers have several tape devices, but only one or two card readers, media conversion can be done by other computers or off-line devices, and the magnetic tape used as input to the main count program.

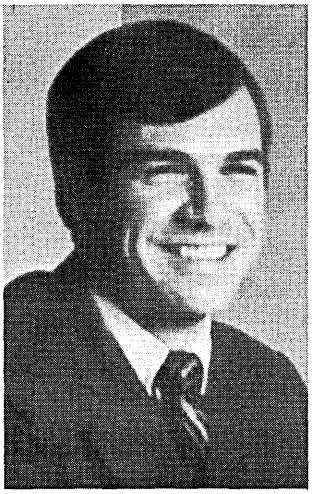
The count program reads the ballots and, through tables, header cards, or previous program generation, adds recorded votes to the appropriate counters. If a ballot contains votes for more than one candidate, the vote for that office is considered "overvoted" or "mutilated," and is not counted. For races with more than one possible valid vote per office (e.g., vote for three of a list), the number of votes is compared to the maximum allowed, and if the number is excessive, none is recorded. The vote tabulation is frequently kept by precinct and, at the conclusion of the count, is totaled, giving the customary count by office. When the count is long, as it is in Los Angeles County, provisions can be made for cumulating this total as the precincts are being counted and, upon request during the count process, providing summary totals. These unofficial returns provide progress reports for the press.

Supplementary count programs can be used to summarize subcounts for input to the main count program. For example, precinct summaries can be produced on smaller computers and these summary data incorporated in the final count by a routine in the main count program. Again, this technique speeds processing for large election counts, but requires a more complex system.

At the completion of the count, a report program is used to match the counts with office and candidate names; and precinct, district, and summary totals are produced, constituting the official returns of the election.

In addition to the three functional programs described, there are supplementary programs in any system. These can include test data production, program generation (to account for different ballot patterns or styles), ballot layout, audit reports, system supervisors, real-time (in-process), count reports, and so forth. The number and significance of these programs to the count process depend on the sophistication of the system and the particular system design chosen. A large system incorporating several levels of counting, multiple input, and provision for in-process reporting can be extensive, complex, and expensive.

To effectively determine the amount of expertise re-



Mr. Springer is also a founder of Systems Research Inc. and is now vice president. He worked on the national vote model and has consulted with political organizations on voter name lists and vote analysis systems. He worked previously with the Altadena Public Library and the Union Oil Co. He has a BS in computer engineering from UCLA.

Mr. Strumwasser is a member of the research staff at Systems Research Inc., as well as a resident consultant with RAND. He has consulted on numerous political campaigns on the development of computer-based campaign aids and mathematical models. He holds an AB in political science from UCLA.

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quired to implement vote-bias techniques, our model vote-count system had to be identical in function and similar in procedure to those systems described above. Of course the size of an actual system could not be duplicated; the cost of using even a small one would be prohibitive. Also, it is not clear that any election board would want these techniques developed using its system, or that the authors would want to develop an illegal technique on a full scale.

We found that, for our purposes, the model need incorporate only the three primary functions: media conversion, vote counting, and reporting.

The model system consisted of two programs. The first, COUNT, performed ballot reading and code conversion and counted the ballots. At the conclusion of each precinct count, summaries for each office and candidate were punched out. The TOTAL program used these summary totals and a table of offices, candidate numbers, and names to prepare the final report.

Two supplementary functions were incorporated in this program—precinct level vote totals, and counts of blank and overvoted ballots. These were listed by COUNT and incorporated in a quality control report of TOTAL.

Both programs operated under the IBM System 360 Disc Operating System (DOS), and were developed and tested under level 20. Since the program size was dependent on the number of candidates and offices, we were able to run on an IBM 360/25 or 360/30 with 32K bytes of core storage.

Specification of the parameters of each office (office number and number of candidates) was included in the COUNT program. To change these parameters, new values had to be assigned to the counter array before compilation. This matrix maintained the total votes cast for each office as well as the number of "no-punch" and "double-punched" votes. These totals were kept both in a cumulative form and also for each precinct as it was being processed. By operator option, either precinct and/or cumulative totals could be listed at the end of the count for each precinct.

The ballots for a given precinct were preceded by a header card giving the precinct number, the office number/candidate number, and card-column-hole relationships for the ballot pattern. These data permitted any of the 960 possible "holes" to represent any official candidate.

The first phase of the count process included reading and decoding the information on a precinct header card. After this was completed, processing of the ballots for the respective precinct could begin. Each ballot was scanned, decoded, and then votes and quality control information (mutilated or non-punched ballots) were tallied for the respective offices. This process continued until either a new precinct or an end-of-data card was encountered. At that time, the counter for each office and candidate was listed on the printer and identified by numerical index. Counter information was displayed in both precinct and/or cumulative form, depending on the operator option specified at program initiation. At the same time, summary cards were punched for each precinct. These cards and a table of candidate names were then used as input to the TOTAL program.

In order to verify that the compilation parameters and precinct header cards were correct, a "logic and accuracy" test was applied. This test consisted of a set of ballots designed to duplicate all possible ballot patterns and yield known totals. This test deck is usually only a fraction of the number of expected ballots—for the model, a 450 ballot "logic and accuracy" test was used.

Since our basic purpose in implementing fraud techniques was to understand the coding difficulty, access required, and probability of detection, we decided upon four criteria to determine which methods were operationally feasible, and hence worthy of further investigation.

In order to be operationally feasible, a computer fraud routine must:

1. Pass the "logic and accuracy" test.
2. Be automatically initiated or require minimal operator or programmer action during use.
3. Not be readily identifiable in core dumps or on load maps.
4. If detected, be attributable to several individuals.

There are three techniques of passing a "logic and accuracy" test. A fraud routine can "count around" the test. For example, if the test is 450 cards, then it passes 500 before beginning vote-rigging. Since such tests are usually only a fraction of the total ballots, the bias routine remains powerful. A fraud routine can require initiation while processing. A particular bit pattern in memory can be set by the operator or by the programmer. This can be subtle. For example, if the operator responds YES, the bias is omitted, while an intentional misspelling YEX signals the bias routine to begin. Also, a fraud routine might be constructed to look for a particular pattern in the input stream to signal initiation. Any of these methods escapes detection of the "logic and accuracy" test and initiates vote-count bias without an abnormal action on the part of the operator or attending programmer, or abnormal appearance of the data control deck.

Code added to a problem program would normally not be identified if added at the completion of development. A few instructions, without comment, could probably escape detection and, if noticed, not be identified. Since listings frequently have object deck changes or source changes on them, little concern would be evidenced over "minor corrections." In contrast to the layman's view, most systems are modified frequently to accommodate new conditions.

Making changes in the object deck can be a trivial matter. Although operating systems normally identify replacement code or REP cards by listing them out, replacing cards and adding code is not difficult. If core sizes are controlled—and few audits include such sizes—then space can be found by replacing some unused or unnecessary function, some constants, or shortening a code. Any programmer accustomed to reducing the size of programs—particularly for the early, small computers—can find space.

Since programs are frequently the product of several people, the operating system is accessible to many, and object decks pass through many hands, it would be difficult to assign legal responsibility for a routine should fraud be discovered.

vote fraud techniques

Of the possible techniques suggested by the original study, three were selected for implementation against the model system. Each was representative of a separate class of rigging approach, and each satisfied the requirements listed above.

The "adversary technique" had yielded three vulnerable areas: the operating system supervisor, object deck, and the program.

Rigging the supervisor. For the first study, the supervisor was modified to register extra votes for one of the candidates. After the card was read, the bias routine checked to see if it was a ballot, and if so, every fourth vote for the opposition was deliberately misregistered in the favored candidate's tally.

Part of the operating system of the maunfacturer-

provided disc operating system was punched out and the necessary additional coding was supplied.[2] The module was assembled with the remainder of the supervisor and substituted on the system disc pack. The coding required a bit flag to be set by the operator through console switches in order to initiate the change—otherwise, the supervisor would operate normally. In fact, the modified supervisor has been used for routine production at the data center without identification of the vote-count bias routine.

The substituted supervisor is 65 bytes longer than the original. This code could have been substituted for part of some other routine, say an error recovery routine, or supervisor tables such as the PIB, PUB, or LUB tables. In that case, the supervisor length would have remained unchanged.

Modifying the object deck. The same operator-initiated fraud routine was incorporated into the object deck of the count program (and could also have been used in a media conversion routine). This procedure required the addition of only three cards.

TXT cards were used to prevent identification during linkage editing, which would have occurred with REP cards. Again, the programmer elected not to "bury" the code in the problem program in order to retain identical program size, although it would have been possible.

The results were identical to those obtained from the modified supervisor, with a 25% shift in the vote and subsequent reversal of winning candidate number.

Rigging the count program. A different scheme was used in the routine incorporated into the count program. The system counted to 500 before initiating the bias routine. In this way, the 450-ballot "logic and accuracy" test could be correctly counted before rigging began. Another comparison with the sample count shows a difference of 15%.

The fraud techniques described did not deal with complex ballot patterns such as would be encountered in large election counts, particularly if ballot position rotation were implemented to reduce voter bias. That is, the techniques used assumed that the vote to be changed always existed in a fixed position. There are many races for which this is true, but there are also others which would require a more complex routine to identify the correct precincts.

The techniques used here made marked changes in the count—15% to 25%. In most elections, only a few percent of the vote would be needed to reverse the results; such alterations could be obtained by rigging only a few of the precincts in the race.

Predicting the effect of selected ballot patterns should be done only in the context of specific situations. Complex ballot patterns merely make the vote-count bias routine more complex; they do not eliminate the possibility of fraud.

This project did not attempt to identify the entire realm of rigging possibilities. As an effort to demonstrate the feasibility of altering a vote-count, it was intended to stimulate those who, in perfectly good faith, had assumed that extensive collusion by a number of people on the inside of a computer center would be necessary.

It is clear that extensive research is needed both to produce safeguards and to further identify potential fraud techniques. As the techniques are made public, those responsible for the accuracy of programs can have a better understanding of the specific techniques which may appear. As safeguards are incorporated, the probability of detection becomes greater, and the task of developing fraud routines becomes more burdensome. Hopefully, this will discourage the potential criminal. Until this research is undertaken, however, we can make specific stop-gap recommendations which would tend to limit the effectiveness of the techniques already identified.

Procedural safeguards include:

1. Examination of the programs for bias routines by a recognized computer professional not associated with either the system design or implementation.
2. Careful adherence to professionally accepted standards for programs, their documentation, operating procedures, and appropriate system tests.
3. The monitoring of election counts by computer professionals knowledgeable of fraud routines.
4. Storing of actual ballots, identified by precinct, for several years following an election. These ballots should be made available to any political party or candidate for partial recount.
5. Strict access limitation during actual count procedures sufficient to assign responsibility to one person for any error.

A redundant mechanical count should be made on a significant sample. The sample size should be selected to make the probability of undetected fraud low. Further analysis could suggest both the sample size and sampling procedure.

There are several system changes, or standards, which would reduce the possibility of vote-rigging. These include:

1. Development of a logic and accuracy test which uses the full range of election ballots, and which would, during execution, detect any unused code and list all counted program loops.
2. Incorporation of a full audit trail to provide ballot counts, vote summaries for machine-to-machine and program-to-program comparison.
3. Provision in the program for in-process core dumps and file duplication for later investigation.
4. Requirements of full documentation and program size control totals, with all final compilations and tests retained (particularly from core dumps and loader maps).

implications

The computer industry, especially with respect to personnel, has experienced an explosive but singularly unstructured growth. Universally endorsed professional standards have yet to be set: in our industry, the developer of a system is often the sole judge of its integrity.

But as computer operations reach out more and more into areas which affect the individual, such practices become increasingly dangerous. Sooner or later, unscrupulous individuals will take advantage of a ripe opportunity. Indeed, cases of computer fraud already have been unearthed.

The faith of the general public in computer operations, frighteningly demonstrated by the reaction of one election official to our findings ("If IBM is acceptable to billion-dollar banks, it's acceptable to me.")[3] must not be shared by those who know better. The computers may be foolproof, but the men who program and operate them are only human, and subject to human weaknesses.

It is past time to structure the profession, to apply the same kinds of safeguards and standards which already hold in other professions. At this juncture, we can do it ourselves, if we recognize the need. Later—after the first big vote fraud, or national security breach, or giant tax swindle—we may wake up to find others doing it for us. ■

[2] The channel scheduler macro SGTCHS was used (*DOS System Control and Service Programs*, IBM, Form C24-5036-4, Endicott, New York, 5th Edition, April 1969).

[3] *Business Week*, July 19, 1969.

VOTING SYSTEMS

los angeles doesn't have one

by Robert L. Patrick and Aubrey Dahl

For some years, the L. A. County fathers have been trying to improve the election process. They considered the standard voting machines available, but concluded Los Angeles was too geographically decentralized and the required number of voting machines would be too expensive. They were then interested in several other devices which were being developed for tallying large municipal votes, but none of them came to pass.

Two or three years ago, after some more competition, they adopted the IBM Votomatic scheme for recording and tallying votes. With this scheme, a small device is supplied for each voting booth in a precinct. After the voter has identified himself to the secretary at the poll, he is given one or more unpunched IBM cards, which are similar to Port-A-Punch cards in that holes may be made in them by using a stylus to punch out the chad. The unperforated cards are placed in a bed and a clever overlay mask is provided for them. When the overlay mask is properly positioned over the card, the overlay printed on the mask positions a ballot key adjacent to a card column to be punched. The voter selects his candidate and punches the chad out of the column next to his choice. When the voter is through, the punched card is placed in a privacy envelope and deposited in the ballot box.

After the polls close, the ballot boxes are opened, the cards counted, the boxes sealed, and then transmitted to a central counting center. At the counting center, the cards are inspected, joggled, and fed into a computer (IBM, of course). They go card-to-tape and the tapes are tallied on a second computer. Typically, the card-to-tape operation takes place on a bank of System/360 Mod 30's and the final tally takes place on a System/360 Mod 65. Using this procedure, Los Angeles County can tally over a million votes for a variety of candidates and propositions with early counts being made available to the press in time for the 10 p.m. tv news, and final counts being available for late watchers about 2 a.m.

During a recent election, a small team of research scientists served as "poll watchers" and then went downtown to observe the central counting processes for tallying the massive vote. They observed that the card-to-tape process was widely distributed throughout two service bureaus to get speed. They also observed card jams (ballots) being casually cleared by machine operators. They further observed that there seemed to be some trade-offs in accountability and auditability being made to produce early, newsworthy copy for the press.

After some thought, this group of scientists carefully and quietly raised the possibility of vote tampering without making a specific charge. The biggest paper in town then took this carefully reasoned charge and in one newspaper article, complete with a Chicken Little banner headline, translated the possibility of tampering into a specific local issue.

Since the county supervisors had bought the system, they responded with a political spasm and appointed a blue ribbon investigating committee. The committee was politically astute, but light in systems analysis (which is where the problem lay). The committee held a series of open public hearings adequately attended by the tv and press. They heard all comers who wished to discuss the Votomatic procedure, they heard from interested laity, they discussed other methods for tallying the votes, and even heard from would-be inventors who had bread-board devices to sell. They took statements from this parade of people, and from local officials unfamiliar with computers.

missing the point

The hearings could be characterized as uninformed, well-meaning, and slightly self-serving. Hard technical questions were set aside in favor of more newsworthy topics. The hearings were covered adequately by the press, but the published reports continued to throw more heat than light on the proceedings.

The reporter who wrote the story that triggered the six-month inquiry was invited to appear before the committee, but didn't, and this wariness was reciprocated by one committee member who stated during the discussion of findings and recommendations to be included in the committee's report that "We shouldn't find the press at fault (for the widespread concern over possible rigging) or we'll never get the report published."

The committee's image seemed to be of considerable concern to the members during the hearings, and a certain vein of plaintiveness ran through the final stages of the proceedings. Several of the recommendations being considered for inclusion in the report had already been implemented by the County Registrar's office, and one member appeared to be somewhat piqued by this thunder-stealing development. "I think we should put all our recommendations in the report, anyway," he said. "We should get some credit." And another added, "I think we've done a damned good job."

At the present time, the status of our vote counting apparatus is as follows: A college professor in political science invented the little recording devices now known as the Votomatic. IBM marketed the Votomatics and the computer programs to count the vote[1]. Obviously, the little punches were profitable and the computer programs were just a necessary evil. Los Angeles bought a copy of the programs and a set of the devices because an economics

[1] IBM has since withdrawn from this market and is licensing small independent companies to continue to support this market.

study showed that the savings in manual precinct workers' wages would pay for the devices in a few years. The active copy of the count program is retained in a disc pack with tape backup. Both the disc and the tape are kept in a safe in the County Registrar's office when not in use.

On close scrutiny, it was found that the difficulties with this voting apparatus are fundamental. First, the vote counting programs use a standard IBM operating system which contains no provisions to prevent tampering. Although the program is locked up in a safe, there is no verification of the operating system prior to the counting process. In addition, in one recent election the machine room procedures did not even cause the remote terminals from which new jobs could be introduced, to be disabled.

The program itself contains no audit trails, no control totals, and lacks tight ballot accountability. In public session, the IBM representative who services the programs and holds the County Recorder's hand admitted that the logic and accuracy tests devised for the programs were designed merely to check against programming errors or control card mistakes, and no thought had been given in their design to the prevention of malicious mischief or tampering. Thus it appears that the programs are of demonstration quality and lack those precise checks one would put in even a simple program designed to perform penny accounting. Furthermore, the set of programs (we hesitate to call them a system) were designed to optimally use the computer to get counting efficiency. Were the programs to be redone, someone should seriously consider keeping them simple and not using sophisticated blocking to and from disc, or other advanced techniques, since these are hard to explain to politicians and the general public.

Prior to each election, program changes are required to accommodate the ballot design for the forthcoming election. The hearing stated that the 30 days immediately prior to an election were filled with programmers making test shots trying to get the ballot design (which can vary with precinct) reflected in the count program. This, of course, gives ample opportunity for nefarious individuals to obtain a copy of the program from the residual code left in the checkout computer after a test shot is over.

dubious precautions

When confronted with these deficiencies, the County Registrar of Voters indicated that he thought adequate precautions had been taken since he zealously guards the program by keeping it locked in a safe when it is not used. Similarly, the IBM representative indicated to the blue ribbon committee that the operating system was too complex for a nefarious individual to tamper with since it required a SYSGEN to remake one—a process known to a very few. (It is estimated that there are in excess of 15,000 computer installations using either DOS or OS/360; at two system programmers per installation, there are approximately 30,000 system programmers capable of patching the operating system in a sophisticated way so the tally could be tampered with without changing the program in the safe.) In addition, the Registrar's security breeds discontent in an open society since it establishes IN and OUT groups.

After surveying the matter, the blue ribbon committee concluded that the programs were good enough, and that the system with all of its loopholes can be gradually improved. As this is written, they have recommended a board of certified computer-qualified auditors (from all political parties) to keep the election process healthy until principles can be established and programs rewritten.

The committee made several other recommendations along with its endorsement of the current system, including one that a random sample manual recount of the punched card ballots be made after each election, and legislation to this effect will be introduced in the California State Legislature at the behest of the County Registrar. A further recommendation was that programs should be written so that total results would be broken down by councilmanic districts, or lower, and periodic printouts would be made during tallying to inform the public and the news media.

The latter seems to be a be-kind-to-Cronkite-and-concerned-candidates recommendation.

The recommendations of the blue ribbon committee may have been the only ones politically practical since L. A. County owns several million dollars worth of Votomatic equipment and is heavily committed to Votomatic as a way of life. However, if your community ever goes in for computerized vote tallying or if L. A. County ever decides to renovate the apparatus they now have and build a carefully tailored system for vote counting, there are several things that are recommended for the new design:

1. As a design concept, the programs and procedures should be open to scrutiny so that ignorance does not breed a charge of tampering.
2. Unbroken audit trails must be provided so that full accountability and auditability are provided. Penny accounting techniques should be used to treat each vote as if it is precious. Batch (precinct) totals must be provided, preserved, and carried through the system. Provisions must be made to allow for partial recounts by precinct for each office/proposition.
3. Each program should be provided with checksums and the operating system must be protected with the same vigor as the tally programs are.
4. Machine room procedures must be established to make sure no remotes are connected, to provide a clean visible workflow, and to indicate on each printout the quality of the data tallied for each precinct.
5. The computer programs should be designed cleanly with tables defining ballot configurations. Thus the programs themselves can be read-only and static from election to election.
6. A pair of utility programs should be provided: one which receives a description of the ballot as input data and compiles control tables for the tally program; and the other which receives control tables as data and decompiles those tables to reproduce the original ballot description. The second program would be used to display the vote control tables that control the read-only tally program and this program could operate in a multiprogrammed environment along with the tally program to allow the "poll watchers" at the computer to randomly display the control tables while the vote is being tallied and assure themselves that no tampering had taken place.
7. Finally, several design principles seem to apply:

A. Keep it simple.
B. Devise table driven read-only programs.
C. Eliminate discs and use only tapes (data flow to disc is difficult to audit and explain).
D. Plan to live in a fishbowl.
E. Do not let the appearance of mystery pervade.

In conclusion, we regretfully report that our votes are being counted by a set of programs with several pathological weaknesses. Furthermore, we have to rely on secrecy to prevent tampering. Until this is rectified, we have a few members of the IN group to get bonded and watch like hawks. Finally, with proper design, all this need not have happened. ■

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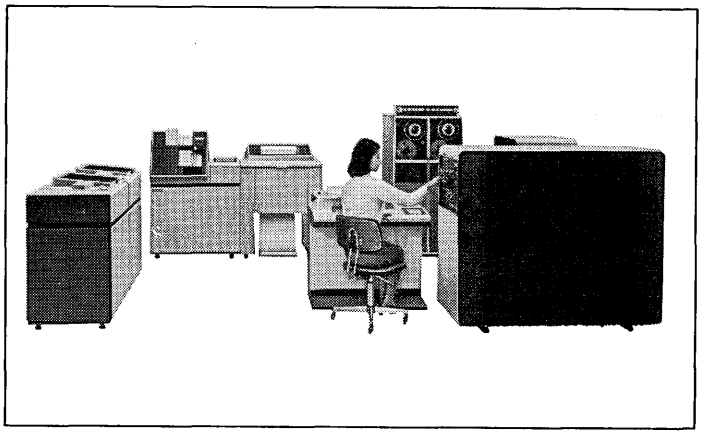

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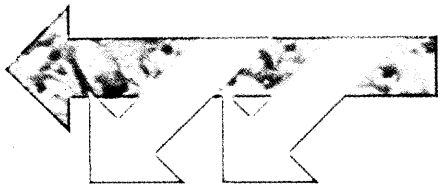

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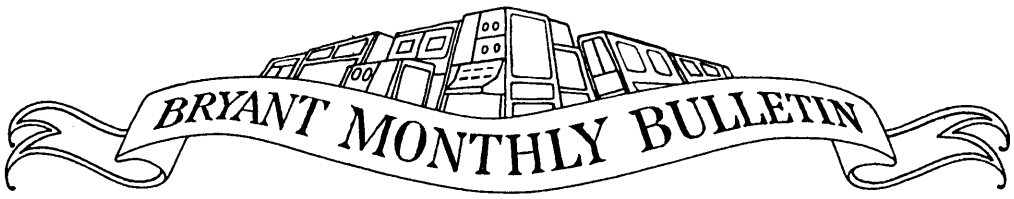

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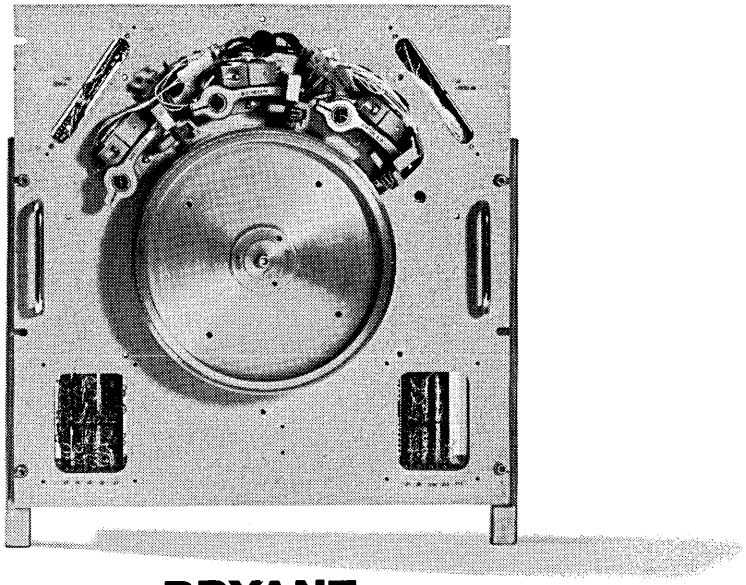

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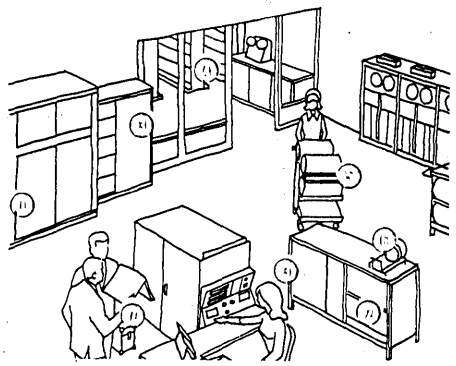

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what if they're wrong?

RELIABILITY OF DATA BANK RECORDS

by Roy H. Lauren

In today's business environment, data banks of significant size are relatively few in number. But the number is growing rapidly and the problems of information security and privacy of the individual are beginning to surface. The problem itself has existed for a long time but, with the advent of edp, the ease of manipulating vast quantities of information about very large numbers of individuals has increased the problem enormously.

There are several areas relating to data banks which are in need of in-depth investigation. This article concerns itself with only one—the problems associated with the reliability of the data stored.

The dimensions of the problems are considerably greater than most people realize. The reason is that each business dealing with or serving the public has a data bank of information which the public could, and probably does, consider to be private. The information in your organization's data bank about the *other* person should be just as important to you as the reliability of information about *you* in somebody else's bank.

When serving the public, you have one or more files containing information belonging to your organization and which is yours by right of having collected it. This has been historically true and has not been contested. For the first time it is becoming quite clear that this will not remain an uncontested premise for much longer. It is a well-known fact that legislators at the national and state levels have been concerning themselves with this problem for more than a year. In all probability, whatever happens in the way of legislation or public pressure will have direct implications for each of us. Data banks are not somebody else's worry—they are ours.

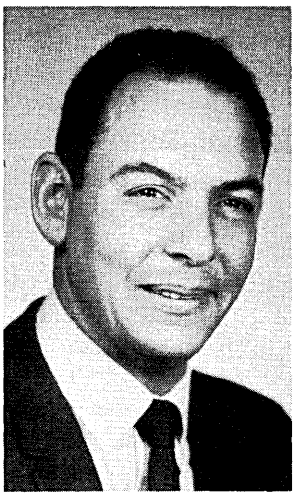
Consider the number of files with information about a given person.

First of all, there is a record in a file of each school he has attended. This includes continuing education long after college is completed. In addition to his grades, his indiscretions might well exist in those files. For most of us, these files remain dormant, but if an individual becomes well-known those files have a way of becoming public knowledge. Two examples are sufficient to illustrate the point. The first concerns the current Pope. Shortly after he was named, articles began to appear which quoted many of his teachers from as far back as his grammar school days. The second is provided by a current issue of a magazine which thoroughly covers President Nixon during his school years.

In another area, many of us have several credit cards, from banks, oil companies, retail merchants, etc. Each credit card we carry represents a record on somebody's file concerning ourselves.

If you belong to a church you are on their file, and perhaps they know quite a bit about your financial standing.

When you make a donation to a political party, you are on the political party file. They probably know more about you (using demographic statistics for the area in which you live) than just what you gave or donated last time you sent them a check.



Mr. Lauren is the advanced services planning director with Security Pacific National Bank in Los Angeles. His responsibilities include MIS and banking as it relates to the branch system of the future. He has been an instructor with the UCLA extension program for six years and designed several of their courses. He has a BS in business administration from California State College at San Fernando.

You are on the property tax rolls wherever you live, and you would be surprised how much they know about you. In the state of California, for example, if you claim a veteran's exemption on your property tax and if you have multiple pieces of property, they keep track of the value and, as soon as the total exceeds specified limits, they automatically remove the veteran's allowance.

At the state level you are on the state income tax file. And if you own an automobile, you are on the files of the Department of Motor Vehicles for driver's license and motor vehicle registration, and probably on several other files.

At the national level you are on the Internal Revenue Service file, and one or more files as a result of having been in the armed services. If you have ever been fingerprinted (and who hasn't), you are in the FBI file; and if you have ever been cleared for security by a government agency you could be in innumerable additional files.

Of all these files or data banks, the publicity has centered on those of the credit bureaus and the larger state or national data banks.

As indicated, it can be assumed that any corporation dealing with the public has a data bank of its own. Some corporations, as a policy, do not give out any credit information on their customers. Other corporations, as a policy, will give out information which the customer could consider private. At this point is is impossible to say how far public opinion will combine with legislation to restrict a corporation or company from passing on information about the credit-worthiness of one of their customers.

mistakes can happen

The problem of reliability is the problem of insuring and maintaining the accuracy of information contained in data banks, regardless of who has access to the data or whether the information is private or public.

Let's look at the problem as it relates to existing files. Many were begun years ago, before edp, and the information was accumulated on ledger cards. In many cases, it is hard to decipher old information. Some of it is in sequence by date; some of it is not.

In most instances, the individual doesn't know what is in the record about himself. There are an endless number of examples to use, but let me illustrate one that happened to me several years ago. I bought a mattress from a local department store chain. For one reason or another they delivered two mattresses. I called them up and they came back and picked up the second one, but of course they billed me for two mattresses. For a year and a half they sent me notices that I was delinquent in paying for one mattress. I found out two years after the incident was settled that this retailer had reported me to the credit bureau as a poor paying customer. I'm sure you all know of many like incidents. Who's to say in this case who is wrong? Is the credit bureau wrong for having put that information on the record? I don't think so. However, my argument was with the credit bureau, later, when I tried to get the information off the file.

In order to have a point of reference in talking about reliability as it relates to some of the larger data banks, let's look at the size and activity of the Department of Motor Vehicles' file in Sacramento for the state of California. This file is maintained in a mass random storage facility which is on-line to a computer and contains 30 million records. It has approximately 13 million driver's licenses and 17 million vehicle registrations. There are 30,000 updates per day to the driver's license part of the file. In addition to that, there are 50,000 inquiries into the file from various sources throughout the state, including government agencies, law enforcement agencies, insurance agencies, etc.

Now, suppose you get a traffic ticket for speeding. You go to court, plead guilty, and pay your fine. This information is going to be put on your record at the Department of Motor Vehicles. The court clerk in transcribing the information, which let's assume is a violation of motor vehicle code XYZ, inadvertently transposes and makes it a violation of XZY. XZY happens to be a conviction for auto theft. Your file ends up reflecting this erroneous data. With the amount of input information which is generated and with the number of people involved in generating this data, it is to be expected that some errors will escape detection.

When driver's licenses are issued, they are issued under a much more controlled and controllable system—driver's license numbers are generated, fingerprints are taken, characteristics are noted, etc. The point is that there are two types of input generated for any type of file, whether it be a government or a private industry file. One is data which is generated under a highly controlled environment, as previously noted, and the other is data which is generated under significantly less control. We all have the results of both types of data generation existing in whatever files or data banks we are working with.

Therefore, in regard to reliability, two specific areas are identifiable for concentrated effort in the future. First, the problem of existing files—how to clean them up to meet whatever standards will be acceptable—and second, how to increase the areas of controllability for the input of information. At this time, almost all government agencies and almost all private credit bureaus have specific people working with these problems. Many organizations, however, have not considered the problem. These are areas requiring much future attention.

must get public acceptance

It is a fact that data banks are a part of almost *every* business; they need data banks in order to function, just as the credit bureau and the IRS needs them.

It is past time where the only concern with data banks is what they can do for businessmen. Today, when the words data bank come to mind, the public's image is one of an invasion of privacy. Of all the articles written, of all the speeches made, not one has given the public reason to believe that a data bank is something which will add to their well-being. Throughout the research which was conducted for this article, nowhere did I find the suggestion that good information was going to be retained in data banks as well as negative information. I am not trying to say that good information should be on file. (However, it is worth considering.) The point is that when all publicity on the subject stresses only the negative side of the information contained, it will be very difficult to convince the public that data banks are something they need or want to have in existence. The question is not whether data banks should exist. They already exist.

Data banks are a benefit to the public in that they allow government and private industry to act in the public's behalf. It is mandatory that we remove the threat of data banks, both real and implied. No formulas exist by which the public can be induced to believe that data banks containing personal information about them is something to be desired. Each one of us must deal with the problem for his organization. There must be a concerted effort on the part of all to achieve a higher reliability factor in the information contained in our files and the fact that we are working toward this objective be related to the public. ■

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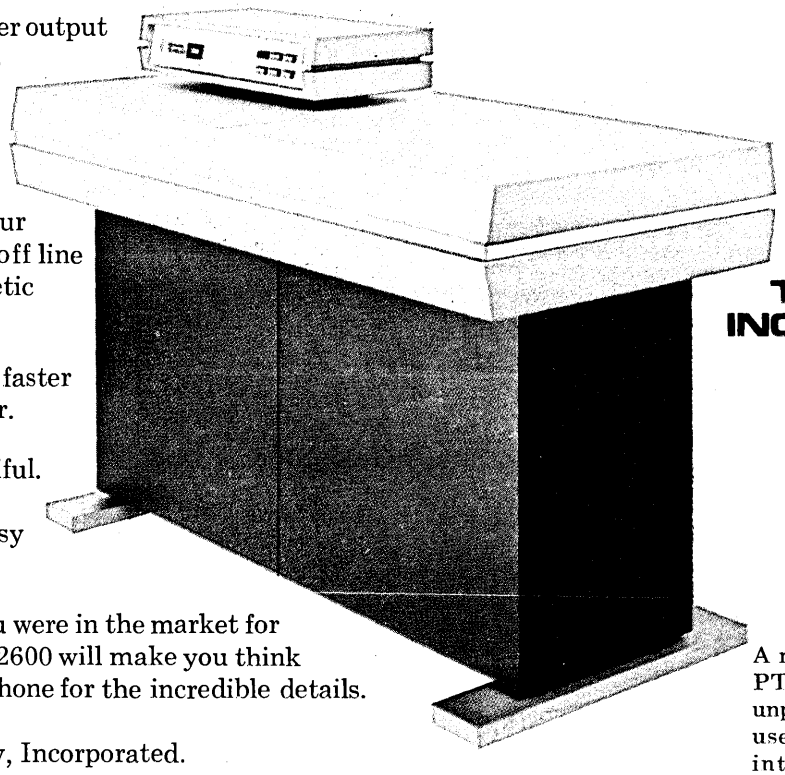

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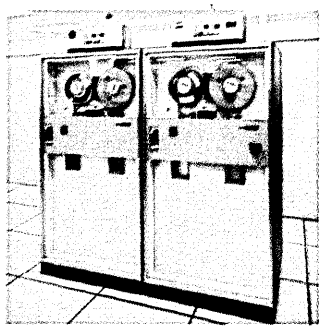


CIRCLE 144 ON READER CARD

ALSO SPRACH VON NEUMANN

CHAPTER THREE
by Eric Blodax

with illustrations
by
Stew Burgess

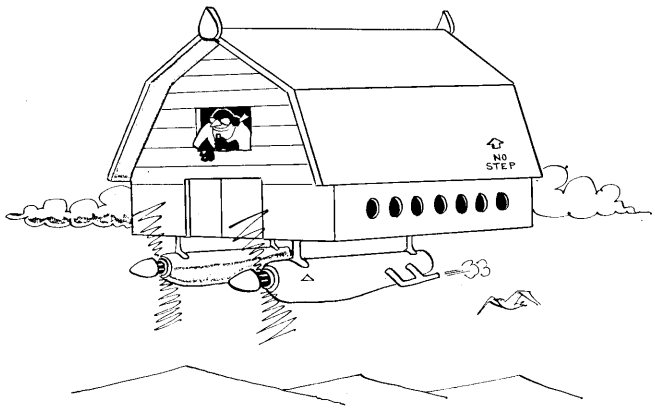
IN THE PRECEDING EPISODES: The Author, pursuing a career in the automative arts, is assigned to sundry ultra-modern computing tasks in the Airship Foundry. Here he develops a basic philosophy of life which is rather on the deep end of the shallow side. Progressing upward into skills based on use of ever-larger computing machines, he eventually becomes disenchanted with life at the Airship Foundry and determines to seek his fortune in the wide world. This he does by joining a large insurance cartel. In this rarified atmosphere he is given an opportunity for reflection and introspection, since there is a minimum of pragmatism and a maximum of arm-waving about him. After sufficient high-level thought, his batteries are recharged and he decides to rejoin the Airship Foundry world.

mens aequa in arduis

It was an exciting time of great changes at the Airship Foundry. The high-ranking senior management, some of whom were disturbed that people no longer came to work carrying glue pots and tack hammers, had taken what was, for them, a monumental and forward-looking decision. They had decided to build the Stratobarn, the world's largest, fastest, and most opulent passenger-carrying airship. Without doubt the *Stratobarn* would obsolete every aircraft in the commercial skies. The fact that ample orders were already booked for the Stratotruck, which looked exactly like the Stratobarn except for its blue windows and its giant aerial refueling hose, was beside the point. It was a fearless and forward-looking management decision, based on very low tooling costs.

Of course, in about three weeks, several members of the competition had announced their own new designs which just happened to look almost exactly like the Stratobarn.

As Jed Mote explained to me, the heat was on. Every possible means had to be found to get the Stratobarn into the air first, and to make sure that it was certified by the U.S. federal government as amply safe to carry passengers into the wild blue yonder. This was not a small task. For many long years the testing and certification of airships has grown like topsy. Many of the old timers at the Airship Foundry remembered with clarity the steely-blue eyes, crooked smile, and straight teeth of Flash MacIntyre, the company's first test pilot. Flash, clad in khaki breeches, leather puttees, a cowboy shirt and the silk scarf of the



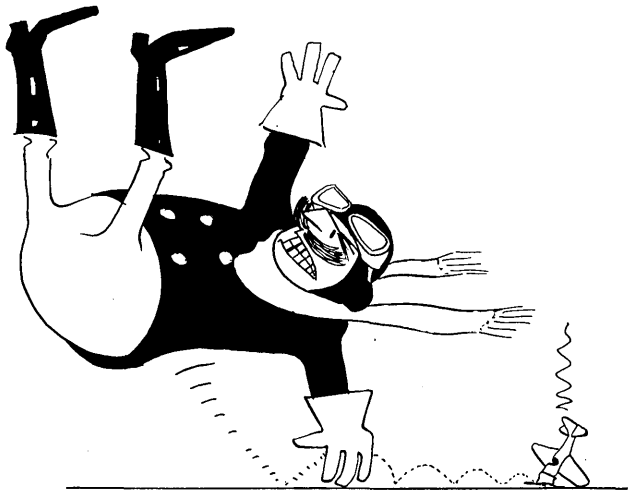
city's leading *fille de joie*, had taken aloft the XB-0, the foundry's first airship. Armed only with a pencil, knee pad, and a stopwatch for taking test data, Flash had put the tiny, overpowered machine through its paces, its Liberty engine hitting on three cylinders and belching blue smoke. Flash made a perfect, six-bounce landing, and taxied slowing into the hangar. As he climbed from the XB-0, Flash aimed his level gaze at the vice president, engineering.

(Continued on p. 94)

"The hell with it," Flash said, "I quit."

Flash's successor, Ernie Strafe, had crashed the XB-0 into a fertilizer plant, killing 83 people.

From these early beginnings the Airship Foundry had come to learn the overriding importance of proper testing



and ample test data taking. Modern airships like the Stratobarn went up with tons of oscillographs, many movie cameras, and teams of observers. They came down with truck loads of strip charts and film and paper records. Each such flight then required a month or so for large teams of sweaty ladies to wade through all the film and paper in order to extract the pertinent facts by hand.

All this Jed Mote proposed to change. Now that we had mastered the day-to-day mundane use of big computers, it was time to think about including the computer as a part of a larger "system" which performed manifold functions automatically in order to accomplish some much-needed job with big economic pay-off, like certification of the Stratobarn. Into the accomplishing of this task I plunged with vigor.

In taking charge of the Stratobarn data system, I inherited one programmer with previous experience on a big computer, two junior engineers with vast background in electrical system drafting, and, of course, the whole stable of sweaty ladies.

It was manifest that we did not have the in-house capability to build our own system, and therefore we decided to go after out-house capability. The first question was, capability to build what? By now the Airship Foundry had on order a truly giant IBM 704 which seemed fit to make the 701 look like a coffee grinder. Also we had available some recobbled equipment left over from one or more dead missile programs which could, if properly installed in the Stratobarn, do a fairly rush job of sampling all kinds of instruments and supplying something purportedly equivalent to the instrument readings to an analog tape recorder. Presumably, if we could figure out a way to extract the pertinent information from the analog tape, digitize it and write it on computer-readable tape, we could assign all the necessary smarts to the 704 and let it do all the orderings and calculations formerly assigned to the teams of sweaty ladies.

Having thought about these great truths, we approached the System Research Division of Radiovision Electronics, the noted builder of cut-rate car radios. We were met with open arms by Dr. Hashishian, director of the division. Actually, we were just what Hashishian was looking for. We provided him the opportunity to book what was for him a really-big system so that he could prove to the home office that they had not really made a mistake in going out on a limb to back his new division.

Over a period of several months we met regularly with Dr. Hashishian. We waded through great piles of interface designs, clocking device specifications, and preliminary wiring diagrams. Hashishian was being very bullish. There was no question, he asserted, that building the needed ground station equipment to take in flight analog tapes and to crank out edited digital tapes for computer processing was about as straightforward as falling off a log into the duck pond.

Finally the great design was jelled, and the corporate legal eagles gave their blessing to every jot and tittle of the proposed contract which would let Hashishian build our system. Jed Mote and I got on the airplane to Los Angeles for the great event of the formal contract signing.

When we walked into his office, the great Dr. Hashishian was not smiling. In fact, he looked most decidedly unhappy. It was odd that he should look so unhappy on such an auspicious occasion.

"Gentlemen," Dr. Hashishian said, "we have a slight problem."

The slight problem turned out to be that the home office of Radiovision Electronics had ordered Hashishian not to sign the contract. Apparently the high corporate hierarchy believed that the System Research Division was a West Coast funny farm, and that Hashishian was in enough trouble on his little contracts so that he ought not try for the chance to stub his toe on a big one.

We had been diddled. Four months of messing around with Hashishian had gone by and we had accomplished nothing. Meanwhile, the first flight date of the Stratobarn was four months nearer.

We went back to the Airship Foundry drawing board. While we had been messing around with Hashishian, a

new giant computing machine had been scheduled for delivery. This was the Univac 1103A, which was to become the first representative of its breed in the Airship Foundry.

We determined to be our own system builders and to forget Hashishian and his fellow disappointments. The 1103A looked like it had some features that would simplify our problem.

The earlier machines out of the St. Paul end of Univac had been equipped with sundry wonderful tape systems, but the 1103A was to be the first machine which made use of time-honored metallic tape out of the Philadelphia end of Univac. This particular tape had a logic which was most interesting, since it was able to read forward or backward, and it carried a clock track laden with "sprocket" bits which indicated the presence of every bit row. Thus ancient-style Univac tape was asynchronous, and the bit rows could be placed about as sloppily as desired. This meant that we could build our translation and digitizing ground station

without a clocking and formatting buffer. It could just squirt out data a bit row at a time, however it happened to come dribbling off the airplane record.

We started specifying the hardware we would need, and booking small subcontractors to supply parts of it. Some we released for building in our own shops. We also initiated a series of design conferences with Univac St. Paul.

This turned out to be a particularly poor time for design conferences with Univac St. Paul. They were hard pressed to meet schedules and fill orders, and about the last thing they needed was a series of conferences with some would-be Kludge builders, no matter how high-ranking.

just a few changes . . .

We had determined that we wanted Univac to modify the tape reading logic of our machine so that we could write long, gapless tapes, and still read them in blocks. Since there was considerable current doubt that the Philadelphia tapes would be interfaced to the St. Paul mainframes on time, the suggestion was about as welcome as bubonic plague. Also, we wanted Univac to supply a tape machine to us with its read and write speeds altered. This we would use for preparing tapes for the computer. Since the supply of tape machines was apt to be marginal for the first computer deliveries, this suggestion did not provoke joy.

We made our final convincing speech based on the noble effect of the Stratobarn on the travel economy of the nation and the world. A phone call into the Univac head shed from Joe Dix, the Airship Foundry engineering vice president, helped a bit, also.

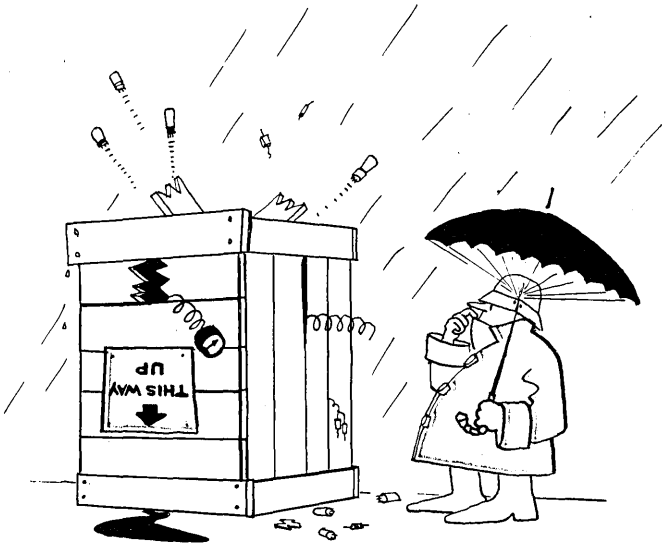
We started software in conjunction with the hardware effort. Troops of programmers went off to St. Paul to school, and came home to fall to at writing the rather monumental set of programs which we had planned to process test data from the Stratobarn. Meanwhile, we began to assemble hardware as it was completed and delivered.

One of the large pieces of hardware was a four-rack set of displays and graphic recorder which was built for us by Boston Applied Engineering and Manufacturing. In each instance we had sent shipping instructions covering packaging, palleting, and shipment by air freight. BAE & M decided that air freight was too expensive, so they shipped their assembled system part by rail freight. When it arrived at the Airship Foundry receiving dock it was extruding broken glass through the newly-formed apertures in the crate. Since the head second shift receiving idiot did not know whether he should officially receive it in such a state, he left it on the outer edge of the receiving dock where the rain percolated through it for two weeks while his paperwork notifying us of official unreceipt passed through the hallowed official poop mills of the Airship Foundry.

At last we had it delivered to the Stratobarn Test Center where we had a BAE & M field engineer standing by as the remainder of the crate was dismantled. We had bought four racks full of mashed vacuum tubes, ripped wires, and rusty metal. BAE & M spent two months and $40,000 rebuilding their equipment at our site.

Nor was all going smoothly with the programming. With the first flight of the Stratobarn looming ever closer, final checkout seemed most elusive. All the essential routines remained at 98% of final checkout for months while programmers issued new estimates and revised old excuses. One programmer in particular displayed the craft aberrations to the full. He became convinced that one particular instruction of the 1103A did not work and therefore wrote his own private subroutine to simulate it. He put this subroutine repeatedly in all his code until I caught him doing it. He also became well-known during this particular period of idiocy for inventing the now world-famous programmer's lament, "It's *got* to be machine trouble . . . "

There were other interesting problems. The Univac tape machine at our test site had its sensing arms controlled by means of two, black-painted tomato cans with slits in them which rode outside of two light bulbs. Each can, fastened by Allen screws to the shaft of the take-up arm, rotated with the arm, and a set of strategically positioned photocells peering at the slits in the can determined when and in which direction to crank tape. When we experienced a tape break, which happened even with metal tape, the arms hit the stops with considerable impact and the tomato cans twisted around out of their canonical positions, causing the can slits to aim in various random directions. There were two interesting results of trying to write tape after such an event. In the first mode, the machine snapped the tape up completely tight and tried its best to rip it in two. In the



second mode, the machine rapidly dumped all available tape on the floor in a monumental heap, completely unloading both reels.

Also, we seemed to have an undefined garbage factor somewhere in our translating machinery. What seemed to be perfectly valid airborne records written on digital tape appeared to be utter gibberish to the computer.

However, Univac had a most useful "developing fluid" for metal tape. When one dipped the tape in this liquid slurp, the recordings became visible as tiny dots on the tape surface. Unfortunately such tape could not subsequently be used for reading by the computer.

One bright young engineer named Fred became quite adept at spending hours reading developed tape in the optical comparator. He got almost as fast at it as the 1103A was, and he proved to be our greatest trouble shooting asset until he was called off to help with the Korean War.

heal thyself

There were long nights of trial and checkout on the computer. The 1103A was the descendent of a line of computers which had originally been based on magnetic drum logic. While the 1103A had ample core memory, it was still rather drum-oriented. The designers had included a spectacular green-faced cathode ray tube which continually displayed bit patterns of information resident in mem-

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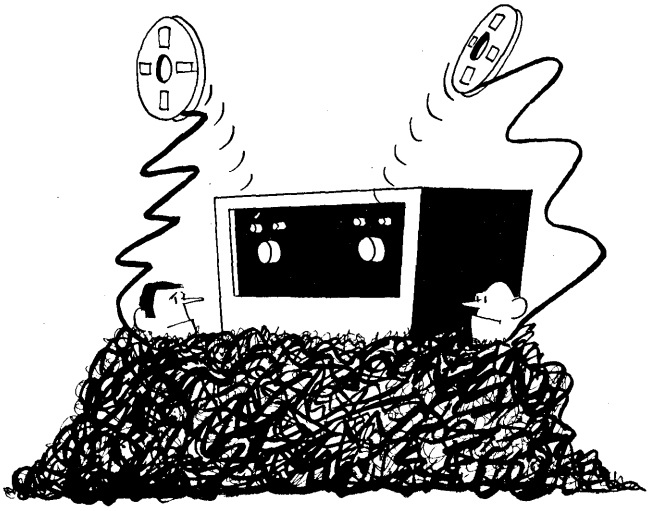
CIRCLE 12 ON READER CARD

ory. It was not exactly clear of what value this scope was as a diagnostic tool, but it certainly looked impressive. We discovered that we could indeed detect certain modes of bewildered operation or aberrations of input data by watching the over-all patterns on the scope as the computer tried to go about its business.

Also, the computer was fitted with a Bull card punch, made in France. This punch, or its interface, were sometimes given to erratic operation, and the punch had a habit of punching a card in the middle of some operation which



required no card to be punched, and this invariably blew the program in operation into a state of idiocy.

One of the most spectacular of the operating nights on the 1103A came on that occasion when a giant thunderstorm hovered over the Airship Foundry. The electrostatic charges in the air kept putting extraneous bits into core, causing us to undergo numerous restarts. Finally there was a most spectacular set of lightning flashes, followed by instant deafening thunder. The green scope of the computer took on a magnificent pattern which obviously depicted the inside of a maniac's mind. The Bull punch responded instantly, punching its entire hopper load of cards completely full of garbage and dumping them on the floor. The overflow light came on, and the machine gracefully shut itself off the air.

Finally the day came when the Stratobarn rolled out for its maiden test flight. Half the city came to see it take gracefully to the air, belching smog upon the sylvan landscape. As it landed we prayed that the tape recorders had failed so that the whole debacle could be blamed on the instrumentation engineers. There was no such luck. The giant flight tapes were loaded into our data translation equipment, and we proceeded bravely to digitize data.

It was about midnight when we got to the computer. We loaded the master control program while Jim, who had written the tape read-edit routine, hid under his desk. We loaded the data tapes, and the chief operator, with trembling fingers, loaded the GO routine. The data tapes spun while the green scope displayed smooth patterns.

When the first output tape was full we went anxiously to the off-line printer. The type wheels clattered into action, and the paper began to move upward rapidly. We had beautiful data. After two years of herculean effort and dogged application of applied ignorance, we had met our goals. We were on the air with a data system that worked.

(To be continued.) ■

COMPUTING IN SOUTH AMERICA

eager but skeptical

by Barry W. Boehm

Brazil—a Brazilian executive for an American computing firm: "There's a terrific shortage of programmers and especially system analysts. We train our own; it takes about 12-18 months. Then we assign them to a customer, and cross our fingers. Because if they're any good, the customer immediately offers them a 50% raise to work for him."

Peru—a university professor: "Sometimes the student activists spark some useful academic changes. The math department here used to be very pure, very rigid. But the engineering students applied enough pressure to force them to hire some applied math professors and start an applied math program. Some of the purists resigned in disgust."

"Until recently, government funds for research were almost nil. But with the New Nationalism and the drive toward more self-sufficiency, our indigenous research programs are beginning to pick up, especially in computing. But they're still at an awfully low level."

Argentina—an engineering student: "It's hard, because the professors aren't around that much. The better ones try, but they have to take other jobs to make ends meet."

"If you want to learn computing, you've got to know English. There's hardly any computer literature in Spanish."

Argentina—an information processing specialist: "But why should we cooperate with your NASA on a data base for this earth resources satellite? How do we know you're not just setting up for another round of exploiting our natural resources?"

Peru—a government planner: "We'll have to automate to some extent, but I hope we can keep it under control. Otherwise, we'll lose our tradition of craftsmanship, which is not only part of our national identity, but also one of the few unique commodities we have to offer the world."

Colombia—a computer center director: "Thirty local companies got together and formed this special corporation

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to provide them computing services. We'll have four separate cost centers: computer time, keypunch-type services, system analysis, and training. The companies can sign up for as much of each as they need, and we'll adjust to keep up with the demands. Also, we have good working relations with the local university people, who helped set this center up."

Brazil—a university professor: "We had 1340 students in our computer courses last year; this year it'll be close to 2000. Our graduate program in computer sciences now has 23 full-time students; they get courses in automata, compilers, data structures, and the standard courses like numerical analysis and programming languages. Also, we have seminars in advanced topics such as graph theory and artificial intelligence. Our big need is for more direct contact with the people doing advanced research in the U.S. and elsewhere."

Colombia—an American visiting professor: "Actually, being 'less-developed' gives the Latin American countries a tremendous opportunity. They're generally not burdened by huge capital investments in semi-obsolete equipment and procedures—take our communications system in the U.S., for example. They can 'leapfrog' over the U.S. and install a digital-based microwave communication system better than we'll have for quite a while. Government information systems are another example. The big danger is that we, and they, may view progress only in terms of their catching up with what the corresponding U.S. system looks like at the moment."

The quotes above are an attempt to provide at least a fleeting impression of the scope and diversity of South American computing trends, and of the similarities and differences in the ways in which the cultures of South America and that of the U.S. are adapting to the bewildering onrush of computer technology. They are a small but representative sample of the conversations I held with computer people in Argentina, Brazil, Peru, and Colombia during a three-week trip to those countries in October, 1969. The rest of this paper will compare my impressions with other observations of computer use in South America, and provide some thoughts on ways to improve the transfer of computing technology to South America from advanced centers such as the U.S.

Table 1 gives a rough idea of the computing resources of most of the South American countries.[1] The data for Argentina and Chile are from Finerman's 1968 paper[2]; those for Venezuela are from a very thorough 1967 report by the Venezuelan computer society[3]; the rest are my estimates, based on the responses I got by asking the local computing people (for Argentina, the results were consistent with Finerman's). The figures yield some interesting information, including:

1. A remarkably constant ratio of about 10-12 computers per billion dollars of GNP (the corresponding ratio for the U.S. is about 80);
2. A fairly consistent percentage of a country's computers in universities of about 10%;
3. A lack of really large-scale computers;
4. A market dominated by U.S. manufacturers, particularly IBM.

An estimate of total computing power (measured in additions per second) in South America is roughly 1% of that in the U.S., with a growth rate of close to 100% per year likely to hold for the near future.

Beyond the data given above, this survey will be necessarily subjective and impressionistic. To give some depth and order to the impressions, I will present some snapshots of five centers of computation which are either typical or especially significant representatives of their areas:

1. An advanced university center: the Pontificia Universidade Catolica in Rio de Janeiro, Brazil; *(Cont. on p. 102)*

[1] Ecuador, Paraguay, Uruguay, and the descendants of the Guianas (Guyana, Surinam, and French Guiana) are missing. Their combined population, GNP, and probable computing capabilities are roughly equivalent to and not significantly greater than those of Peru.

[2] Finerman, A., "Computing Capabilities at Argentine and Chilean Universities," *Comm. ACM 12*, 8 (August 1969), pp. 425-431.

	Argentina 1968	Bolivia 1969	Brazil 1969	Chile 1968	Colombia 1969	Peru 1969	Venezuela	
							Installed 1966-67	Planned 1967-68
Total computers	< 200	8-10	300-400	< 50	60-75	30-40	92	120
Largest computer (number)	GE625	360/40	360/50	360/40	360/50	360/40	IBM 7074 (2)	360/50 (4)
Next largest (number)	360/40 (10)	360/20	360/40 (15) B3500 (10)		360/40 (8) B3500 (2)	360/30 (7)	360/30 (8)	360/40 B3500
Largest on order (number)	360/50		360/65 (3)	360/40	360/50 (4)	360/40 (4)	360/50 (4)	
Chief manufacturers (% of market)	IBM GE/Bull NCR Burroughs	IBM	IBM (60-75) Burroughs (20-35)	IBM Burroughs NCR	IBM (90) Burroughs	IBM (> 90) NCR	IBM (85) NCR (6) Univac (6) Burroughs (3)	IBM (89) Burroughs (6) NCR (3) Univac (2)
Computers in universities	11	2	~ 30	6	~ 8	4	5	10
1967 Population (millions)	23.3	3.8	85.7	9.1	19.2	12.4	9.4	9.4
1967 Gross National Product (billions of dollars)	18.7	0.7	27.7	5.1	6.2	3.3	7.9	7.9

Table 1 Computing resources in South American countries

What's a Honeywell 1648 Time-Sharing System?

It's FORTRAN IV: Hollerith strings; mixed mode arithmetic; memory-to-memory format conversion; octal constants; file I/O with six concurrent files; dynamic file redefinition; random files; time functions; compile and go; AND, OR, EXCLUSIVE-OR functions; program trace; item trace; object files.

It's BASIC: extended matrix, string, file I/O with six concurrent files, dynamic file definition, external subroutines chaining, time functions, trace, compile and go, data format statements.

It's 48 simultaneous users, random files, tape files, project accounting, 960 subscribers, many active temporary files, dedicated or dial-in ports, password files.

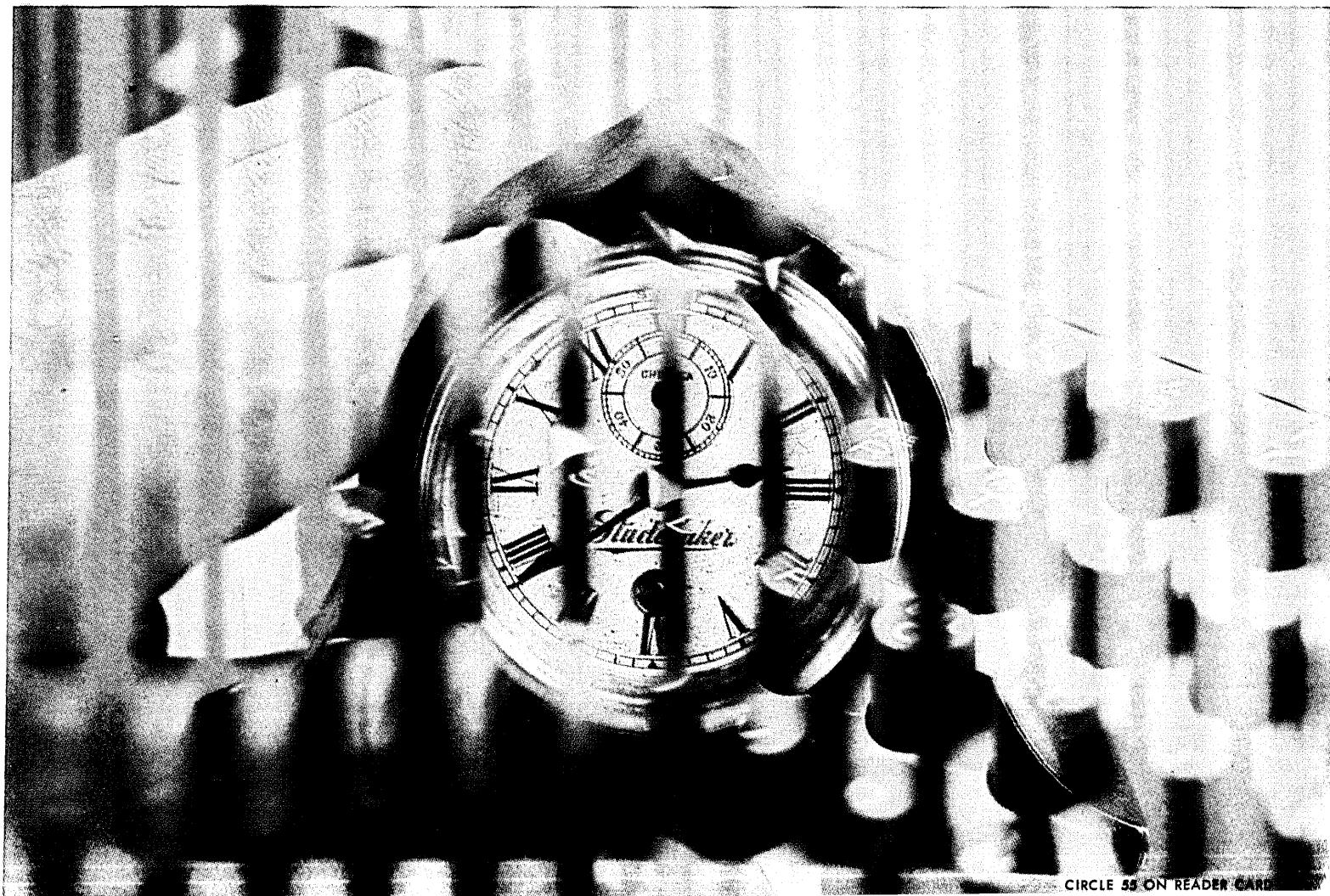
It's an applications library of programs: business and marketing, curve fitting and regression, general education, electrical engineering, financial, general engineering, mathematics, mechanical engineering, operations research, social science, statistics, general purpose utility, general purpose scientific, etc.

It's over 30 commands. It's EDIT. SOLVE. TEACH. It's the best in cost/performance.

It's worth finding out more about: the H1648 Time-Sharing System. Buy or lease? Write Honeywell, Computer Control Division, Framingham, Mass. 01701. Can't use a whole one? Rent a piece of one. Write Honeywell, Information Services Division, Minneapolis, Minn. 55408. But whatever you do, consider the alternative. Consider Honeywell.

The Other Computer Company:

Honeywell



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2. A smaller university center: the Universidad Nacional de Inginieria in Lima, Peru;
3. A scientific center: the Comissao Nacionale de Atividades Espacais in Sao Jose dos Campos, Brazil;
4. A commercial center: The Centro Información y Computo S.A., in Cali, Colombia;
5. Government computing: Venezuela.

The Pontificia Universidade Catolica (PUC) in Rio de Janeiro, Brazil, has probably the most advanced computer sciences department in a South American university today. The campus is beautifully situated in a residential section of Rio, bisected by a wooded stream and backed by one of the steep, individual mountains which are scattered so generously about Rio. One drawback to this location is that expansion is difficult; the computer center is located in a new high-rise building right next to the side of the mountain.

The computer center contains an IBM 7044/1401 system and an IBM 1130; these have succeeded a Burroughs B205 installed in 1960 and a B200-B300 system installed in 1964. Formal computer-related courses consisted solely of numercial analysis until 1965, when FORTRAN programming was added. In 1967, graduate courses in advanced programming and logical design were established, followed in 1968 by the creation of the computer science department (departmento de informatica) and the addition of several more courses. These included introduction to computer science courses, one for social sciences students and one for physical sciences students; graduate courses in computer systems, compilers, list processing, and data structures; and seminars in automata and assembler design. In 1969, these seminars were converted to graduate courses, a graduate course in simulation was added, and new seminars established in artificial intelligence, formal languages, and graph theory.

In 1967, when the graduate program began, there were seven faculty members (one with PhD, two with MS, four with BS), seven graduate students, and 500 undergraduates who took a regular course in computers. In 1969, there were 18 faculty members (three with PhD, 10 with MS, five with BS), 23 graduate students, and close to 2000 undergraduates taking a regular course in computers. Significantly, seven of the faculty members with MS degrees have obtained them at PUC. Other degrees were primarily from MIT or the University of Waterloo in Canada, with which PUC has a reciprocal agreement.

The faculty members I met were quite impressive. In keeping with the warm climate of Rio, they were casually dressed in sport shirts. But it was evident that they spent a good deal of time keeping up with the literature in the U.S., and they asked a number of penetrating questions on such topics as the economics and software aspects of computer graphics, American experiences in time-sharing with OS/360, and integrating formula-manipulation capabilities into FORTRAN. This last was an area in which they had already implemented a working system on their 7044 FORTRAN compiler. Furthermore, they were quite active professionally, in coordinating their program with local industry and government, and helping to organize an upcoming Brazilian National Computing Conference. They were quite happy with the contact stimulated by their reciprocal agreement with Waterloo. Also, they were hoping to establish similar programs with American universities, and in general to increase their direct contact with advanced computer researchers in the U.S. and elsewhere.

Not many South American universities are at the same advanced level of computer sciences as PUC. The University of Sao Paulo, with a Burroughs B3500, an IBM 360/44, and an IBM 360/65 on order, has an extensive program and is particularly strong in engineering. The University of Chile has also evolved a strong computing program, with an IBM 360/40 and courses including information systems, simulation, and statistical data analysis. But, although some have promising plans, the general pattern in other universities today is a service-oriented computer center with courses in numerical analysis and perhaps FORTRAN.

Like PUC in Rio, the National University of Engineering in Lima, Peru, also has a steep mountain for a backdrop. But there the similarity ends. Here, everything is dry and dusty; it hasn't rained in Lima in 20 years. Instead of green forest, the mountain carries white-painted slogans: "Che Guevara—Lucha Armada (Che Guevara—Armed Battle)." These are echoed by further student battlecries painted on the university walls and even on the buildings themselves: "Reforma Universitaria o Muerte (University Reform or Death)."

But even the activists here see university reform as somewhat less than a life-and-death struggle—at least according to the students I spoke to, who tended to be busier being students and earning their keep than fomenting political activity. However, even with them there was a healthy appreciation of student power; this is the institution in which student pressure reoriented the mathematics curriculum.

The computing center at this university has an IBM 1620 and some tab equipment. Along with a course in numerical analysis, FORTRAN is taught to and used by students, but the engineering and scientific applications are written mostly in machine language for execution speed and storage efficiency. These applications include calculations of radio communications propagation throughout Peru, roadway design factors, and architectural structures, generally using standard numerical techniques. The 1620 is also used to do accounting for the university and some other government agencies.

For the future, the university has an IBM 360/40 on order for 1970 and hopes to have a computer sciences curriculum by 1971; some professors are busily studying U.S. university catalogs and ACM guidelines. The university has an informal agreement with Iowa State University in the U.S.; many graduate students go there for training. Also, the Peruvians send computing graduate students to the University of Chile.

But progress will be slow, because many of the professors work only part time, and the low pay scales require them to find other jobs, often only slightly related to their teaching specialty, such as COBOL programming at a bank. A government program to provide research grants is in its early stages with the creation of a national commission on scientific research. This would be an excellent way to build toward a full-time staff and a strong research program, if enough funds become available and a high standard of research could be defined and maintained. Here again, professors in the computing field feel the need for more contact with North American and European computer specialists in order to achieve this standard.

Here at the Peruvian National University of Engineering, as in similar centers such as the University of Campinas in Brazil and the Universidad del Valle in Cali, Colombia, I was impressed with the infectious enthusiasm of the students and younger professors in computer sciences. They were willing to overcome the barrier provided by my limited Spanish and almost nonexistent Portuguese to ask no end of questions on computer developments in the U.S. In the

smaller centers, the questions tended to be more applications-oriented and general (How is PL/I doing? What is APL?), with a healthy interest also in social implications of new computer technology.

The Brazilian space agency, Comissao Nacional de Atividades Espaciais (CNAE), was established in 1963 in a campus-like setting just outside of San Jose dos Campos in the temperate Brazilian highlands, about 50 miles east of Sao Paulo. Externally, the site looks like a smaller version of one of the newer NASA centers in the U.S., say Goddard or Houston, with modern buildings interspersed with stretches of grass and improbable-looking communications antennas. Internally, the buildings are even more impressive, with well-stocked laboratories and generous but tasteful uses of high-quality Brazilian tile and hardwoods. The technical staff of about 140 is also highly competent; the scientific director is considered a good administrator by the staff and is internationally known as a realistic, technically sound leader in his efforts to achieve a satellite-aided educational-communications network for Brazil.

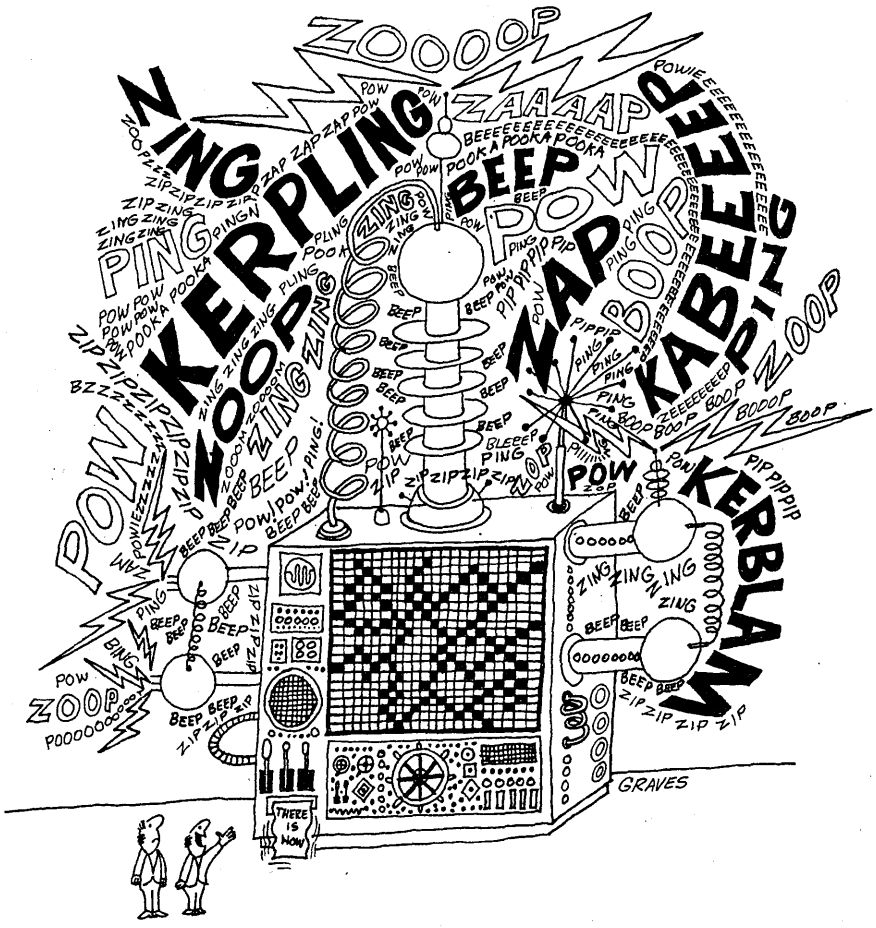
The computing center contains a Burroughs B3500, with fairly standard peripheral equipment including a CalComp plotter, and has a total staff of about 30. About 75% of the programs are written in FORTRAN, many by open-shop engineers and scientists, for solving problems in space-flight mechanics, structures, aerodynamics, and the like. These generally use standard textbook numerical analysis techniques, although some of the more ambitious programs, such as one for heat transfer calculations, require some extensions and specializations of the standard techniques and also require much of the code to be written in assembly language for efficiency.

In addition, there are administrative data processing programs written in COBOL, and a good deal of telemetry data reduction from U.S. scientific satellites reading out to CNAE when over the Southern Hemisphere. For the most part, the CNAE people do their own systems programming. They seem fairly happy with the B3500 and the Burroughs support, although a couple wish they could get their hands on a DEC PDP-10. There seems to be little opportunity or effort to realize any advantages from users' groups.

I drove back and forth to CNAE from Sao Paulo with a young Burroughs system analyst who makes a weekly trip there as the primary Burroughs representative. As the CNAE people are largely self-sufficient, his duties there tend more toward public relations, but his other activities involve him in enough design and analysis work to keep the job technically interesting. He has a BS degree in electrical engineering, and during his last year of school he participated in an 18-hour-per-week Burroughs training program in basic computer hardware, operating systems, and system analysis, culminating in the system analyst job with Burroughs, which began with further on-the-job training. Most of his contact with advanced computer concepts comes from the Burroughs people sent down from Detroit and Philadelphia to explain new hardware and software products. There is relatively scant opportunity for him to travel the other way. There is a strong esprit de corps within Burroughs-Brazil—which is essentially completely staffed by Brazilians—in their campaign to extend their share of the computing market against the strong competition of IBM. But outside of this, there seems to be little feeling of a general computing profession with which to identify. User group and professional society activities are almost nonexistent. If an interesting job opportunity came along in another field, he would have little motivation not to take it.

Cali is the third largest city in Colombia. Its population in 1950 was 284,000; now it is over 800,000. Located in the rich Cauca Valley and blessed with an ideal climate, it is the center of a highly productive agricultural hinterland. Although much of the city's activity is related to processing sugar, cotton, fruits, and other agricultural and livestock products, Cali is also a growing industrial center with sizable chemical, pharmaceutical, and rubber tire plants.

Up to now, computing in Cali has been confined to a couple of IBM 1401's. To meet future demands, 30 of the largest corporations in Cali have banded together to form a unique cooperative service bureau. This is CICSA (Centro Información y Computo, S.A.), a separate corporation



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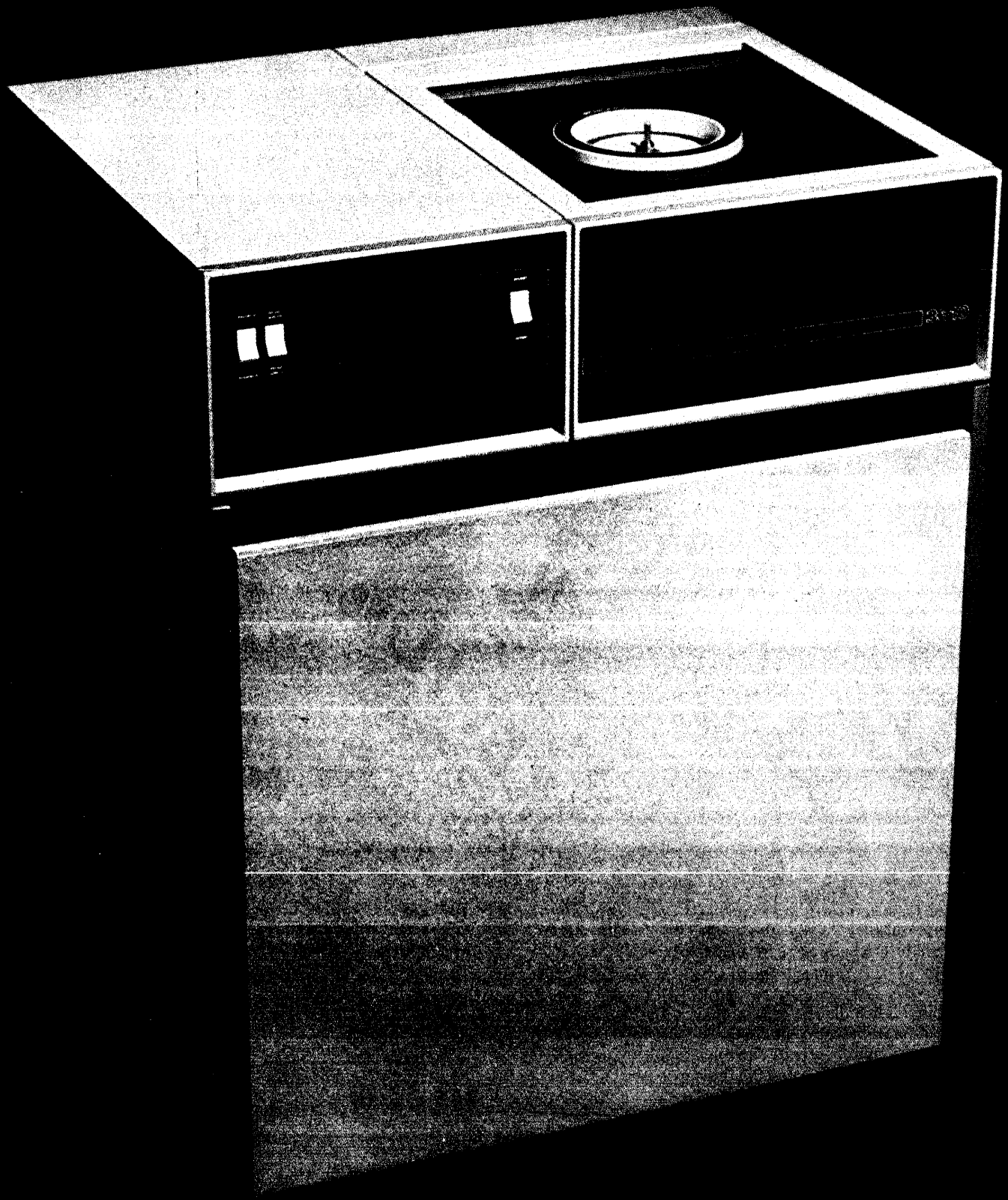

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whose stock is wholly owned by the 30 cooperating companies. Its charter is to provide computing services at competitive rates to these companies, and to others as the opportunities permit.

The capital provided from the stockholders allows CICSA to evolve in a fairly orderly fashion. Some thought was given at the beginning to a remote-access time-sharing system using an IBM 360/50 or a Burroughs B5500, but CICSA (wisely, I think) resisted the temptation and chose a batch-oriented Burroughs B3500 as its first configuration, to arrive in February, 1970.

Service on the machine will be provided at essentially fixed rates based on expected long-term demand; this provides the advantage of better price stability at the expense of perhaps not showing an immediate profit. Three other services will be provided by CICSA, each being operated as a separate cost center: keypunch and tab services, system analysis, and training. Thus each cooperating company can develop an internal edp competence at its own rate and, at least according to the plan, CICSA will have enough resources and flexibility to accommodate the diverse needs and plans of the companies, which range from banks and office-equipment firms fairly experienced in data processing to relative novices in the agricultural processing field.

The organization is fortunate in having a Colombian manager with a warm, outgoing personality and lots of contacts and edp savvy picked up from years as a systems analyst, programmer, and installation manager at such firms as Pan American and W. R. Grace & Co., both in Colombia and the U.S. In October, 1969, his staff consisted of four people, but he has been recruiting further, with apparently good success, for 8 to 10 experienced people who will arrive soon. In addition, he seems to have good rapport with his stockholder-customers, and strong ties with the engineering and information sciences staff at the local Universidad del Valle, whose dean of engineering, a Colombian doctoral graduate of MIT, was one of the key catalysts and motive forces in the establishment of CICSA.

The progress of CICSA in the next year or two deserves continuing scrutiny. If successful, it would prove an excellent model for similar edp operations in the commercial, and perhaps even governmental, sectors of developing nations. There will be difficulties: peak load problems, lack of local backup for the B 3500, pressures from cooperating companies with national affiliates having different edp policies, and the fact that some of the cooperating companies are commercial competitors.

But, as many companies in Colombia and similar nations have found, the alternatives are generally much worse. Getting one's own small machine is a continual uphill battle against economies of scale and personnel shortages. Signing up with a service bureau exposes one to the frustrations of lack of control over priorities, configuration changes, personnel reassignments, and installation operational procedures. Even in its current embryonic state, CICSA looks like a sounder model for commercial edp operations in developing nations.

Due to geography and oil, Venezuela has closer computer contacts with the U.S. than other South American countries. But the Venezuelan government computing situation, described in a thorough report in 1967,[3] is still fairly typical of government computing elsewhere in Latin America.

The computing centers in the various government agencies had sprung up in response to internal agency demands for data processing, with very little centralized coordination. Some were called "computer centers," some "electronic centers," some "data processing centers," some still "mechanical tabulation division." Their places in the organizational structure were equally diverse; sometimes they reported to the general director of the agency, sometimes to assistants for finance, plans, or administration.

Eight of the 13 executive ministries (agriculture, communications, education, etc.) had computers, as did 14 other government agencies (Social Security, national banks, etc.). Most of these were IBM 1401's, with IBM 360/30's on order or under consideration. The government computer rental budget was about $300,000 a month and was growing about 27% per year. But, although this was about 40% of the total computer rental budget for Venezuela of about $750,000 a month, the lack of coordination between agencies gave the government very little leverage in dealing with suppliers, influencing training and education policies, or promoting interagency information processing. However, the Council of Ministers had taken a first step toward coordination by the formation of the Consulting Committee on Computation. This committee advises on the selection, acquisition, installation, and management of data-processing equipment, and on the selection and training of personnel.

There is a chronic personnel shortage. One familiar reason is that government edp people are generally underpaid. As of 1966, the average government "programming supervisor" was paid about $900/month, with none making more than $1150/month. Yet for some companies the *average* salary for comparable employees was $1300-1500/month. Thus the government serves a useful function as a training ground for programmers, but the better ones soon leave for more attractive positions elsewhere.

I would like to discuss now some general policy considerations for aiding technological development.

As is often the case elsewhere, the first generalization is to beware of generalizations.[4] Social and economic conditions within the various South American countries are rarely uniform, and striking differences exist between countries. Still, in computing there is a surprising uniformity and intensity in the eagerness to learn and apply the latest American techniques (exceptions: the entrenched conservatives in some government, commercial, and university centers), and a general agreement that practically all the significant advanced computer work is being done in the U.S. (exceptions: WATFOR, SIMULA, etc.) Also, as the Southern Hemisphere is somewhat out of the mainstream of world affairs, there is a general tendency toward disengagement from affairs outside the country's boundaries, which comes as a surprise to people from more "mainstream" countries. This tendency to "tend one's own garden" also manifests itself in a somewhat skeptical curiosity towards international altruists.

The primary problem in South American computing is a shortage of trained personnel. Thus, for example, a program to provide computer hardware without provisions for train-

[3] *Inginieria de Computacion*, Asociacion Venezolana de Inginieria de Computacion Electronica, Caracas, November 1967.

[4] Along this line, my lack of first-hand experience makes it impossible for me to say how relevant these conclusions are to computing in the developing nations outside South America or to other technological fields within South America.

ing the necessary software and maintenance personnel would create more problems than it would solve.

Another major problem is the limited contact with advanced research and applications in computing. There is very little travel either way between computer people in the U.S. and South America, very little computing research going on in South America outside of numerical analysis, and very little computing literature in Spanish or Portuguese. This has two unfortunate consequences, often mutually reinforcing. One is that infeasible computing projects are adopted due to lack of perspective on their real difficulty, often ending up as major disasters. The other is a tendency to be intimidated by the spectre of disaster, resulting in a failure to begin many feasible and worthwhile computing projects.

A third major problem is the fragmentation of computing resources, resulting in hardware diseconomies of scale and inefficient use of scarce personnel.

why bother

Why should one commit resources to aiding computer technological development rather than other undertakings? Here are a few reasons:

The inevitable prominence of computerized information processing in South American countries. Some of the key national decision-makers we will be dealing with in the 1980's are programmers or system analysts right now. In general, the growth rate in South American computing is comparable to that in the U.S., and will continue to outpace a country's over-all growth rate for many years.

Computing helps people. Goals involving a better living and more self-determination for South Americans are virtually impossible to achieve without good data, and without some people who can deal with both computer-based quantitative analysis and local unquantifiable factors.

Learning computing helps people. A person who has learned to flowchart has learned to organize a little better. A person who has written and run a computer program has created an environment over which he has total control. There aren't many comparable testing-grounds for personal initiative within many South Americans' normal range of experience. A person who has debugged a program has learned the necessity of making plans thoroughly. Also, as one can't learn Spanish without absorbing some of the Spanish-Latin culture, so one can't learn FORTRAN without absorbing some aspects of a scientific, cause-and-effect world-view. An "IF" statement branches three and only three ways; there is no "quizás" (perhaps). Fortunately, common sense keeps people from going overboard in viewing the world as a FORTRAN program.

We have something to offer, at least right now. South Americans look to the U.S. for their computing hardware and techniques. But there's no guarantee that our technological edge in computing will last forever. Maybe in 20 years the world computer industry will look more like the world shipbuilding industry, and the U.S. will need all the friends it can get.

We can help reduce misconceptions. Computer people in South America bear especially little resemblance to the common stereotype of "mañanaism." Computer people in the U.S. bear especially little resemblance to the common stereotype of imperialism. And people don't really seem to be that different. Some Americans wonder at the popularity of religious pageantry and the confessional, even among highly educated South Americans. But some South Americans wonder equally at the popularity of astrology and "sensitivity training" among highly educated people in the U.S.

However, such social considerations make it especially important that computing aid programs carefully project their probable impact on other components of society. Automating handicraft industries would be in many cases an extremely shortsighted policy. So would policies which diluted the effectiveness of existing programs, such as SENA, Colombia's outstanding vocational-training agency.

Assuming we accept that the advancement of South American computing competence is a good thing for both the U.S. and South America, what specifically can we do? Here are some suggestions.

What can South American governments do? Finerman's report[2] contains some good suggested policies for South American governments, especially with respect to universities. These include relaxing the formidable (up to 50%) customs duties and import restrictions on computing equipment; providing more funds for computer education programs, travel, and computer-oriented research and development in universities; implementing regional computing centers; and overcoming conservative faculty attitudes. One particularly helpful measure would be to supply research funds in such a way as to make a full-time job out of a university professorship.

Outside the universities, South American governments can do more to discourage fragmentation of computing resources both in the commercial and government sectors. Within most of the governments, more centralized coordination of edp system selection, acquisition, installation, and management are needed, along with better pay scales for edp personnel. And in the general use of computers, the government should be alert to the possibilities of "leapfrogging" counterpart systems in the U.S. for such capabilities as microwave or satellite-based digital communications, advanced agricultural resource-management systems, or computer-aided instruction.

What can the U.S. government do? Although the U.S. government may supply initiative for some U.S.-aided South American computing projects by pointing out to South American governments the potential value of the project or the adverse implications of existing policies, the ultimate responsibility and authority to initiate the project belongs to the local government. Within this role of supporting the South American government's computing assistance program, what can the U.S. government do?

One possibility is to extend Peace Corps participation in computing fields. Another is to support a program of U.S. graduate internships at South American universities such as that proposed for AFIPS sponsorship by professor Harry Huskey of the University of California—Santa Cruz. A significant step in this direction has been taken in the field of chemistry with the National Academy of Sciences Overseas Research Fellow program in Brazil.[5] Another useful step would be to provide more incentives for South American graduate students in the U.S. to return to their country after receiving their degrees.

Another possibility is an extended "technology utilization" program to transfer U.S. experience in computer system evaluation and management, software engineering, and data management. The current edp assistance program within our Agency for International Development is helpful on its limited scale, particularly in data collection and statistical analysis for government agencies, but it could be much more helpful with broader and deeper coverage. For example, it could feature more reciprocal visits by edp

specialists in the U.S. and South America, and improved access to U.S. software repositories such as SHARE and NASA's COSMIC. Once again, though, the local anomalies and "leapfrog" possibilities should be carefully thought through before stretching South American programs to fit current U.S. software or procedures.

What can U.S. universities do? As mentioned more than once in the text above, people in South American universities need more personal contact with advanced computer scientists in the U.S. in order to improve their effectiveness in establishing research and teaching programs in computer sciences. U.S. universities can be of great benefit here by forming and exercising reciprocal agreements with South American universities to exchange students and professors.

But there are some other less obvious policies that would help, also. For example, one very useful policy for U.S. universities would be to accept languages such as Spanish and Portuguese in fulfilling requirements for advanced degrees. Language requirements for advanced scientific degrees were established when Americans had a lot to learn from France and Germany. Now, especially in computing, this is rarely the case. But this doesn't mean that language requirements should be dropped altogether; rather, they should now reflect the fact that the American PhD will use his foreign language more as a teacher than as a learner, and that the computer scientist who knows Spanish or Portuguese, or Korean, will generally do more with his language than the one who knows French or German.

What can U.S. computer manufacturers do? Given the rising tide of nationalism, a tremendous competitive edge will accrue to the first computer manufacturer who approaches the South American country with a "30-year plan" which guarantees to train people and plan local operations so that total ownership is assumed by the employees and local investors by the year 2000. For the next 30 years—or at least until competitors followed suit—the company would enjoy greater security from expropriation or other adverse government policies, more highly motivated employees, and the foundations for better relations with local-company and government clients. True, the U.S. company shows no direct profits after 2000, but the accumulated personal relations and investments in hardware and software provide a strong position for future sales. In any case, there is a much lower risk to worry about along the way.

What can foundations and professional societies do? One useful project would be to stimulate authors of popular English-language textbooks to spend some time at a South American university with the goal of producing and publishing a Spanish or Portuguese version of the book, perhaps as a joint venture with a publishing house. Another would be to support U.S. graduate student internships in South America, or sabbatical years in South America for computer people in U.S. industry.

Computer society activities in South America need more support in order to advance the professional identity of computer people there. Occasional computer conferences at the national level and at the Latin American or Western Hemisphere level would serve a number of useful purposes also.

What can individual computer people do? Of course it isn't the only thing you can do, but here's a possible three-step plan:

1. Take that next European vacation in South America instead. It's a surprisingly beautiful, friendly, and dynamic continent.

2. Drop by some local computing centers on your way. It helps to have arranged this beforehand but, even on a casual visit, there will generally be someone who speaks pretty good English and appreciates the opportunity to talk shop with someone from the U.S.

3. Play it by ear from there. Even if it's just sending along an occasional technical article and exchanging Christmas cards, there's no telling what may eventually develop. At the very least, you will be proving gringos are people as well as computer experts! ■

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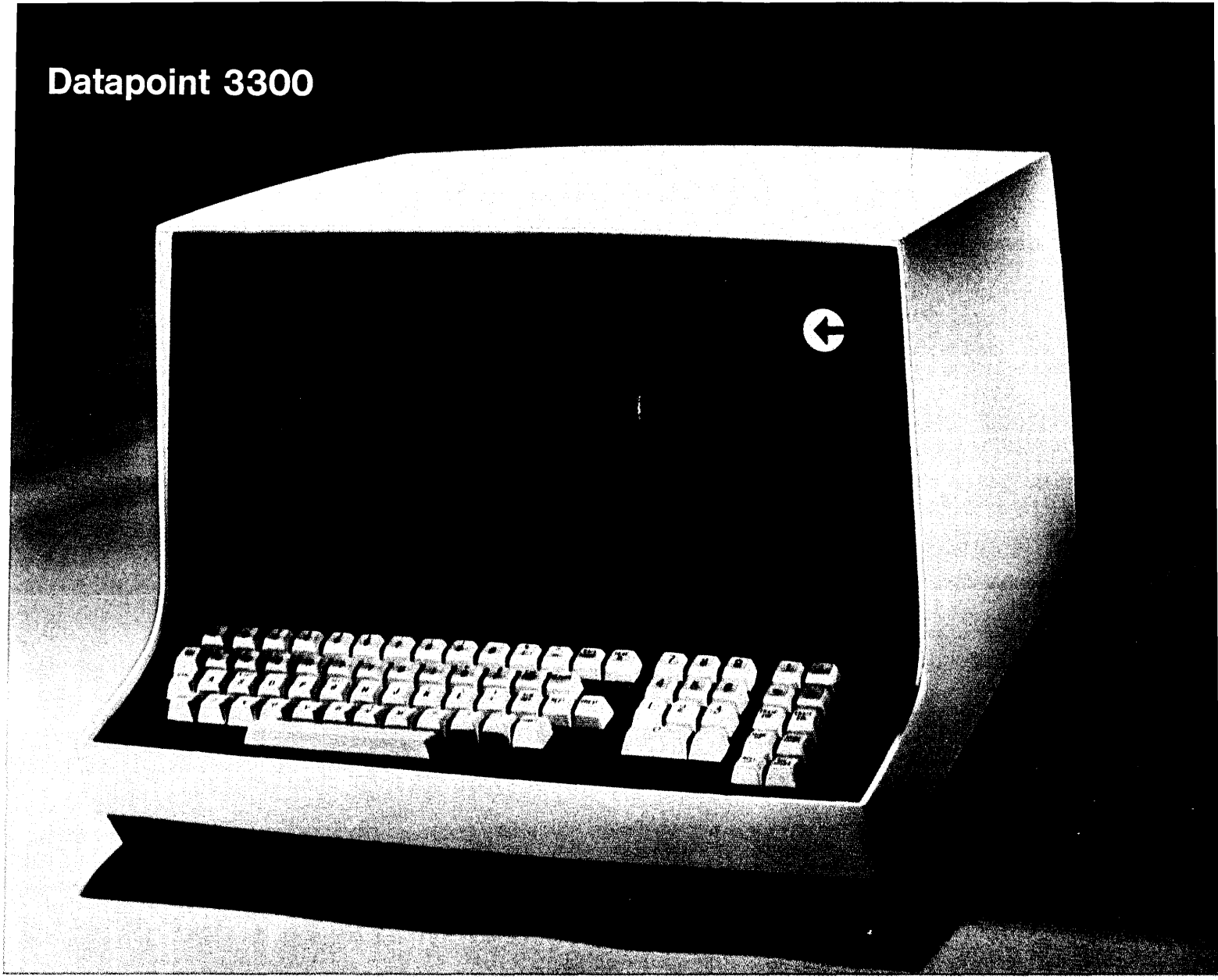
[5] "Program Sends Young Faculty to Brazil," *Chemical and Engineering News*, January 5, 1970, pp. 32-34.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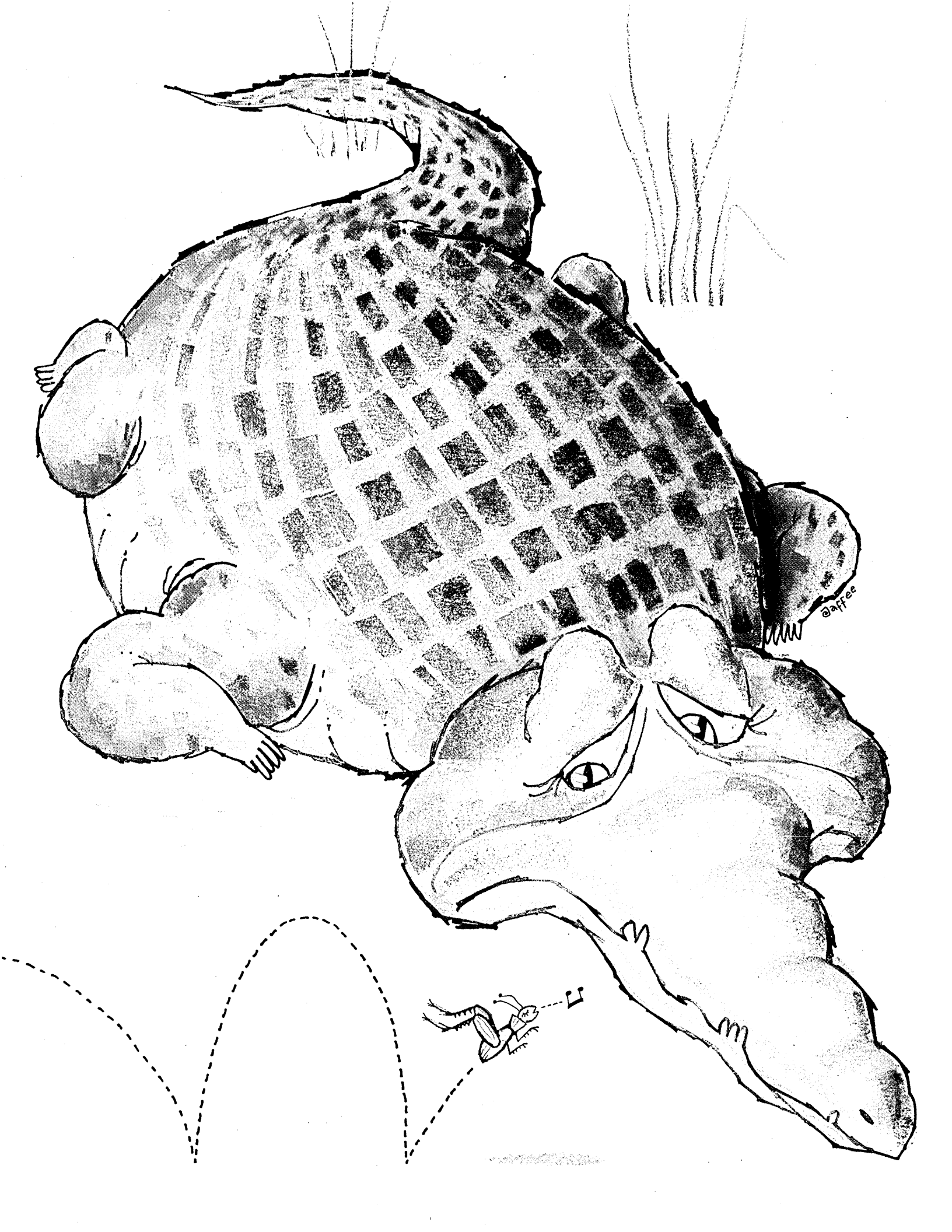
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DATA PROCESSING IN BRAZIL

ibm down, burroughs up

by Richard Iannuzzo

This article addresses itself to the topic of data processing in Brazil. Although the subject can be considered in many ways (in reflection of the sociological or economic situation, for example), we will discuss it in a relatively straightforward, factual sense, with data processing meaning simply use of computers. The areas to be considered then are obvious: the history of data processing here, the current situation in data processing, and what the future is likely to bring.

As nearly as can be determined, data processing began here in 1932 when a Brazilian firm contracted with IBM to import conventional equipment, primarily for use by the Brazilian government. The Brazilian firm, led by Valentim Boucas, was named Instituto Brasileiro de Mecanizacao S.A. Later IBM took control of the company, at which time they dropped Boucas. Subsequently in 1945, Remington Rand introduced its Powers line of conventional equipment.

Only conventional equipment was present until, in 1951, IBM imported a 650, exclusively for promotional purposes and in 1961 Catholic University of Rio received a vacuum-tube Burroughs 205 with a drum memory. Another early development was a vacuum-tube Univac 1105, which was bought by the Brazilian Agency for Geography and Statistics to be used for the census of 1960. The computer never worked in time for the census, for multiple reasons difficult to determine. At this time IBM was, of course, present, but concerned primarily with conventional equipment.

Now let us turn to a consideration of what is happening today. Hereafter, we shall be discussing only computers and related off-line equipment, not conventional machines.

manufacturers

Currently IBM, Univac, Burroughs, Bull-GE, and NCR are represented; Honeywell and Control Data are not, and are not attempting to penetrate the market at this time. IBM controls some 80% of the market but during the past year Burroughs has increased its share at the expense of IBM. Almost all hardware is imported; computer mainframes are imported exclusively by U.S. companies from factories around the world, while off-line equipment is imported from Sweden, Germany, and Italy as well.

There is no production of hardware by Brazilian companies, although Burroughs has a factory in Sao Paulo for the assembling of core memories. IBM produces key-punches, verifiers, and sorters in two factories, one in Rio, which will be closed some time in 1970, and one in Sao Paulo.

Authoritative figures are not available regarding the computer population in Brazil, and published reports are unreliable, so it is impossible to show graphically the growth of the industry since its inception. However, a recent survey contained some information of interest (Table 1). Because manufacturers do not divulge information regarding their sales, and the government does not indicate the number of computers it uses, the population figures are not to be considered accurate. But, we can see from this report not only which models are in use but also, by inference from the population figures, which are the most popular.

Because of the lack of adequate published reference material, I have relied almost exclusively upon interviews with top dp management and upon my personal observations for the information presented in this article. The consensus of these is that at this time there are between 350 and 400 computers in Brazil. Of this number about 30% are third generation, except for Burroughs equipment for which the ratio of second to third generation is probably 50-50. The System/360 population consists of 360/20's, 360/25's, 360/30's, a few 360/40's, and one 360/50.

There are about 10 IBM 1130's in Brazilian universities,

Mr. Iannuzzo is presently a management and systems advisor for Creative Computer Services, a New York-based software consulting firm. He has recently spent four months in Brazil assisting the largest service bureau there in the formation and implementation of their dp plans. He has had more than 12 years of experience in systems, with such organizations as Printronic Corp., Control Data, and CEIR, Inc. He studied business administration at New York University and English literature at Columbia University.

MODEL	APPROXIMATE NUMBER
IBM 1401	69
IBM/360	44
Burroughs B-3500	21
*IBM 1130	20
Univac 1004	20
Univac 1005	19
Burroughs B-500	17
Burroughs B-300	15
Univac 9300	7
IBM 1620	6
Univac 1050	5
Univac U-60	5
Burroughs B-200	5
Burroughs B-2500	5
Univac 9200	3
Bull GE GAMMA-30	3
IBM 305 RAMAC	2
IBM 1460	2
Univac 418	2
Univac U-120	2
Univac USS-90	2
Bull GE GE-415	2
Bull GE GAMMA-10	2
NCR 315	2
Univac USS-80	1
IBM 7044	1
Univac 1105	1
Burroughs B-6500	1
Bull GE GE-115	1
NCR 390	1
NCR Century	1

* Not mentioned in newspaper article

Source: O GLOBO, Sao Paolo, Aug. 18, 1969, p. 15.

Table 1

and the Catholic University of Rio de Janeiro has had a 7044 for about a year. Although designed as a commercial machine, this is the largest computer being used in Brazil for scientific work.

Olivetti is a strong seller of off-line equipment, especially its off-line paper tape to magnetic tape converter. Other paper tape equipment is provided by Burroughs, NCR, Facit, Sweda, Addo, and Frieden. MICR equipment, widely used, is available from IBM, Burroughs, and Olivetti. Recently, CMC7-type characters were designated as standard by the central bank. OCR equipment is in use by only a few companies, notably the Brazilian Light and Power Company.

Most equipment is rented; about 10% is bought. Regarding IBM equipment, the arrangement is very straightforward—the client pays all initial costs (transportation, customs, taxes, and insurance), all of which total about one year's rental. The client then pays a "normal" U.S. rental, with an extra charge of more than 20% built into the monetary conversion, presumably to offset expected inflation during the year. (The Brazilian economy in recent years has had an annual inflation rate of over 20%.) There is, in addition, a "cost of living" increase by IBM every six months, with other intervals used by other manufacturers. Contracts are for one year, but can be broken on short notice.

Consideration is given to the fact that the first customer to order a machine is hit by all the import costs. If the contract is interrupted before 30 months has elapsed, the original amount of all the extras is prorated on the basis of 30 months and returned to the client, with the next user paying the balance.

Some typical delivery times are one year to 18 months for computers and I/O devices, and three to six months for keypunches, off-line equipment, and conventional equipment. Replacement parts are usually available immediately and hardware servicing is widely described as excellent.

The leading suppliers of cards, forms, ribbons, etc., are IBM and Continac, a Brazilian organization started by the son of the aforementioned Boucas. Generally speaking, the cost of supplies is greater than in the U.S. For example, a reel of magnetic tape may cost as much as $75 (Table 2).

The average utilization of available hours on computers in Brazil is less than 40%. This poor level of usage suggests the basic problem—a lack of training on all levels, from operations personnel up to and including potential designers of domestic computers.

	SUPPLIERS	APPROXIMATE PERCENTAGE OF MARKET
Tapes & Discs	IBM	60%
	Burroughs	25%
	BASF	10%
	3 M	5%
Cards	IBM	60%
	Continac S.A.	40%
Forms	Continac S.A.	40%
	Gomes e Souza	35%
	Formulários Nacional	10%
	Cardex	5%
	Interprint	5%
	Others	5%

Some approximate prices:

$1.75 per thousand for cards
$15 per 3 thousand single-part paper
$75 for a reel of magnetic tape
$1,000 for a 1311 disc pack

Table 2

Part of the reason for this lack of education is that hardware sales are often achieved by the manufacturer's promise that he will train the purchaser's present staff to operate and to program the equipment. The training then provided is minimal. In fact, heavy selling pressure in Brazil, to people lacking in knowledge, is responsible for the purchase of a large degree of excess computer power.

Manufacturer support to software problems is generally inadequate. There are few facilities resembling the large-scale training centers available in the U.S. Those courses that are offered are not workshop courses. IBM has training in keypunching, operating, and programming in all the state capitals, while Burroughs has courses in programming only in Rio and Sao Paulo. That is more or less what is available from the manufacturers.

There are some private programming schools, mostly bad. For example, they will accept students who have only an elementary school education, or who are illiterate. On the other hand, they are only able to charge $40-$60 for a 50-hour course in programming, compared to the relatively astronomical prices charged in the U.S. (All money amounts used in this article are U.S. dollars converted from Brazilian cruzeiros.)

FORTRAN lessons, and classes in general concepts of data processing, are provided in the universities without charge to members of the mathematics, engineering, social science, and science departments, for whose use computers are available. A postgraduate course in computer science, leading to a master's degree, is available from the Federal University.

Here, the unusual juxtaposition of electronic computers with the living standards of an underdeveloped country,

has led to some very remarkable salaries (Table 3).

It can be seen that at the lowest levels, salaries are a fraction of what they are in the U.S., but on the higher

POSITION:	MONTHLY SALARY:
Programming managers	$500 - $1,200
Operations managers	500 - 1,200
Systems analysts	350 - 800
Programmers—trainee	200 - 350
Programmers—experienced	250 - 650
Console operators—trainee	50 - 150
Console operators—experienced	130 - 250
EAM operators	40 - 200
Keypunch operators	40 - 150
Clerical workers	40 - 120

Note: By law, all workers in Brazil receive a bonus of one month's salary each December.

Table 3

levels, there is more of a resemblance to American standards. This salary pattern generally reflects the distribution of wealth throughout Latin America, with an enormous spread between the lowest and the highest, many more on the lowest level than the highest, and few in between. The fact that an operator can make $150 a month if he is very good, and then if he becomes a programmer, can start at $300 a month, suggests the absence of a strong middle class, which is, in fact, the case. What this means to the dp community is a direct inversion of the customary cheap hardware, expensive personnel situation prevalent in the U.S., and instead a situation in which the hardware works out to be 25-30% higher, and people to about one-half the U.S. expense.

Experienced programmers and operators are scarce. Even among those who are experienced there is a great absence of perspective. Industry does not generally apply new techniques, but rather relies upon doing things as they have been done in the past. The effect is that after two or three years an individual becomes inefficient because of repetition. The wide range of activities often engaged in by a programmer in the U.S does not generally occur in his Brazilian counterpart. Instead, the activities of Brazilian personnel are, in general, quite rigidly defined.

A wide spectrum of organizations use service bureau facilities, with the heaviest use in the sphere of banking. Because there is little scientific use of computers in general, it is not surprising that the use of service facilities is almost exclusively commercial.

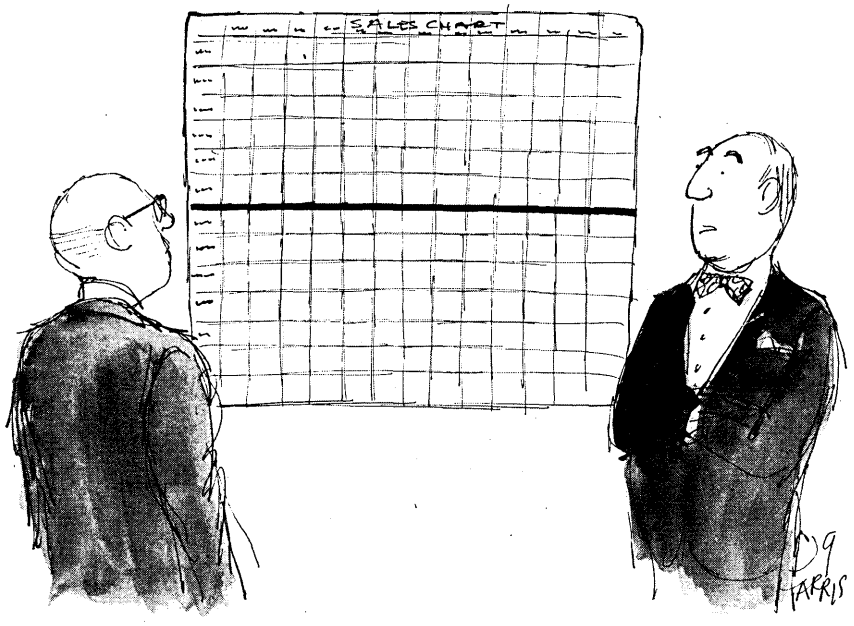
The service organizations on the Brazilian scene can be put into two categories: large American companies and medium-sized to small domestic organizations. Among the former are SBC and ITT. The latter group, much more important to Brazil's future growth, is led by the Datamec, S.A., a fast-growing group of service companies with branches throughout Brazil. In terms of market percentages, the domestic service bureaus command perhaps 10% of the market, compared to 90% for the foreign companies.

user organizations

There are only two organizations representing the dp community in Brazil. The older of them is ABRACE (Associacao Brazileira de Computadores Eletronicos), formed in 1962, a relatively loose organization of individuals interested in the scientific use of computers.

The other organization, much more viable and constantly growing, is SUCESU (Sociedade de Usuarios de Computadores Electronicos e Equipmentos Subsidiaros), a national organization for users, manufacturers, and suppliers. It was formed in 1964 and currently has about 320 organizational members. It devotes itself to the problems encountered in daily commercial life and seeks to solve them by committee discussions, seminars, and exchange of information. (Much of the information presented in this article about the quantity, types, and costs of hardware and supplies was made available through SUCESU.) Lists of users of similar equipment, for a common purpose of information exchange, are available to members. SUCESU also provides translations of relevant articles for Brazilian consumption and sponsors dp congresses to enhance the general level of sophistication among computer users. It also seeks to discuss with the government the fiscal problems of the dp community in order to try to ameliorate the difficulties peculiar to the computer industry.

Now let's hazard some guesses as to what the future holds. First of all, the hardware prices will probably go down somewhat in comparison to U.S. prices, in response to greater user sophistication and increased competition among manufacturers. Concurrently, salaries will increase—not through inflation but as a result of the increased value of the greater skill demanded by more sophisticated applications, as well as a general decrease in the current national level of 25% unemployment or underemployment. Lastly, as greater sophistication of thought results in more widespread use beyond the commercial field, it can be assumed that a scientific computing community will begin to appear. ■



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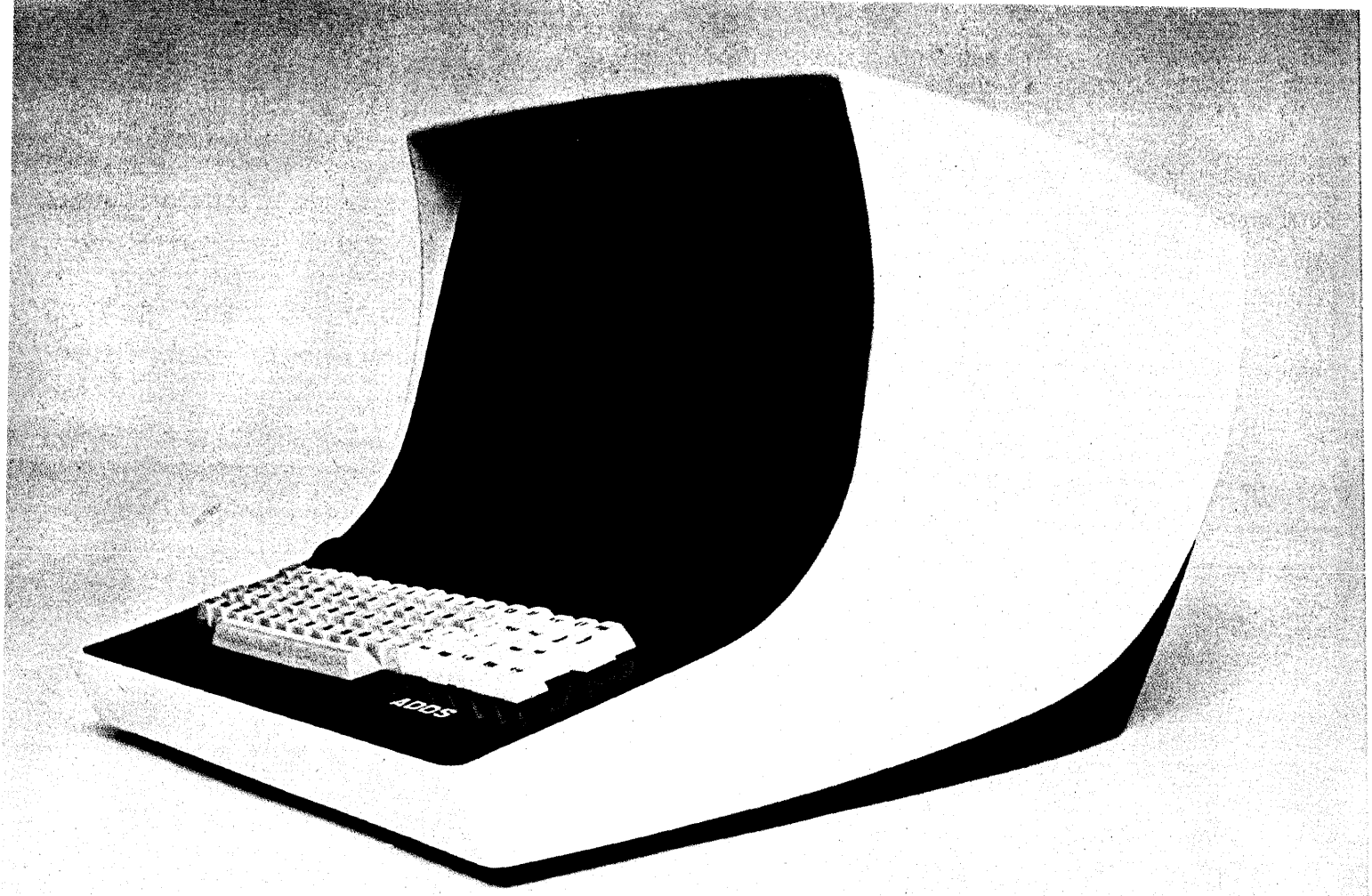

The skin-deep part

The reality of appearance. A computer terminal is truly beautiful only when it combines aesthetics with fine engineering at the right price.

To arrive at that combination we started with the electronics. We took them right out of our MRD-200 readout display because of its proved reliability.

The keyboard is the same one we use in our portable terminal. It will take a pounding without getting wobbles of the keys.

The 9" TV monitor is a commercial product of long established dependability. We like its reliability and it lets us use standard raster techniques for high character legibility.

We added a built-in acoustic coupler option. The coupler is the best made. It operates over 40 dB attenuated lines in half duplex instead of 30 dB lines like other couplers. We make the coupler ourselves. It operates at 110 and 300 baud.

Then we put all this together in a snug case that lifts up for easy maintenance, added a plexiglas front panel, and we had our terminal.

In fact, we had three terminals, the Consul 800, the 840 and the 880. They display respectively 16 lines of 32 characters, 16 lines of 64 characters, and 20 lines of 80 characters. They cost respectively $2995, $3495 and $3995. And they are all Teletype* compatible.

A la mode. The Consul will operate in three modes, page, message and conversational. The conversational has a special editing sub-mode. When you move the cursor to correct a mistake, the terminal automatically switches to the sub-mode. After retransmitting the corrected line, the terminal automatically switches back to the conversational mode.

In the message and page modes, you can edit several lines or a whole page of data before transmitting it.

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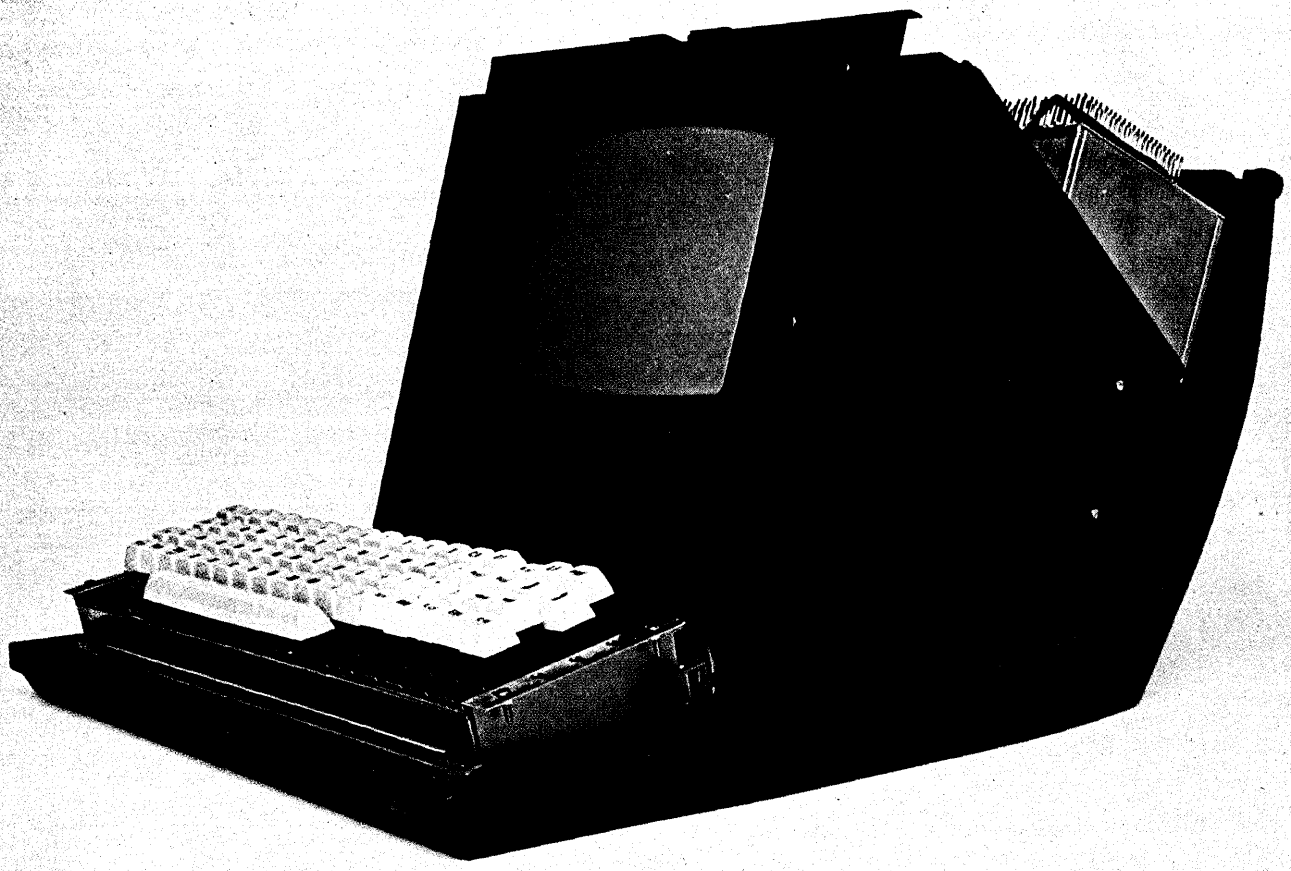

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In both of these modes a look ahead feature saves transmission time. It scans ahead and if the rest of a line is blank, the cursor goes directly to the next line.

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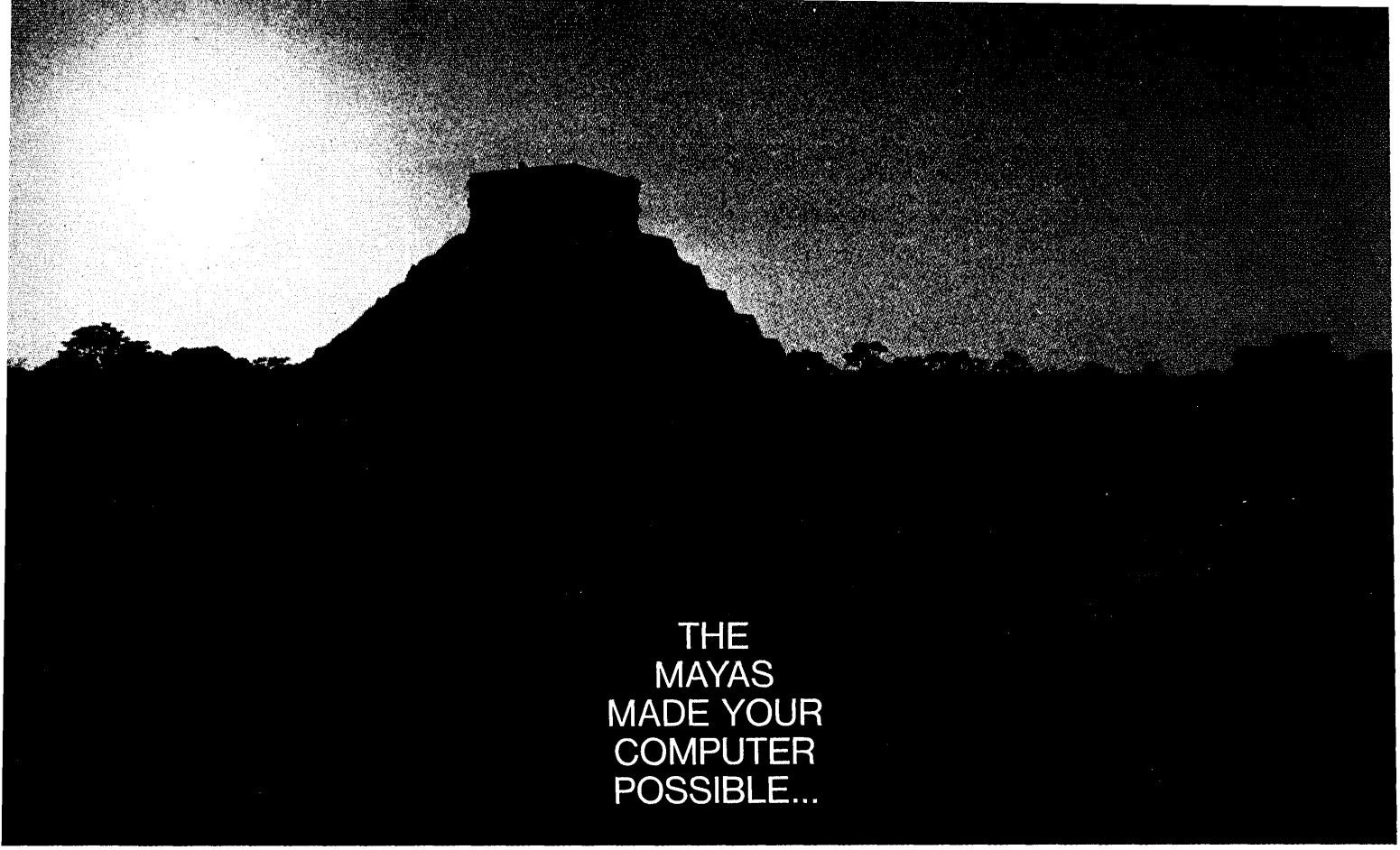

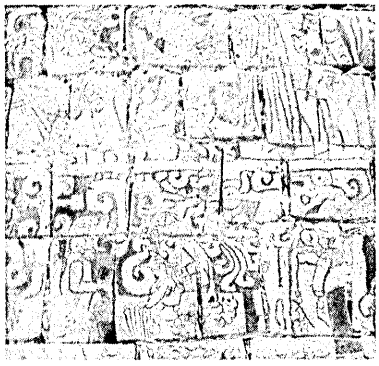

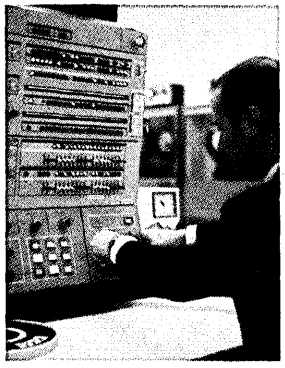

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▫ *Photos above: The Ancient Mayas were the most advanced computational experts of their time. In ceremonial centers such as this at Chichén Itzá in Yucatan, Mexico, they used a time counting system—from which the name KATUN derives—that was more accurate even than the calendar we follow today.*

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a survey

THE INPUT/OUTPUT ARCHITECTURE OF MINICOMPUTERS

by Robert Rinder

In the many applications of minicomputers, the input and output of data is a dominant factor. Minicomputers are being used extensively for process control, data multiplexing, communication line concentration, switching, and other areas in which data is continuously transmitted between the computer and external devices. Requirements for minicomputer systems in even one I/O application area can vary greatly. For example, when multiplexing communication lines, a typical small-scale system might consist of an in-house time-sharing computer with a minicomputer front end. The minicomputer would be used to handle the communication line processing for say 10 to 30 low-speed lines, each connected to a single teletypewriter. At the other end of the scale, are the line concentrators being built by the Bunker-Ramo Corp. for the National Association of Securities Dealers' Automated Quotations System (NASDAQ). These remote concentrators are designed to handle up to 64 full duplex regional lines at speeds up to 4,800 BPS. Each line can be polled to select one of 32 possible control units, which in turn can accommodate up to 24 crt terminals.

The wide diversity of user requirements has led minicomputer manufacturers to provide a number of special facilities for handling various data rates. However, manufacturers have taken different approaches to the solution of the I/O problem and are offering different capabilities. It is therefore important that potential users of minicomputers understand the basic approaches to I/O and their relative merits. With some 60 different models to choose from, an understanding of I/O handling techniques will facilitate the selection process and help to insure that the minicomputer system properly matches the prospective application.

In applications dominated by input-output, the computer selection process consists essentially in making trade-offs between cost and throughput. More specifically, throughput can be increased by reducing I/O interrupts and program control of I/O transfers. However, this reduction can only be obtained by employing additional equipment in which I/O transfers are controlled by hardware instead of by program. This additional hardware costs money, and hence the need for trade-offs.

Two points must be born in mind by those investigating

Mr. Rinder is a systems engineering specialist for the Bunker-Ramo Corp.'s Business and Industry Division in Stamford, Conn., where he has been involved in the evaluation and selection of minicomputers for applications in communications systems. He was formerly a computer systems consultant associated with the Auerbach Corp. He has a BS in physics from UC, Berkeley.

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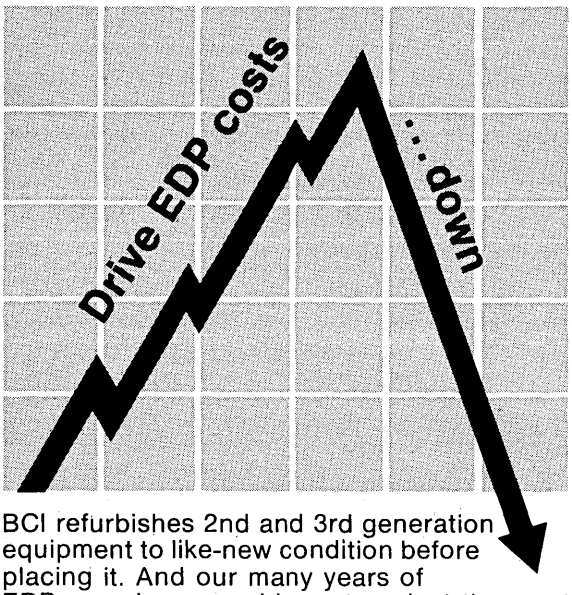

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the minicomputer market for the first time. Firstly, there is no standardization in nomenclature. An investigator must be prepared to see different names used for the same equipment, and the same name used for different equipment. Secondly, capabilities that may appear the same in a brochure or summary chart can in actuality vary greatly both in function and cost.

the input-output bus

The basic facility for transferring data between the computer and the I/O devices is generally referred to as the I/O bus. Other names which may be used to designate this facility are Interdata's Multiplexer Bus, Varian's Party Line, etc. The facility for the I/O bus is usually offered as standard equipment, and included in the price of the basic processor.

Functionally, the I/O bus permits the transfer of data between I/O units and the working registers of the computer. Some computers have dedicated registers for I/O transfers, reducing housekeeping requirements. Fig. 1 shows how the I/O bus interfaces with various components of a mini computer system.

The number of devices which may be connected is

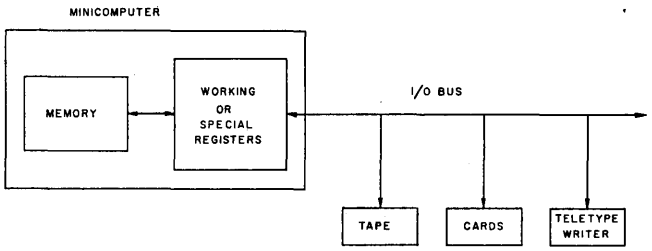

Fig. 1 The I/O bus—data transfer is by word under program control.

determined by the size of the address field of the computer's I/O instruction, and correspondingly, the number of address lines in the I/O bus. Thus, a one-byte addressing structure will accommodate 256 individual I/O units. This is, of course, a theoretical maximum and does not imply that the logic for these devices can be contained in one cabinet, nor that the computer has the capability of accommodating the throughput of any combination of 256 devices working simultaneously.

Allowing for certain variations in methods of implementation, the I/O bus will contain the following lines, or, at least the following functions:

1. Data output lines for transferring one word of data from the computer to the device.
2. Data input lines for transferring one word of data from the device to the computer. Transfers are sometimes in multiples or submultiples of a word.
3. Output address lines for enabling the computer programs to select one of the I/O devices connected to the bus.
4. Input address lines for enabling an I/O device to identify itself to the program.
5. Function lines with which the program designates the functions to be performed by the selected I/O device.
6. Status lines whereby the device indicates to the computer program its status of busy, ready, etc.
7. Program interrupt lines with which devices signal the program to request an interrupt.
8. Parity error lines whereby a device indicates to the program the detection of an error.
9. Various miscellaneous control functions such as set-

ting and clearing of interrupt mask, system reset, timing, etc.

In order to simplify construction and reduce costs, manufacturers tend to combine some of the above functions onto the same lines. For example, it is common for the data lines to be used also for the device address and the function information. Then, additional signal lines are used to indicate the type of data present. A typical data transfer would be performed in the following steps:

1. Send device address and function (I/O command, test, etc.).
2. Send (receive) data to (from) the I/O device.

The time-sharing of lines by different pieces of information achieves lower cost at the expense of slower operation.

hardware

In terms of hardware, the I/O bus may take two forms. Within the main cabinet the bus may consist of printed-circuit connections from one subassembly slot to the next. Outside of the main cabinet the I/O bus is in the form of a cable which can be connected in daisy-chain fashion from one I/O unit to the next. Manufacturers have provided for the easy addition and removal of I/O units. As a rule, devices can be added simply by extending the I/O bus cable for connection to the additional units. However, a rearrangement of units on the cable may be necessary, since position on the cable usually determines priority during interrupt requests.

In some cases sufficient drive power is provided in the basic unit to accommodate the maximum number of devices. If this number is large, typically over 25 devices, it is likely that additional power drivers will be required in the bus between groups of I/O units.

In order to connect an I/O device to the I/O bus, interface circuits are required as follows:

1. Electrical signal interface.
2. Functional interface.
3. Device controller, if not included as an integral part of the I/O device.

Although all computers require all three interfaces, differences exist between manufacturers in their methods of packaging, configuration, and pricing the interfaces. In some cases all three may be separate. In estimating costs, care should be taken to determine the interfacing technique of each computer under consideration.

Signaling on the I/O bus may be either nonresponsive or responsive (hand-shaking). Nonresponsive signaling is simple, and less costly. Signals remain on the lines for a time dictated by the worst anticipated conditions, and then are removed under the assumption that they have been detected at the receiving end of the bus. Responsive signal systems present data to the receiver until an "acknowledge" signal is received. Advantages of the latter approach are:

1. Less strict tolerance, or faster operation.
2. Greater control.
3. Flexibility in adapting to variations in controller speeds or in bus lengths.

program control of i/o

In the sense that over-all system operation is under control of the program, it may be said that all input/output transfers are also under program control. However, there are wide variations in the amount of program control necessary to effect a transfer. When full program control is utilized, each word is transferred on the I/O bus between a working register and the I/O device, and stored in memory by means of program instructions. On the other hand, when

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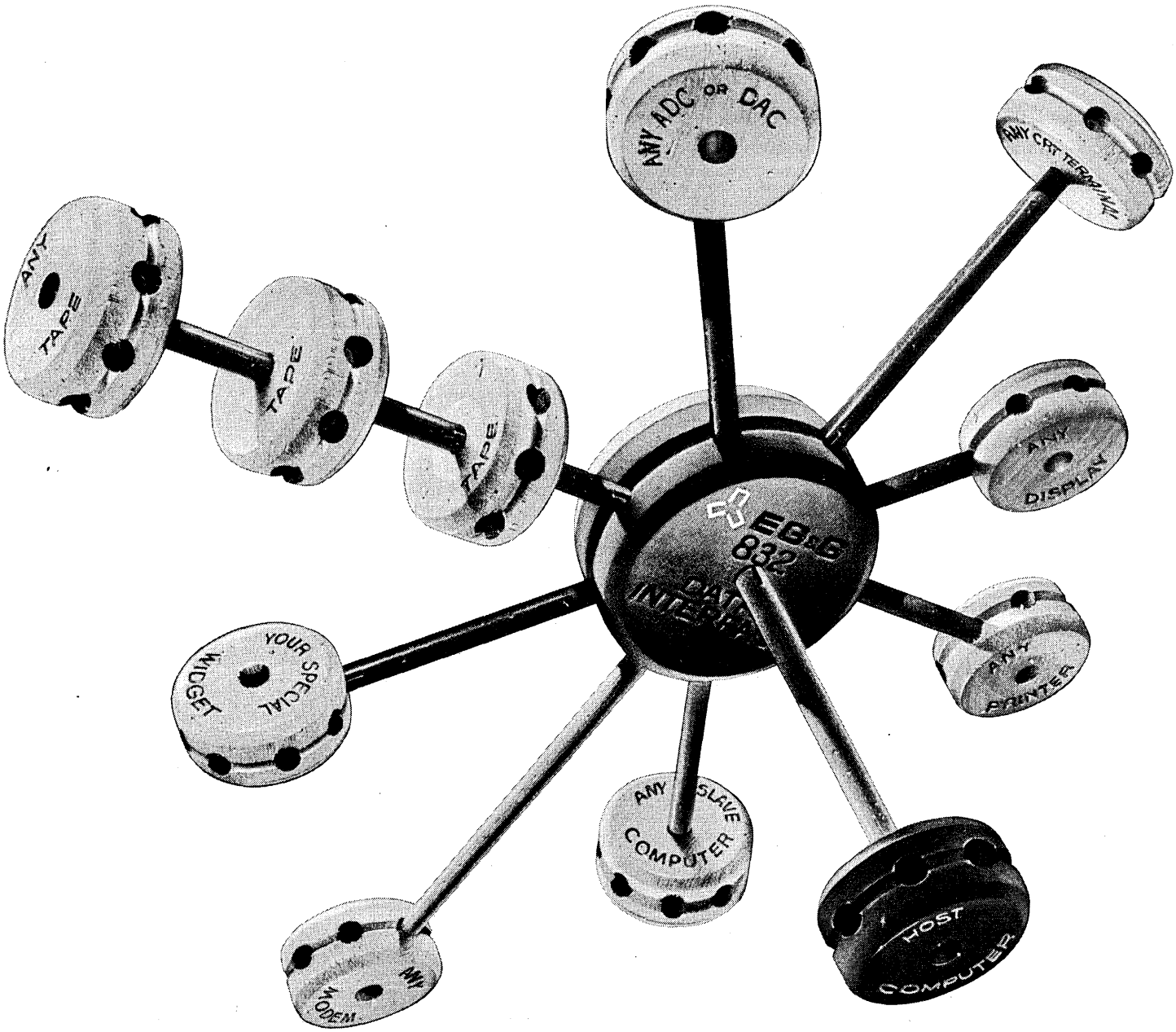

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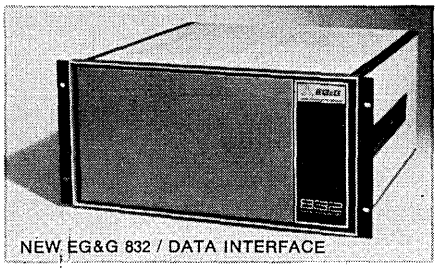

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data is transferred directly between an I/O device and memory, program intervention is required only at the beginning and end of the transfer, or when there is a detected error. Thus, it is possible to transfer large blocks of information while simultaneously processing other data.

Data transfers performed on the standard I/O bus will require program intervention for each word transferred. There are two methods for using the program to control transfers. The transfer of each word can be simply effected by means of a program request. The program addresses the desired I/O device and then waits until the device is ready to transmit or receive data. The need for the program to wait of course leads to processing inefficiency, and this method is reasonable only in cases where the I/O data is highly disciplined (predictable and program synchronized), or where processing requirements are low.

Alternatively, in order to free the program for other tasks during the waiting period, the interrupt method is used. After the I/O device is instructed on the function to be performed, the program may continue processing until an interrupt signal is received, indicating that the device is ready for the next instruction. With this method an interrupt is still required for each word that is transferred.

In either of the above methods programming overhead is high. In order to reduce this overhead, manufacturers offer special devices which enable transfers to take place directly between I/O devices and memory, thus eliminating both the direct-processing time for the transfer and the time required for program interrupts.

hardware control of i/o

Devices for controlling direct transfers of data from I/O devices to memory fall into two basic categories, as follows:

1. Multi-device units for handling a number of I/O's.
2. Single-device units designed for high-speed data transfers.

Multi-device units, in turn, fall into two further subcategories as follows:

1. Those which can multiplex transfers to memory by word. The transfer of words associated with different I/O's are interlaced so that many long blocks can be handled simultaneously.
2. Those which transfer data in blocks. Only one I/O unit can access memory at a time. The others must wait until end of block.

Configurations for controlling direct memory transfers are shown in Figs. 2, 3, and 4.

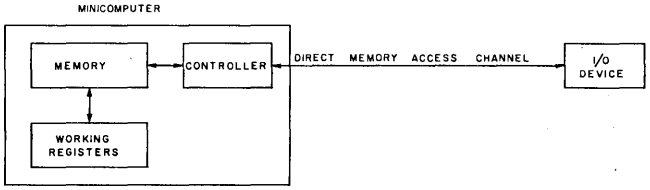

Fig. 2 Single-device, high-transfer rate controller.

Devices which can interlace by word are very useful when the I/O data is highly undisciplined, as in communications systems. Here, each character can be transferred from (or to) its proper position in memory as it arrives at (or is requested by) the input buffer. This type of device will generally cost between $2,000 and $3,000 and may go as high as $5,000 for units capable of handling over 128 devices. Units which can multiplex by word are variously called, direct multiplex channel, direct memory channel, or simply multiplexor channel.

In the second category of multi-device units (i.e., those that transfer by block), terminology also varies, although there seems to be a tendency to call this type of device a selector channel. Other terms such as buffer interface controller are also used. These units are useful for block-oriented I/O units such as tapes, drums, discs, etc. These units usually sell for around $2,000, although one, more powerful unit, is priced above $5,000.

In all cases when investigating hardware control of memory transfer, the user must be careful to determine any

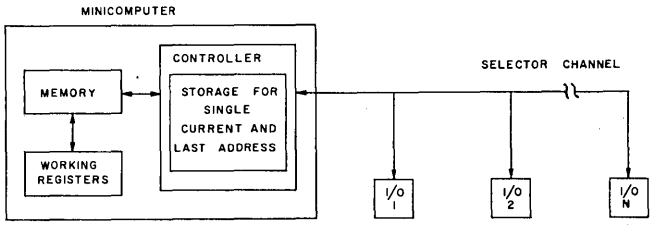

Fig. 3 Multi-device controller without interlacing capability.

additional units that may be required for interfacing with the memory bus because these interfaces may be priced separately.

Hardware controllers which provide for connection to only a single I/O device in order to transfer data directly to memory are useful when low-cost, high data-rate transfer is

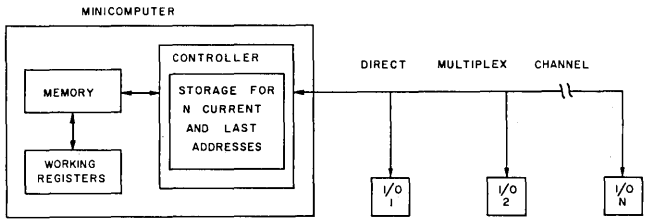

Fig. 4 Multi-device controller with interlacing capability.

required. They are usually referred to as direct memory-access channels, and are priced between $1,000 and $5,000. Again, special interfacing equipment may be required. In at least one system, provision is made for switching the direct memory-access channel between one of two devices.

read-only memory

A less direct method of hardware control is the use of a read-only memory (ROM) in conjunction with a microprogrammed processor. Powerful I/O instructions are designed for efficiently handling the operations required of a specific application. These special instructions are implemented by coding micro-instructions in an ROM. For each instruction a subroutine of micro-instructions is required.

The read-only property enables ROM's and their stored micro-instructions to operate at cycle times in the general range of 300 to 500 nsec. Comparing this to 1 to 2 usec. for the core memory, a gain in speed of two to seven times may be obtained. Whether this speed advantage is sufficient to offset the limited micro-instruction repertoire—typically 10 instructions—depends on the application. At best, the ROM will be less efficient than the direct-access controllers discussed above. However, ROM's are more versatile, and changes are easier to implement. They appear to be particularly suitable for multiplexing low-speed I/O devices on a bit-basis. Since each bit, as it is sent or received, can be processed by the ROM program, I/O buffer requirements are reduced.

An ROM of 1K capacity will cost about $1,500. There will

be an additional charge of about $350 to wire in custom programs written by the user.

Another approach to increasing I/O data rates is to provide two sets of working registers. One set of registers can be reserved for the I/O data transfers and the other set for non-I/O functions. Then non-I/O parameters need not be stored in core during interrupt, and interrupt overhead is reduced. Although not as powerful for high throughput rates as hardware control of I/O, the use of multiple register sets provides other benefits in terms of processing versatility.

address control

In all hardware control of data transfer, it is of course necessary to perform a number of functions by wired logic. The current address and the end of the data block must be stored and accessed. As each word of data is transferred, the current memory address is updated, and a check is made to determine if the final address has been reached. If so, an interrupt must be generated. The current address is initialized by the program at the beginning of the transfer operation as the starting address of the data transfer.

Current and final memory addresses may be stored in reserved locations of core memory or in separate external registers. The latter case results in more expansive but faster throughput. Those devices which are capable of interlacing transfers by word will require a set of current and ending addresses for each device connected, or for the maximum number of devices capable of simultaneous operation.

One manufacturer supplies, in addition to the current and ending address registers, a third register used for detecting such conditions as "end of message" or "end of block." Since the register is associated with a control unit and is program loadable, the user has wide flexibility in his selection of criteria with which to end a data transfer and interrupt the program. This type of capability will be required whenever variable length blocks must be processed.

priority control

When a number of units are connected together on a common bus, several techniques are available for establishing priority and resolving contention between two or more units. If I/O data is disciplined, transfers can, with reasonable efficiency, be under program control. Then the selection of the I/O unit may be by any appropriate algorithm. Alternatively, if control is by means of interrupt, three basic techniques are employed, as follows:

1. A single common line is used by all I/O's to signal an interrupt. When the interrupt is allowed, the program polls each device, according to a polling table, to determine which devices are bidding. The priority is implicit in the order in which I/O's are listed in the polling table and can be altered if not stored in a ROM.

2. A single interrupt line is used, and a single go-ahead is used. I/O devices are connected in a daisy-chain arrangement on the go-ahead line, with priority assigned in the order of connection to the line. Higher priority units obtain access first, and, when not bidding, relay the go-ahead signal to the lower priority devices in order; the device which is successful in obtaining an interrupt sends its identity on the address lines.

3. Separate interrupt lines and separate go-ahead lines are provided for each device. Contention is resolved on a priority basis by some type of hardware or ROM logic.

In a number of computers, priority can be program controlled by what is usually referred to as a masking instruction. This type of instruction can selectively prevent an I/O unit from generating an interrupt until the instruction is negated. This facility provides an efficient means for allowing only higher priority interrupts to interrupt lower priority interrupts.

In many applications oriented towards I/O, the avoidance of program interrupt will be required to obtain reasonable efficiency. In other words, some means for hardware control of data transfers will be required. In terms of selection criteria, it can be seen from the above that there are a number of options open to the user. Although the interrupt procedure itself can certainly affect processor efficiency, it will usually be found to be of secondary importance compared to the method of data transfer.

Table 1 gives the price range of various hardware transfer units. Some indication of the relative cost of hardware transfer can be obtained by comparing Table 1 prices with those given in Table 2 for processors and core modules.

In terms of the increased processing efficiency obtained, hardware transfer units will usually be well worth the expense. Note also, that if the use of a hardware transfer unit can prevent the program from spilling over into an additional core module, there can be a net reduction in cost.

TYPE OF UNIT	Number of I/O Devices	Price Range Dollars
Multiplex by word directly into memory	16	2-3,500
	128	4-5,000
Multiplex by block directly into memory	8	1.5-2,000
	25	4-5,000
	64	5-6,000
Single device directly into memory (direct memory-access channel)	1	1-3,000

Table 1 Price range of hardware units available for transferring data directly into memory.

UNIT	Cycle Time (usec) 2.5	1.5	0.9
Basic processor with 4K of core	$7,700	$9,700	$16,200
Core module 4K of 16-bit words	$3,700	$5,500	$ 7,500

Table 2 Approximate prices of minicomputers and core modules for various core cycle times.

Some firms, recognizing the needs of various applications, offer special purpose I/O units as front ends for their minicomputer. These special-purpose devices serve as hardware multiplexors or concentrators that can usually be implemented on a modular basis.

A typical unit might handle up to 128,100 WPM lines, performing all timing, buffering, and memory transfers on a cycle-stealing basis.

multiple register sets

The above description is not intended to be an exhaustive enumeration of all the I/O techniques used by minicomputer manufacturers. On the contrary, the aim has been to distill the basic elements from the many I/O approaches, so that prospective users will have a framework with which to proceed to a more detailed study of specific computer systems. ■

whatever happened to decompilers?

USING THE COMPUTER FOR PROGRAM CONVERSION

by Maurice H. Halstead

From the systems designer's point of view, one of the most troublesome facts of life lies in the hundreds of millions of dollars worth of checked-out computer programs running on obsolescent or obsolete hardware.

Since the advent of Aiken's Mark I, improvements in hardware capabilities have come far faster than improvements in computer software. By now this lack of balance has reached such serious proportions that it has already slowed the progress of the hardware side as well. To confirm the magnitude of the roadblock created by the software "conversion problem," one can consider either the design effort being devoted to obtaining compatibility—upward, downward, and even sideways by the manufacturers—or the user management's lack of freedom of choice in replacement selections and phase-out scheduling.

In the first case, since computer design has not yet achieved the ideal internal structure, nor even an optimum repertoire of machine instructions, it follows that the need for compatibility with earlier designs hampers progress in the development of computers—where the only excuse for that need lies in the prior investment in machine-dependent software. With respect to the selection and scheduling of replacement equipment, computer center management is almost invariably denied the economic choices which would obtain if the conversion problem could be ignored. As a result, the economic advantages inherent in the most advanced machines cannot be exploited in any reasonable period of time, while the effort of many of the best programmers must often be devoted to reprogramming. No matter how neatly a job is programmed on the second, or even the nth occasion, the time and energy required to do it is stolen from some new task which might well advance the state of the art.

Since these problems have been apparent for many years, it would be worth while to examine the solutions which have been proposed, and the results which have been obtained. Perhaps the most dramatic has been the combination of hardware and software called emulation. Since Henry Lichstein has recently given an excellent analysis of this area in "When Should You Emulate?" (DATAMATION, November, 1969), that approach will not be probed here.

machine-independent languages

A procedure which avoids a problem instead of solving it is often the best solution after all, and in the case of the conversion problem we might consider the introduction of machine independence into higher level languages as offering such a solution. But since this approach is as old as

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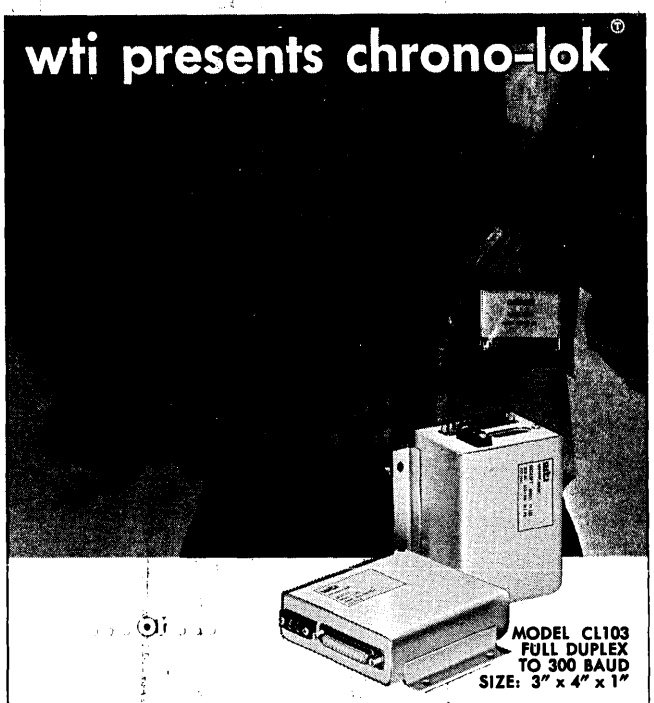

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ALGOL and COBOL, and the conversion problem is still with us today, even it must have some inadequacies. A few of these are obvious, while others are more subtle.

First, some of the oldest, most important programs in the typical installation were written before a machine-independent language was adopted. Second, the fact that most of these languages prevent the programmer from getting sufficiently close to the machine has resulted in inefficiency in object programs. Consequently many installations, even after they have officially adopted a higher level language, have accepted an escape clause for those few programs which required great efficiency. These special programs, written in assembly language, somehow tend to have the greatest life expectency. Third, and some would consider this more important, is the fact that it is possible to write machine-dependent programs in any contemporary machine-independent language, just as it is possible to tell a pun in French, which might be explained in, but could not be translated into, English. Fourth, compilers do not yet handle all of the housekeeping required by a program. Consequently, the algorithms supplied by the programmers must often be tailored to the particular configuration for which they were written, and take little advantage of a newer machine's larger internal memory, random access devices, or other improvements.

As an example of the more subtle problems, it may come as a shock to the computer manager to realize that just because the binary deck he has been running is backed up by a FORTRAN source deck does not prove that he has the correct source deck, or even that one ever existed. Binary patches have often been made in object decks, and cases are known in which a programmer upon departure substituted an undebugged deck, so that he could take his pride and joy with him. The above should not be taken to mean that machine-independent languages do not constitute the best contribution of computer software to the conversion problem, but only that it is a far from complete answer.

decompiling

Decompilers were originally conceived as a software contribution to this specific problem[1,2,3], and the remainder of this article will be devoted to their potential and actual use in theory and in practice. As the name implies, a decompiler is the inverse of a compiler, and it has proved itself a useful tool in the program conversion process. It is merely a computer program which accepts an absolute binary program for machine A, analyzes it in great detail, translates it into an equivalent program in a higher level language, and provides flags which mark any ambiguities which its analyzer routines were unable to resolve. Any ambiguities are then resolved manually, and the program is then compiled for machine B.

The analysis phase is strikingly similar to the detailed program flow analysis employed in the optimization passes of the most recently described FORTRAN compilers[4,5], although the decompiler must spend additional time in

[1] Maurice H. Halstead, *Machine Independent Computer Programming*, Chapter 11, "Decompiling," Spartan Books, 1962.
[2] Ascher Opler, "Automotive Program Translation," DATAMATION, May, 1963, pp. 45-48.
[3] W. A. Sassaman, "A Computer Program to Translate Machine Language into FORTRAN," *Proceedings of the Spring Joint Computer Conference*, 1966, pp. 235-239.
[4] Sam F. Mendicino, Robert A. Hughes, Jeanne T. Martin, Frank H. McMahon, John E. Ranelletti, and Richard G. Zwakenberg, "The LRLTRAN Compiler," *Communications of the ACM*, November, 1968, pp. 747-755.
[5] Edward S. Lowry and C. W. Medlock, "Object Code Optimization," *Communications of the ACM*, January, 1969, pp. 13-22.

separating data from instructions, and identifying those program parts which are used as data by one section of the program and treated as instructions by another. While in theory the presence of a machine-independent, higher level language between machines A and B might be avoided, its omission would seriously cripple the system without any compensating advantages.

While decompiling has been successfully employed for several years, the area has lacked visibility because of the "proprietary package" nature it has enjoyed, much as compiling techniques were held as trade secrets in the late 1950's. A further analogy to the early compiler days, with their entrenched detractors, can be seen in published claims that decompiling was impossible "because there is no way to find out what the programmer had in mind." While of course the latter statement is true, it has nothing to do with the problem, since we all know that the computer does what the programmed instructions demand, even when that is not quite what we intended.

Perhaps a more important, but again irrelevant, criticism has come from those who have visualized the operation as strictly comparable to that of an emulator. In order to use a decompiler system in such a way, it would be mandatory that it be perfect, since manual correction of flagged ambiguities would be intolerable if programs were to be decompiled every time that they were run. While such perfection is theoretically attainable, it would be uneconomic on two counts. First, a prime advantage of converting a program to a higher level language lies in the ability to treat it in a routine way thereafter, retaining the generated source deck for future changes, and a relocatable binary object deck for normal runs. The second point involves the entire economics of the design and implementation of decompilers. This is a fascinating area in itself, so let us go thru it step by step.

design and implementation

First, we need a figure of merit for decompilers, but since there has been no general agreement among the experts, this area is open to interpretation. We may discard at once the notion that one merely takes the percentage of instructions in the repertoire of the machine which are decompiled correctly, because a given instruction may be handled easily in some combinations, and not at all in others. Further, since programs do not contain an equal number of all possible instructions, such a figure would be of little help in an economic analysis. It is better to start with the percentage of correctly decompiled instructions in a sample of actual programs as a base figure. This figure does tell us the fraction of a program which must be handled manually, but, as we shall see later, it does not tell us directly what fraction of the total reprogramming task has been automated.

Now it seems to be in the nature of decompilers, that the implementation effort required to raise this base figure half way to 100% from wherever it is will be approximately equal to the efforts already expended. Using reasonable estimates, where one unit of effort (perhaps a man-year on a machine as difficult as an IBM 7094) will produce a decompiler which handles 36% of the instructions, two units will handle 68%, and so on. This relationship is shown in Fig. 1, where it can be seen that to reach the practical values above 95% requires considerable effort. As we shall see later, decompilers with a low capability are actually worse than useless.

The second step in this analysis involves the fact that those situations in which the decompiler analysis can not

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resolve an ambiguity are increasingly difficult the fewer there are of them. In other words, decompilers handle the straightforward cases perfectly, and only give up in situations in which a man might be slowed down. For the case of a 36% decompiler, it appears that the remaining instructions are twice as difficult to handle manually as the average

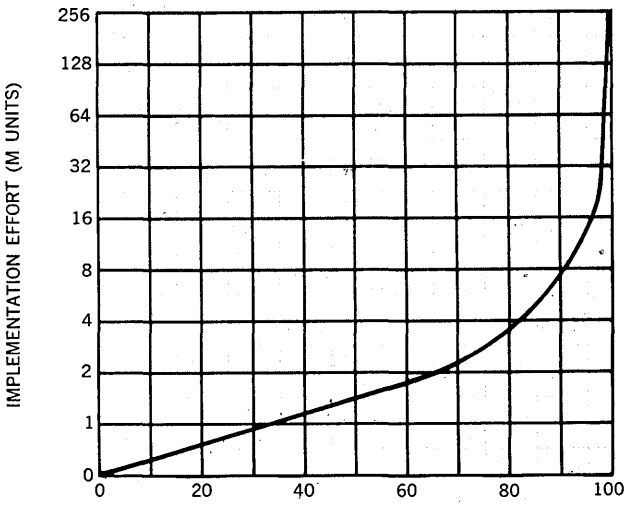


Fig. 1 Approximate relationship between the effort required to implement a decompiler and the percentage of code which it will translate.

instruction. Since $(100\text{-}36)\times 2 = 128 > 100$, using such a system would cost more than straight reprogramming. For a 68% decompiler, the remaining instructions require approximately three times as much effort, but since $(100\text{-}68)\times 3 = 96 < 100$, it should just pay to use it, though it would require 50 units of use to recover the initial two units of effort invested. From here on, however the situation improves for awhile, as Table 1 shows.

A bit of study of Table 1 shows a number of interesting

COST TO IMPLEMENT	PER CENT DECOMPILED	PER CENT BY HAND	RELATIVE DIFFICULTY	CONVERSION COST AS % OF REPROGRAMMING	FIGURE OF MERIT
(M UNITS)	(%)	(%)		(%)	(%)
1	36	64	2	128	−28
2	68	32	3	96	4
4	84	16	4	64	36
8	92	8	5	40	60
16	96	4	6	24	76
32	98	2	7	14	86
64	99	1	8	8	92
128	99.5	0.5	9	4.5	95.5
256	99.75	0.25	10	2.5	97.5

Table 1 Estimating decompiler figure of merit.

points. First, a decompiler which correctly decompiles an average of 98% of a total work load has a figure of merit of 86%, since the 2% which must be handled manually represents a class of difficulty some seven times greater than average. This may well explain any discrepancies between claims and achievements.

Second, it becomes apparent that higher and higher figures of merit can be attained by extending and improving a decompiler, as shown in Fig. 2, but that there is an economic limit which depends upon the total size of the work load to be converted. In other words, one must recover the cost of the decompiler by using it to convert programs previously written for a given machine, and since the

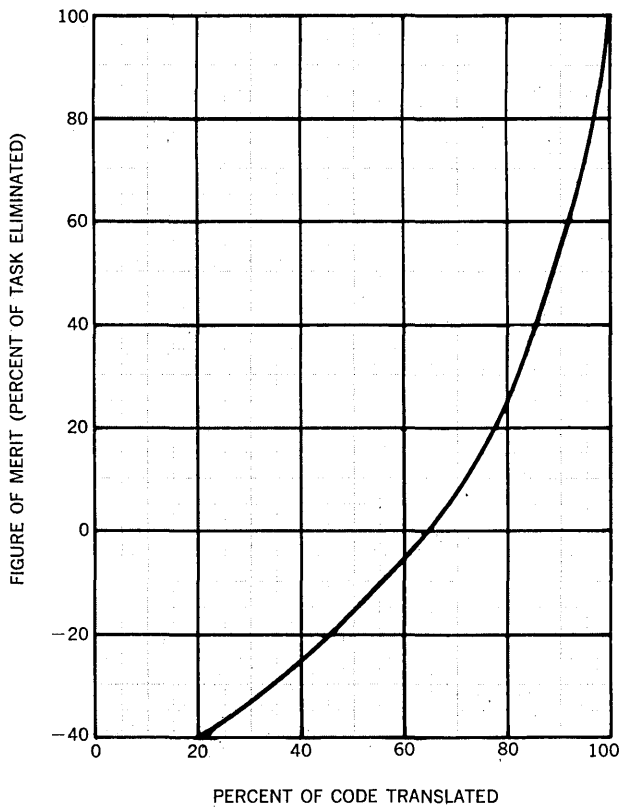


Fig. 2 Approximate relationship between the fraction of code translated by a decompiler and the fraction of a reprogramming job which it will eliminate.

number of such programs is not increasing, the optimum goal must be below 100%. This relationship is illustrated by the calculations in Table 2.

There are some seven theoretical limitations to the decompiling process, some of which have been reported earlier[6] and others which have been recognized more recently. First, it is theoretically impossible to decompile only a part of a program. This is obvious from the fact that the missing part of the program could conceivably alter instructions in the remaining part. This limitation, while true, has no real significance, since no one would be running the part program alone anyway.

Second, a decompiled and recompiled program will require more core than the original. This results from a combination of effects, and amounts on the average to about 32%. Since memory in general is increasing on the newer computers, this factor has had no practical effect.

Third, decompiling requires more computer time than compiling. This is a trivial, but interesting, limitation. It is trivial because a given program is decompiled only once, but interesting because it gives some measure of the relative

[6] Maurice H. Halstead, "Machine Independence and Third Generation Hardware," *Proceedings of the Spring Joint Computer Conference, 1967*, pp. 587-592.

amount of work required. Available experience indicates that the decompile pass requires a factor of 50 more execution time than a one pass compilation run for a reasonably large program.

Fourth, while it may be possible to resolve all ambiguities automatically, it will not pay to do so. This point is distinct from the cost-of-implementation effect noted in Table 1, and was only discovered operationally. It arises from the side effects of certain machine language instructions on the original machine. Assume such an instruction in which the side effect is very seldom used, and in which the analysis to determine whether or not it was used in a given case is

FIGURE OF MERIT	NET SAVINGS FOR WORK LOAD SIZE OF: 100M UNITS		500M UNITS		1000M UNITS	
(%)	(M UNITS)	(%)	(M UNITS)	(%)	(M UNITS)	(%)
−28	− 29	− 29	−141	−28.2	−281	−28.1
4	2	2	18	3.6	38	3.8
36	32	32	176	35.2	356	35.6
60	52	52	292	58.4	592	59.2
76	60	60	364	72.8	744	74.4
86	54	54	398	79.6	828	82.8
92	28	28	396	79.2	856	85.6
95.5	−32.5	− 32.5	349.5	69.9	817	81.7
97.5	−158.5	−158.5	231.5	46.3	719	71.9

Table 2 Net savings of decompiler use over reprogramming when decompiler implementation costs are considered.

excessively tedious. At this point the implementor is tempted to treat all cases as the worst case, much as an emulator must, and issue the cumbersome higher level statements required. While this does indeed increase the figure of merit of the decompiler, in the majority of cases it produces excessive code in the object program. As a decompiler system has progressed from experimental to operational use, it has been found that much tighter code resulted in the object program if such cases were not decompiled, but flagged as ambiguities instead.

Fifth, programs originally written entirely in a higher level language will decompile either perfectly, or almost perfectly; yet unless the source deck is missing, it will not pay to decompile them. In other words, the standardization present in the original compiler tends to render the decompiler analysis almost trivial by comparison with the subtleties embedded in some machine language code. But since the decompilation process will usually introduce some inefficiency in both core requirements and executive time, a LIFT or SIFT technique is preferred in such cases. In practice, however, it is often found that a higher level language program depends upon an important number of machine-language subroutines.

Sixth, gaining an over-all understanding of a program's objectives and the way it was written will detract from the speed and efficiency of a programmer using a good decompiler. While this effect may well vary with the figure of merit of the decompiler system in use, operational experience has shown that the resolving of flagged ambiguities does not require such understanding. Therefore, it is only if or when a requirement for modification of the program develops later that such study is warranted.

Seventh, there is an inherent fear on the part of many programmers of having their machine language programs subjected to the transparency treatment of decompiling. This is understandable when one contrasts the reputation for tight code which machine language enjoys with some of the absurdities which it often contains. As a result, this is one of the most serious limitations of decompiling and one which must be recognized and in some manner eliminated.

Despite these limitations, on balance they have proved surmountable. The decompiler developed by Lockheed Missiles and Space Co. has been used both internally at Sunnyvale, and under contract for customers in the U.S. and Canada to convert from IBM 7094 binary to NELIAC and thence to the Univac 1108. (To provide choices other than NELIAC, it is understood that at least one group is writing a NELIAC to JOVIAL translator, and others would appear feasible.) Decompilers to convert from the IBM 1400 series to COBOL have been operational for some time, and at least IMI's version is constantly being improved. Decompilers for both the IBM 1400 series and the IBM 7000 series computers have performed with such success that fixed-price conversion contracts are available, usually at about one dollar per word or statement. The LMISC decompiler has been used to convert several million dollars worth of 7094 programs, and has successfully handled a contract job of over 500,000 instructions.

Since decompiler conversion is available in some cases for which no other method is appropriate, it is not surprising that interesting situations arise, and they do indeed. Perhaps the most amusing was the case of a decompiled and recompiled random number generator, which still produced random numbers—but random numbers which differed in some random way from those produced on the source computer.

In a recent Chicago case, a hundred words of binary code were found between two large FORTRAN decks. After several weeks of study, an expert analyst gave up on them, convinced that they "involved some strange sort of bit-pushing." A minute of decompiler time showed that instead, the binary code provided a clever I/O routine, and the problem was eliminated that afternoon.

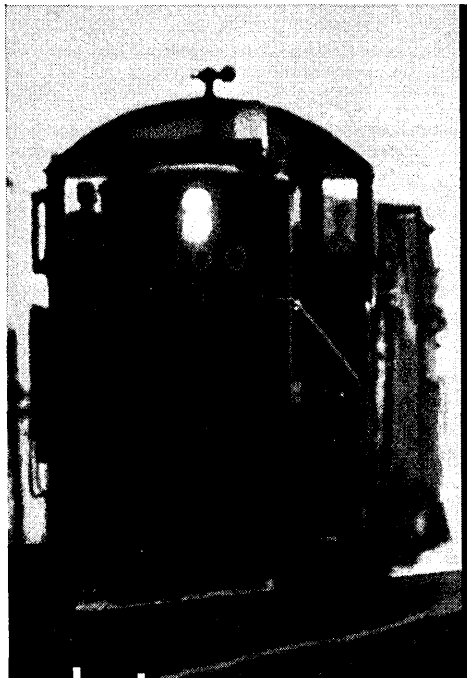
From the manufacturer's point of view, decompilers have been of critical importance in replacement negotiations. At least half a dozen large, third-generation computers have been sold against the strongest competition, and successfully installed and operated by decompiling the old workload, thus avoiding dependence upon emulators and the machines which provided them.

operational advantages

On the basis of such operational experience, the decompiling process has a number of unique advantages. It can be used in cases where emulators have not, or could not, be developed; it does not require the continued equipment costs nor the dual mode of operation of emulation; and it frees the user from all reference to old machines, while at the same time eliminating the development of a new dependence upon the machine language of the new machine.

With respect to reprogramming, the decompiling process eliminates from 75% to 90% of both the programmer cost and calendar time required, and simultaneously provides a higher level language statement of the programs for subsequent use in the inevitable modifications which will be required. It would therefore appear prudent for computer-user management to consider decompiling as a software tool whenever that management is straining to provide true progress in addition to incidental growth.

In conclusion, it might be said that decompilers are alive and well and living in some of the most advanced software environments, and that they are doing their bit to eliminate the roadblock to progress inherent in the machine language programs running on obsolete computers. ■



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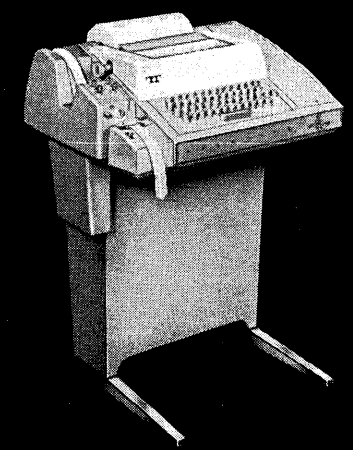
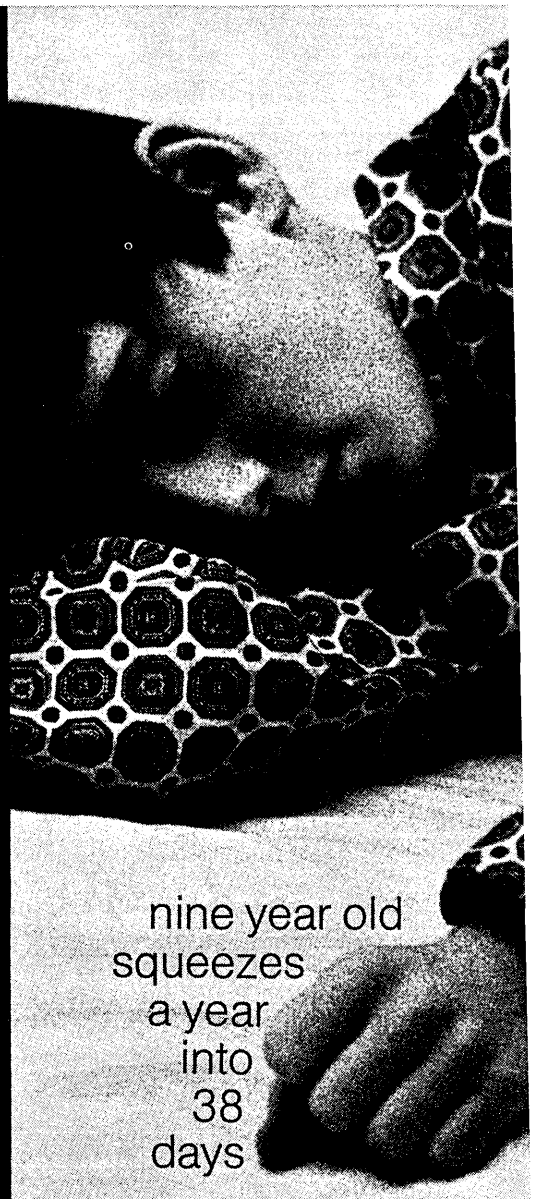




nine year old squeezes a year into 38 days

A young boy became so fascinated with a Teletype 33 terminal that he completed a whole year's arithmetic program in 38 days. His school is involved in a computer assisted educational program using a remote university computer. The simplicity of the terminal enables the youngest of students to master its operation in a short period of time.

Some subjects included in the program are reading, science and arithmetic. Students receive individual drill and instruction geared to their own level of comprehension. The slower student gets much needed practice at a level which he can achieve. The average student reinforces his grasp of the subject with drill and practice at the terminal. The bright are offered programs that challenge and are limited only by their own abilities. Computer assisted education also enables teachers to find more time for individual student needs.

erasing errors on-line

Teletype has an interesting solid-state device called the Stuntronic™ parity error detector which helps locate and eliminate parity errors. It can be used with Teletype 33, 35, 37, Telespeed™ and Inktronic® terminals.

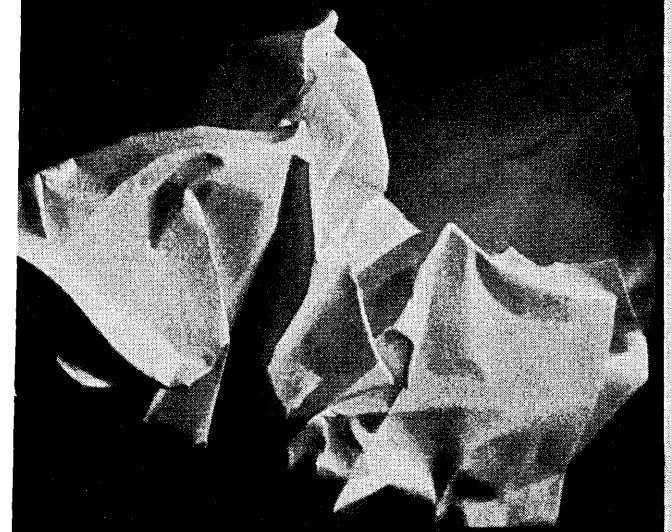
This accessory will accept a signal with up to 45% distortion and regenerate the signal with less than 5% distortion before passing it on to the terminal. Minimizing erroneous print-outs due to distorted signals.

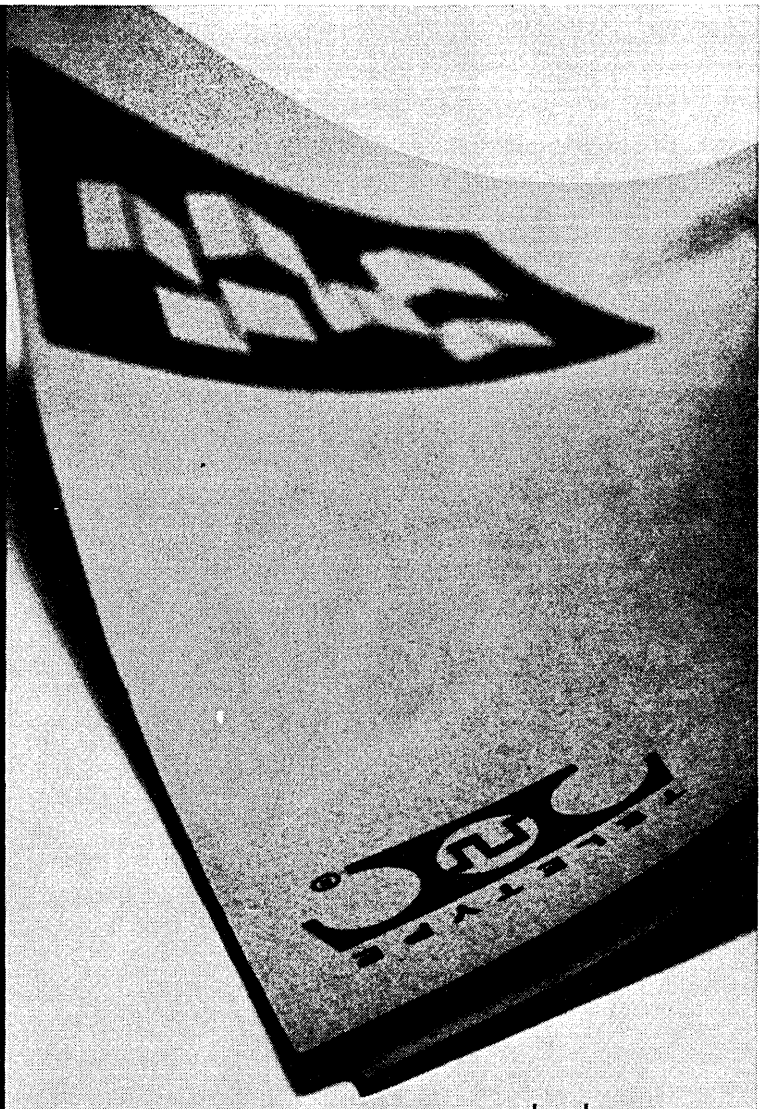
It will also locate individual vertical parity errors and alert the station operator so that corrective action can be taken.

```
HERE IS AN EASY WAY TO SPOT AND      432*
CORREC* ERRORS RECEIVED IN TEXT      5678
OR NUMBER TRANSMI*SION.              90*2
```

With the Stuntronic detector, a preprogrammed substitute character can be used to graphically indicate exactly where an error is on the terminal print-out.

Stuntronic accessories can also count errors, light a signal lamp and generate a line break, notifying the sender of any errors.





recommended reading

Teletype has a number of bulletins on equipment, applications, and case history data. A short description of what is available is contained in: *"How to get answers to your questions about Teletype equipment." Write for your copy.*

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MATERIALS HANDLING: NEW MARKET FOR COMPUTER CONTROL

by Justin A. Perlman

Storage and movement of goods in manufacturing plants and warehouses costs a not insignificant portion of each sales dollar. As more stringent customer-service requirements are placed on the manufacturing and warehousing "system," the storage and movement costs can rise sharply.

A great amount of effort has been invested in information systems for production and inventory control, and many successful applications have been installed which provide for computer-planned and, in some cases computer-directed, storage and movement operations. Installations with computer *control* of physical movement of goods, tied into a company's integrated management information system, do not exist in any quantity today. The market for computer and materials handling hardware, software, and services for computer-directed and computer-controlled installations should reach $200 million annually in the mid-1970's, and increase substantially thereafter.

Let's look at the storage and movement operations we're discussing:

Receive
Identify
Sort
Determine storage location
Move to storage and put away
Store
Allocate stored goods for issue
Determine where goods are stored
Pick from storage
Marshal the picked goods
Check the picking and marshalling
Pack (if necessary)
Ship, or move to work station
Prepare records, update files

This generalized list is meant to cover raw materials and purchased parts inventories, work in process, and finished goods; but it does not cover any one of these inventories exactly.

The critical element in each of these operations, and for the functioning of each of the inventories, is time. In the past the prime trade-off against time has been increased inventory, thereby creating a physical buffer to decouple the manufacturing plant, retail customer, etc. from the effects of a stockout (lack of goods). This physical buffer has been expensive in that nearly all the cost factors of inventory holding and processing have been increased: space, equipment, labor, and investment in inventory. These costs are not small; total inventory carrying cost normally runs from 10% to 30% of the value of the goods, annually, depending on the industry. At times, too, the additional inventory buffer can have the effect of clogging the system such that service to in-plant or outside customers actually suffers.

Much has already been done to improve the efficiency of inventory systems, to reduce inventory size, and to lower their cost via computer planning; i.e., forecasting and classic production and inventory control. Computer-directed systems—those in which the computer issues step-by-step instructions to men, in such a way that a new instruction is not issued until the preceding step has been accomplished—provide an order-of-magnitude improvement. Computer control—with the man removed from many of the unskilled and semiskilled labor loops—is feasible in a number of industries and can provide further improvement.

life in a warehouse

To depict the range and depth of the operations which must be performed, we will create an example of a manufacturer's finished-goods warehouse which is nearly fully controlled. The illustrative example is extreme—its economics as a single system will be questionable for a number of years—but each of the segments of the example can be economic today when the correct combination of needs exist.

For our example, the goods which are the input to the warehouse may arrive discretely from a distant location, by rail or truck, typically in palletized form, on pallets by forklift truck from an adjacent location, or more or less continuously in unit-carton quantities by conveyor. Let us assume in this example that we are dealing with a nonperishable commodity packed in a sealed kraft carton with unit size of about 1 cubic foot, and with maximum weight of about 10 pounds. The product comes in many variations (e.g., styles, colors, and sizes) which all fit within the carton size and weight criteria. Before leaving the manufacturing operation the individual cartons are marked with machine-readable data describing their contents.

Upon arrival at the warehouse, the pallets are unloaded from the rail car or truck and then passed by an ultraviolet,

Mr. Perlman is managing partner of the consulting firm Innovation / Development in Pacific Palisades, Calif. His company specializes in new company development, market analysis, and financial and general management. He has a BSEE from MIT and an MBA from Columbia.

optical, or other reader which identifies the goods to the computer. The locked-pattern pallet (with cartons arranged to stay put) then goes to a depalletizer/palletizer controlled by the computer based on identification of the pallet (and the appropriate locking pattern). Here the shipping pallet with several different stock-keeping units is broken down and re-formed into smaller pallet groupings of single stock-keeping units with the individual cartons all properly aligned for positive identification and selection by the picking mechanism when the goods are later removed from the warehouse.

If cartons arrive at the warehouse in a continuous flow by conveyor, only the identification and palletizing functions are provided. An SKU or stock-keeping unit, by definitions, is the lowest unique type which can be specified for retrieval from the warehouse; i.e., in our example, a particular style in a specified color and size.

The computer now knows what quantities of which SKU's have arrived, and based on its knowledge of empty rack slots in the warehouse and of whether each SKU is a fast mover or a slow mover, automatically determines the proper storage location, moves the goods to that location, and puts each SKU away in its assigned rack slot. The rack slot assigned may be one which is normally reserved for that SKU, or the assignment may be made on a "floating slot" basis from among all slots currently available. Movement from the receiving area to the slot may be via conveyor, stacker crane, computer-controlled vehicle, etc. A stacker crane is a fixed-rack structure, possibly 30-60 feet or more high, with controlled, constrained carriers running horizontally and vertically in narrow aisles to store or retrieve goods in slots in the rack structure. Computer-controlled vehicles which exist today are automatically driven horizontally and extend their lifts vertically to operate at heights to about 30 feet. The vehicles are not constrained to one or a few specific aisles in the rack structure.

the computer's job

During the course of putting away the goods, the computer has updated its inventory records and is now ready to pick from both the old inventory and from the new goods just added to inventory. Orders received by mail, by data terminal from distant salesmen, etc. are processed by the computer in standard ways for customer credit verification, order allocation, etc. The computer then makes up optimized order-picking runs for the stacker-crane carriers, computer-controlled vehicles, or other retriever and moves the equipment to the storage location. Depending on the type of equipment, the computer may have to solve the dynamic problem of traffic interference, and may bear the brunt of precise positioning of the retrieval mechanism, at and within the proper storage rack slot, using a variety of sensors and limit switches. The computer must recognize the exact physical placement of the unit carton; control the grasping mechanism (mechanical, suction, etc.); determine when the carton is safely on the retrieving carrier, vehicle, or conveyer; and then provide for movement to the correct marshalling point. Checking, packing, and shipment may then be manually aided or possibly controlled to a large extent by the computer. Just prior to shipment the computer automatically prints out necessary paperwork to accompany the goods: packing slips, bills of lading, invoices, if required; and updates its accounts receivable, order status, sales statistics, and other files as necessary.

While this imaginary example is extreme in that all the functions have been described as computer controlled, installations exist today which demonstrate that each of the functions can be computer controlled economically; although there is no operating installation today, to my knowledge, which demonstrates full computer control of all the functions *and* is integrated with a total corporate information system.

costs and savings

Our example illustrates the functions involved in a rather restricted case: a finished-goods warehouse handling small-cubic-volume packaged goods. The same functions must generally be performed in other finished-goods warehouses, and in large work-in-process, raw materials and parts holding facilities; but the materials handling equipment solutions are different, and new requirements are placed on the control equipment.

Take the case of automotive parts stored in palletainers (rigid wire baskets)—shapes are irregular, units must be counted and grasped. Or take the case of bagged or hanging garments—again, counting and grasping differ from the simple kraft carton, and the transporting means may be different. Or take the case of work-in-process storage of engine kits weighing a ton or more—the unit weight and the need to move many individual loads in and out of production work stations call for different transporting equipment and pose some different problems for the control equipment. The over-all system problems, however, are basically the same for the full range of in-plant storage and movement situations, and sensors and mechanisms already exist which can be combined to implement nearly any installation requirements. The big question is cost, and by this we mean "total cost."

The concept of total cost here includes not only those directly attributable costs which are normally part of a discounted return-on-investment determination, but also the assessed value of improvements in customer service (and at times the necessary deterioration in service), etc. Lest the computer-controlled warehouse example above be too convincing, it should be remembered that, for many types of goods and warehouse situations, man's faculty for visual recognition and his tactile capability are difficult to replace economically.

Where do the benefits of computer direction and computer control arise?

Labor saving
Space saving, increased use of warehouse cube
Decreased inventory
Improved customer service
Decreased breakage and pilferage
Decreased utilities cost
Better adaptation to seasonal or other peaks
Better management control

Many of these benefits are also available from computer-planned systems but in lesser degree.

Warehouse labor currently costs $8,000-$10,000 per man-year, including fringes, and is headed higher. In addition to the saving on "direct" personnel such as order pickers and packers, there is normally a saving also on supervisory and warehouse protection personnel. While the saving in unskilled and semiskilled warehousemen is offset in part by new skilled personnel, the dollar saving is typically large. Labor reduction, however, is important for several reasons besides this dollar saving. Although appreciable unemployment exists in several parts of the country, particularly among minority groups, it is frequently difficult to fill warehouse jobs. This difficulty will probably increase. It is especially severe when trying to build up the warehouse force to handle peak periods. Training is also something to

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reckon with, considering the high personnel turnover rate in many warehouses and the sudden large accessions in peak periods.

Space saving comes about by being able to stock and pick at heights in the 16-60 foot range rather than being limited to what a man can reach with a stepladder. It is generally cheaper to go up than out; cheaper to utilize a warehouse's existing unused height, or build a new warehouse higher, than to increase the ground level dimensions. With new warehouses costing $4-$8 per square foot and up, this can be a considerable saving.

inventory and other savings

Decreased inventory results from the ability to "work" a small inventory harder under computer direction or computer control. Items received for storage are immediately available for picking (even from the receiving area before storage, if necessary). With total inventory holding cost at 10%-30% of inventory value annually as cited earlier, this is reason enough to keep inventory low. Additional savings are offered to manufacturers of style and seasonal goods due to rapid response time—fewer problems with obsolete stock and missed markets. Decreased inventory also benefits makers and distributors of items with limited shelf life. Decreased inventory may be the result of reducing inventory at a single location, or the consolidation of a large number of warehouses into a few facilities or into a single facility. The cost savings here can be particularly large, but the acceptable and desired levels of customer service must be reviewed carefully to determine how much consolidation is appropriate for the best "total cost" solution.

Customer service, in many industries, is the prime competitive characteristic among products similar in quality and price. Shipping orders the same day received, the next day, or always meeting the committed date, is worth money. The ability to respond immediately to emergency orders is another plus factor in gaining and retaining customers. Over the past several years there has been a discernible trend for both retailer and industrial customers to demand smaller shipments, per item, on a more frequent schedule. This demand is expected to grow.

Decreased breakage and pilferage can mean large savings, especially where consumer-usable goods are concerned. Fewer personnel in the warehouse, and having the warehouse under greater control, yield these savings quickly and dramatically. With a computer-controlled system, fewer access points to the warehouse building are necessary, thus somewhat reducing plant protection needs.

Decreased utilities cost is applicable primarily to new warehouses where very few or no stocking and picking personnel are needed. A computer-controlled stacker crane needs neither heat nor light in the rack area. This saving may appear to be small at first glance, but the investment and operating costs turn out to be large.

Better adaptation to seasonal and other peaks has been discussed above in terms of labor and inventory levels. This is a key point for many companies whose annual profits depend heavily on the peaks.

Better management control may seem to be a too general intangible, but this factor has turned out to be one of the major benefits in current successful installations. Consider only two aspects: in a computer-directed system in which men are given step-by-step tasks by the computer, work can be paced at an agreed level and variations from this pace are immediately visible exceptions. Second, and more important, in either a computer-directed or computer-controlled system, is management's ability to program stor-

age and movement strategy and tactics into the computer and have them implemented automatically. As an example, the change from a fixed-storage slot to a floating-slot strategy in a large manual warehouse is a huge undertaking which many times would not be attempted even with substantial benefits in sight. Under computer direction or computer control, assuming the programming is manageable, the physical changeover can be a routine matter woven into normal stocking and picking operations.

hardware and systems

How can these benefits be achieved? Primarily, by good "systems" work; secondly, by judicious selection of hardware. Good systems work is necessary for proper solution of the storage and movement problems, but even more so for efficient and usable integration with the corporate management information system (MIS).

Current and future requirements of the MIS for processing power and data storage will dictate the hardware configuration to a large extent. The physical control of even a sizable network of materials-handling devices usually requires only a minicomputer with an 8K-16K core. More capacity is required for tasks such as allocation of orders to transporter runs, dynamic optimization of the runs, updating of inventory records, handling of exception conditions (such as lack of stock that has been requested to be picked, automatically establishing "back orders," and reporting these actions to the customer).

These tasks can be performed either by the central processor on a periodic basis, or split between the central processor and a beefed-up satellite unit. If desired, the load on the central processor can be kept to a very low level, essentially only accessing the central discs briefly and infrequently. Suffice it to say that the system economics require careful study. Hardware is currently available to perform all the necessary jobs, but the range of cost is extreme between the right configuration for an application and the many wrong ones that will do the job by overpowering it.

One highly important requirement for this "process control" system is high reliability. If the computer or other key equipment goes down, the user's shipments to his manufacturing floor or to his customers suddenly stop. The business interruption cost is high. It must be minimized by system design.

to come

The computer-directed and computer-controlled systems to be installed in the early 70's will be tailored to the requirements of individual large warehouses, both as to software and to some of the hardware. By large warehouses we mean those which in addition to having large cubic capacity regularly stock many thousands of stock-keeping units[1] and fill at least several thousand orders (line items) daily. While this market is quite sizable, the field will really "take off" when standard software is developed which will allow systems to be installed in smaller facilities with only minor tailoring, and which can be hooked into time-shared computer equipment not operated by the user.

The combined private and public warehouse market is huge. It will be maturing in the next few years for those suppliers who start now to put together teams with depth of experience and knowledge in warehousing, materials handling, computer control, information systems, and large system design. ■

[1] Or alternately, large unit quantities of a small number of SKU's, as in a refinery barrelling plant.

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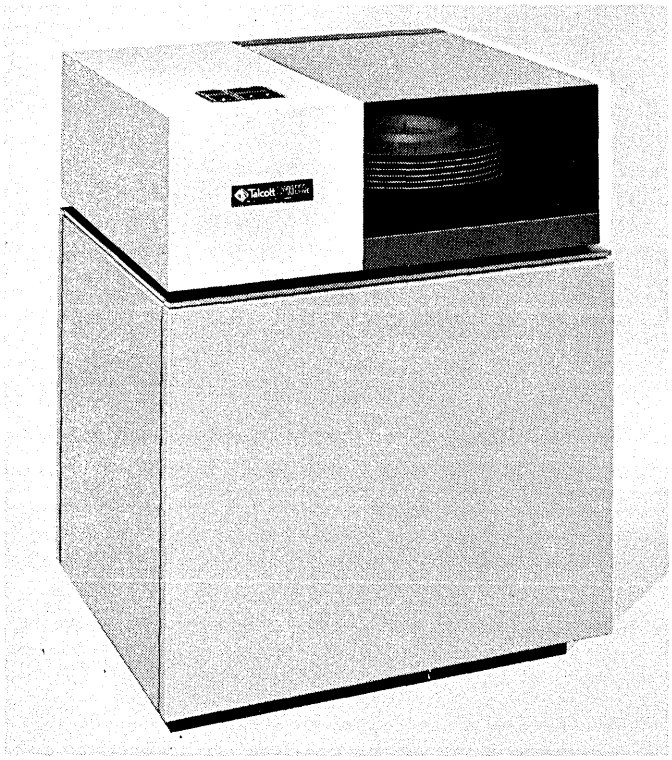

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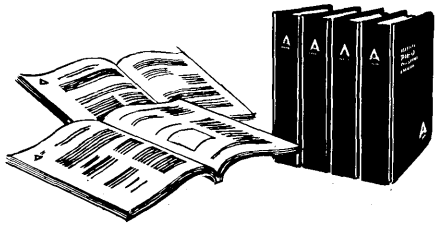

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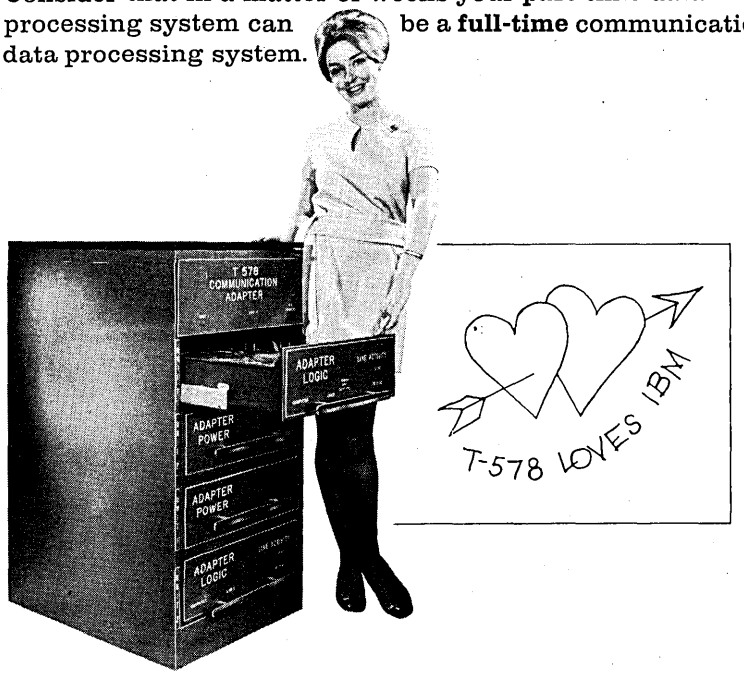
And that's only part of the T-578 story. The kit enables your 1130 to control any remote terminal—from a Model 33 Teleprinter up to an IBM 2260 Display Station. It accepts any speed-code combinations up to 240 characters per second with either serial or parallel transmission, on dial up or dedicated telephone lines. And, if volume requires it, the T-578 can have all 64 lines working at 1200 bits per second!

What's more, T-578 turnkey systems—including hardware and software—are also available.

So take that long hard look at your 1130 computer. Consider that in a matter of weeks your **part-time** data processing system can be a **full-time** communications **and** data processing system.



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CIRCLE 48 ON READER CARD

It's made time-sharing a graphic art.

The new time-share terminal. Hewlett-Packard's answer to the graphic time lag. HP's graphic terminal picks up where the Teletypewriter leaves off and provides a revolutionary new capability: in-house graphic plotting of all time-share computer data. Instantly. Accepts time-share EIA ASCII inputs from the Teletypewriter..

The HP 7200 Graphic Plotter generates visual presentations of mathematical and engineering functions, no matter how sophisticated. Or it plots business computations like bar graphs and pie charts. It can spot a trend, prove a theory, compare data, generate engineering designs. It lets the time-share user get more use out of a terminal because he can get more use out of the numbers. He instantly comprehends typewritten data in smooth, clear plotted form.

HP's versatile new Terminal for time-share systems plots points or lines. Each data point is defined by its X-Y coordinates and the 7200 is a vector plotter, plotting absolute coordinates from all inputs. The position of the plot is adjustable and any preprinted grid or blank paper can be used. No special training is required to operate the 7200.

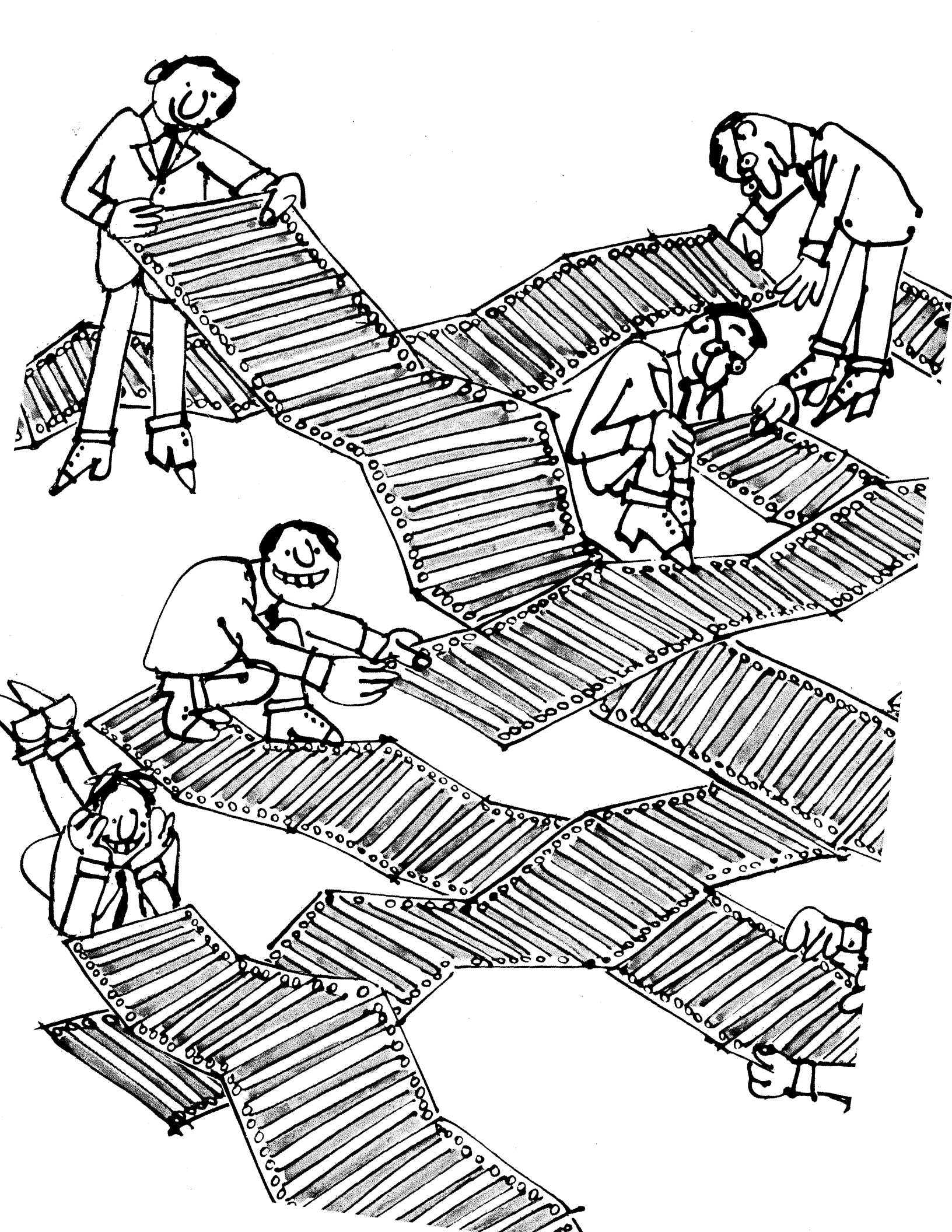
Check out Hewlett-Packard's new 7200 Graphic Plotter. It's available through time-share services. Call and learn how simple it is to plot computer-resolved problems—points, curves, circles, lines, ellipses, contours, bar or pie-charts. You name it. Look into expanding your time-share capability. Any time-share service that hasn't heard about the 7200 should talk to us.

HEWLETT hp PACKARD

GRAPHIC RECORDERS

CIRCLE 87 ON READER CARD

11920



New Mimix makes a good impression from beginning to end.

Each Mimix copy is so great you'll never hear a complaint from the back office. And you can get eight or more sharp, legible copies on computer printers.

The coating technologists at St. Regis have created Mimix, a new carbonless paper. Unlike most carbonless paper, Mimix was designed for use on high-speed computer printers.

And when the job's done. It's done. There's no time lost for removal and disposal of carbon paper.

Everyone likes his copy. And there's no carbon ruboff with Mimix. You'll get clean dust-free, smudge-free copies... every time.

Mimix is now available in white. However, our representatives will be happy to talk with you about any special order you might desire. In fact, we'll be glad to talk to you about any questions you may have on Mimix, another St. Regis innovation for better business forms. Give us a call or write: St. Regis, Laminated & Coated Products Division, Troy, Ohio 45373. Tel. (513) 332-1271.

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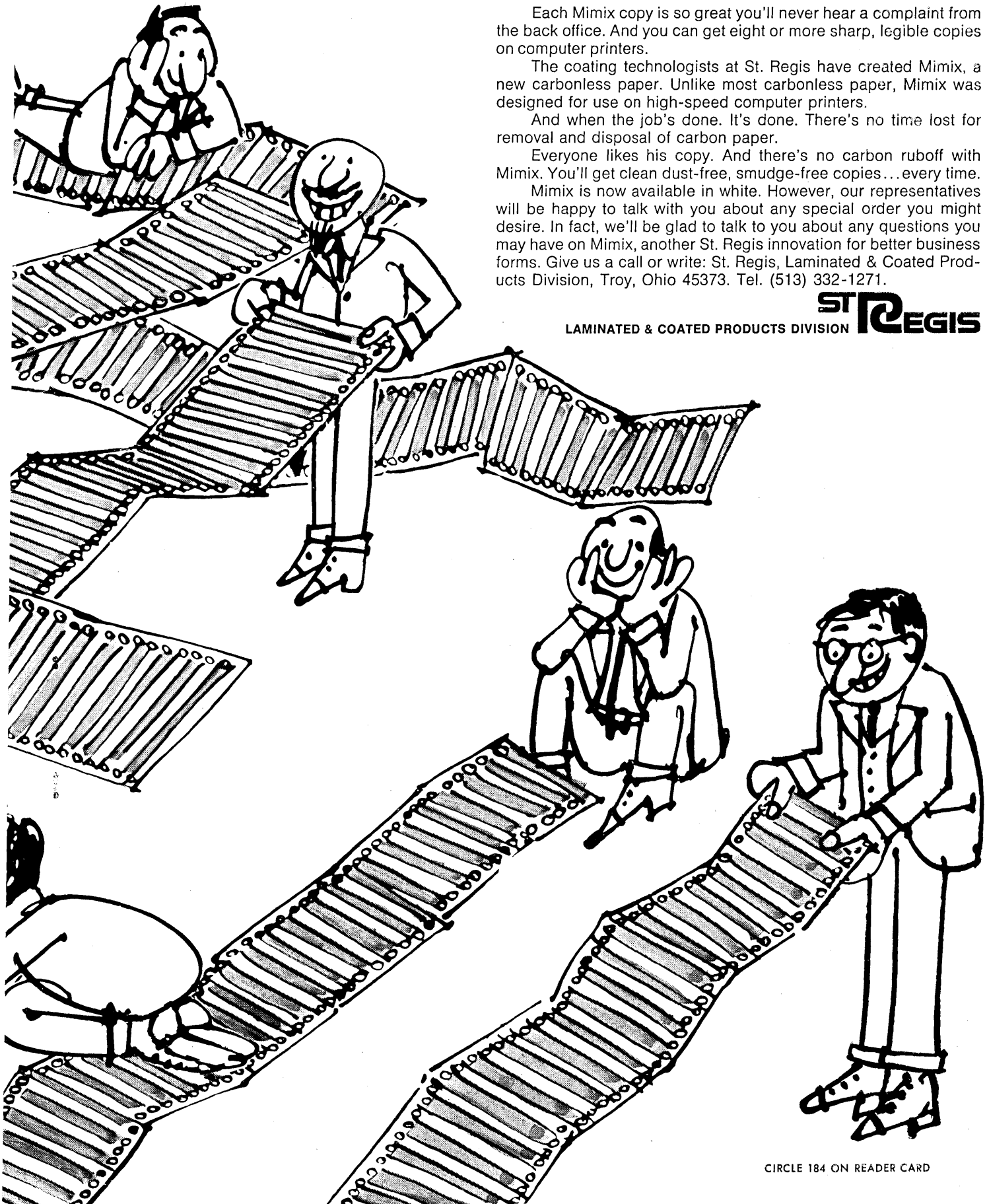

CIRCLE 184 ON READER CARD

june 16-18
washington, d.c.

IEEE 1970 INTERNATIONAL COMPUTER GROUP CONFERENCE

One of the more prestigious computer conclaves of the year, the IEEE International Computer Group Conference, is scheduled for June 16-18 at the Washington Hilton, Washington, D.C. This annual gathering has become so respected for its technical content that the hardware session at the Spring Joint Computer Conference had to be canceled, apparently because authors preferred to submit their better efforts to the IEEE program. An international roster of industry authorities will focus on the engineering and design aspects of new developments in memories, terminals, and peripherals in keeping with the conference theme, "Challenge of the Seventies."

plenary session

Because it has been estimated that close to three-quarters of every computer dollar will be going into peripherals by the end of the decade, it is important that the technology projected for the 1970's be understood in relation to the marketplace. Thus, the conference opens Tuesday morning with "Tomorrow's Technology and Markets," a plenary panel session chaired by DATAMATION editor Robert B. Forest.

It opens with brief position papers by panelists Lowell D. Amdahl (who will treat Tomorrow's Technology), J. Peter Ross (Industry-Oriented Markets of the Seventies), Werner L. Frank (Software in the Seventies), George Cogar (Tomorrow's Memories), Robert Seeds (Semiconductor Technology), and L. C. Hobbs (Tomorrow's Peripherals). Chairman Forest and discussants Dr. H. R. J. Grosch, F. G. Withington, Patrick J. McGovern, Phillip H. Dorn, and Dan L. McGurk will then quiz the panelists, after which panel and discussants will accept questions from the audience.

tuesday afternoon

Tuesday afternoon you'll have to choose between three concurrent sessions. One, titled "New Memory Devices," is a formal session that will describe an array memory technology which offers very high bit densities and low drive currents (challenging plated wire techniques); a proposal involving a crt as a flying-spot scanner and photoconductor - ferroelectric memory chips; a sonically accessed magnetic film memory; a shift register memory that involves controlled comain wall motion along fine wires of a special magnetic alloy; and holographic memories. Session Chairman is R. O. McCary, of GE's R&D Center.

A second session, "Packaging for Electronic Systems," is chaired by Robert E. McMahon, of Lincoln Lab. It is a formal session, to be followed Tuesday evening by a dig-deeper discussion. The five papers will examine the problems and trade-offs at the various technological levels ranging from the semiconductor monolithic chip and complex substrate to the actual system design. Particular attention will be devoted to the problems of future substrate designs and the role of computer-aided layouts, as well as to economic factors.

The third Tuesday afternoon session is "Computing Power in Terminals," a panel discussion chaired by Prof. Edward L. Glaser of Case Western Reserve Univ. The central question will be: How much processing power should be included in the terminal, how much in the computer, and why? The panel will consider display terminals, uses of video technology, two-way speech I/O capabilities, man-machine relationships, the complexity vs. utility issue, minimizing the size and cost of terminals, terminal-computer communications circuitry, logic-memory trade-offs, and human engineering.

Tuesday evening there's a panel session on "High-Risk Money for New Computer Companies: How, When and Where," chaired by Robert F. Johnston, and presumably directed to bright young technical types thinking of streaking out on their own. The panel includes representatives of the sources of advice for the management of a young company—private investors, lawyers, and investment bankers.

wednesday morning

The highlight of the conference may prove to be "Main Frame Memory Technology," a three-debate session chaired by Tudor R. Finch of Bell Telephone Labs. The first debate is between Leo J. Slattery of Fabri-Tek and David A. Hodges, Bell Telephone Labs, who will discuss magnetic vs. semiconductor memories. Debate II is on core versus plated wire, with Philip A. Harding of Electronic Memories and Magnetics arguing for the cores, and George A. Fedde of Univac tout-

ing plated wire memories. The third debate will feature hybrid semiconductor memories vs. single technology semiconductor memories. The merits of each will be discussed, respectively, by Wally R. Raisanen of Motorola Semiconductor and Gordon E. Moore of Intel Corp. Audience participation in the Great Memory Debate is invited at the evening follow-on session.

"Terminals for News Processing and Editing," a paper/panel session, will attempt to describe computer-assisted news processing and editing; to relate news editing and processing procedures to specialized requirements for display terminals; and to examine current approaches to the design of terminals for this application. Both developers and users will be represented on the panel, and the audience is encouraged to participate in the discussion. MIT's Electronic Systems Laboratory director, Prof. J. Francis Reintjes, will chair the session.

The third Wednesday afternoon session will be "Terminals & Peripherals for Special Purposes," a formal presentation chaired by Dr. Wolfgang Giloi, professor at The Technical University of Berlin.

Pictured are (at the left) Bob O. Evans, President, IBM Systems Development Div., Conference Chairman, and Dr. Gardiner Tucker, Assistant Secretary of Defense Systems Analysis, Technical Program Chairman. Maurice Allegre, Director of Electronics, Republic of France, is conference International Co-Chairman. Program Co-Chairman is Dr. Martin Greenberger, Chairman of Computer Science, Johns Hopkins Univ.

the conference luncheon

Dr. Lee A. DuBridge, President Nixon's Science Advisor and Director of the Office of Science and Technology, will address the conference luncheon Wednesday noon. Also being presented at the luncheon is the W. W. McDowell Award, to be received by Dr. Frederick P. Brooks, Jr., of IBM, for outstanding contribution to the computer architecture and programming and for leadership in cooperative efforts to further education in the computing field.

wednesday afternoon

"Software and Terminals" opens with the presentation of papers which address the software needed to support optical character recognizers, the impact of the APL terminal language on numerical applications, and software for a modern OLRT medical terminal. The session will be chaired by Henry S. McDonald, assistant director of Bell Telephone Labs. Panelists are John Couleur, UCC; Robert Masters, director of Medical Systems Research Lab, Minneapolis; and Prof. Frederick Heath, Univ. of Manchester, England.

Six papers will be presented for "Diagnosable Design and Diagnosis," a formal session that will review the essential characteristics of a reliable circuit, discuss new diagnosable logic designs, and apply some advances in mathematical techniques for diagnosing hardware failures in both combinational and sequential logic. The session is chaired by Ralph J. Preiss, of IBM's Systems Development Div. A follow-on session is scheduled for Wednesday evening.

Current and future trends and problem areas in the rapidly emerging field of "Low Cost Teledisplays" will be presented Wednesday afternoon at a panel session chaired by Charles Fisher of Electronic Engineering Co. of California. Panelists include Derek Chambers, Raytheon Co. (who will discuss moniscope character generation); Enrique Moreno, Beehive Electrotech (LSI refresh memories); Tom Cheek, Computer Displays, Inc. (storage screen displays); Neil Clark, TEC Inc. (centralized store refresh memories); and K. R. Fechter, Univac (low cost systems).

thursday morning

Three concurrent sessions are scheduled, all quite promising. The first is "Functional and Control Memories," to be chaired by James L. Previte, from Rome Air Development Center at Griffiss AFB. Descriptions of various functional memories will illustrate their application to a number of important system functions to demonstrate that the cost effectiveness aspects of large scale integration point the industry toward wide usage of these memories in computer design. Papers include: Processing Memories; The Use of Read Only Storage Modules to Perform Complex Logic Functions; Functional Memory as a General Purpose System Technology; A Modular Plated Wire Associative Processor; and Associative Memories for Executive Control Functions in an Advanced Computer System.

"Advanced Terminals and Sensor Actuator Devices" will describe and evaluate techniques which may lead to radically new design options. The ideas range from the nearly practical (electro-luminescent panels) to the exotic (eye-tracking and speech input). The session is chaired by Dr. Jerome A. Feldman of Stanford University's Computer Sciences Dept.

The last concurrent session is titled "Rotating Memories and Electronic Drums—Performance and Cost Considerations." Edwin I. Blumenthal of Burroughs will chair the session. Panelists include Dr. Richard Arnold, IBM; Berne D. Broadbent, Hughes Aircraft; Robert Lloyd, Advanced Memory Systems; Reginald Tickell, Univac; Robert Jack, Burroughs; Irving L. Wieselman, Data Products Corp.; and Harold S. Yang, Information Storage Systems. Each will discuss his views on the state of the art for each class of memory device projected for the mid-seventies: solid-state memories designed to replace high-speed drums, high-speed drums and head-per-track discs, moving-head fixed-media drums and discs, and removable disc pack drives.

paper and panel evaluation

It is the audience who will determine the winners of the best paper and best session awards to be presented at the close of the conference. Each attendee will be given a punched card at the beginning of every session. After evaluating each paper and the session as a whole, he will poke the card in the appropriate places and submit it after the session. A computer program is now being written that will deal with these cards to determine the award recipients. Just in case anyone tries to get *funny*, an awards board will back up the decision this first time around. Plenary sessions are not eligible.

(Continued on p. 148)

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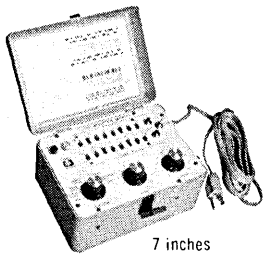
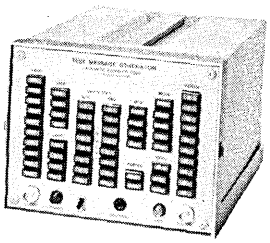
You wouldn't know by their small sizes, light weights, and low prices, but this family consists of the real pros when it comes to generating telegraph and data test messages. They out-perform all the rest . . . and there's one for **your** special purpose.

(TMG-3 SERIES.) A small, solid-state, portable instrument. Operates at speeds from 45 to 150 baud. Provides an alternating 2-character sequence, and has a push-button control for single transmission of either character. Distorts from 0–45% in 5% increments. 2 output jacks. (7 lbs.)



7 inches

(TMG-10 SERIES.) For test center or field use. Operates at speeds up to 1,000,000 baud. Provides controlled distortion to 45% at speeds up to 50,000 baud: marking, spacing or switched bias. Front-panel push-buttons for programming 2-character message and for controlling even or odd parity for error rate detection at higher speeds. (10 lbs.)



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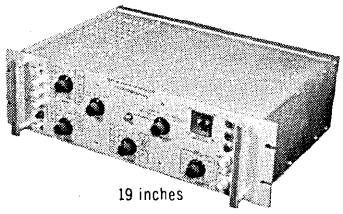

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CIRCLE 153 ON READER CARD

IEEE 1970 INTERNATIONAL . . .

closing session

A three-hour plenary panel session on "Systems Architecture" closes the technical program. According to session chairman Michael J. Flynn, of Northwestern Univ., two developments in recent years have played major roles in determining the direction taken by system architecture. The first is positive—the realization that the total developments in time-shared systems, terminals, and communications are tacit attempts to integrate the ultimate user into the system and provide better system response. The second is the relative failure to improve I/O access or response time, in spite of continuing advances in basic computer performance.

Position papers will be presented by Dr. Daniel L. Slotnik, Professor at the Univ. of Illinois, "The Only Thing That Counts Is How Fast You Can Subtract"; Dr. Gene M. Amdahl, IBM, "Storage and I/O Parameters and System Potential"; Dr. Lawrence Roberts, ARPA, "Communications in Systems Architecture"; Dr. Wallace Givens, Argonne National Laboratory, "Storage From a User's Point of View"; and James E. Thornton, CDC, "Storage and Operating Systems."

exhibits!

For the first time, exhibits will be held in conjunction with an IEEE Computer Group conference. Afraid that a sideshow might detract from rather than enhance the technical content of the program, the IEEE board made the decision that the exhibits be as totally compatible with the content of the sessions as possible. An estimated 5000 people are expected to shuffle through the exhibits of approximately 70 terminal, memory, and peripheral manufacturers in the Hilton's Exposition Hall. The exhibits should be an important attraction for the many government agency representatives in the area who haven't had the opportunity for local viewing of the latest gear since the ACM held its 1967 national conference in D.C.

registration

Advance registration for IEEE members is $25; $30 for non-members. Conference registration is $30 and $35, respectively. Fees include sessions, *Proceedings*, conference luncheon, and admission to the exhibits. For information, contact Don Doll, IBM Corp., 18100 Frederick Pike, Gaithersburg, Md. 20760 (301/840-6217). ■

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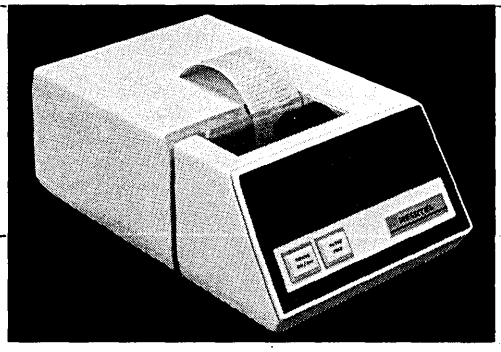
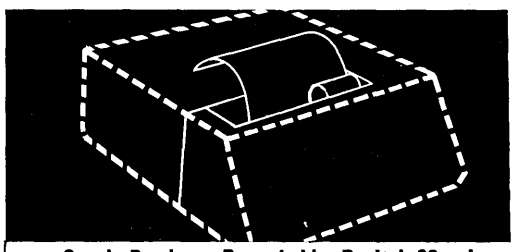
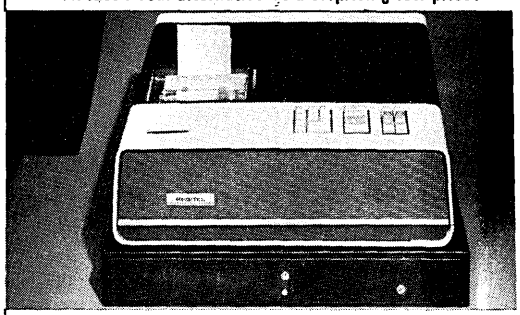


Just coming off the production line and already the most sought-after printer in the data world: the Regitel 4440! It's a compact machine designed for economical operation in a variety of communication terminal applications. It's currently available in either 30 or 40 column width with friction feed or exclusive Regitel Mini-Pin® feed.

The Regitel 4440 is unique in its quiet way (comparable in sound level to a modern electric typewriter) and its complete command of the English language (all 26 letters of the alphabet, 10 numerics, 8 symbols). Print visibility is immediate on single-ply plain paper, multiple-ply carbon or impact paper. The Regitel 4440 is versatile, reliable—thoroughly remarkable!



Sneak Preview: Remarkable Regitel 80-col. Printer See it first at SJCC! It's the 4440-C80 with full alphanumerics; it delivers 30 characters a second; it's plug-for-plug compatible with Teletype. At last a real alternative at a surprising low price!



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CIRCLE 15 ON READER CARD

a conference report

SECOND ANNUAL IIA CONVENTION

by Phil Hirsch, Washington Editor

Big improvements in the federal government's data distribution program were predicted by Assistant Secretary of Commerce Myron Tribus when he spoke at the second annual convention of the Information Industry Association in Washington recently. Even if only half of the predictions materialize, they could easily generate a quantum jump in commercial demand for government-collected statistics, technical literature indexes, and related products. Actually, there is a good chance most of the predictions will come true.

The IIA's "Infor-Expo '70" was opened by "The Harbingers," a young folk-singing group; after a few numbers, they had the audience singing along with them. This was quite an accomplishment considering the hour —9:30 on an overcast Monday morning—and the fact that most of the audience consisted of gray-haired, dark-suited business types who probably feel more comfortable with Bach, or possibly Guy Lombardo.

After the Harbingers came a three-day technical session. Besides Tribus' speech, it included an extended discussion of whether firms that develop computer programs under government contracts can retain property rights in the software.

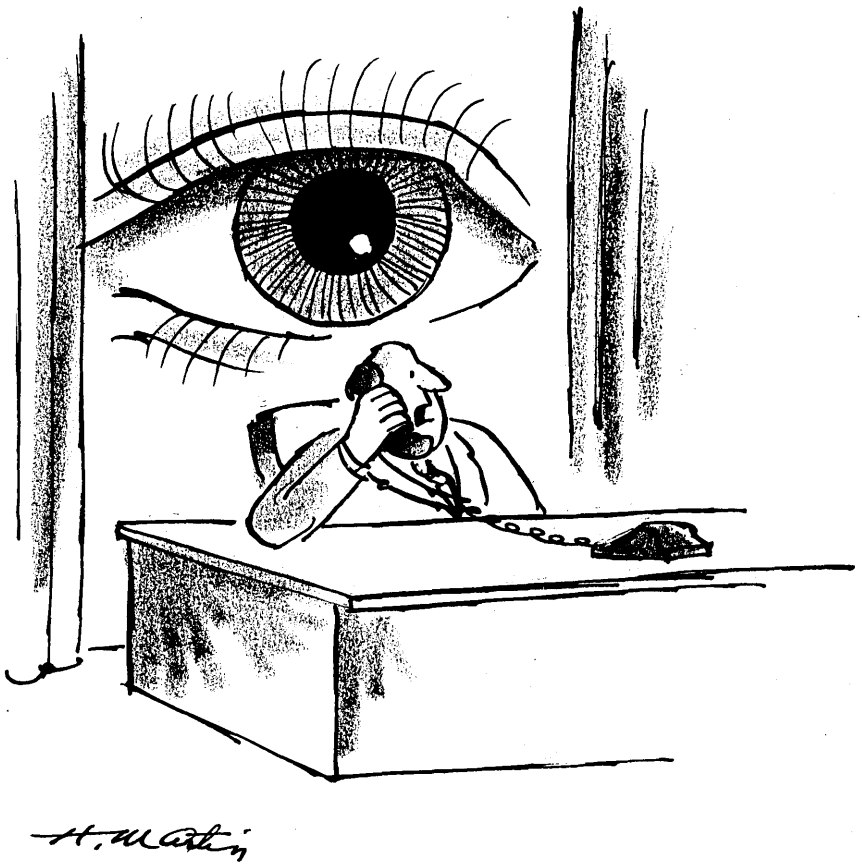
About 400 individuals attended the proceedings, and toured a nearby exhibit area; among the exhibitors were the Westinghouse Tele-Computer Systems Corp., which recently began offering t-s services east of the Mississippi; Eastman Kodak, which announced a new microforms publishing service; and a number of firms selling computerized literature search services.

Tribus indicated that data supplied by the Census Bureau, Business and Defense Services Administration, and other statistics generators within the Commerce Department will be converted into "smaller, more specialized packages aimed at particular users," will utilize "deeper indexing and categorizing" techniques, "an increasingly wide range of recording media," particularly microforms, and new pricing mechanisms.

The new prices probably will be higher, Tribus indicated, because the department wants to recover data collection and processing costs as well as the expense of publication and distribution. Current price schedules usually cover just the latter items.

Apparently, Commerce is also thinking of copyrighting some statistics generated by its constituent agencies. Tribus covered this point only in general terms, but he left the impression that Commerce wants to negotiate licenses with outside information brokers under which each firm would get an exclusive right to market specified data. Under existing legislation, the Secretary of Commerce already has power to copyright the output of one federal statistical program, the National Standard Reference Data System. He can also set the prices of NSRDS publications at a level designed to reflect the costs of compilation, publication, and distribution.

Another future improvement may be on-line data distribution to outside users. The weather data network operated by ESSA (Environmental Science Services Administration) is a possible model. "Commercial users tie into (this) network at no cost" beyond their own terminal and line charges, Tribus explained. "We can easily envision within the Commerce Department . . . a system tying department business data banks to inquiry terminals in the 42 Commerce field offices throughout the United States. We might, following the ESSA precedent,



"Send somebody up from maintenance and have them tear this office apart. I have a funny feeling I'm being watched."

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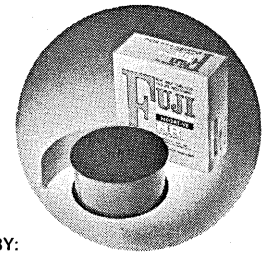

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CIRCLE 140 ON READER CARD

permit commercial users to tie into this communications network . . . (They) would obtain the data for their own use or for repackaging and resale."

Tribus thought Commerce would make greater use of outside intermediaries to disseminate data to the public. He mentioned the Census Bureau's summary tape processing centers as one beneficiary. (For more on these centers, see "World's Biggest Data Bank," p.).

He added that the department wants to increase file compatibility so that users can pull together information from a number of different data bases. Also, some in-house file processing and reproduction work, now scattered among various Commerce agencies, is likely to be consolidated at the Clearinghouse for Federal Scientific and Technical Information "to take advantage of the economies of scale that result . . . " The consolidation could involve some census-processing operations, Tribus told us afterward.

Possibly the most informative treatment of contractors' rights to machine-readable data products they develop under government contract was presented by Gerald McCoy and Andrew Bain. McCoy is deputy assistant to NASA's general counsel for patent matters; Bain is the Singer Co.'s vp for contracts.

McCoy discussed recent changes in the agency's "rights in data" clause. Basically, under the old rule, contractors could copyright technical data; now, they can copyright nontechnical data as well. But computer programs are still largely outside the pale.

The reason, McCoy said, is that "NASA is required to seek for the public the widest possible dissemination and benefits for its technology." If contractor-copyrighted software was disseminated, users might be subject to infringement suits. But McCoy quickly added that "a deviation to this general policy would be considered by NASA should the contractor establish that a private copyright would enhance the dissemination and utilization of the computer program."

This new policy applies only to software developed by a contractor directly in connection with a NASA contract. If the contractor develops a program on his own, he's free to copyright it, but usually must grant the agency a royalty-free license "when the material is included in the (contract) work product," said McCoy.

Unless contractors take special precautions, Bain contended, they will lose the value of copyrighting independently developed programs bought by NASA. This is because the agency's "widest possible dissemination" rule will apply. He indicated that the rule would negate the copyright and allow use of the program without payment.

The way to avoid such difficulties, clearly, is for the contractor to negotiate limited-use arrangements with the government beforehand. NASA's recently adopted regulations permit this, McCoy said, but Bain argued that negotiating them is extremely tricky, particularly where a contractor wants to sell the same program to NASA and DOD. The basic problem is that the two agencies define independently developed data in different, often conflicting ways. Actually, current DOD regulations don't even allow a suppplier of independently developed programs to retain any proprietary rights in his product. The regulations are likely to be changed shortly, but until they are, said Bain, the supplier must protect himself by negotiating special contract provisions.

Bain added that "a contractor faces an almost impossible task in affixing the required (limited use) legend on some of the new forms of data. How do you place a legend on computer programs, tapes, cards, etc?" Even more difficult is the task of restricting use of privately developed data when it is part of a package that includes nonproprietary data which can be disseminated by the government without restriction.

Bain also questioned whether a limited use arrangement is really as restrictive as it sounds. Normally, he said, the arrangement keeps the government from releasing the data to outsiders. But he suggested that "internal users" can include state and local governments unless they are explicitly excluded.

Bain discussed a number of other legalisms that enable a contractor to restrict the scope of unlimited use arrangements. For example:

When the contractor grants Uncle Sam unlimited rights to machine-readable data, the thing he's giving consists, by definition, of symbols or codes recorded on a specified medium. The contractor can still restrict use of the same data embodied in another medium. There is even some question, added Bain, as to whether "unlimited use" allows the government to transfer the contractor's data to another medium and use it under the original contract.

"It is important to note that unlimited rights go only to the government," he added. Uncle Sam cannot obtain data from one contractor and give it to a competitor "so that he can build an item for commercial sale . . ." ■

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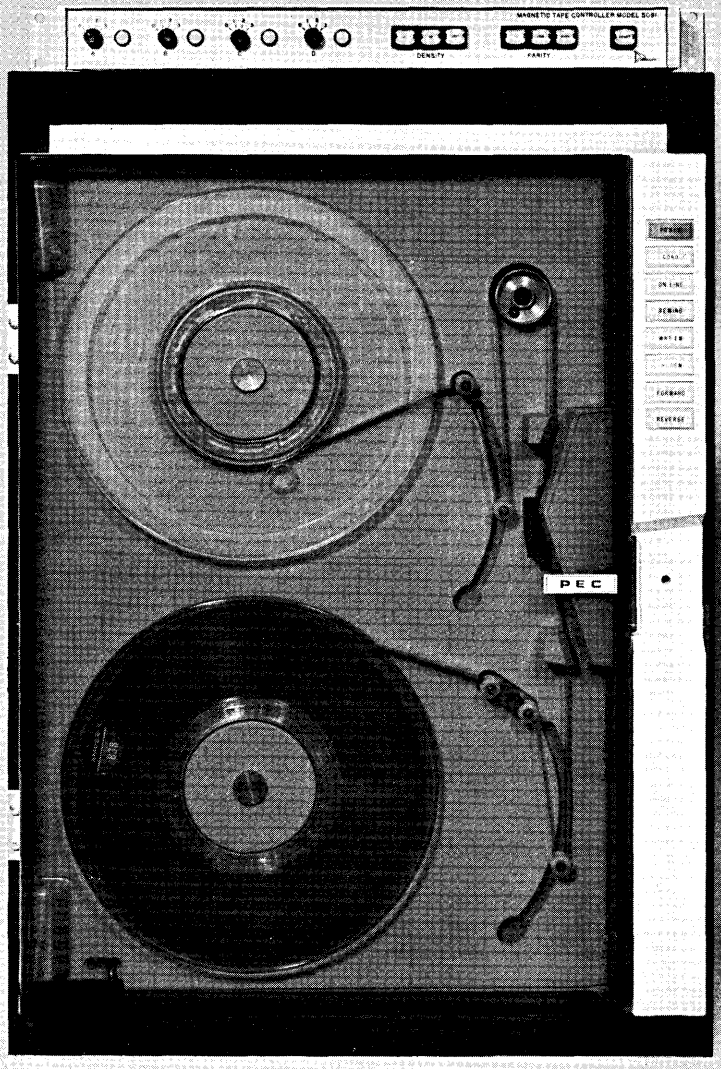

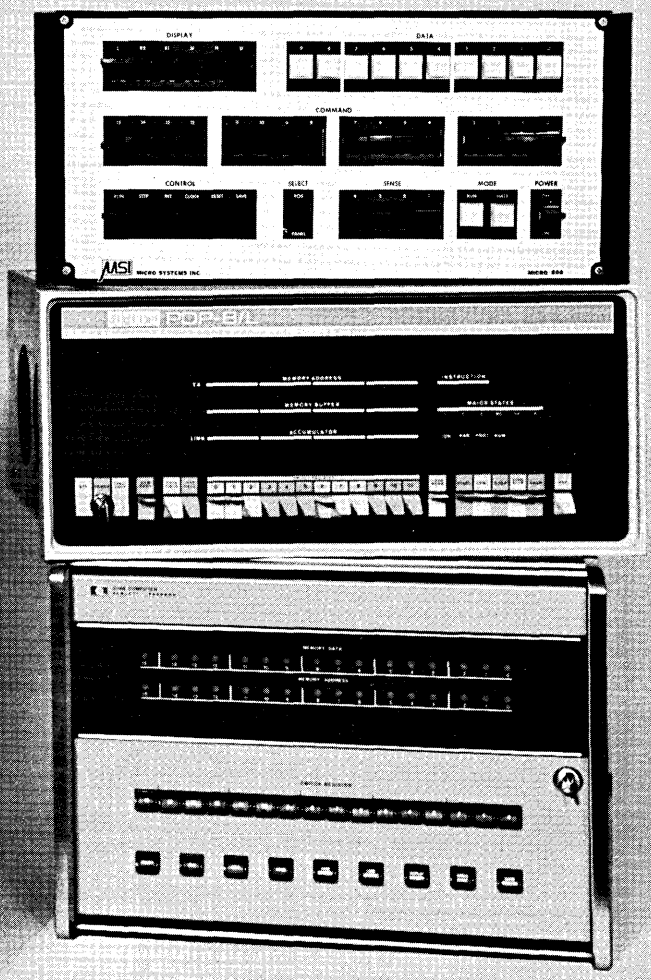

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a conference report

INFOTECH LONDON SEMINAR

by Pearce Wright, European Editor

Users, mainframe makers, software merchants and just plain philosophers converged on London from most of Europe for the first "State of the Art" series of lectures sponsored by an enterprising young company called Infotech.

In one sense the European community has an even greater problem than the United States in establishing efficient channels of communication between all the parties involved in the evolution of information processing and computer sciences. Government policies vary from country to country in the type of support proffered for industrial development and educational promotion; both manufacturing and software are a mixture of American and indigenous know-how; and relationships between universities and the hardware and software producers are as varied as the geography.

Number one in the Infotech series took on the shadowy concepts of the "fourth generation" for debate. At time of writing the future of the big machine, and the role and trends in terminals, were among topics for further meetings.

Ian Barron, founder of the U.K.'s flourishing Computer Technology Ltd., summed up the fourth generation for an obviously sizable fraction of the audience in rhetorical style.

"Will there be a fourth generation?", he asked. "We can ask it in a number of senses. Perhaps the most obvious one is this: will IBM announce a new range of computers to obsolete the 360? The answer to this question will affect the future of the computer industry during the next 10 years far more than anything that has been discussed during the three days so far."

Mr. Barron thinks the answer is "no." And for what he considers are the two best reasons in the world. It is not in the interests of IBM and it is not in the interests of the customer. Barron argued it was, perhaps, one of those happy coincidences that both these considerations were operating in the same direction.

Anyway, this came toward the end of the meeting after many users from the platform and floor had amply shown that rigid adherence to some traditional and inflexible attitudes of naming generations had caused a great deal of floundering in muddy waters for the users. Ironically, the first users view came from G. E. Hall, who is an IBM user for no lesser reason than that his job is to install the systems in the management information network in Europe for IBM's own manufacturing.

Here was a man of real interest to the audience, for he was speaking within weeks of the expected unbundling operation for IBM in Europe. (An event, again at time of writing, which was expected to be treated differently according to country in Europe.)

Mr. Hall thought there would be a breakthrough somewhere in teleprocessing, either in hardware, software or a combination of both. He asserted that we must get much improved teleprocessing software and hardware.

On hardware, he believed that we (meaning users) were going to get to the kit-of-parts stage, where we would get hardware from various manufacturers on a cost performance basis, and the user—at least with the next generation—would configure those himself to suit his basic needs. In line with this, he considered systems assurance, or the term for the somebody who had to certify the architecture of the whole system as a viable proposition. He didn't know whether independent consultants would do this or the larger manufacturer—but was sure as hell it had to be done.

Reflecting on past glories, he suggested that older dp personnel among users would remember when pessimistic systems analysts came along to say how much it was going to cost, how long it was going to take, and what we

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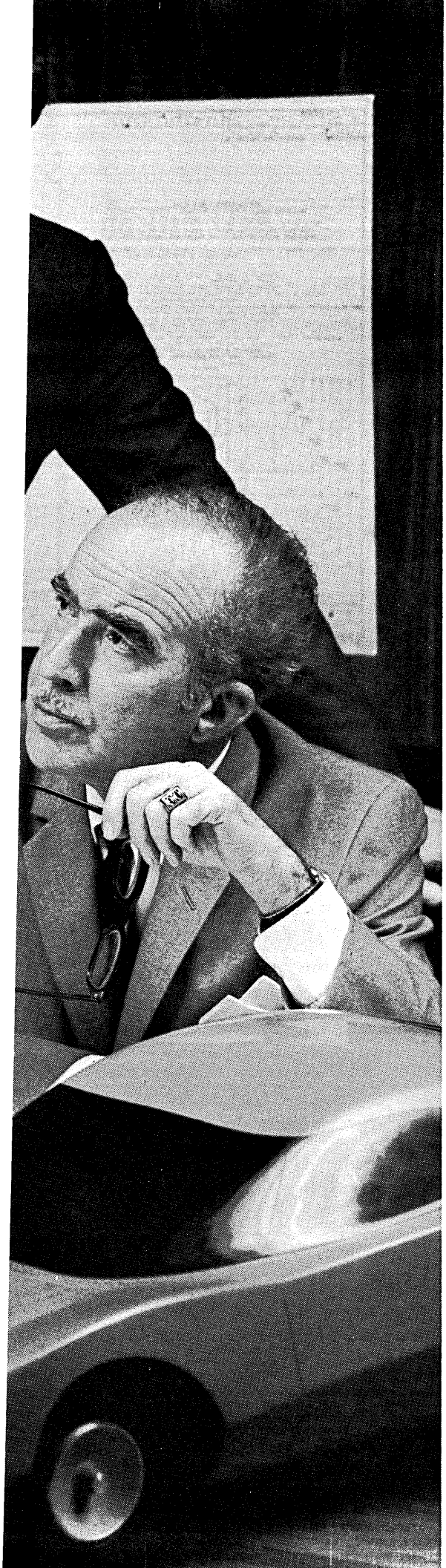

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22942

LONDON SEMINAR . . .

were going to get. The artful guy overlording planning, according to Mr. Hall, multiplied the cost by two, the schedule by two and divided by two the scope of the system he was likely to get.

When the third generation came along the rule changed to 3 x 3 x ½. Mr. Hall said he hoped there wasn't a need for a 4 x 4 x ¼ rule with the fourth generation, "but from the way it looks now it's a long road."

From the floor, Mike Woddger, National Physical Laboratory, asked what was expected in the way of a fourth-generation maintenance man.

Hall wasn't sure whether this person would be a systems programmer with engineering training, or whether it would be a group of people. He wasn't even sure where they would be located at the moment, because there was the interface with the telephone company on these networks and maintenance contracts to negotiate. Mr. Hall said that, when he first started going into the transatlantic telephone business, he ended up more of a lawyer and a politician, trying to negotiate this type of contract.

The next user, Ralph Laing of Rolls Royce, with three 360-65's, models 40, 50 and several in the smaller range, made the distinction between user and customer. He said that at Rolls Royce the dp managers were not the customers but managed a service organization. The real customer was the guy who ran the show—in his particular environment the production director and, much more directly, people like the production shop managers. Simulations seemed to take up more and more time at Rolls Royce, and for obvious reasons he could absorb faster and cheaper hardware.

Laing said that operating systems fell into a slot between hardware and software, and there was a considerable amount of work to be done in this field. He had talked to Hall earlier that day over coffee on the subject, and he was not satisfied that operating systems were generally at all customer-oriented.

The theme covered by Neil Gammage, from Elliott-Automation's computer research laboratory, was "addressing structure—the focal point of fourth-generation architecture." In part of his assessment he took as the baseline the estimated breakdown of effort required to produce a working program—something like 10% planning, 20% coding and the 70% debugging that also mops up nearly all the machine time. Gammage thought the fourth generation could supply at least three partial answers to the debugging problem. Architecture could be designed bearing in mind that good programming practice requires programs to be written in small, independently compiled units, with well-defined interfaces between them. Secondly, better diagnostics could be made available than at present. Thirdly, there was the development of multi-access terminals for debugging.

Another major problem facing users was efficiency. For example, the size of operating systems and the proportion of machine time absorbed as overhead was ever increasing as more facilities were demanded for organizing complex multiprogrammed and multi-access facilities. Mr. Gammage reckoned that although it had been possible to stay slightly ahead of the problem by cheaper and faster hardware, they were living on borrowed time. More hardware assistance was needed for the complex tasks that operating systems performed, a line of argument which took him into store management and addressing structures.

Experience with PL/I took up quite a bit of space in various papers. But one discussion period brought a contribution from the government-backed French manufacturer CII. This was as the users pitched their complaints about operating systems and the manufacturers batted them back.

Leclerc said CII had designed a time-sharing operating system for the French copy of Sigma 7. A PL 360 type language had been used which was designated LP 70 (because LP is programming language in French and 70 is the end of the French name for Sigma 7). In design, an arbitrary number of values was used when an event was transmitted to a coding process, in the sense that the activation of the process when an event came was really the same thing as coding the procedure with an arbitrary number of parameters.

The French found this language well suited to writing operating systems and a number of features had been added to the language to make it more and more machine independent. The CII programmers wished to dispense with allocation of registers or other peculiarities of the machine—like the fact that in order to move a word from one location it had to go through a register.

Leclerc thought machine-dependent languages would evolve with little difficulty into machine-independent ones. The problem was not of dependence versus independence, but of how simple one wished to make the language. ■

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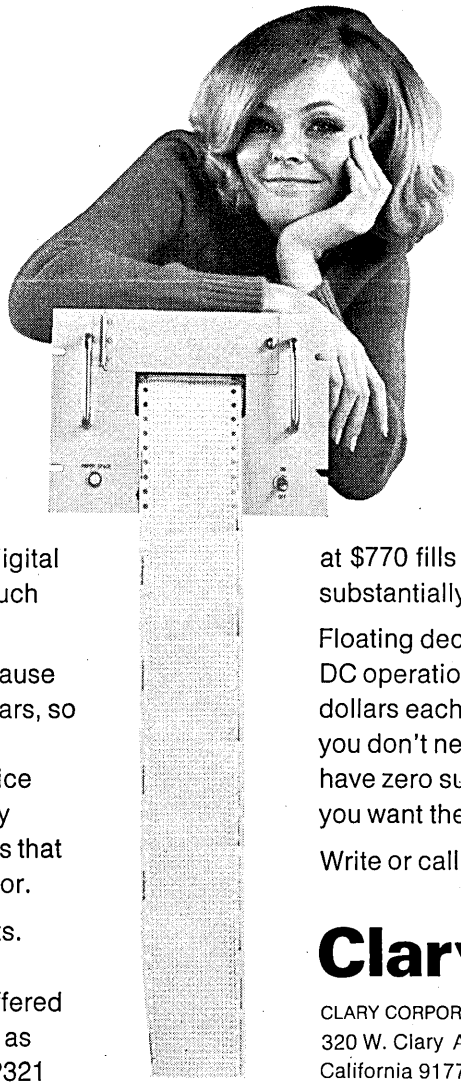

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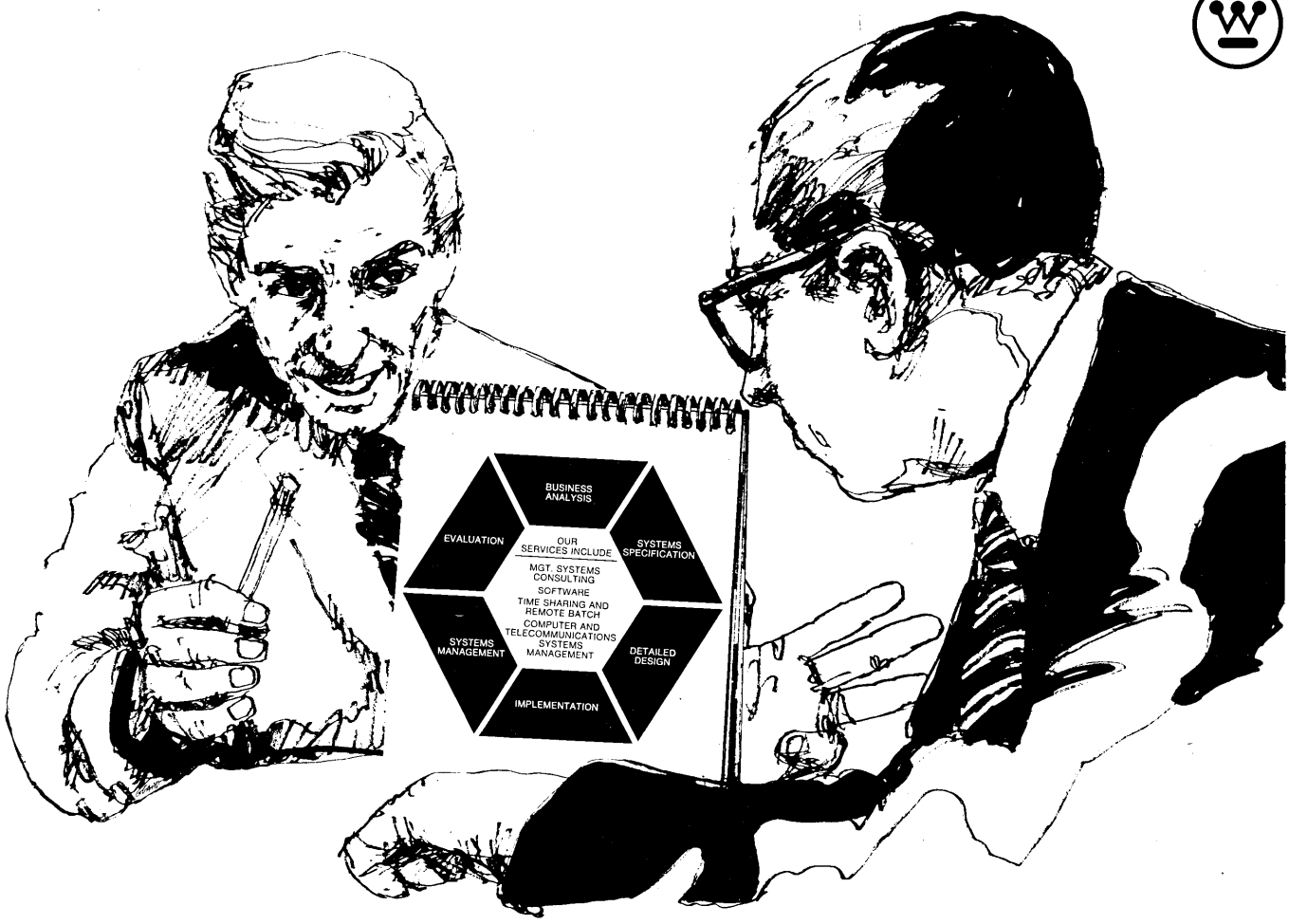

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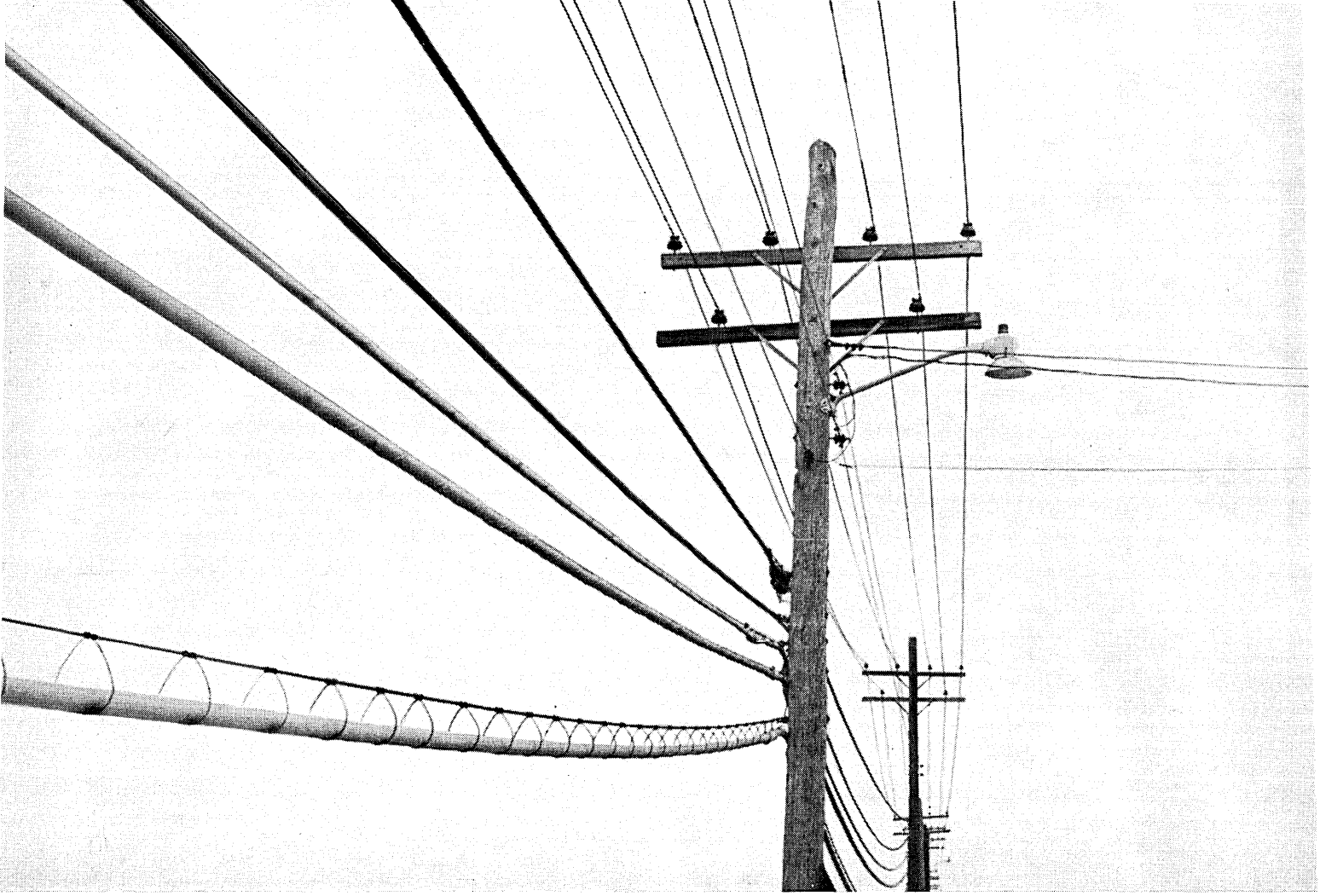

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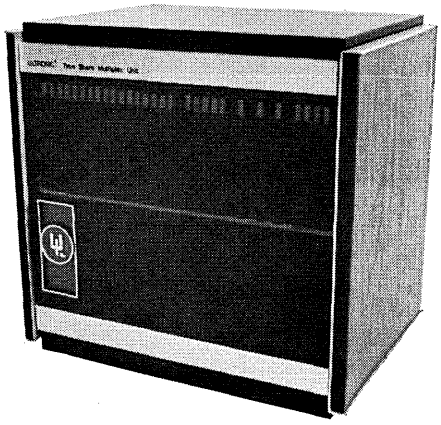

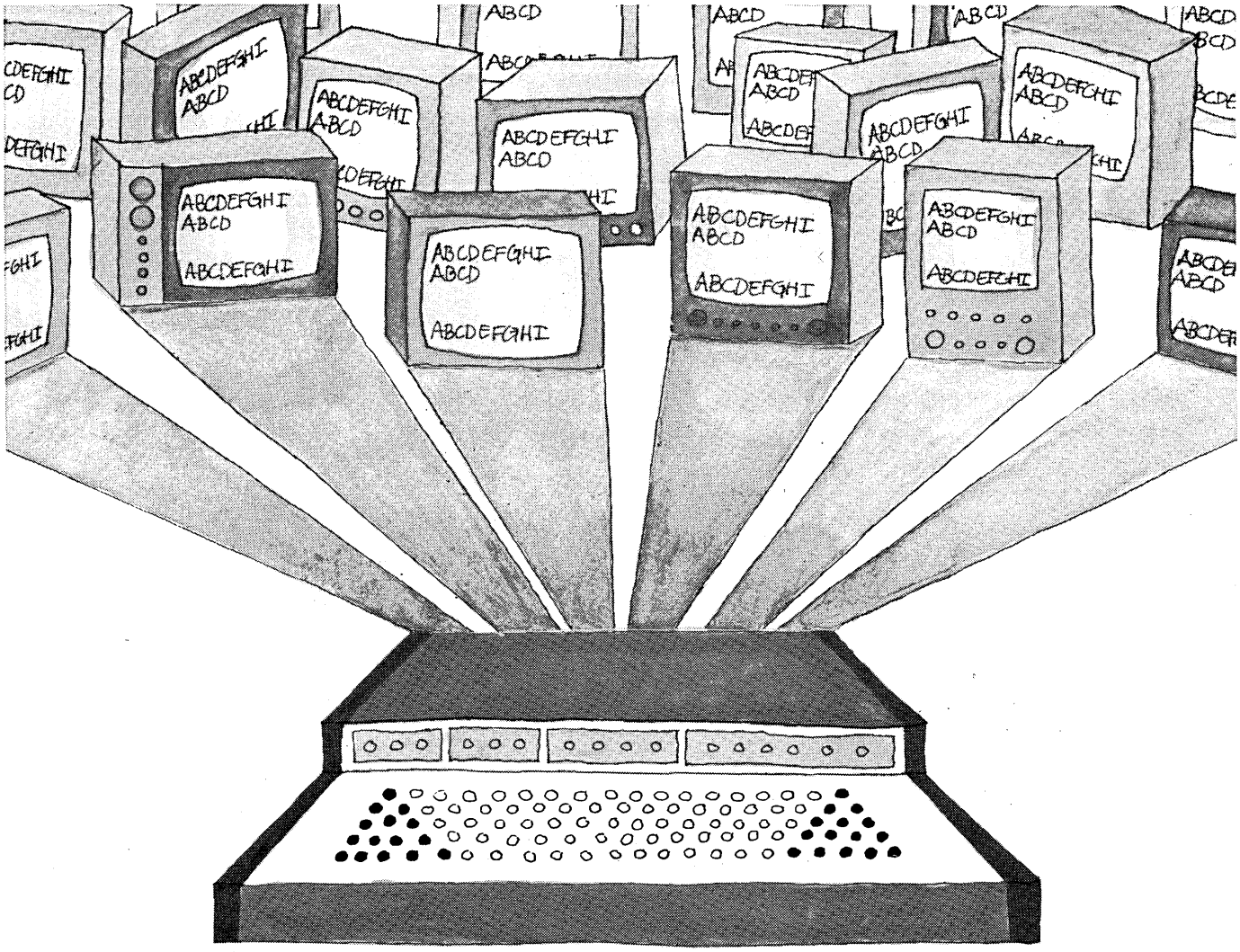

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news scene

an interpretive review of recent important developments in information processing

COMMON CARRIERS TO GAIN LEVERAGE DESPITE FCC PLAN TO PROTECT SB'S

On-line service bureau operators don't need to be regulated by the federal government, but they do need to be protected against unfair competition from communication common carriers. So said the FCC last month in a long-awaited decision bound to have far-reaching impact on the service bureau industry. The decision is tentative at the moment, but the final version probably won't differ basically.

Although dp industry spokesmen welcomed this protection, they wondered whether it would be effective; also, they were bothered by the commission's contention that on-line dp services utilizing remote terminals are regulatable, even if regulation isn't considered necessary right now.

The decision is the product of a 3½-year FCC inquiry into the growing interdependence of computer and communication services and facilities. A mountain of responses from dp firms, communication carriers, and trade associations was generated, along with a seven-volume analysis by Stanford Research Institute (April '68, p. 32; June '69, p. 126).

Interested parties have until the 13th of this month to comment on the decision. Afterward, there will be oral hearings which, hopefully, will be followed by a final decision.

separate carrier dp co.'s

To safeguard service bureau operators against predatory competition, FCC proposed that communication carriers which want to offer commercial dp services do so through separate companies. These affiliates would have to be staffed with separate officers and operating personnel, and use equipment and facilities "devoted exclusively to the rendering of data-processing and other noncommon carrier services." They'd be required to maintain separate books and file annual reports with the FCC. Each affiliate would have to give the commission details of all agreements and arrangements negotiated with its parent. Also, the parent would have to supply communication facilities and services to the affiliate under "the same terms, conditions, and practices ... applicable to any other customer." No carrier could "engage in the sale or promotion of data processing activities on behalf of its data-processing affiliate." Nor could any affiliate refuse "reasonable interconnection with the facilities of a customer."

If these proposed safeguards are finally adopted, the commission intends to ask each carrier's dp affiliate for a detailed report designed to show whether parent and offspring are keeping a proper distance from each other.

a question of degree

The question of what constitutes adequate separation is clearly going to be a basic bone of contention in the comments generated by last month's tentative decision. Already, differences of opinion are apparent.

The commission, in its April policy statement, said "It is noteworthy that, in varying degrees, the safeguards provided for above have already been implemented" by Western Union, GT&E and United Utilities — which suggests that FCC views the competitive threat posed by carrier-provided dp services as prospective, rather than actual. At least one carrier's dp subsidiary has already stressed its corporate ties in bidding on a contract against independent service bureaus, however.

Continental Data Services Corp., a subsidiary of Continental Telephone Company, recently used this pitch in a proposal to the Sierra Club, a large conservation organization, and subsequently won a contract to process the club's membership lists and do related bookkeeping.

"We have the full financial management support of our parent, who is putting the major thrust of their corporate expansion efforts into the data services industry," CDSC's bid proposal explained. It added that CDSC's "specific competence" in data processing depends "on the experience of our parent corporation in data transmission." Two pages were filled with a description of the data systems operated by the two companies, and the work they are currently doing. More than half of the entries described capabilities of Continental Telephone Company.

carriers gain

FCC spokesmen admit that CDSC wouldn't have to modify any of these statements if the proposed rules laid out in last month's decision became effective. Apparently the rules would allow carrier affiliates to gain leverage in several other ways as well. For example, an affiliate could borrow money from its parent, at little or no interest. A carrier could transfer its in-house dp work to the affiliate, providing the latter with an assured revenue source that might lead to lower charges for other customers. If independent dp firms were competing for the business of these customers, the affiliate's lower prices could be a powerful weapon.

The proposed safeguards also don't prevent the carrier and its affiliate from offering the convenience of a joint billing arrangement to the customer who patronizes both of them. Nor would the carrier and its affiliate be barred from establishing sales, engineering, or maintenance staffs under a single roof, so long as costs were properly allocated and separate records were maintained. Policing such an arrangement would be difficult, and probably impossible considering the commission's limited resources.

no regulation, but ...

The other major conclusion in the FCC's tentative decision — that commercial on-line dp services should not be regulated — is based on the premise that "data processing services of all kinds are becoming available in larger volume ... (T)here are no natural or economic barriers to free entry ... and ... no indications that any of these markets are threatened with monopolization."

But the commission insisted that it has the authority to regulate dp services under the Communications Act of 1934, as subsequently interpreted by the courts. The gist of the court decisions, said the Commissioners in their April pronouncement, is that FCC has "a comprehensive mandate" to regulate all forms of communication, including those developed since 1934, and is entitled to "leeway" in coping with these developments because of its responsibility to promote the public interest.

During the computer utility in-

quiry, dp industry respondents argued that the commission lacks authority to regulate commercial dp services. These same groups lost on another point when the commission, in last month's statement, said "major progress has been made, and is continuing, toward improved and more economical communications services for computer users." The commission apparently won't push the carriers to do more — as BEMA and its allies want — but it did promise to set up a continuing discussion with the carriers and their dp customers, during which complaints about present and future service can be discussed.

Knowledgeable FCC sources told us these discussions will be similar to the informal conferences which were established several months ago to resolve the foreign attachment hassle. Dittberner Associates, which has been advising the Common Carrier Bureau on that matter, probably will do likewise in connection with the new one.

isal irritation

One communication service that irritates on-line service bureau operators at the moment involves Information System Access Lines — a new rate classification, embracing computer access lines, which increases communication costs as much as 400% for operators of on-line service bureaus. The increase was killed in Ohio (April, p. 195), but it has been adopted in Missouri, Arkansas, Texas, most of Mountain Bell's territory, and South Carolina, and is pending in Illinois.

BEMA has voted to ask FCC for a declaratory ruling which would say, in effect, that ISAL service is an interstate matter and should be under the jurisdiction of federal, not state, regulatory agencies. But the commission, in last month's statement, said it was satisfied with the way the carriers were responding to dp users' communications needs — which suggests that BEMA's request won't accomplish much. Also, trying to take jurisdiction away from the states is political dynamite. Finally, there is dissension within BEMA's own ranks about the whole idea, we understand. IBM is said to oppose asking the commission for a declaratory ruling. Although Armonk has been overruled — on a 10-1 vote within BEMA's Data Processing/Telecommunications committee — another meeting is to be held before the FCC request is finally drafted.

The final section of last month's policy statement concerned message-switching services. The commission said they should be regulated, except where message switching is incidental to data processing. The basic difference between the two kinds of service, said the tentative decision, is that data processing changes the content and/or form of a message, while message switching doesn't.

Hybrid services will be evaluated on a case-by-case basis to decide which should be regulated, and which shouldn't be, the commission added. "One . . . test will be whether the service, by virtue of its message-switching capability, has the attributes of point-to-point services offered by conventional communications common carriers . . . Another test will be the extent to which the message-switching feature of the service facilitates or is related to the data processing component, or whether such message-switching is essentially independent of such data processing."

If that language remains essentially unchanged in the final draft, dp firms will be prevented from offering separate computerized switching services unless they are willing to become common carriers. But the carriers have been pretty successful in keeping them out until now. The only firms immediately affected would be RCA Communications and ITT, common carriers which have been offering computerized message-switching services to the airlines on a non-tariffed basis. The commission has deferred action on these cases, but in last month's statement told RCA and ITT they would have to either tariff the airline services or convert them into largely data processing activities.

The commission added that Western Union's Infocom-Sicom services, as now set up, are message-switching activities subject to FCC regulation. But if either one becomes primarily a dp service, it would have to be offered by a separate dp affiliate, on a tariffed basis.

—PHIL HIRSCH

BELL'S NEW SERVICE HELPS SHARE THE TIME, BUT PEOPLE MAY BE A HANGUP

Recently, two large national time-sharing service vendors completed independent marketing surveys of potential customers in the Los Angeles area. Company X determined the best central location for its computer center, rented the space, and prepared to move in. At exactly the same time, Company Y was renting its new quarters — in the same building. In almost any other U.S. city this situation could have led to a real conflict, a competition not so much for customers, oddly, but for phone lines. In L.A., because of a new kind of service initiated by Pacific Telephone, the problem will be minimal.

Not everyone realizes it, but time-sharing bureaus are often forced to do their marketing research not only on a basis of how far they are going to be located from their customers, but also on a basis of which telephone switching office they must use. Spokesmen for some firms say this is the prime consideration in placing new offices. So when X and Y companies chose their office sites, they did so partly on the basis of phone service, and both came up with the same answer.

In Los Angeles, such a coincidence is not really surprising. The city has been the fastest growing user of time-sharing services; its occupants now support more than 34 time-sharing service bureaus with a total of 92 computer or multiplexer locations. (And for heavily aerospace-oriented L.A., these are slack times. There were at least 40 service bureaus in operation there only two months ago.)

Coincidental or not, two new time-sharing centers opening in the same part of town, let alone in the same building, can clobber a local central switching office in L.A. or anywhere else. Data transmissions, particularly of the t-s variety, cause many problems in the exchange. The holding times per call (as long as three hours) that are characteristic of an engineering application and, conversely, the short but frequent (as many as one per second) accesses characteristic of a stock broker application can block a switching office's capabilities to handle the voice traffic for which it was originally intended.

Because of the loads that t-s places on a switching office, it is not uncommon for lines to be routed around a local office to one with more available capacity. In Los Angeles, this can mean far around. In one case, where six lines were being run to Beverly Hills from Commerce (roughly 15 miles northwest), four went directly to the customer and were installed rather quickly. Then, two weeks later, the installer came back to put in the remaining two lines to Beverly Hills. When asked why the interruption, he explained that there was not room for *those* two lines in the local office, so

they had to be routed first through Long Beach (10 miles to the south).

Although new installations will hopefully not always call for that kind of far-reaching solution, they often do call for a circuit designer who is experienced in data transmission. Also, new installations or changes to old ones require a good deal of coordination between the vendor, client, and the phone company. That kind of communication is one for which the Bell System has been noted. But in one or two pilot organizations within Pacific they are trying to do better.

Pacific's new service organization is tentatively being called Compucom, for "computer communications unit." In the Los Angeles office it is composed of 12 staff members with long telephone company experience. (In fact, one youngster with only 21 years in had to settle for fifth place on the vacation schedule.) More important, all have had specialized training in data handling and circuit design for data communication.

Compucom's inception signals a change in one facet of the continuing "computer industry versus the phone company" saga, a change for the better. The phone company has long been a whipping boy for the industry, and not without reason. The company badly misjudged the growing need for data transmission facilities, has been very slow in providing data lines, and, when it has installed service, often has not delivered lines immediately capable of carrying digital transmissions. More galling, perhaps, is the fact that, while thus proving incapable of serving its own customers' needs, Telephone has attempted to exclude other carriers from the data transmission business, and to extend its phone line franchise into a "communications" franchise.

busy signal

On the other hand, the phone company is in an unenviable position, faced with increasing line demands for digital transmission on the one side and on the other with antiquated equipment that was never intended for carrying anything but voice. The changeover is taking time and money, and if the company's reaction to customers has often been too little, too late, it may be partly because it is damned hard to sell 8½% bonds for financing new construction on today's market.

Still, the changeover to more capable equipment is taking place. In a letter to stockholders included in the 1969 annual report, AT&T board chairman H. I. Romnes stated that 70 electronic switching offices (which, by the way, are computer based) were completed by the end of 1969, and that these ESS offices would be put in operation at a rate of almost one every working day by the mid-70's ... presuming, of course, that they can sell their bonds.

Whether or not that rate of construction will handle that rate of growth is open to question. However, what happens *before* the "mid-70's" should be of more concern.

One of the things occurring *now* is that the phone companies are beginning to understand what is happening to them. In an interview with Gene Keener and George Klauss, the two Compucom sales managers, it was learned that Pacific Telephone has forecast that 16,354 datasets will be in operation in the L.A. Central area — up from 12,266 at the end of '69 and from only 2,731 in 1965 — and that 68,902 are expected by the end of 1975. "With figures like this staring you in the face, it's not difficult to see what a volatile and complex industry time-sharing has become," said Keener. "And roughly 75% of these datasets were of the 100 series type, up to 300 baud, which are most common for time-sharing." Nationwide figures show a comparable rate of growth. According to AT&T's report, there were 131,000 datasets installed at year end 1969, up 56% from '68.

The data transmission growth within California is partially responsible for the fact that Pacific Tel has a bigger slice of Bell's construction budget monies than any other company within the system. Pacific will spend $740 million in 1970, more than two million each day of the year. Of this amount, $56.8 million will be used to construct new ESS offices. By mid-1971 PT&T expects to provide touchtone capabilities to 50% of its customers, and by 1972 data is expected to account for 50% of the total volume transmitted over its facilities.

can you hear us?

These numbers helped convince Pacific to try a new tack, and for the first time, unbelievably, the company began to regard the time-sharing business as an industry with its own particular requirements. While the phone companies have historically provided special handling of such industries as petroleum, financial, and aerospace, and for local, state and federal government units, the time-sharing industry has been handled under "general business" accounts. Now, in Los Angeles and beginning in San Francisco, Compucom will change that. Each t-s bureau will interface with one account rep instead of several offices within each of the exchanges it does business with. That representative will handle the firm's foreign exchange problems (for providing service to users in other prefix areas), provide a single contact for both customer and vendor, coordinate paperwork within the phone company, and keep t-s vendors from conflicting or competing for scarce central office equipment.

Max Beere, speaking for Tymshare, Inc., in Palo Alto, says about the new operation: "The service we are now getting is far better than before. Primarily this is due to the fact that communications are better between Tymshare and the phone company. We can tell the phone company our needs and let them translate that into service. What it amounts to is that we are letting them do — no, demanding that they do — the job they do best." Tymshare works out of the San Francisco PT&T office, and Beere mentioned that the Compucom counterpart there had just been formed. He also mentioned that the phone user problems in California are much slighter than those of users elsewhere. His example was New York, where he thought that for every five lines installed maybe two would work, and where you fight for every line.

Larry Dann, the L.A. branch manager for Call-A-Computer, said about Compucom, "It has taken a lot of weight off us. The problem was always getting to the right guy in the phone company. It used to be we took three wrong guesses before we got to him."

In the past, some companies have been able to get the AT&T long lines departments to provide someone to be their interface, but the service fell something short of what Compucom and its counterparts hope to offer. Klauss and Keener, Compucom's sales managers, and their boss, Mike Gibbens, all talk about applying specialized people to data processing rather than the generalists supporting other industries.

comes the evolution

The evolution of this kind of specialist may be the most important outcome of the new organization. And these people are sorely needed. Most dp managers will admit that although they can set up a multiterminal multicpu hardware installation, they would rather not have to deal with the transmission links.

Undoubtedly, these communications specialists should come from outside the phone company, too, but there just aren't very many of them, yet. Many who have left the Bell sys-

tem to be part of private industry are faced with the same kinds of problems experienced by IBM Systems Engineers and Field Engineers who leave the fold and are cut from the umbilical information tube.

don't hang up

But it would be imperative that when the outside specialists do appear they will have someone on the inside to work with. If they are in Los Angeles or San Francisco, and if they are a time-sharing firm's representative, and if they are interested in line speeds below 40.8 kilobits, then they at least have Compucom ... for now. Yet, the Bell System seems to be pulling its punches here, too, by closing the highly regarded Cooperstown, N.Y., training center that produced men like Klauss and Keener. The last class that that school will turn out has just started its courses. After it closes, the specialists to staff Compucoms throughout the country will be harder to find.

The rationale behind the school's closing is difficult to determine, although the training there is reputed to be expensive and many grads seem to wind up in customer's shops rather than in Bell System offices. There might be a parallel here with IBM. Hasn't the much maligned computer giant trained many of the best people in our industry? And when they leave the company they know all about IBM gear, right? Perhaps that hasn't worked out too badly.

Compucom is a necessary and welcome addition to the industry, and an indication that the industry is recognized as a force in communications. It also will be necessary and welcome for Bell to recognize the need of both Bell and the industry for a continuing supply of trained data communications people. Something has to answer the phone.

—R. L. MACLAUGHLIN

HEAD HUNTING BY COMPUTER — THE BUGS ARE THERE BUT SO ARE THE $

Computerized skills retrieval is the preferred name of the game, but it has been called head hunting by computer, automated recruitment advertising, employment communications, occupational classification control and even "people systems for a people market." It also has been called a billion dollar market.

John Sullivan, president of National Registry, 1½-year-old New York City-based computerized manpower register, sees it as a "leaderless billion dollar market," and he sees his company as the one to provide the lacking leadership. He has competition.

But, according to Dale H. Learn, president of Information Sciences, Inc., New City, N.Y., whose wholly owned computerized registry service, PICS, Bennington, Vt., has been around five years, the competition isn't hot and heavy yet because "it's an idea that has yet to come into its own." It's come into its own in the profit columns even if it hasn't received the wholehearted endorsement of the recruiting industry. Sullivan's firm had $1 million in sales last year and expects to exceed that "by a big factor" this year.

success story

Three-year-old Employment Systems, Inc., New York City, provider of a complete computerized job-match system including data base and terminals to employment agencies, companies, and its own registry, expects its sales to top $3 million this year. ESI was formed as an outgrowth of National Manpower Register by Tom Jackson, president, and Edward T. Dear, vice-president. Both had been with Careers, Inc. They decided five years ago there was a need for a national registry of job seekers so they left Careers and started NMR. It was manually operated at first, but this was clumsy so they got together with some time-sharing people from GE and automated it. This was better, Jackson says, but something was still lacking. "We realized what we really needed didn't exist then — a specialized, cheap, portable terminal."

They set out to find one and they did. A small southern company called Computone had developed a working prototype of a terminal which was much like what they wanted. They got together with Computone and a New Jersey electronics company, Squire Sanders, with production capabilities. Jackson and Dear added their requirements; Squire Sanders acquired Computone; and the merged organization began producing the terminals under the Computone name. ESI was formed as a subsidiary of NMR with exclusive rights to market and use the employment version of the terminal.

And now it's a case of the tail wagging the dog, says Jackson. NMR is still going strong, but ESI does three times the business and "takes up 70% of our time." ESI maintains its own dedicated computer center in Detroit as a joint venture with REALTRON, which uses it for real estate retrieval. Equipment is leased, and the base is a 360/40. For a flat monthly fee (average is $300), ESI maintains a client's data file and provides him a terminal (additionals available at $40 apiece), rights to unlimited search and unlimited communications. The terminals are easy to use. Simple dials fix the format of a search before the computer is called.

user reactions

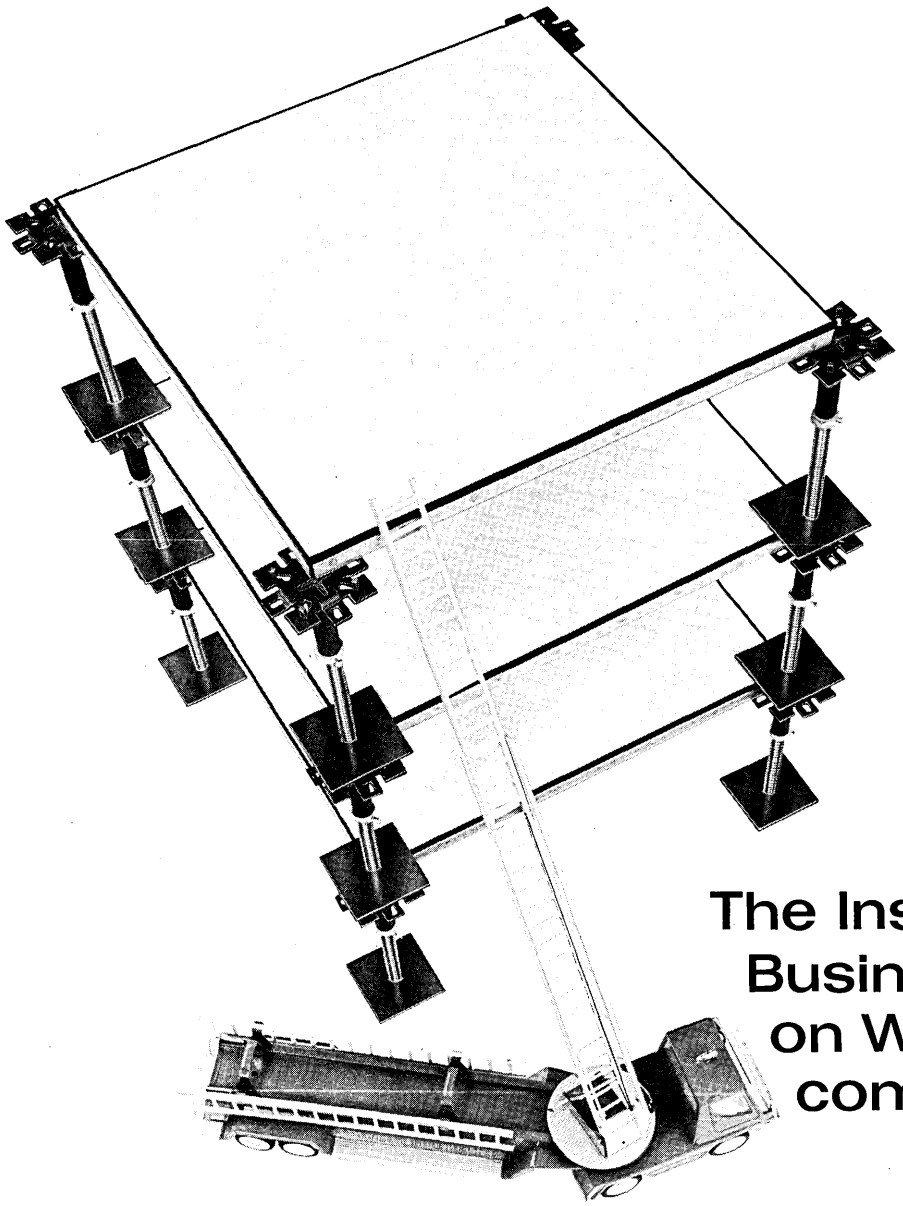
Jackson feels use of a flat fee as against time charges is a big marketing plus. In a few cases, he said, a client might pay less if he were time-charged, but our clients don't like to think that way. "They like a figure they can budget and they don't like to think computer. They're not in the computer business. We try to get them to think of their terminals as 'my little tool,' something they will use as naturally as they would an adding machine or a typewriter."

And how do the users like it? Bob Gregory, general manager of Management Recruiters, Los Angeles, thinks it's great. His outfit is one of 105 offices of Manpower Recruiters International, Cleveland. Each has one or more ESI terminals linking it to a central data base in the Detroit center. They call their system Scans. Jackson says each ESI subscriber uses the same basic system, but "we don't name it. It's their system and each gives it his own name."

Gregory can use his Scan terminal to search the 80,000-applicant central Manpower Register file which he finds useful, but he finds it even more useful to search his own 7-9,000 applicant file. The ability to make interstate and even cross-country job matches has been the most highly touted of computerized retrieval, but Gregory rates that second to the speed and convenience of searching his own files in seconds without leaving his desk and tying up "valuable counselor time in tedious manual searching."

Another ESI user group is National Personnel Associates, a 131-member organization of smaller employment agencies. J. Allen Shaw, president, says the association has had its problems since adopting the system last April because, "we're so green and fumbling, but we know our satisfaction will grow as our skills grow." They call their system Mark Sense and their terminals, Mark Sensors.

The only resistance from members,



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he said, came from several in the deep south who thought, "the computer talked yankee and talked too fast. We programmed in pauses and that was that." The association has about 15,000 jobs and applicants in its data base now. Shaw feels this should be 100,000 and would be if it weren't for the lack of skill in encoding which is taking members from 20 to 30 minutes per applicant where it should take six to eight.

Not all employment agencies who have tried computerized retrieval are as happy as Gregory or even guardedly optimistic like Shaw. Many have tried it and dropped it with cost the most-cited reason. A counselor for the Los Angeles branch of a 90-office national agency network said, "it took us seven years to learn this (computerized retrieval) was a good way to lose money." Another agency said it wasn't so much cost as the time and effort involved in updating the data bank that was "more trouble than it was worth." Another flatly stated, "the computer is not for private agencies dealing in middle management."

Gregory, on the other hand, believes the computer is the thing that will upgrade the placement agency business — something he thinks is needed. "It takes top level people to run this (computerized) kind of an operation. The turnover of counselors in many employment agencies runs to 100% every 30 days. These kinds of people couldn't use a computer system."

way to go

Jackson said ESI's biggest market is private placement agencies and believes this will grow, but he sees his company's biggest growth coming from employer systems which are "our big push now."

The earliest applications of the computer to placement were within companies, including IBM which set one up in 1959. Learn, who was with IBM at that time, left in 1965 with four other edp specialists to form Information Sciences Corp. with the idea that other companies were an obvious market for personnel retrieval systems. Learn describes ISC as a company "dedicated to applications of computer technology to the better development of human resources," and he believes it is the only such one. Toward this end, the firm has designed more than 65 different "human resources" systems for corporate use. About 20 have been installed.

ISC runs its PICS system on a 360/30 in New City. The PICS data base of some 30,000 people is made available to companies under two different plans: $1250 for five searches with up to 40 matches per search and one hire guaranteed, or one search for a standard 10% of annual salary if a hire results. Individuals whose qualifications are in the data base are charged $18 per year.

ESI's NMR data base of 20,000 active applicants (40,000 inactive) is made available through affiliated employment agencies in 70 cities. NMR does not charge applicants; nor does it give information to employers or job seekers, only to the agencies.

Sullivan's National Registry provides output only to applicants. He describes the service as "automated recruitment advertising" and says its data base of 70,000 subscribers is the "largest data bank of any private agency."

The National Registry charges its subscribers $10 per year. An employer pays $250 per search. The computer outputs address labels of applicants who match the job description, and the applicants receive the employer's "Opportunity Bulletin" and can take whatever action they choose.

oportunigrams

A somewhat similar service is in implementation stages in Newport Beach, Calif., under American Registry, Inc., a new company licensed to market a computer system for "occupational classification control" developed by the Foundation for Advanced Computer Technology (FACT), Newport Beach. With this service, an employer making a search gets back a list of ID numbers of qualified applicants, ranked according to the degree to which they qualified for his job (like third out of 50). Applicants receive an "Oportunigram," a 5000-word message from the employer describing the job. They, too, are told where they stand. As with the National Registry, they can do what they want.

FACT director David Farrell said his system is the only one which makes full use of the Dictionary of Occupational Codes (DOT), a nine-digit code used by the government in which the first three digits indicate job area (more than 23,000 job titles); the second three relate to traits desirable in a qualifying applicant; and the last three are subdivisions of the job titles covered by the first (7 to 100 per job title).

The system is programmed in assembly language, and test searches have been time-shared on a 360/40 and a 360/30 with Montgomery Ward in Buena Park, Calif. Terminals for on-line use are ASR 33's; Oportunigrams are batch processed. Farrell said the system can compare 75,000 names and rank them against 100 job orders in seven minutes.

He sees two future applications for the FACT system. He sees it in the in-house personnel control field where American Registry would provide a program which a company could run on its own computer or on-line with the Registry's. And he sees it used to keep track of demand for and availability of specialized skilled labor and matching the two; i.e., 150 lobster fisherman out of work in Southern California because of water conditions would be referred to the East Coast where they were badly needed. He feels this kind of application would be mainly for government.

for the disadvantaged

The government and quasi-governmental non-profit agencies already are active customers for computerized matching systems. Information Sciences developed a system under contract to the North Carolina Manpower Development Corp. which is in use in Charlotte matching the hard core unemployed to job and training opportunities.

ESI designed a system for a pilot program in a Department of Labor training center in Antioch, Calif. The system uses the basic ESI terminal which, Jackson says, is taken right into the ghetto to call up opportunities and jobs in seconds right before the impressed eyes of the underprivileged applicant. ESI also designed a system for the California Human Resources Administration for an automated job center which Jackson describes as offering "one stop shopping for employer and job seeker."

ESI's future plans include design of a system for military placement to be implemented through military associations. They already have Compujob, a college recruitment service which operates off-line for college seniors and works through college placement offices.

on campus

College interest in computerized placement is growing against resistance in some quarters. Michigan State Univ. and the Univ. of Massachusetts have pilot programs using ESI systems. Re-Con Systems, Inc., similar to Compujob, markets through campus representatives and the National Students Assn. It relies on placement offices as a meeting ground for recruiters and students but bypasses them in original matching, which has made some placement officials unhappy.

(Continued on p. 173)

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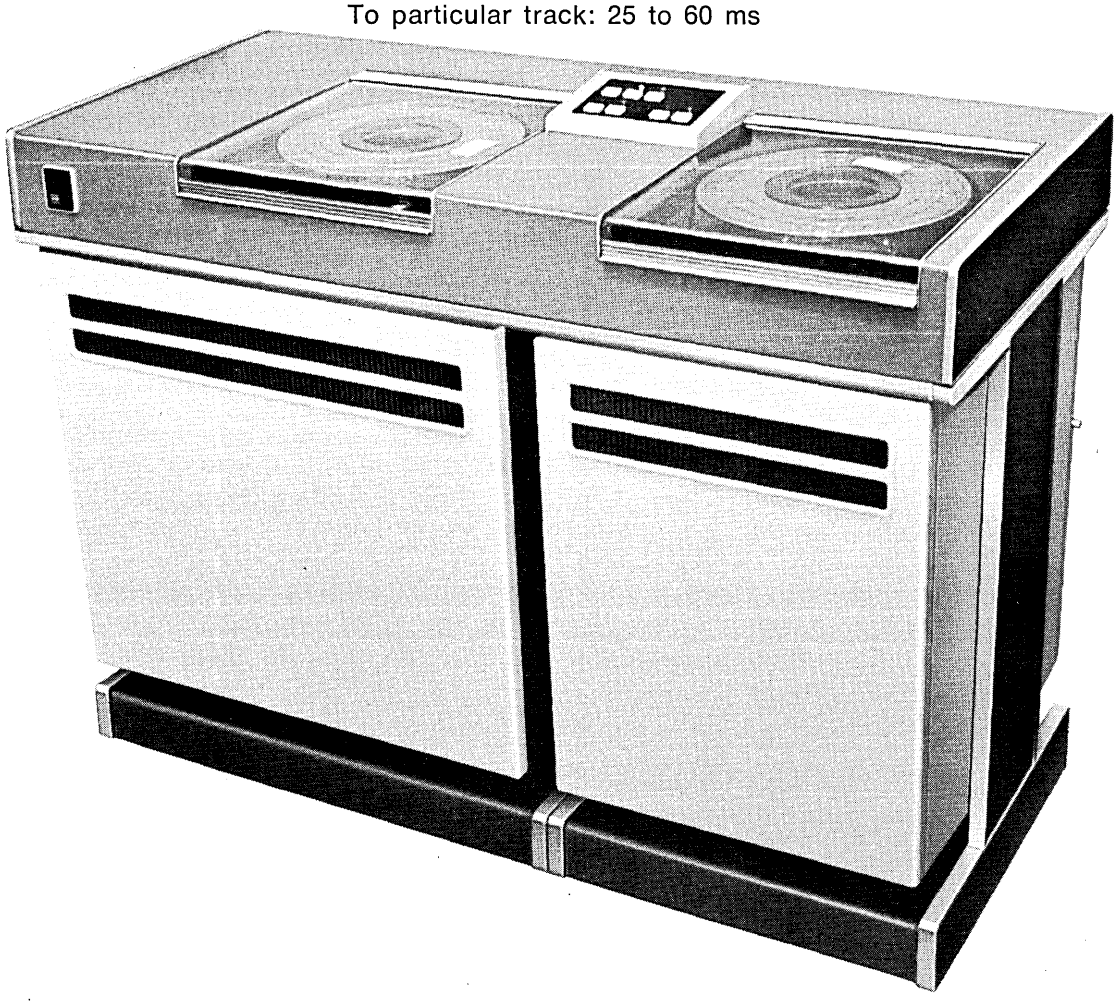


CIRCLE 96 ON READER CARD

The Univ. of California, Santa Barbara, has a pilot program going in educational placement which it designed "in-house." Educational placement director, E. R. Chalberg, is enthusiastic. The program is in its second year. Chalberg said the system has freed him to attend important conferences he had to miss before and has allowed him to spend more time with candidates instead of having to "hurry them out of the office so I could get back to shuffling cards."

The program was born because Chalberg had to prepare a 52-page annual report with "lots of columns and tabulations," and he happened to show it to someone in the UCSB computer center who told him the computer could do it in 45 minutes. Since the job normally took Chalberg 80 work day hours plus evenings and weekends, he was interested. He was introduced to programmer Mike Meeker, who was working for his PhD on campus. As they worked together, Meeker and Chalberg somehow forgot the report and got caught up in the idea of placement by computer. Meeker wrote the program for the placement match system, and it was implemented. The report eventually was prepared manually.

The UCSB system is programmed in PL/I and operates on the university's 360/75. Its data base includes all education students registered at the school and some alumni. Positions are batch fed to the computer in 4-6 minutes every other day (40 to 50 vacancies per batch), and matches are made with reports of jobs sent to candidates. Matches are based on type of position, subject matter, geographical area preferred, degree required, age, sex, etc. Chalberg said some 94 million combinations are possible. He hopes the system will be put to use university-wide and feels this could be done for about $1,000. "The program is written. All they need is programmers who can read."

Chalberg hopes soon to test-use on-line terminals for his system and likes the on-line idea for the hoped-for university-wide system. He feels his system, while designed for educational placement, "could be switched to include business and industry within two weeks." The UCSB system has attracted attention and even visits from all parts of the country. Chalberg said he'll give the program to any college that's interested.

San Francisco State College has never used computerized placement, but Mrs. Maria Charnow of the school's placement center says it's "the thing to come and will be used in the next five years or so." She sees some kind of automated sorting as an intermediate step.

Dr. Ed Clements, placement director of San Jose State College, doesn't quite agree. His school has a CDC 3300 which has never become operative because of "lack of support." He had planned to use it initially for part-time placement and then for career placement, but thinks now he'll limit his use to sending out notices. "There are too many personal things that can't be programmed in," he said ... "a wife with sinus trouble who can't take damp climates or a daughter who's a high school yell leader and, at the last minute, balks at leaving her friends." He also feels that simple, indiscriminate mailings of job listings has an educational effect on candidates. "A guy with a math background ... thought he wanted to be a programmer, but watching the listings finds few openings to his liking, but does see something that tickles his interest in the industrial actuarial field ... thinks, gee, how about that."

But college interest is definitely there, even in Canada. A national data file of qualifications of university graduating classes is being built up north-of-the-border by Career Assessments, Ltd., Don Mills, Ontario, using the computer facilities of Multiple Access General Corp., Ltd., which has a substantial interest in the placement firm.

alumni, too

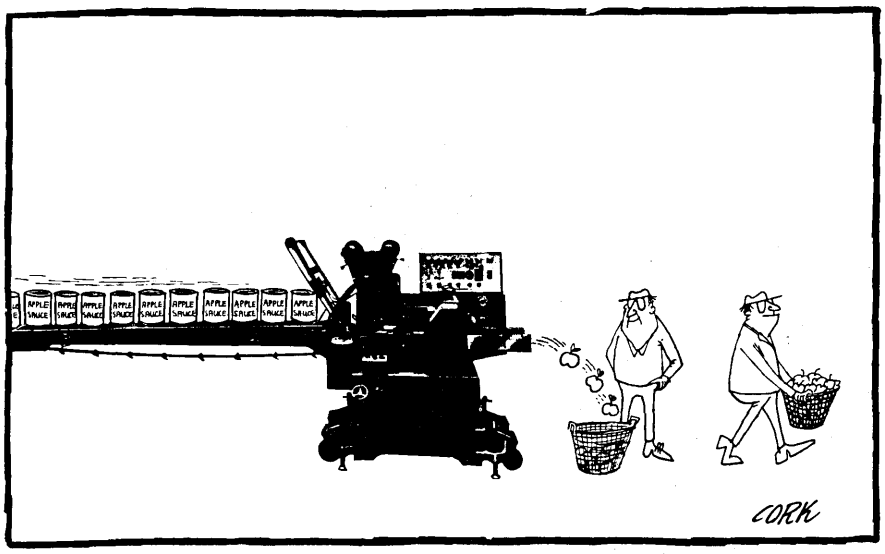
For the alumni there is GRAD (Graduate Resume Accumulation and Distribution) sponsored by the College Placement Council in Bethlehem, Pa., a data base of college graduates. GRAD time-shares on a GE 605 in Valley Forge, Pa. A 634 is used for batch programs, statistical reports and housekeeping. Programs are in FORTRAN with a smattering of COBOL. Employers can search the data file on-line or by mail. Output is a microfilmed copy of each pertinent resume. Hard copies are sent to employers who can contact candidates of their choice. Candidates are not aware of a match unless contacted.

plan ahead

Even students at lower levels, junior high and high school, can use a computer in making professional plans. Sextant Systems, Inc., Milwaukee, creator of vocational guidance materials, has an Information Sciences-designed system for its Sextant Series Career Aptitude Profile. A student wishing to use the service requests a personal profile from his school. With his parents' help (but hopefully using his own judgment) he completes a self-evaluation form covering his aptitudes, interests, personal traits, abilities, etc. These are computer-matched against some 1400 occupations in less than a minute at a cost of less than $6 per student. The computer printout describes the 20 careers for which the student's "success factor" is highest and shows how close he came to being 100% suited (i.e., physician, 93%; bio-chemist, 80%). The list is forwarded to the student along with a job sheet for each of the 20 occupations, showing job requirements, pay and skill levels, advancement opportunities and job duties.

And, in theory, away he goes, computer-directed first to the proper training and later through appropriate job switches to the top in the field right for him ... if a wife with sinus trouble or a daughter who's yell leader don't get in the way.

—EDITH MYERS



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news briefs

FCC ASKS FOR OPINIONS ON AT&T'S ROLE IN SATELLITES

Datran and MCI are "seriously considering" plans to operate domestic satellite systems, key officials of each company said last month; a few days earlier, FCC announced that it would soon begin accepting applications.

Datran reportedly is considering at least two alternatives. One would use satellites as part of the nationwide data and alternate-voice microwave network the company proposed several months ago (December '69, p. 193). The other option involves a satellite system offering a full complement of voice, data, and video services, which would compete directly with all of Ma Bell's offerings.

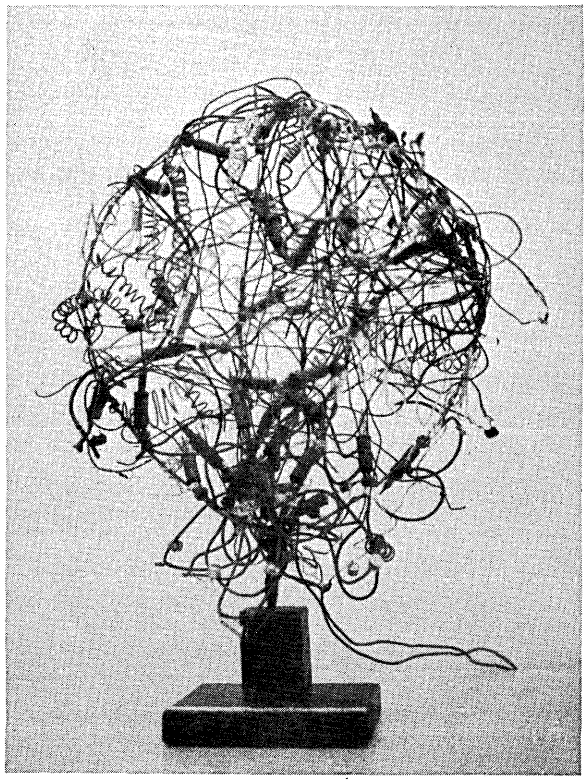
Almost certainly it will be several months until the first domestic satellite applications are filed, because each will have to include a mass of information related to the techniques of launching and operation, and, to numerous economic and public interest questions. In last month's statement, the commission described the information it wanted but admitted that it was "unable to determine, on the basis of the information presently before us, whether domestic communications satellite opportunities would be more fully and effectively developed through one or more multipurpose systems, specialized systems, through a combination of both, or through an essentially 'open-entry' policy . . . (W)e believe it preferable to permit potential applicants to take the initiative is submitting system proposals for the Commission's consideration."

Despite this open-ended invitation, the commission did indicate at least some of the key factors that will affect the outcome. It seems clear, for example, that the applicant who can show how to minimize interference between satellites and other users of the frequency spectrum will have an important edge.

The commission also asked for "comments . . . on what initial role of AT&T in the domestic communications satellite field would be appropriate . . . A question has been raised by the Executive branch as to whether AT&T might discourage or foreclose entry by others into its special service markets through a policy of inter-service subsidy." This is a reference to the White House Report on Domestic Satellites (March, p. 149) which said that common carriers should be accorded the same opportunity to operate domestic satellites as non-common carriers "after a determination by the Commission . . . that no cross-subsidization between monopoly public message and specialized (i.e. competitive satellite) services would take place."

The Commission apparently takes a harder line on the AT&T problem than the White House. For, in last month's statement, FCC said "Aside from the possibility of market foreclosure through cross-subsidization, there is a question as to whether innovative satellite planning by AT&T would be constrained by its existing terrestial facilities and services . . . Moreover, AT&T is the dominant domestic carrier and other potential common carrier developers of domestic satellite systems cannot approach the problems and possibilities of domestic statellite applications from a reasonably equal competitive opportunity position. Thus, a further question is . . . whether AT&T's expansion into the satellite field, at this initial stage, might pose a substantial constraining factor for such potential entrants . . ."

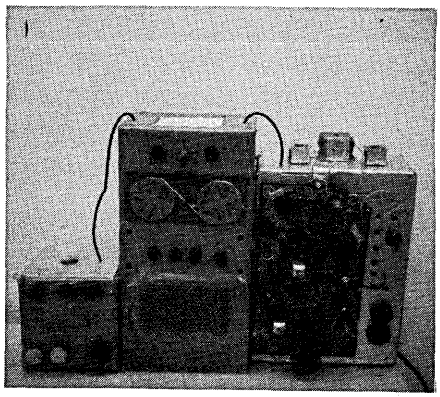
But here, as elsewhere, the commission asked for opinions instead of giving its own. "Applicants and other interested persons are requested to comment . . . on the question of whether the public interest would be better served by: (a) authorizing



what's a computer to you?

kids' contest entries boggle the mind

When Data General Corp. thought up the idea of having a "Kids and Computers" art contest, with entrants from preschool age to 12 expressing how computers appeared to them, it didn't reckon on the mail strike, which set back judging by about two weeks. Still, more than 600 entries were received, including many from overseas, and even from behind the iron curtain. Some of them are pictured here.



Most entries, and some of the best, were received from 9-year-olds. What amazed Data General was that the kids "really knew about computers." The minicomputer maker awarded a $500 scholarship to the grand winner, with a $200 second prize and $50

domestic satellite facilities to AT&T without restriction as to type of service; (b) authorizing facilities limited to ... public message service; (c) following the procedure recommended by the Executive Branch; or (d) confining AT&T's participation ... for an initial period, to the leasing of satellite channels in systems established by others."

GE RAISES AND LOWERS T-S PRICES FOR PROFIT

New prices for Mark I and Mark II users, aimed at increasing revenue "at least 8%," have been announced by GE, effective the first of this month. Bigger volume Mark I users and Mark II customers whose applications involve a lot of conversation but relatively little I/O data may both pay less. Specifically:

Terminal charges for Mark II drop from $11 to $7/hour, but along with this fee, the user pays 25 cents/1000 characters of I/O. He's offered the option of storing data in binary, nonreadout mode at a charge of 50 cents/1280 characters per month, or in ASCII for $1.10/1280 characters/month. GE refers to the former as a DSU (Data Storage Unit) and the latter as a PSU (Program Storage Unit). Formerly, only ASCII storage was available, for $1/1280 characters/month.

Using binary storage for both alpha and numeric data saves money because of the lower price/unit, but there is an additional saving where numeric data is involved because fewer binary characters are needed than ASCII characters to represent a given number.

For $1200/month, a Mark I user gets access to a dedicated computer port, plus 10K "computer resource units" and 200 PSU's. The Mark I PSU is 1536 characters. The CRU is an amalgam of cpu, file access, and swap time, plus a specified amount of core memory. Mark I users who don't buy dedicated access will pay $8.50 for each hour of terminal connect time (up $1), 5 cents/CRU (up one cent), and $1.75/PSU (unchanged). Mark I users also will be able to store their programs in object code, as Mark II customers had been able to do previously. This feature increases storage costs, but eliminates the time and expense of recompilation before a run (it also adds decompilation time and expense if the user wants to work on the program).

A "deferred run" option is another new Mark I feature; the user can call a program on-line, have the job run overnight, and get the results delivered the next morning. He saves terminal time charges that would otherwise be incurred while the job is running.

Paul R. Leadley, general manager of GE's Information Services Department, agreed that the deferred run option is a synonym for remote batch, and he didn't disagree when it was suggested that GE seemed to be seeking a foothold in that market. Leadley also confirmed that the minimum charge is aimed at eliminating small-volume customers (although GE, according to other sources, is planning to tap this group through franchisees); that the binary storage option is aimed particularly at users of large data bases; and that the I/O charge combined with lower terminal fees represents an attempt to cope with higher bit transmission rates, which tend to reduce terminal connect time.

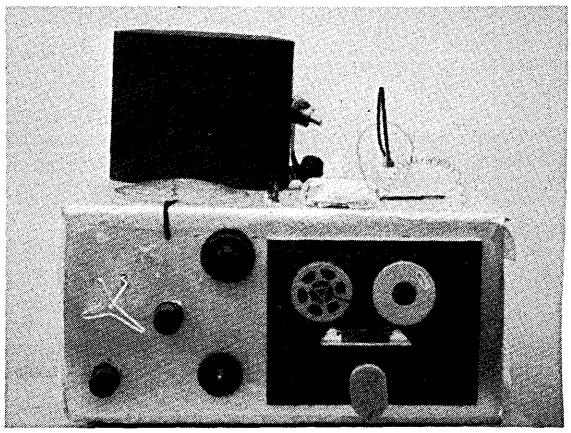
"We're really going after the network-type user," he added, "the company that needs to access a large data base from a number of widely dispersed locations."

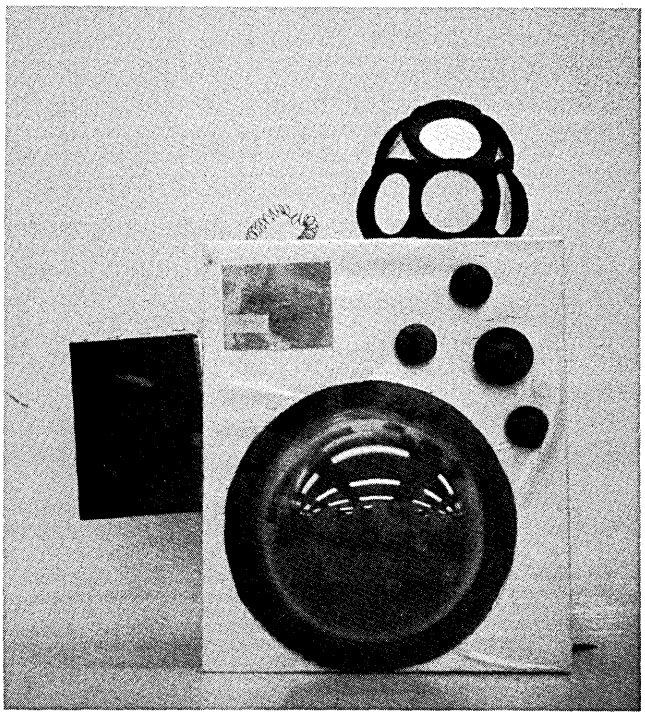
Under the new price schedule, a Mark II user whose I/O load didn't exceed 16,000 characters/hour would pay as much for terminal time as he formerly did.

The breakeven point for Mark I users choosing between dedicated and regular service seems to be about 43 hours of terminal time/month. Since the dedicated option includes 10K CRU's, which cost the regular user $500, and 200 PSU's costing, regularly, $350, the net terminal cost in a $1200 bill for dedicated service is $350. At regular $8.50/hour rates, this buys about 43 hours of terminal time.

"Well over half our Mark II customers are interested in the binary file storage option," added Leadley.

He said that GE will be operating Mark II nationwide from three locations "shortly" — L. A., Cleveland, and Teaneck, N. J. Schenectady is to be shut down. Mark I service, which formerly encompassed 17 processing sites, is now down to 12, and will be reduced to the three above-men-





prizes in four different age categories. Judges included Walter Allner, Fortune magazine art director; Toshihiro Katayama, Harvard University Center for the Visual Arts; James F. Moore, of the Boston Museum of Science; Mrs. Signe Hanson, of Boston's Children's Museum; and Mrs. Margaret Taylor, of the Boston Museum of Fine Arts.

The Children's efforts will be exhibited at these institutions, and perhaps others across the country. Now as for software .... ■

Nortec's line printer for remote terminals is successfully launched.

The people who make typewriter-type printers and the people who make big-computer line printers have lost a very lucrative market:

The people who make remote terminals.

They've lost this market to the people who make a line printer especially for terminals:

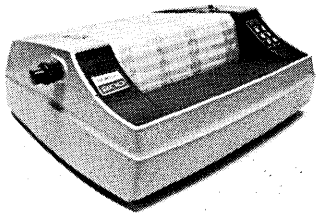
Us.

Our mini line printer isn't too slow, like the typewriter-type printers.

And it isn't too expensive, like the big-computer printers.

It's just right for remote terminals.

Nortec's mini line printer.



Nortec 200 is 132 columns, prints at 200 lines per minute, produces crisp type on up to 6 copies. The entire unit, with all electronics including buffer controller, easily interfaced with any computer, is as low as $6000 in large OEM quantities. It's just a little larger than an electric typewriter. The $6000 price includes these standard features: IBM-compatible vertical format unit, front-opening yoke assembly for easier forms loading and ribbon changing, self-test feature for testing electronics and mechanism. Nortec Computer Devices Inc., a C+T Company, Southboro, Massachusetts 01772, 617-481-2500.

tioned locations "before the end of the year." But Mark I service will continue to be offered nationwide.

Four new software packages — designed for electric utilities, electronics manufacturers, chemical engineers (particularly in petroleum refining), and mass production-type manufactures — have been unveiled recently, and six more are on the way. The next one will be a banking-financial package. Each is aimed at providing a comprehensive group of specialized processing jobs geared to the specified industry's needs.

According to another source, Mark II service is currently being offered, via satellite, to a select group of users through GE's London service center. Programs can be accessed from this side of the water, but not data. Negotiations to expand the service are continuing with the British Post Office. Also, GE is looking into the possibility of introducing the service on the Continent.

Gene Ringstad, GE's regional manager for hardware sales in the Philadelphia area, and Don Stone, the district information services manager, are meeting frequently to exchange customer leads, as part of an experiment designed primarily to increase business for the former group (and possibly, to reduce friction between the two sales forces). But Leadley emphasized that "we aren't thinking of consolidating our hardware and information services sales teams." He added that incentives for the service center salesmen to refer their larger volume customers to the systems division "are under consideration."

GOVERNMENT BUYS UNBUNDLED FROM IBM

The General Services Administration is "concerned" about IBM's per-cpu charge for programmed products and seems likely to try modifying it.

The concern was expressed by a key official of the agency last month, shortly after GSA and IBM signed a Federal Supply schedule contract for FY '70, which ends next June 30.

One way of modifying the per-cpu charge, our source added, would be to ask for competitive bids on general purpose packages. Independent suppliers competing with IBM would almost certainly offer more liberal terms.

The regulations governing federal acquisitions of separately priced software specify that competitive procurement procedures must be used unless sole-sourcing can be justified; the regulations also direct an agency to get GSA's prior approval before awarding a contract for software that has "the potential for substantial use elsewhere in the government."

Any "substantial use" software listed in the federal supply schedule can be obtained without a specific OK from GSA, but that provision isn't likely to hinder independent suppliers. For one thing, only 24 IBM program products are listed in the FY'70 schedule; many more will probably be needed by federal users. Also, nothing prevents an independent supplier from getting *his* package added to the schedule. If he doesn't charge extra for running such a program on more than one cpu, the independent obtains a clear competitive advantage over IBM, for the regulations require federal agencies to obtain *all* their software — including packages listed on the schedule — at the lowest overall cost.

GSA's future plans regarding the per-cpu charge are not settled, our source emphasized, but their direction can be inferred from a notice recently sent to all federal procurement officers:

"Program products are to be ordered on a separate purchase or delivery order ... and (are) not to be grouped on the same order with equipment or maintenance. In order to aid GSA to evaluate the impact of this feature and formulate future procurement policy, one copy of any order for a program product(s) is to be forwarded immediately upon issuance to GSA headquarters."

The new contract also opens the door to independent suppliers of systems engineering and training supports. Like commercial users, the government will now have to obtain both of these on a separately priced basis if it chooses to contract with IBM. The budget bureau recently asked the Civil Service Commission to look into new ways of providing training support. The Commission already provides some in-house and contract dp training, but it is oriented towards managers. There is a good chance CSC won't feel qualified to offer technical courses, in which case it probably will let additional contracts.

In the past, federal agencies that couldn't obtain adequate SE help through already negotiated contracts had to see it, in-house, through GSA's sharing exchanges before they could award contracts. The unbundled FY'70's contracts IBM has just negotiated with the government will almost certainly increase the amount of separately priced SE supports required. GSA is now thinking of setting up a central clearing house to handle the resulting requests. One likely result is that the agency will decide to bolster the government's admittedly inadequate in-house SE support capabilities by buying additional help outside via competitive contract.

The terms won by the government from IBM are generally the same as those available to commercial users, with some key differences:

Agencies having ADPE and PCM equipment on rental or maintenance throughout July and August '69 are entitled to a special credit against their basic monthly charges of approximately 12%.

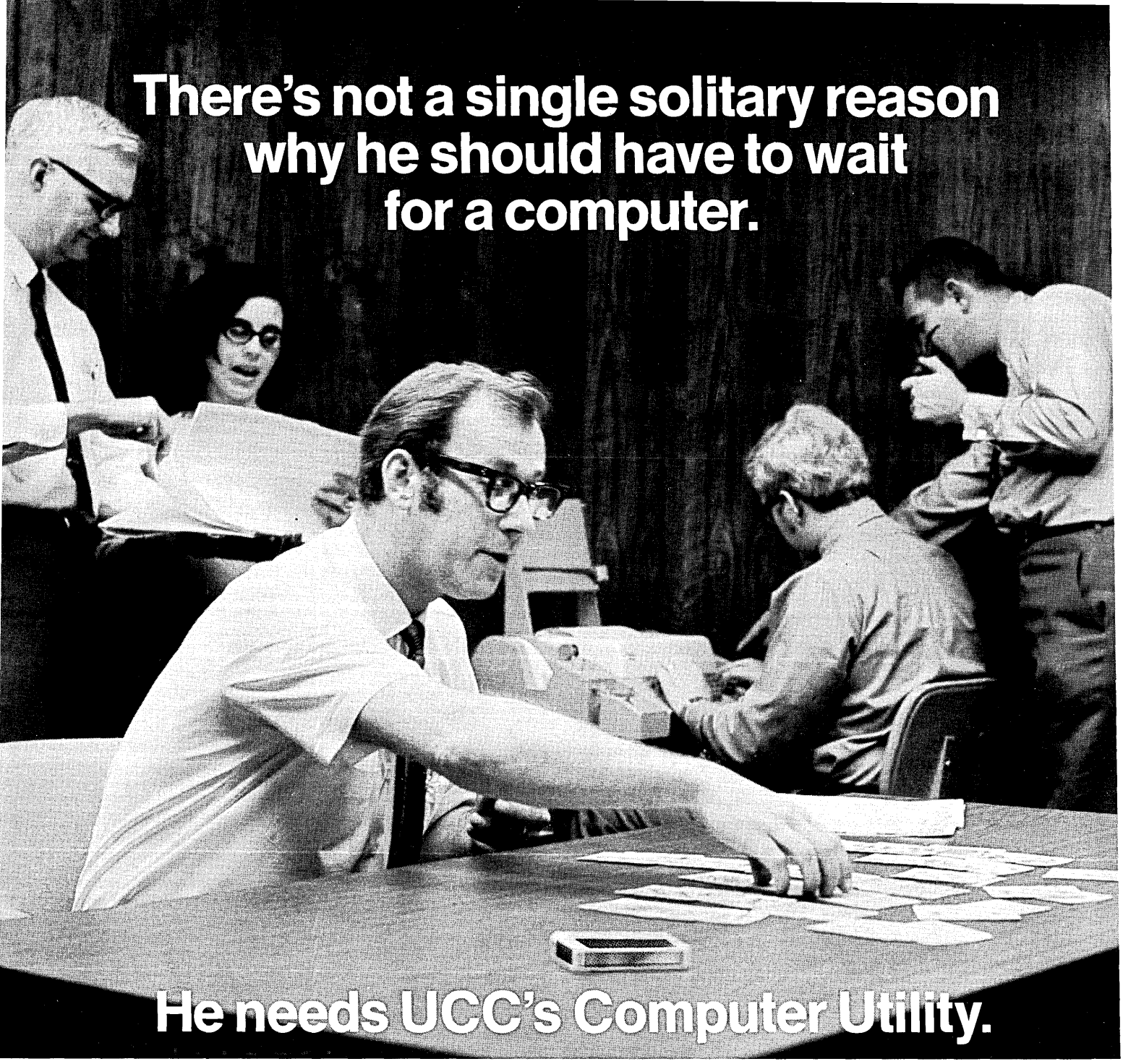
Custom contracts systems engineering, training, and program product services that IBM specifically agreed to support beyond the termination of any prior year contract will continue to be provided but only within the scope of the prior agreement. This means, in effect, that if the 1969 version of any separately priced program is still being used by an agency, it continues to get that software version free of extra charge. But IBM is not required to continue supporting the 1969 version unless it has agreed to do so. Already, the company reportedly has terminated support for one of the Navy's System/360 programs, offering in its place an "improved" version that is separately priced.

A liquidated damages section provides that if IBM fails to meet an agreed upon shipping date for a programmed product the company will pay the government one thirtieth of the monthly charge for each day's delay, up to a maximum of 180 calendar days.

The government's "minimum use period" is 90 days after monthly charges begin, versus one month in the IBM commercial contract. But Uncle Sam, unlike commercial users, can discontinue a program product contract "at any time prior to commencement of monthly charges."

When an FE service call results from a government error, or when "no specific defect is identified," the government doesn't have to pay for the service call provided it involves executive (Type I) or applications (Type II) software and the systems cpu is rented from or maintained by IBM. Under the new contract, the government pays basically the same FE rates as commercial users — $22 per hour for class I and II equipment, $30 for class III.

The twenty-four program products specifically added to the federal supply schedule includes 15 designed for the 360, seven for System/3, and two for the 1130. Within the 360 group are GIS(S), carrying monthly charges of $1,500, two text processors, two arrayed processing subroutines, and



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CIRCLE 131 ON READER CARD

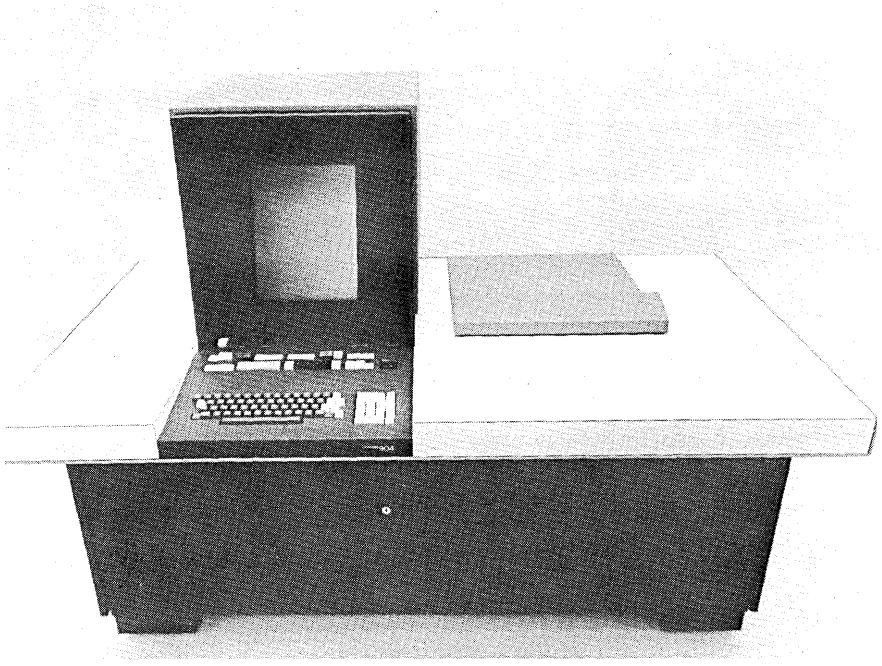
version 2 of the advanced Life Information Systems (DOS). The text processors are Edit/360 (DOS), which lease for $250 per month, and Pagination/360 (DOS), priced at $450 per month. Release of the latter is estimated for next August. The list also includes version 2 of IBM's medical information system programs (DOS); this package is scheduled for release next July, and will be leased to Uncle Sam for $50 per month.

Most of the system/3 products are scheduled for release in October. This group includes a basic assembler for $75, disc RPG II for $45, disc-resident card utilities routine for $10, and disc sort for $10. A utility program for the Mod 1255 magnetic character reader is scheduled for release next December, at $60 per month. The other two System/3 packages on the schedule, released last January, are a card-oriented RPG II, at $35 per month and a card-oriented utilities package for $10 per month.

CORNING GLASS ARRIVES: $19K GRAPHICS DISPLAY

Rumors that the Corning Glass Works would enter the edp field with a revolutionary replacement for graphics terminals were confirmed last month: Corning announced the formation of Corning Data Systems, a manufacturing and marketing organization within the firm's Electronic Products Div., and a $19,650 graphics terminal that uses photochromic glass, developed by Corning, to create a storage display without refresh electronics.

The secret of the low price is the photochromic glass, which darkens when exposed to ultraviolet light and clears when exposed to infrared. An electron beam activates pinpoint areas of the photochromic glass faceplate, producing an image that is cast through a projection system onto the screen. The photochromic glass darkens with a single pass of the beam and remains dark until it is erased, although the image gradually deteriorates so that after 15 minutes it is no longer clear. And erasure sometimes leaves a ghost image on the first try.



The use of photochromic glass to create a storage display without refresh electronics is the secret behind the low price of the Corning 904 graphics terminal.

Called the Corning 904, the terminal is intended for time-sharing use over voice-grade lines and is Teletype-compatible. It provides graphics and alphanumeric display, has an overlay system using transparencies that eliminates the need for computer generation of forms, and includes a built-in Addressograph-Multigraph electrostatic copier for up to 20 hard copies of a mirror-reflected image of any display. The last two capabilities are intended to lure business users, although the primary market is expected to be in the scientific realm.

The screen displays 72-character lines (as do Teletypes), with a maximum of 64 lines on the 8½ x 11 inch screen. The character generator produces all printable ASCII characters. Line resolution for graphics is 1024 x 1024. The characters and graphics are dark green on a light green screen, producing a display that is so directional that one almost has to be in the operator's chair to read it.

There's no selective erase capability for the operator to use in case of an input error, but erasure of the entire screen requires only eight seconds, and characters may be crossed-out by keying X's over them, as on a typewriter.

Standard input is through the keyboard, with a joystick or a mouse optional. Other options include a kit for making overlay slides, and paper tape handling equipment.

Corning has not forgotten software, either. The 904 comes with 57 FORTRAN IV subroutines, and more are under development. The software is written especially for time-sharing and is intended for users with a wide variety of sophistication.

Field service is being provided by Honeywell until Corning can develop its own capability. In case you don't have the $19,650 just now, you can rent a 904 for $820/month for one year, or $675/month for four years, including maintenance. For information:

CIRCLE 400 ON READER CARD

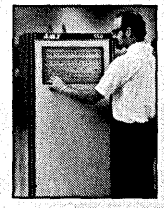
IBM BEGINS WORLDWIDE UNBUNDLING

After four months' experience in the U. S. and Canada, IBM is moving to extend its new pricing policy worldwide. It started with an announcement in March that unbundling will be instituted in stages in 15 Western European nations and completely in three other countries — Australia, New Zealand and South Africa. The company is studying unbundling for Latin American and Asian countries and is expected to make these known in the summer.

The new pricing policy for Australia, New Zealand and South Africa is essentially the same as that announced a year ago for customers in the U. S. and Canada. It includes a 3% discount on rental and purchase prices.

In Europe, however, unbundling will affect only products introduced after the company's March 25 announcement, and a discount is not available. Nor was there any word on whether a discount would be available when the new policy starts to affect all products on July 1, 1972. IBM will provide system control programming essential to the operation and maintenance of a system at no charge, but there will be a monthly charge for program products. Except for the lower cost System/3, IBM will continue to provide "free" system engineering installation assistance, education courses, and programs already in pro-

The System Preserver.



The largest semiconductor memory in the world will give your system forty times faster access, twice the capacity, and up to ten times the block transfer rate of high speed drums.

Storage can cost you less than a penny a bit for all usable storage . . . no record gaps.

You can achieve one and a half to five times faster throughput.

Its capacity for program storage and block transfer rate will enable you to utilize almost 100% of your processor's capability for the first time.

It will extend the life of your System/360 with no programming changes.

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CIRCLE 67 ON READER CARD

gram libraries.

The European countries involved are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

TERMINAL SHAKEOUT ON THE WAY

Art Hughes, Auerbach's product and market planner, says there's a serious shakeout brewing in the terminal industry and that the next two years will see the decline and fall of some 30 of the 60 terminal manufacturers in business today.

Chairing a panel on Terminals & Displays at the recent Time Sharing Applications Symposium in Philadelphia, soft-spoken, incisive Hughes revealed the findings of his ". . . sampling based on approximately 7,000 installations of edp equipment with data communications and terminals."

He started with a head count as of Dec., 1969: 125,000 terminals, not counting any military or some 25K dedicated ones. Then, by industry: banks, 16%; federal business, 8%; insurance, 6%; services, 6% (includes commercial t-s . . . only 2% of total sample); air transport, 5% (excluding dedicated systems); machinery, 5% (not including electrical); electrical machinery, 5%; educational services, 5%; local government, 5%; 26 other industries, 39%.

And by application, Hughes says distribution of terminals now looks like this: financial accounting, 15%; business accounting, 12%; inventory control, 8%; production control, 8%; science/engineering, 7%; business management, 6%; billing, 6%; banking/check handling, 5%; payroll, 5%; government accounting, 4%; insurance, 3%; 40 other fields, 21%.

Then he touched off fireworks of figures illuminating 1974. In '69, 65K terminals were shipped; in '74, 240K will be. In '69, there were 125K terminals installed; by '74, there will be 900K. A half-billion dollars was spent on terminals in '69; by '74, it will be $1.7 billion. And the average cost of a terminal (including modem, controller, etc.) will decline from $7,700 to $7,000 over the five-year period. Hughes says terminals by type will look like the table below:

	1969	1974
tty's	50% (62K)	20% (180K)
alphanumeric and graphic displays	8% (10K)	27% (240K)
teleprinters (mostly IBM Selectric)	13% (16K)	15% (140K)
remote batch systems	10% (13K)	10% (90K)
application-oriented units	15% (19K)	20% (180K)
small acoustically coupled units	1% (1K)	5% (45K)
others	3% (4K)	3% (25K)

Then panelists had their say. Two current trends came into sharp focus; a pitched battle between OCR and terminals, and growing interest in color crt's.

Jim O'Donnell, manager, communications and data terminal planning of RCA's ISD, says the elimination of paperwork at the point of data capture may well undo OCR. He feels the next four or five years will see a proliferation of terminal applications (e.g., at gas stations) that will tip the scales decisively in favor of terminals.

Gary Bard, vp, engineering, Delta Data Systems Corp., and Ralph Sleep, engineering manager, graphic display devices, Monitor Displays (both make color crt's), say the process control and numerical control industries are becoming increasingly interested in terminals with color crt's. (Both industries are color oriented. In process control, nearly all pipes, valves, etc., are color coded. In N/C, many blueprints, etc., are.)

After the panel, Hughes confided: "My own feeling is that, with approximately 60 people in this field — 20 perhaps in the top (say, 10 mainframers and 10 like Raytheon, Ultronics, Sanders and the like) . . . after you get through these, you have about 40 independents. And there's going to be a shakeout in the next one or two years . . . and I feel that there's only going to be five or 10 left of those 40. Now, some of them will be absorbed into other companies. But, certainly, as they exist today, there will not be those other 40."

COMPUTICKET STUBS TOE, LEAVES THE RESERVATIONS

The battle for survival in the entertainment ticket reservation biz between Ticket Reservation Systems (now called Ticketron) and Computicket, a subsidiary of Computer Sciences Corp. (April '69, p. 189), no longer wages. CSC announced abruptly last month that it was folding Computicket and writing off $13 million of "uncoverable capital" for fiscal 1970, ended last March 27.

The sudden surrender caused a further drop in CSC stock to around 16, compared to its 1970 high of 34, but the company held to its earnings projection of $1 a share for a time after the announcement, with later projections in the 25¢ to 50¢ range. CSC estimated that it would have taken another $10 to $12 million to turn Computicket around, and this is money it would rather include in the $100 million or so it plans to put into Infonet, the company's new time-sharing network, which hopefully will make its turnaround into the black by 1972.

At presstime, the fate of Computicket's people, equipment and current contracts was undecided, although the firm stated that all tickets purchased prior to announcement of the demise would be honored. This was small comfort to at least one client, the California Dept. of Parks and Recreation, which had been using Computicket to handle reservations for camp sites and other facilities at California state parks. The shutdown has resulted in a "hopeless snarl," according to one state official, who said the service had been working well for the department, providing immediate alternative sites to a prospective camper, where weeks of correspondence to confirm a reservation had been the previous practice.

Perhaps the reason Computicket worked well for the state is that preferred sites for preferred customers were not withheld from the system, and Computicket was able to operate the way it should, providing the best available location at the time requested to the customer. However, such was not the case in many instances where entertainment reservations were involved. Show business impresarios and boxoffice personnel are traditionally reluctant to surrender their seating prerogatives and, according to a Computicket spokesman, followed this prejudice in allotting seats to the system. As a result, many a buyer would ask for the best available ticket at a price from Computicket and then find himself at the attraction with four empty rows in front of him at the same price. Confidence in the system was apparently not en-

couraged by entrepreneurs.

However, an official at Ticketron says it is whipping this problem and only hopes that the public won't lose confidence in the idea because of its former competitor's failure. Ticketron, which already has invested over $20 million in its operation, expects, naturally, to benefit from the passing of Computicket and will mourn a minimum. Press releases were issuing forth on Computicket's behalf just before and even after the announcement, indicating a certain respect for the show must go on tradition. One release carried the information that Computicket had been installed in the New York Playboy Club, where it was to be operated by a bunny. And another told us that Howard Erskine, director and actor, had been appointed director of marketing.

Erskine had to leave show biz for his shortest run. That's computer biz.

VIATRON CLAIMS NO MONEY PINCH AFTER BIG '69 LOSS

Viatron has reported a 1969 net loss of $9,471,615 for the fiscal year ended last October. Perhaps the delay in reporting is an indicator of the progress the purveyor of the $39-a-month terminal made in its first year of operation.

It should, at least, be weighed against the report of a tenfold increase in sales, since these had nothing to do with System 21, but were $716,241 in revenues from Viatron Programming and Photics Research, subsidiaries which previously brought in $72,131.

Speaking to the New York Security Analysts, Viatron president Dr. Edward M. Bennett also said that the company has reached a point — for the first time in its two-year history — where management need not be concerned about money. He anticipates that cash flow from sales and normal lines of credit will supply adequate money reserves for the foreseeable future. Thus far Viatron has converted only $9.5 million of its recent $25 million convertible subordinated debenture, he said. And there is still the $60 million credit line from First National Bank of Boston, although access to this is contingent on public acceptance of System 21.

For those concerned about Viatron's source of semiconductors and MOS, he reported contracts for $50 million worth of electronics had been let to Texas Instruments, Motorola, and American Microsystems and that other large contracts were being negotiated. The MOS prices were below original estimates, he said.

Viatron's own MOS installation is making 200 wafer starts a day, according to the company president. The $1.8 million installation, planned as a back-up source, could increase this to 600 starts a day.

Dr. Bennett also reported on personnel, and there has been further decline in the number of old faces. Those that have followed Dave Sudkin out are Lloyd Ireland, vice president of finance, and John Terzian, vp of system engineering operations. Ireland has not been directly replaced, but Richard Bowen, formerly with the National Bank of North America in NYC, a specialist in marketing commercial paper, banking and debt, has been named a company vice president. S. E. Greenfield, former head of advance planning, has been named to Terzian's old post.

In addition, Roger Phelps, a vice president and general counsel and president of Viatron International, was named to the board of directors; and Harry Schwedock, who has been acting vice president of marketing since the departure of Sudkin, was confirmed in that post.

Production of System 21 is up to 600 a month, and 158,000 square feet of space has been taken for manufacturing and support. It's impossible to find out previous production rates or total production figures, but Bennett said that current direct costs of manufacture, including current variances, are substantially below retail price of the machines.

Viatron, he said, is determined to maintain its low price. However, it has completely abandoned its original plans of leasing the units and now has a marketing goal of 100% sales. According to Dr. Bennett, all current shipments are being made against sale orders. Casual conversation with some of Viatron's representatives makes one wonder where these sales are coming from, since they speak of few placements of more than one or two units on lease, primarily for testing. Nevertheless, Viatron is quoting delivery time for sales at four months and for lease orders at 12 months.

There are no figures on how many units Viatron is shipping, but Dr. Bennett claims that in the next few months export sales will take 25% of shipments.

COMPUTERS CRAMP MAIL MESS MANAGEMENT

Any introductory text on edp will emphasize how inflexible computers are — they only do what they're told, and precisely that. Which is exactly what causes problems when something as

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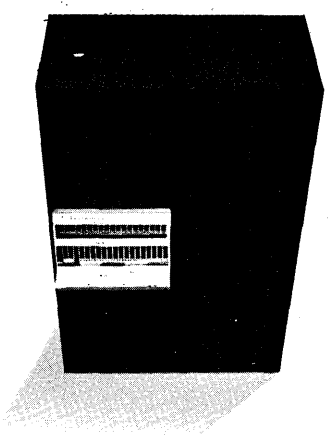

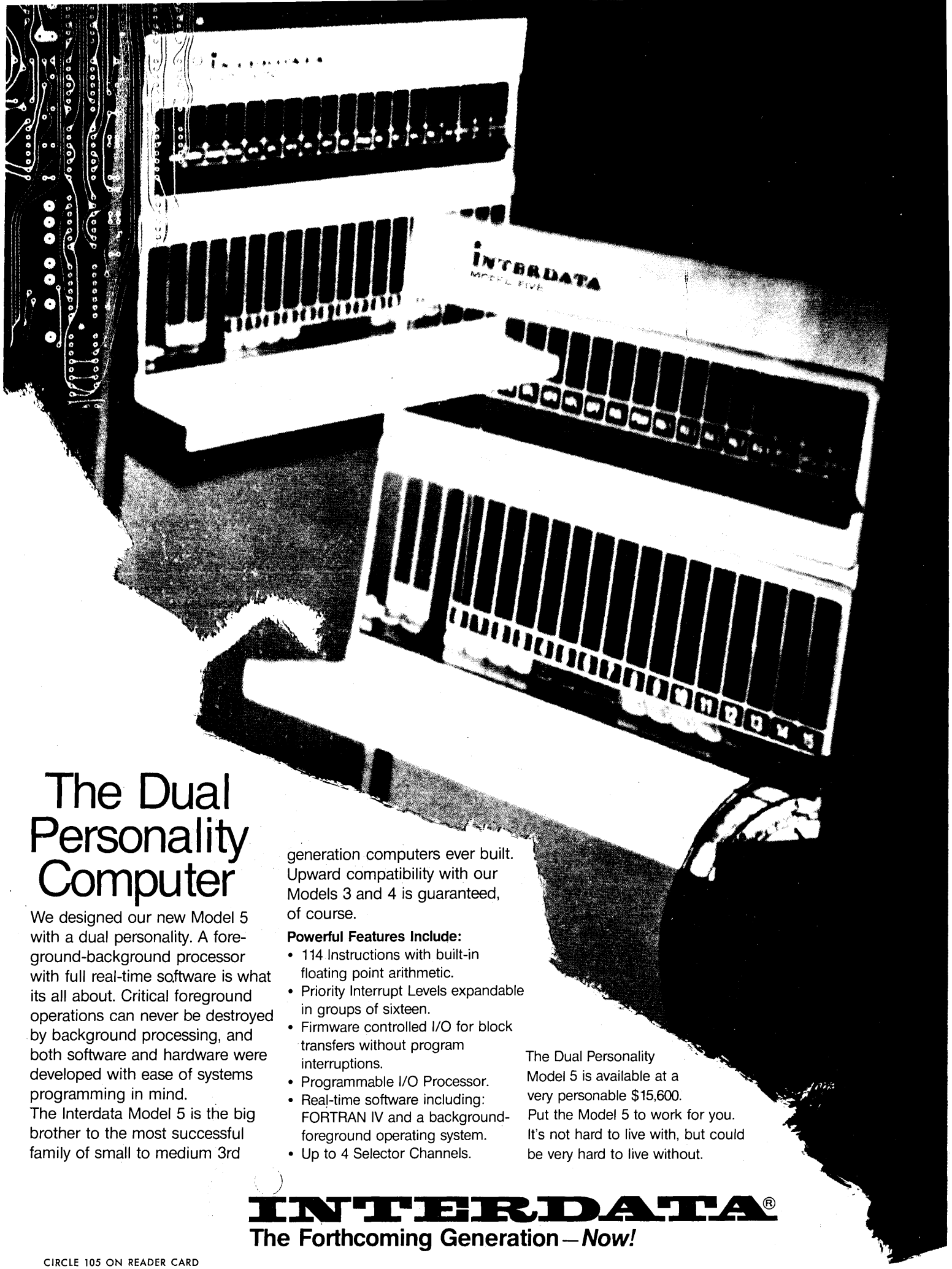

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CIRCLE 105 ON READER CARD

completely unforeseen as a mail strike occurs. As Art Buchwald commented in his syndicated column, "it's hard to explain to a computer what a mail strike is all about."

While the problems of the Post Office are partially due to a lack of automation, the problems faced by postal patrons were compounded wherever computer systems were interfaced with the mails, as in billing applications. Obviously no reprogramming to accommodate the strike was feasible, so computers just kept adding interest charges and printing out dunning letters for overdue accounts, though the letters couldn't be mailed any more than the payments could be received in areas victimized by the strike.

Organizations which depend on computerized billing and receivable systems are generally reticent in talking about the affects of the strike. American Express, for example, didn't want to reveal its policy on handling cardholders who couldn't sent interest payments on time because of the strike. Firms with heavy mail order business, such as Sears, Montgomery Ward, and Spiegel, either would not comment or downgraded the problem. March is a slow month for the mail order business even without a postal shutdown, and some smaller mail order houses were forced to temporarily suspend computer operations for want of sufficient input.

One firm which did not hesitate to talk was Chemical Bank New York Trust Co., which administers the MasterCharge Card. Chemical stated that it would cancel the 1½% interest charge on payments more than 25 days overdue for any cardholder who claimed the mail strike had prevented payment. A spokesman explained that this required no reprogramming because provisions already existed for cancelling or refunding interest charges which are disputed by cardholders. All credit cards allegedly have similar provisions, although it isn't always evident to customers who feel they are being unfairly penalized.

In the computer industry itself, the service bureau sector was apparently only slightly affected by the strike, because it relies very little on the mails. Service bureaus often have their own pick-up and delivery services or use private services, especially in the metropolitan areas where the striking was most prevalent. In California, however, Computing and Software's Valley Computing Center experienced difficulties with their far-flung payroll service when input stopped arriving from customers in Missouri, Minnesota, Texas, New Mexico, and especially Illinois. This problem was partially overcome by using the phone for input, and Air Express for delivery of output.

So computers fared fairly well during the postal strike, and, at least, no one can blame the strike itself on the computer industry.

Postal automation has not extended far, and where it does exist it is very much on the periphery of the computer industry. According to *Business Week*, optical character recognition systems developed under contract by Philco-Ford are found in eight post offices, and Burroughs has sold a couple hundred letter-sorting machines to the Post Office; but no computers are in use for processing the mail.

IBM INCREASES MAINTENANCE FEES

Increases in maintenance charges will result in increased monthly rental and higher maintenance fees for most IBM unit record equipment and increased hourly per-call maintenance fees for most equipment, including computers, effective July 1. Purchase prices are unaffected.

Increased rentals affect 48 of IBM's approximately 600 machine types, all in Class 1, including unit record and card handling equipment. Increases are from 1-10%, except for the 029 keypunch, which jumps from $67 to $77 per month, or 15%, and the 059 verifier, which rises $15 — 22.3%.

Hourly maintenance charges for Class 1 equipment will rise from $18 to $22. Charges for Class 2, including small computers up to the Model 20, remain at the present $22 per hour. Class 3 charges, for computer Model 25's and up rise from $22 to $26.

IBM states the increases reflect increased costs and are necessary to continue to provide a high standard of maintenance service.

RESULTS IN NEW APPROACH TO BANK EDP

Bernie Hogan, who resigned as president and board member of Corporation S, has started Results, Inc., in Dallas — together with Ed Lott — to rescue banks floundering in the intracacies of third-generation systems.

Both are old hands in banking biz. Lott was previously exec vp at American Fletcher Bank in Indianapolis, and Hogan, before joining S about a year ago, had been with Wells Fargo six years as senior vp of marketing and systems. Incorporated in December, Results already has (at least) five contracts and a staff of 20. They have got together a line of systems programs, but instead of going the package route, will adapt their wares, get them running for the bank, and support them under contract.

Their inventory now includes a customer system, to which demographic statistics can be added for bank customer classification; a financial system developed jointly by a large bank and Ernst & Ernst; a data management system of their own design; and an on-line commercial loan system acquired from bank sources.

Hogan's formula for getting top people: the company is privately financed, with a block of stock set aside and assigned to new employees.

CTI AND UCC AND LTV AND LTA AND STC

Computer Technology, Inc., reports earnings of nearly $1.5 million in its 1969 annual report. Revenues were $70 million, almost evenly divided between CTI and its then subsidiary, Service Technology Corp. All but $1.4 million of this revenue came from business outside the Ling-Temco-Vought sphere of influence.

CTI was put together from a melange of LTV edp operations and subsidiaries in August 1968 to do facility management. A coterie of executives was enticed by attractive — $30K to over $50K plus stock, etc., — long term deals. It was taken public in April 1969 when LTV sold 689,530 common shares. The revenues from the captive LTV FM business and some fanfare about the future of facility management got the offering and the company well launched. Since then, passage has been quite rough in spots and despite reports of profit, business hasn't come up to expectations.

By August 1969, LTV or rather Ling Temco Aerospace, which held 71% of CTI stock, was looking for a buyer of its facility manager. No specific reasons were given for this move, but its was seen as part of the LTV effort to clear up its own problems.

The Prudential Insurance people were the interested party, but in mid-November withdrew their offer. The reason for this was that Prudential had too much second generation equipment for CTI to profitably merge into its operation and that the FM fees Prudential would pay to what would be its subsidiary would not cover the losses incurred from the purchase of the equipment. Facility managers generally buy or take over leases of customer equipment.

Failure of a deal was not the only result of the CTI, Prudential negotiations. They also brought the removal of George W. Woerner, Jr., as CTI

president. The ex-IBMer was replaced by LTA president Paul Thayer. Later, word got around that Woerner, now senior vp of marketing and executive assistant, had been and still was trying to get sufficient money support to buy the company.

Then along came University Computing Corp. Initial negotiations between UCC and CTI produced a list of stock transfers, company exchanges — all with buy back clauses, and service contracts by which UCC would have taken over the company. The result of the dealing was that UCC bought slightly more than half of LTA's stock.

UCC got two million shares (35.5%) of CTI, a $2.5 million CTI debenture and all outstanding warrants to buy more CTI stock. If exercised, the warrants would give UCC 49% of CTI stock. UCC also got the right to vote LTA's CTI stock for the next two years and management assistance deals with CTI and LTA that will bring in $200,000 a month plus costs from each until December 15, 1972.

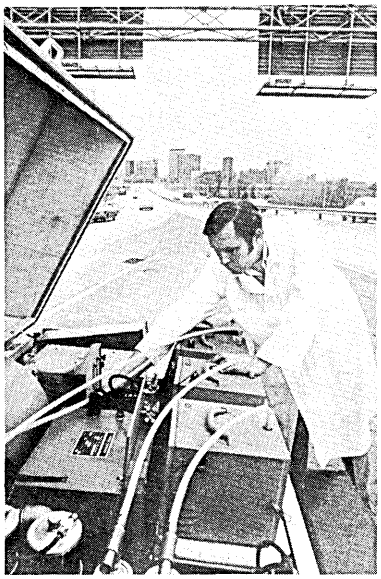
For this it paid LTA $20 million in cash and its interests in the Academy of Computer Technology, Inc., and Alcorn Combustion Co., Inc. UCC got the right to buy back these companies for $17.5 million in cash or its stock before March 31, 1972. LTA got the same rights for Service Technology Corp., but only for six months at the book value not to exceed $2.5 million. It bought STC on March 6 for $2,234,000.

The deal was sealed on January 7, 1970. Sam Wyly, Charles Wyly and E.W. McCain of UCC and Douglass Parnell, newly appointed CTI president, were elected to CTI's board of directors. Woerner kept his senior vp post and a directorship, although he had earlier written the directors refusing to move with the company headquarters from Skokie, Ill, to Dallas and claiming the right to again be president and chief executive officer.

The board didn't take any action on the Woerner letter until early February after he had assumed the role of protector of minority stockholder interests. He did this first with a telegram and then a suit charging UCC, LTV and LTA sought to enrich themselves at the CTI shareholders' expense. The telegram said the three companies had taken action that violated antitrust laws and that the majority of directors had violated their fiduciary duty not to dissipate the corporation's assets. The message listed six demands and gave the board 15 days to meet them or he would file suit.

The demands were: 1) nullify the elections of Parnell, Sam Wyly, Charles Wyly and E.W. McCain Jr. to the board; 2) require UCC to divest itself of shares and other securities of CTI; 3) enjoin UCC from future ownership in CTI and enjoin LTV and LTA from transferring any CTI interests to UCC; 4) recover damages from UCC, LTV and LTA for the effect on CTI of their violation of antitrust laws; 5) take action against the directors who approved or authorized transactions with UCC, LTV and LTA; and 6) recover damages from UCC, LTV and LTA for violation of their fiduciary duties as majority or controlling shareholders in CTI.

UCC said there was no legal or factual basis to the assertions. CTI took issue with the alleged facts and legal conclusions and said if there was to be a lawsuit it would be contested wholeheartedly and defended vigorously. The board of directors then removed Woerner from the board and the CTI payroll. Woerner had broken his contract, according to the company. By not coming to Dallas he had refused to perform his duties and this, they said, amounted to a resignation. His five year contract had three and a half years to go.



Fixing a stalled car? No, collecting data for a computer. This technician for Travelers Research Corporation of Hartford, Conn. (soon to be known as the Center for Environment and Man) is setting up a mobile air sampling station beside an expressway near downtown Hartford. The equipment will provide air quality measurements for analysis by an IBM 360/40, which compares the area's air pollution to "acceptable limits." Travelers says such comparisons have shown that pollution in some areas exceeds these limits by 50% to 125%. Predictions of future pollution levels also are possible.

Woerner filed his complaint in the U.S. District Court, Northern District of Illinois, asking $87 million in damages from UCC, LTV and LTA and asking that: 1) the three be enjoined from exercising control over the company; 2) for the appointment of someone to administer their shares in CTI; 3) cancelation of the agreement for CTI to pay UCC management fees and reimbursement of the payments already made; 4) an accounting be made by LTA of the stock premium it got in the sale; 5) and payment be made to CTI by each of the three of their profits from the sale.

In its annual report, CTI acknowledges the lawsuit and notes that since no damages are asked of CTI there should be no adverse affect on its earnings. Actually, performance will be the only affector of earnings and CTI still must show that it can perform.

Parnell has done some belt tightening. A spokesman describes it as a fundamental reorganization. Corporate overhead has been cut, much simply by the move from Skokie. CTI in Dallas reportedly only had room for 20 of the 85 that staffed the Illinois headquarters.

Austerity is supposed to move to the three CTI regional operations. Last year, start-up expenses for these were $2.9 million. The aim is to eliminate duplicate functions with Dallas taking over major proposal and program development work plus support functions, while the regional groups concentrate on marketing. Operations will be handled by staffs assigned directly to accounts.

Marketing is what is needed, according to one spokesman. The $1.4 million in non-LTV revenue for 1969 was only 18% of goal. Most of the work is for processing at CTI's own facilities, and comes from such companies as Chevway Corp., Chicago fleet leasors for Chevrolet; the Barnett Banking Chain in Florida; Suffolk Grocery, Inc., New York food wholesalers; the Jacksonville (Fla.) Naval Credit Union; Financial Services, Inc., of New York; and Detroit's Maccabee Mutual Life Insurance.

ADAPSO RELEASES THIRD SERVICE INDUSTRY STUDY

Increasing cost of entry and the trend toward economies of scale which favor the merger movement will slow down the growth of the data processing service industry in the next five years, but it *will* grow — and at a rate of 30-35% per year.

This projection by ADAPSO is based on its Third Annual Industry Study, a survey of industry operating results in 1968 for 98 companies which re-

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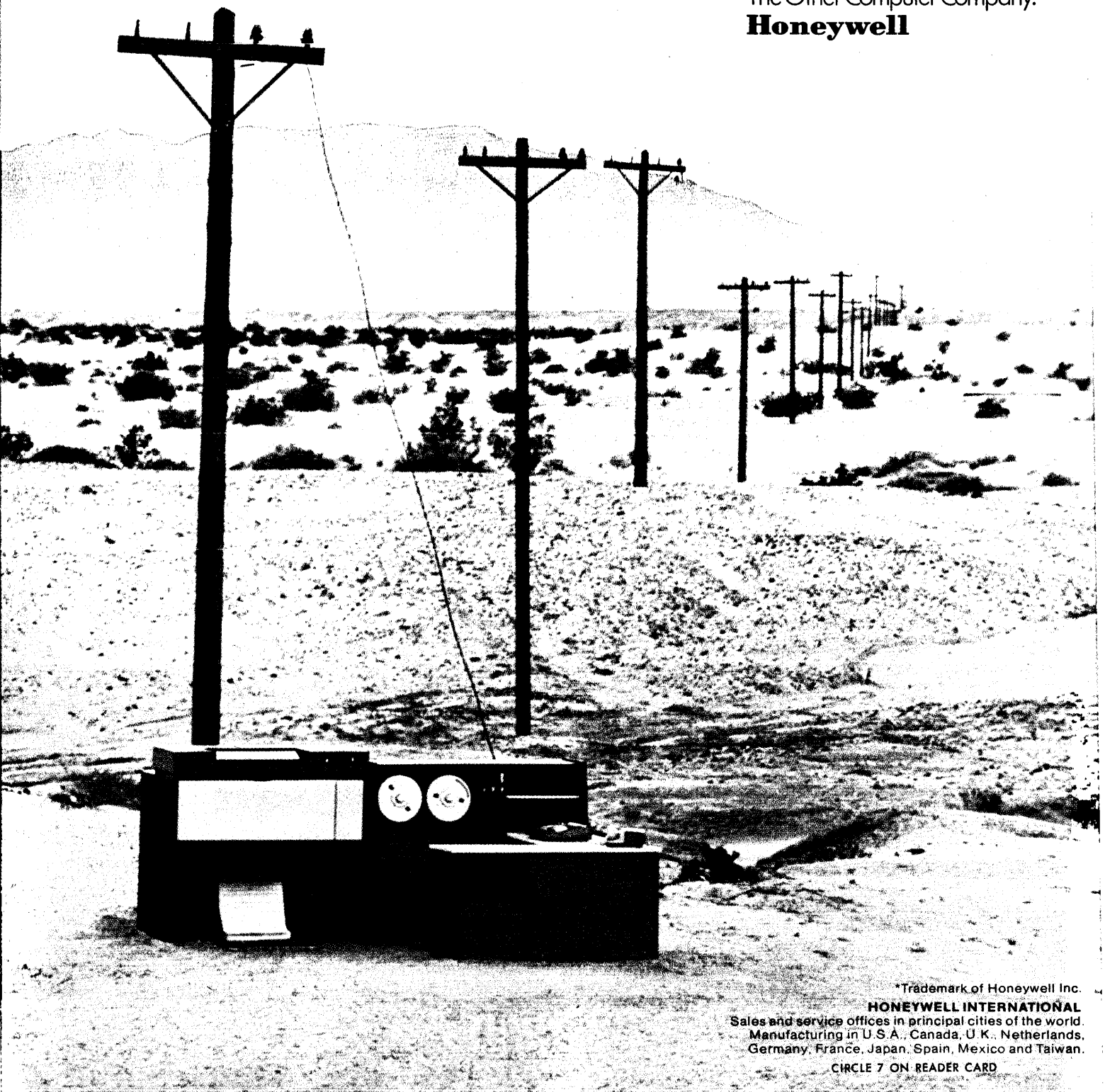

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CIRCLE 7 ON READER CARD

sponded to a mailing of 1500 questionnaires. The study indicated the industry in 1968 was made up of 2200 separate offices of which 1035 were operated by 235 multiple office firms. Estimated industry earnings were $1,090,000,000.

A typical firm that year operated one office; earned $400,000; showed a revenue growth of 14% over the year before; was a private corporation; was located in or near a large city in the Middle Atlantic states; had been in business one to four years; served 49 or fewer customers; provided 22 different services with the emphasis on accounting; had 85 employees; spent 45% of its revenue on salaries; had one or more computers installed which it used 250-300 hours per month; rated its field as highly competitive; called personnel its biggest problem, and ... was a member of ADAPSO.

The study estimated 83% of all companies earned less than $1 million. Of the 15% which earned $1-6 million, the average was $2,500,000. Gross revenue of the remaining 2% was estimated at $600 million. The study breaks the industry down into data processing, software, and time-sharing, with data processing accounting for the lion's share of revenues, $990 million. Software and time-sharing chalked up $500 million and $100 million, respectively.

Growth rate in number of firms was estimated at 20% annually since 1966 and growth in total industry revenues was set at 36% per year. The study concludes that while the number of firms is still increasing, "a group of large multi-center firms which will dominate the industry by the end of the 70's is beginning to emerge. The growth rate ... should begin to slow down with the peak in the number of firms occuring in the mid 70's. However, the number of offices will continue to increase throughout the decade."

The percentage of firms which saw their field as highly competitive in 1968 (49%) compared to 34% in 1967 and 40% in 1966. Other data processing service firms were the most frequently cited source of competition, but 49% listed banks, 47% named computer manufacturers and 10% pointed to universities as major sources.

The reason given for the increasing cost of entering the industry: "... many firms in the industry are becoming more specialized, and specialization usually requires a major investment to determine the market potential for the service and to develop a superior product which will effectively satisfy the specialized demand."

Among the companies which cited personnel as their biggest problem (67%), most were concerned with acquiring and keeping high quality personnel, especially programmers and systems analysts. Other high-point problems were inadequate financial resources, low profits and increasing competition.

This ADAPSO study was the first to combine operating ratios with economic analysis. Separate survey results were issued in 1967 and 1968 (for 1966 and '67). The latest survey indicated that time-sharing firms have, in general, the lowest percentage of expenditures for salaries and the highest for equipment and other operating expenses. Software firms had the lowest expenditures for equipment and the highest for salaries.

Among data processing firms, the study indicated, the high-profit firms appeared to be providing more accounting services and slightly more financial and marketing programs, while the low-profit firms were providing more packaged programs and more information systems.

Copies of the complete study can be obtained by writing: Association of Data Processing Service Organizations, Inc., 551 Fifth Ave., New York, N. Y. 10017.

STANDARDS OIL TROUBLED WATERS

The small, ever-active, unappreciated band of people that works toward computer industry standards continues its seemingly quixotic quest in a series of related and unrelated, dated and late developments that range from credit card sizes to typewriter keyboards. In some cases, perhaps, the group should go unappreciated.

A draft proposal for letter ballot approval of credit card specifications has been submitted to the members of American National Standards Committee X4, Office Machines and Supplies, by the subcommittee, X4A11, which had been specially created to work on this project. After considering styles of cards issued by airlines, banks, oil companies, retail firms, travel and entertainment organizations, and plastic card manufacturers, the subcommittee, in effect, recommended two sizes of credit cards, the use of OCR A, and "also recognized the prevalent use of Farrington 7B type as a de facto standard to facilitate interchange agreements between card issuing companies."

Thus, two standards for both size and font were presented to X4, and as one standards participant observed, "Now, we'll have 'boy' and 'girl' size cards and my wife wanted only one, even if it was the 'boy' size." It is his opinion that X4 is doing something against ANSI (American National Standards Institute) rules by pointing to the Farrington font, and he expects X3, the Computers and Information Processing Committee, to "blow the whistle" to ANSI about it.

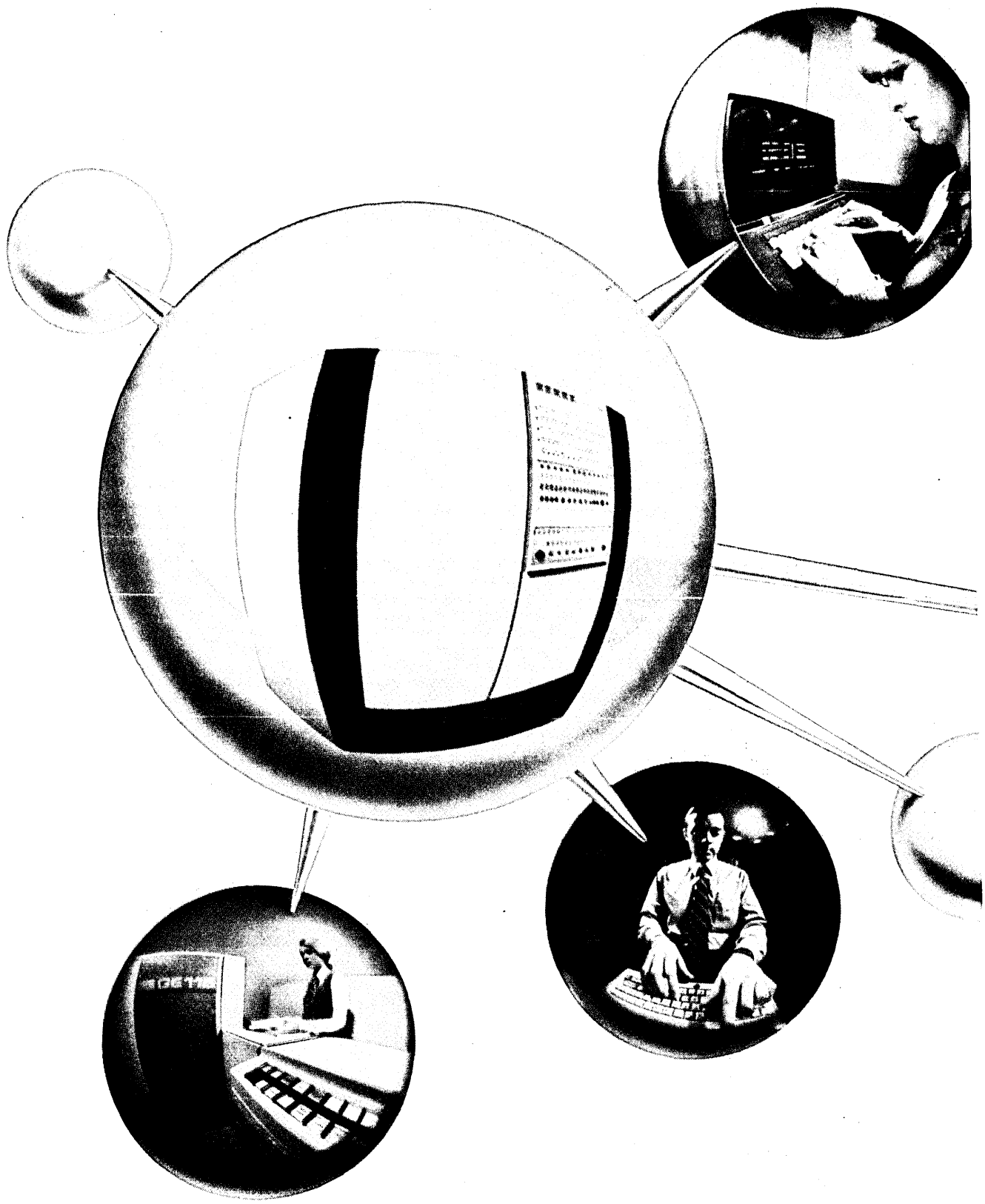
In another continuing standards issue, the standardization of PL/I is in limbo because a 2/3 majority of the subcommittee of 12 can't be mustered to forward it to X3. The last vote was six to one in favor, and eight is 2/3 of 12, and six and one adds up to only seven, so ...

X3.6.6 is the ANSI task group on Network-Oriented Project Management Systems and is headed by R. Lambird, of NYU, who replaced Ralph Pace of Arthur D. Little, Inc. This group is embarked on a cooperative effort with the International Committee on Networking Standards (INTERNET) to develop, what else, international networking standards. Thus far, according to the Standards Newsletter, they have developed either approved or draft standards in network analysis terminology and symbols. A review of X3.6.6's proposed guidelines for project management computer systems design is scheduled at the May 21-22 meeting of that group at the Roseville, Minn., plant of Univac. The main object of consideration at that meeting will be working paper X3.6.6/1, "Special Vocabulary for Network-Oriented Information Systems," which represents "approximately five man years of effort." For the time being, this group reports to Tom Steel, head of SPARC (Standards Planning and Requirements Committee).

ANSI also is involved in launching a new publication, *Standards Action*, a biweekly that will be distributed to industrial firms, trade, technical and professional organizations, and the trade and technical press. The purpose of the publication will be to solicit public comment on standards that have been submitted to ANSI for approval as new or revised American National standards. The biweekly will be concerned with computers only as such computer standards developments occur, and the rest of the time will focus on plumbing or materials or road signs or whatever.

Government support for ANSI was espoused by Richard O. Simpson, deputy assistant Secretary of Commerce for product standards, at a press conference in New York. Pointing out that ANSI is the only organi-

General Electric announces the network communicomputer



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A DATANET-500 system will link any brand of host computer that can communicate over telephone lines to a wide array of terminal devices and peripherals. Almost any combination is possible.

The system can communicate over any class of communication channel, including parallel channels for Touch-Tone input.

And the DATANET-500 system can reliably perform all your required networking functions. As a remote concentrator, for example, it can consolidate up to 250 remote keyboard terminal lines into a scant few voice-grade lines. Or, as a remote batch concentrator, it can funnel many satellite computer inputs to the host via broadband lines. Either way, your line costs drop dramatically.

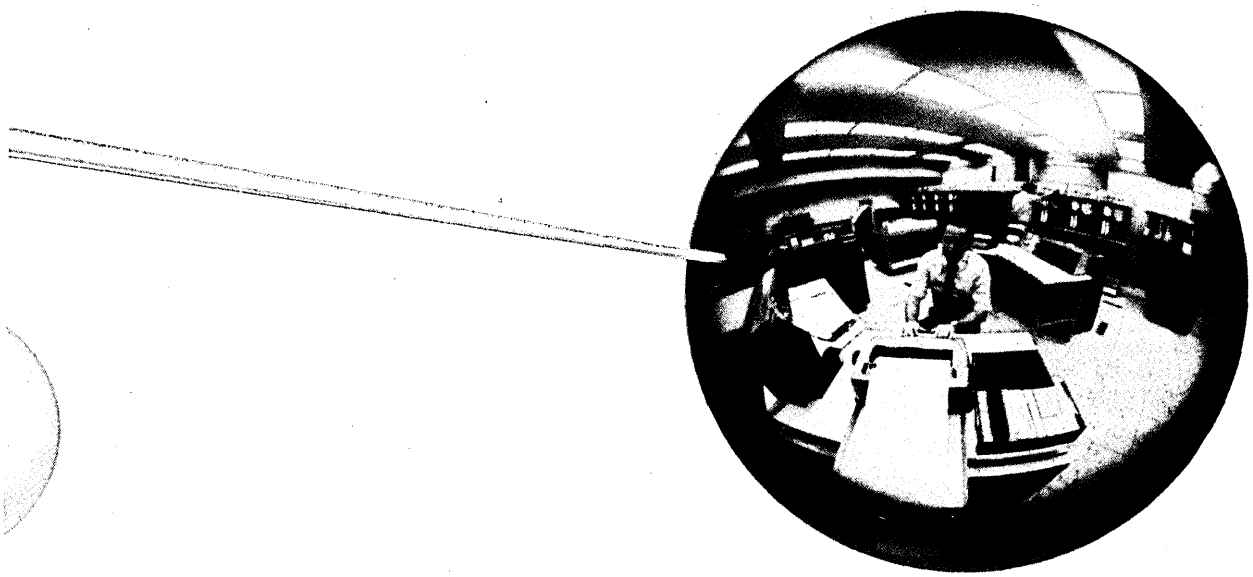
And, as a complete network processor, the DATANET-500 can tackle many communications network jobs that used to be done by the host computer itself. A computer in its own right, the DATANET-500 relieves the host of several processing duties . . . jobs like inquiry processing, and data collection and distribution. The system also frees your host computer from tedious real-time tasks such as line servicing, error detection and correction, and message switching.

The DATANET-500 communicomputer keeps your data flowing despite the many, varied hazards you find in the data communications environment. Take power failures: The DATANET-500 offers a battery option that continues operations for up to 30 minutes following a power shutdown.

The DATANET-500 system is also the most modular communications processor in its class. You can start small and grow in numbers and speeds of communications channels . . . grow in processing and/or memory capacity (up to 65K, 20-bit words) . . . grow in numbers of terminals and peripherals the system will handle.

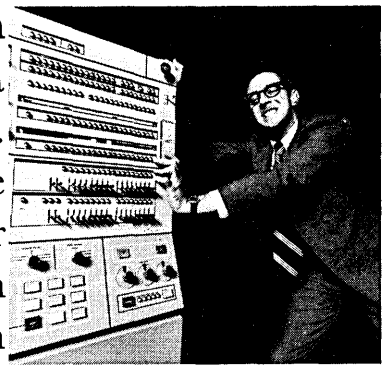
Unite your computer systems with the DATANET-500 network communicomputer. Call your nearest GE Information Systems Sales Representative for more facts. Or write to General Electric Company, Section 290-72, 1 River Road, Schenectady, New York 12305.

GENERAL ELECTRIC



General Electric DATANET-500: Uniting your systems of the 70's

COMPUTERS CAN BE CONQUERED.



Before your frustration gets you to turn all your edp operations over to a facilities management firm, let's get together. There's another, far less drastic, and much more reliable way to get back control of your computer operations. And in an hour long meeting we can describe it in detail. The approach uses your own computers to diagnose and then solve your edp systems, operations and scheduling problems. Our services include everything you need to get full control, fast—the top level people, special computer management software, systems monitoring hardware, and training for your staff. It costs money, yes. But far less than all other alternatives available to you. The important fact is that it works. Our more than 400 clients in industry and government will tell you that. Our reputation and experience was first built with SCERT—our dynamic software package that uses computer simulation techniques to solve edp management and expansion problems. And to SCERT we added several advanced new tools and techniques and services to provide the full range assistance that today's computer control crisis calls for. For full information, write or call: Comress, Two Research Court, Rockville, Maryland 20850. (301) 948-8000. Or call the local Comress office nearest you. Together we can get your computer to remember who it works for. You.

COMRESS
THE CONQUEROR.

CIRCLE 17 ON READER CARD

zation that represents the U.S. in the work of the two international standards groups, the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO), Simpson stated that "participation by U.S. industry in the work of IEC and ISO is essential to the protection of U.S. interests in world markets, and ANSI makes that participation possible." The government has never given ANSI any financial assistance, and Simpson said he thought it should and he would try to do something about it.

That may not thrill too many manufacturers, many of whom think federal officials are already trying to run the show.

A European Computer Manufacturer's Association (ECMA) committee, ISO/TC95/SC14, achieved a great stride forward this year when it reached some agreement on the standardization of international keyboard layouts. The major difficulty in such standardization is the differences in languages, the number of letters in the various alphabets, accented letters, etc. And another difficulty, according to D. Hekimi, secretary general of ECMA, is "a passive resistance of big user organizations in each country to modify anything to their equipment."

The basic keyboard almost agreed upon (Germany and Czechoslovakia, where the letter Z is often used, were reluctant to accept its placement in the lower left corner) is essentially the one now in use in the U.S. Italy and France made several concessions in agreeing to this keyboard — they have slightly different arrangement of letters on their keyboards and their numbers are on the upper case portion of the keys.

It must have been simpler in the early days of the typewriter to set standards. The reason QWERTYUIOP is the upper line of letters is that typewriter salesmen insisted on it so they could type the word "typewriter" quickly ... all of its letters are on that line.

AUSTRALIA CPU POPULATION NEARS ONE/13,000 PEOPLE

Whether the figure of 1000 computers installed in Australia was passed some time ago, is about to be passed, or will be passed some time in the future depends very much on which type of machine is included in the definition of a computer. If machines like the Univac 1104 are included, but visible record machines are excluded, then Australia is about to pass the 1000 mark for digital computers installed. If analogs are included, the figure was passed late in 1969 or early in 1970.

Excluding manufacturer's own machines for education, training, and bureau use, of which there were 52 installed and four on order at the end of September last, according to figures released by the Australian computer magazine *Data Trend,* 757 digital computers were installed at that date and 152 on order. The comparative figures for 15 months earlier are 555 and 110.

The company showing the best overall improvement during that period — in numbers, but not necessarily in value — is NCR, which had 19 on order by July of '68 and 34 by September 30, 1968 — including 10 Century 200's and 21 Century 100's, six of which already had been installed at the cutoff date.

Company	*6/30/68*	*9/30/69*
Burroughs	5	4
CDC	2	7
Digital Equipment	7	13
GE	7	3
Honeywell	5	17
IBM	35	42
ICL	25	25
NCR	19	34
Univac	4	5
Misc.	1	2
	110	152

BULL-GE IS IN BLACK

Compagnie Bull General Electric is profitable. The two operating organizations, Compagnie Bull and Societe Industrielle Bull, that GE took over in mid-1964 moved into the black in 1969. Bull-GE, the marketing organization, reported net profits of $435,000, and SIB-GE, the manufacturing, research and development operation, had $212,300 in profits. Revenue is reported to have risen 33%, and net orders increased by 40%.

M. Henri Desbrueres, president of B-GE and SIB-GE, attributes the change in fortune to "the plan we established several years ago." He noted the success of the GE-600, reporting over 15 orders and installations to date, and the continued success of the GE-50 series. There are more than 1200 GE-50 systems installed and on order; 100 of these are in the U.S.

Bull-GE also claims leadership in European time-sharing, and has something of a foothold in Eastern Europe via its licensing agreement for production of the Bull 140 by Tesla Enterprises at Pardubice, Czechoslovakia.

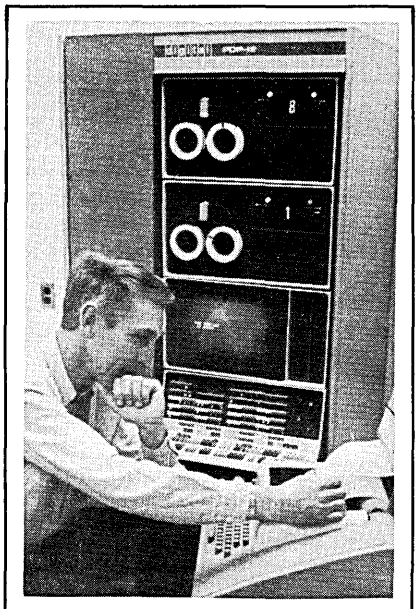
"We have completed a decisive phase in our program," said M. Desbrueres. "Our technical, industrial and commercial resources are now stronger than ever and fully integrated — both within the B-GE network and in the worldwide General Electric computer business." The company has three manufacturing plants, a network of 22 foreign affiliates and branches and employs 15,000 people.

General Electric bought a 51% interest in Bull in 1964 and in 1966 raised its interest to 66%. Its losses at Bull for the four years it has controlled the company were $45.9 million for SIB-GE and $56.6 million for Bull-GE.

GE's overseas computer interests also include GE Information Systems Italia, renamed and restructured from Olivetti-GE when GE bought out the Italian business equipment manufacturer's computer division, and GEIS, Ltd., which markets GE computers in the U.K.

SPEEDATA SLOWS, COMES TO A HALT

Computer Applications Inc. has terminated Speedata, Inc., its computerized national market information serv-



Dearie, do you remember...? Dr. Bennet Murdock, University of Toronto psychologist, shown here checking a program he is writing for research into human memory, wants the answer to that question and more; how you remember, why you remember and what can be done to help you remember. Using the tv-like screen of his PDP-12, Dr. Murdock shows a subject a word group for a few seconds. The subject tries to memorize the words then tells the computer via keyboard what he saw. The computer then comes up with a new set of words based on the first response and on and on. Dr. Murdock is using the results to test current theories of human memory and to develop new ones. He hopes also to suggest ways to present material for easy or difficult recall.

A dirty tape can put a computer down.

Depressing. Dirty tape causes data dropouts. And dropouts cost you money. That's a bad scene.

RCA Computer Tape helps keep computers up.

It's a special formulation that starts cleaner. Every inch of every reel is tested and certified in the cleanest of white-room conditions. (No statistical testing for us.) And it stays cleaner, longer.

Result? Fewer dropouts, more efficient computing.

Show your computer what a good scene really is. Write RCA Magnetic Products, 201 E. 50th St., New York 10022.

Our tape makes it.

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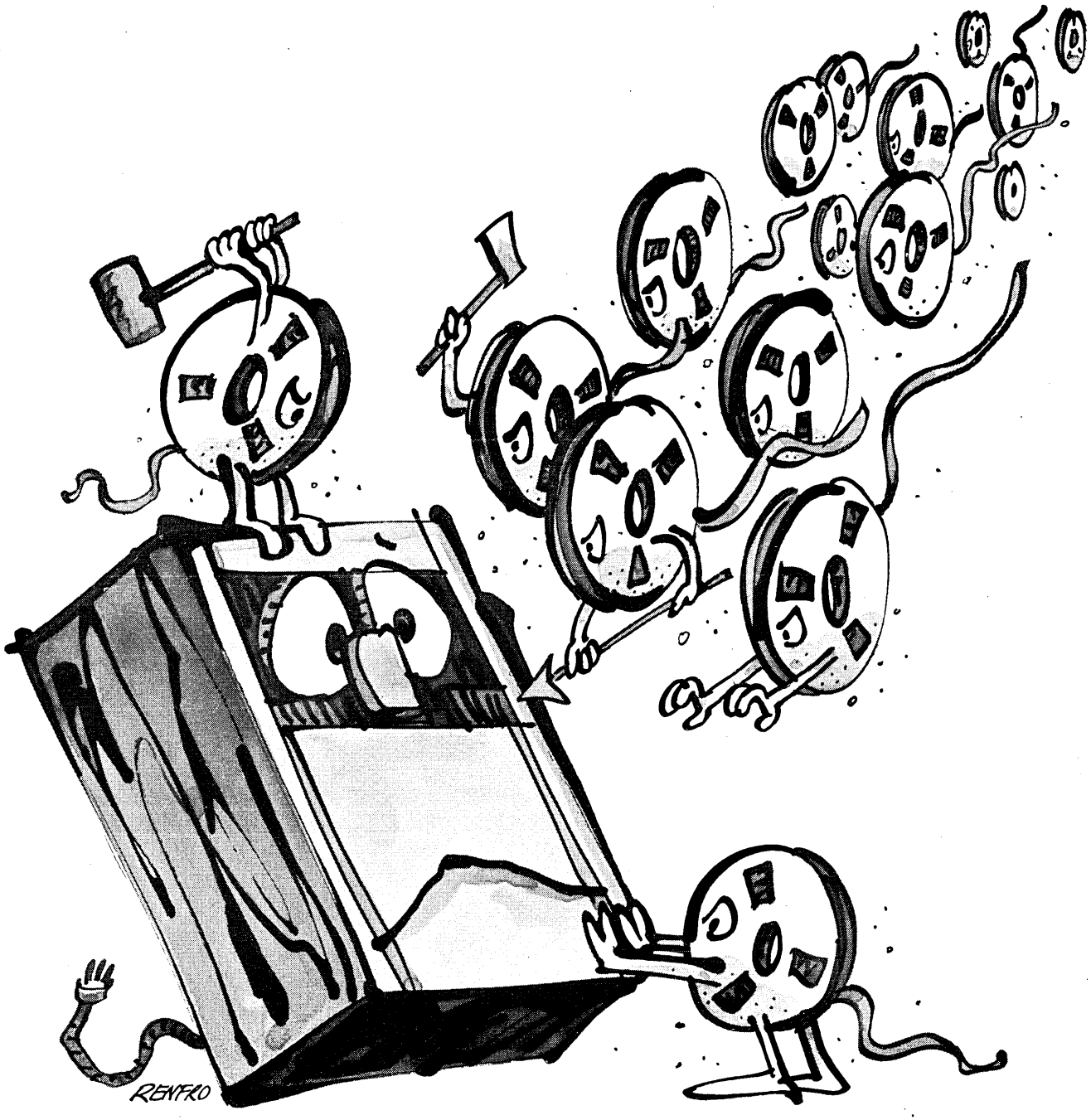


CIRCLE 78 ON READER CARD

ice for the grocery business. It has also terminated most of the 200 people who staffed the service and closed the four Speedata offices.

CAI had invested five years and $16 million in Speedata and only last fall completed the national reporting protion of the system. In concert with other software houses that have discontinued programs that had yet to pay their way, CAI blamed tight money. It couldn't get or afford to spend the money to support Speedata.

The immediate results of the service's demise is the loss of business to EBS Data Processing, CAI's service bureau subsidiary, and at least an $11 million write-off in FY 1970. The company wrote off $5 million of the Speedata investment in FY 1969.

CAI survives however with four divisions and some 2,700 people.

BELL FOLK FORM COMMO SOCIETY

A data communications society called the Communication Systems Management Association is being formed, and Ma Bell is probably relieved that it's not an anti-Bell organization. In fact, the five founders and initial membership are drawn exclusively from graduates of AT&T's three-month course in data communications at Cooperstown, N.Y. Recruiting literature was mailed to 3700 Cooperstown graduates last month. (See News Scene, p. 167).

CSMA claims Cooperstown graduates may not be the best qualified persons in data communications, but they're the only personnel with formal training. A primary goal of CSMA will be to develop their own certificate in data communications to replace the Cooperstown certificate as the only recognized symbol of proficiency. CSMA membership will be open to anyone involved in communications, probably with a requirement of a resume and a personal interview for non-Cooperstown graduates. Later, a written test should be developed.

Additional goals of the organization are to fill the educational gap in the communications area, promote sound communications practices, and provide a professional voice for communications. CSMA concedes it could find itself in opposition to Bell when it takes stands on issues, but does not envision itself as an organization in opposition to Bell. Significantly, two of the founders are presently employed by the Bell system.

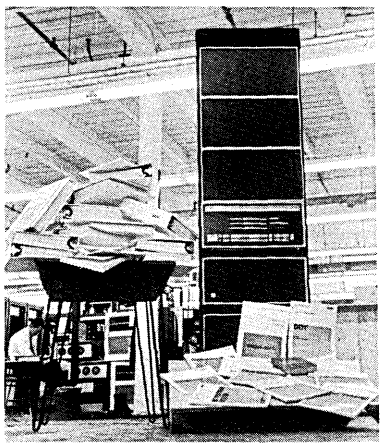
Those interested should contact Donald Sesseman at Princeton Time Sharing Services, Inc., U.S. Highway 1, Princeton, N.J. 08540.

NEW SEMICONDUCTORS PROMISE RELIABILITY, LOW COST

Latest development at Bell Laboratories is a new class of semiconductor called Charge Coupled Devices which perform many of the functions of complex integrated circuits, yet are easily fabricated three-layer structures. The CCD's use the silicon-silicon dioxide system, a technology not previously applied to semiconductors. CCD structures consist of metal conductors, a layer of silicon dioxide, and a base of homogeneous silicon semiconductor.

Use of the CCD's will be for imaging, logic, and memory functions. It is expected that CCD's will be produced at lower cost and have potentially higher reliability than complex integrated circuits presently used for the same operations.

No timetable for release of the CCD's or prices were found in the announcement. And despite Bell Labs high level of R&D, no one could be reached for comment because no telephone connection has been possible between Greenwich, Conn., and Murray Hill, N.J., for several days prior to presstime.



Two weeks? Digital Equipment Corporation's publicity department assembled the support literature that comes with its PDP 8/1 mini for this interesting photo. With the photo comes the notation that the price of $8,500 includes *two weeks* of training.

new services . . .

For anyone who has tried wiring flowers the last minute on a holiday and been turned down with scorn, there is now relief through a computerized communications system installed by Teleflora Worldwide, provided by International Reservations Corp., L.A. The harried florist can place an unlimited number of outgoing orders for delivery anywhere in the U.S. by making one toll-free telephone call. One of the advantages of the system is that it beats the time-zone problem with 16-hour availability (7 a.m. to 11 p.m.) seven days a week. Teleflora has 10,000 nationwide subscribers. . . .

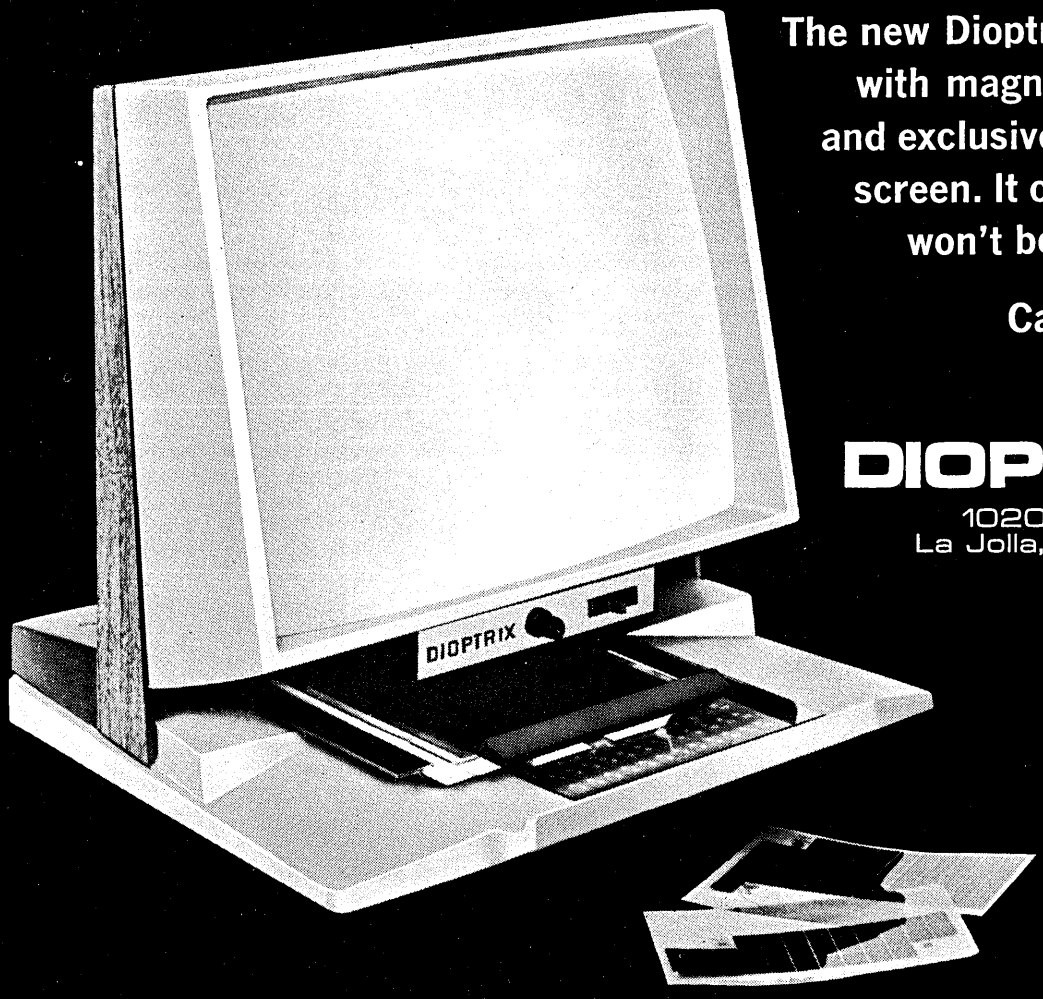
After a 14-month test with 76 auto dealers in the southeast, Graykel Co., Inc., Hinsdale, Ill., has nationally launched an inventory control and parts locator service called TAP-IN. The system enables the dealer to avoid the long delay in special-ordering parts while giving him a better opportunity of disposing of his dead inventory, which Graykel figures amounts to $14,000 on the average. It also accounts for price changes and credit returns. Dealers have a direct leased tie-in to the memory bank. . . .

With so many U.S. film companies operating in Europe, a computerized system has been devised by Cybernetics International Corp. to keep track of the shipment and handling of prints, and their inspection and distribution. Other back office services such as trailers (promotion) and accessory gimmicks can be controlled and consolidated by the company's Cinema Exchange division. CIC estimates that the motion picture industry spends from $80-$100 million yearly on distribution and administrative services, and can trim that amount substantially. . . .

A group of Boston engineering firms got together to build their own library of engineering application programs. The first 15 of what the group hopes ultimately will be "hundreds" of programs have been filed on the AL/COM time-sharing network operated by Applied Logic Corp. Coordinator of the project is Computer Dynamics, Inc., Boston specialist in computer applications related to civil engineering. Categories of engineering applications proposed for the program include electrical, structural, construction project estimating, civil and mechanical. A committee of contributing users decides which programs are included. A contributor is responsible for maintaining his program's accuracy and for updating it. He pays the storage charges. Users pay a surcharge above normal costs of time-sharing. . . .

Computer time-sharing for contractors is the specialty of ACT (Applied Computer Timesharing) of Denver. The company is headed by Harold Tamblyn, a former construction consultant and cost estimator who said his system enables a contractor to computerize his operations in such areas as estimating, scheduling, labor, material equipment and subcontract

Fiche Story



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CIRCLE 176 ON READER CARD

cost analysis and control, automated payroll and accounts payable processing and accounting. "ACT," he says, "talks the contractor's language, not computerese." ...

Freedom for logic and systems designers from the routine tasks associated with bringing their designs to prototype hardware is the billed end-result of a new service offered by the Electronic Engineering Co. of California, Santa Ana. Called LogicWare, the service takes input in the form of a simple pin list and provides delivery, within 30-45 days, of computer-automated prototype hardware plus an exception report to the designer if basic design errors are discovered, a string list for systems checkout, discrete components, chassis hardware, power supplies, racks, drawers and associated hardware components....

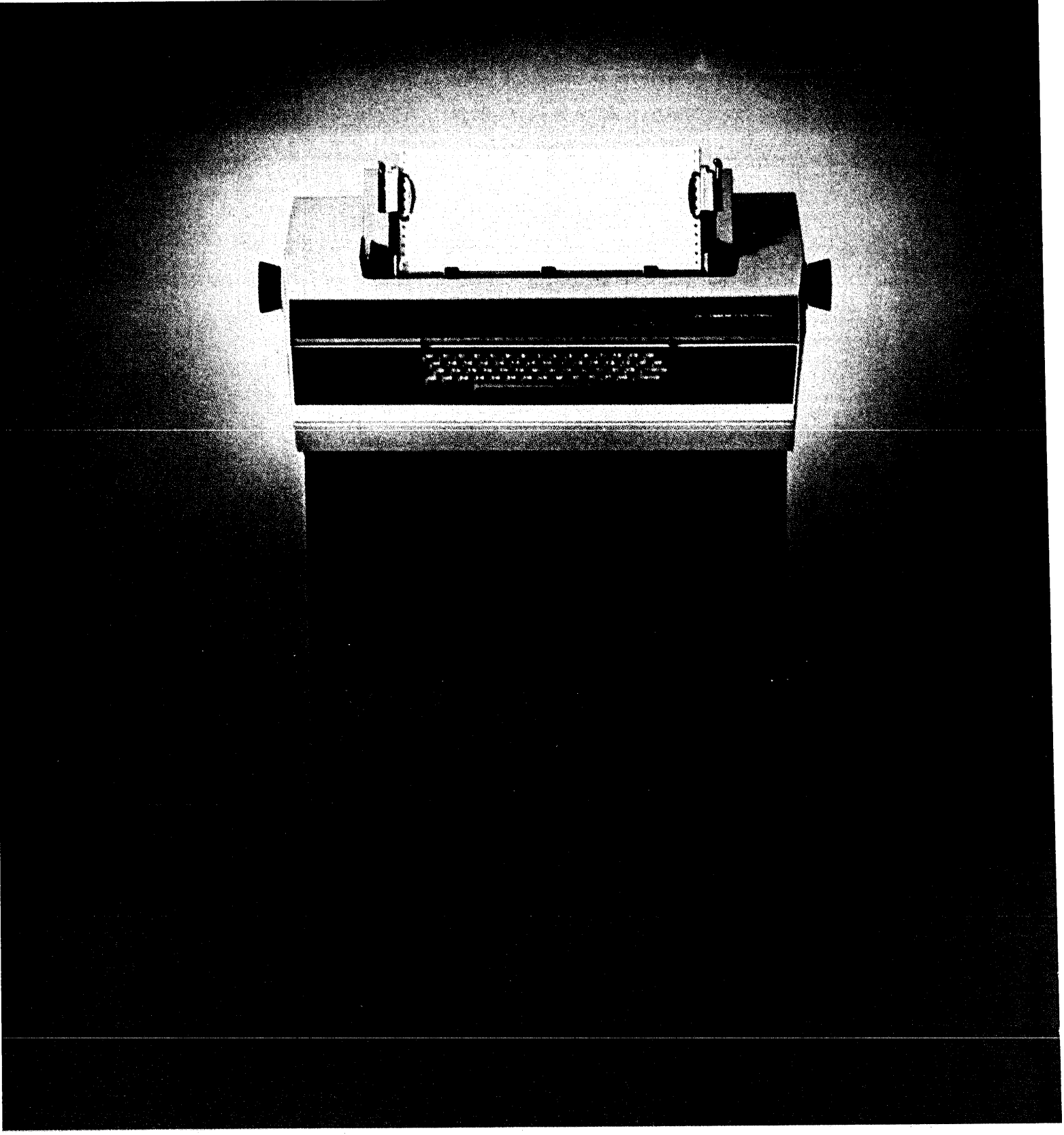
Fortune Magazine's 15-year data bank of vital statistics on the 500 largest U.S. industrial concerns has been opened to on-line time-shared use by COM/UTILITY, Inc., subsidiary of North American Computer and Communications. The 500 firms account for 64% of total U.S. industrial sales and 74% of profits and employ some 70% of all industrial workers. COM/UTILITY operates service centers in Boston, Washington D.C., Houston, and Philadelphia.

new companies ...

"We know that there are many new companies entering our field," said W. L. Loveless, president of **I/O Com, Inc.**, in an understatement announcing the formation of his company in Sunnyvale, Calif., to make data terminal equipment. But he maintained that automatic monitoring systems with unattended communications to a central computer are especially needed and "where the volume is sufficient to justify specialized equipment a dedicated approach can often produce solutions that would not be possible any other way." Principals in the new I/O entry represent a composite of marketing and engineering experience in dp, electronics, aviation and investment/management.... Another popular field, medical applications, has some new entries: **Laboratory Data Exchange, Inc.**, Greenwich, Conn., will carry a product line with all the necessary equipment and programming to handle a clinical pathology lab, including interfacing regular lab devices to the system. Reports go direct to nursing station terminals.... **O'Brien and Lowe, Inc.**, has been started in Rockville, Md., under the wing of Computer Learning and Systems Corp., and will provide systems, staff, and computer equipment for hospitals, already has its own proprietary software. (John) O'Brien was assistant administrator and controller of a 700-bed hospital in Fairfax, Va., and (T. Dale) Lowe was assistant administrator and controller at Cafritz Hospital in Washington, D.C.... **Interscience Management Corp.**, Columbia, Md., is a new subsidiary of Hittman Associates, and will go under the direction of Dr. Howard T. Go, furnishing management consulting to medical institutions, as well as in banking and real estate.... The bold ones are still leaving to form their own ventures: **Software Engineering Associates, Inc.**, has been set up in Rockville, Md., by three time-sharing execs from GE and a fourth from North American Rockwell, who was systems analysis manager for that company's Arlington facility. President George U. Kendrick, formerly in charge of GE's MARK II software, says the firm already has a contract to develop a major t-s system for "an advanced equipment and communications complex".... In Northridge, Calif., **Seidel Computer Associates** has been formed by Kenneth P. of the same name, to provide software design and programming. Although he broke away from Informatics a year ago to be an independent consultant, this formalizes his establishment.... Julius S. Bendat, formerly president of Measurement Analysis Corp. and vp of Digitek Corp., has formed the **J. S. Bendat Co.** in L.A., with a group of consultants, and will disseminate a printed lecture series on measurement and analysis of random data.... And **R. W. McGrath & Associates** has opened its dp sales training and education services at Merry Oaks Trail in Chagrin Falls, Ohio, its founder of that name being a 16-year veteran with IBM.... A firm specializing in applications engineering for minicomputers, **Command Systems Corp.**, has been formed in Arlington, Texas; it is a joint venture of Kordell, Inc., and Radiation Research Associates of Forth Worth.... **CoDaSci, Inc.**, is a new resident in Columbus, O., marketing computer services to 11 states — Michigan to the Gulf Coast. Major programming language it markets is ADPAC — its president was formerly a regional director for that concern.... **Ridall Associates**, Pennsauken, N.J., has been set up by Data Systems Analysts to furnish consulting in computer and systems management.... Name changers: Alphameric Data Corp. to **Alphacom, Inc.**, in Cranbury, N.J., and Comtec to **Interstate Computing, Inc.**, in Dallas. It is the service subsidiary of Financial Technology.... After Itel acquired Intercontinental Systems, Inc., it promptly split it into two divisions: **Itel Information Products** and **Itel International.** ... International ventures: Data Packaging Corp., Cambridge, Mass., is combining forces with Bowthorpe Holdings, Ltd., Sussex, England, to launch **Hellermann Data Packaging, Ltd.**, which will market products in 19 European countries and the Commonwealth.... **Diebold Computer Leasing, Ltd.**, is going it alone in the U.K. after dropping an arrangement with Great Universal Stores, Ltd., and getting new English financing.... Data 100 Corp. is using the purchased resources of Scientific Furnishings, Ltd., in Chicester, England, to start its own subsidiary, **Data 100 Systems, Ltd.**, which will manufacture, market and service peripherals.... **RCA** has established a solid-state division, to handle "one of the fastest growing segments of the electronics industry ... revolutionizing communications and data processing."... Off-the-shelf plated wire products will be a part of the memory technology offered by **Nemonic Data Systems, Inc.**, Denver firm which had to give a substantial interest to Stromberg-Carlson Corp. in return for patents, processes and manufacturing equipment owned by that General Dynamics subsidiary.

mergers, acquisitions ...

Intranet Computing Corp., L.A.-based organization that has changed its name a couple of times since it was Information Industries, is not fooling around about building, if not an empire, at least a time-sharing network. Within two weeks it acquired two companies, without any preliminary negotiating announcements: the Data Systems division of **Datametrics Corp.** in suburban Van Nuys, maker of interfaces and controllers, and then **Universal Data Systems, Inc.**, Westminster, Calif., software specialists who are currently working on the California Aqueduct Program and have completed important projects in aerospace and offshore oil drilling. Intranet has put together its own large-scale computing equipment, its own software, and of late a growing amount of its own peripherals, which it makes available to other dp operators.... Elsewhere on the t-s scene, **Data Network Corp.**, N.Y.C. firm that recently arranged to acquire Logistic Distro Data in its announced plan for a nationwide t-s service, has agreed to sell **Com-Tel Network Corp.**, a Dallas marketing subsidiary, to **Academy Computing Corp.** of Oklahoma City, which is building its own south-and-west network.... Pacific Plantronics, Santa Cruz, Calif., which had agreed



The new Memorex 1240.

In commercial use and in time-sharing applications, it's everything you could ask for in a communication terminal.

There's a choice of 10, 15, 30 or 60 cps. With local or remote horizontal tab control. An original and five copies are produced on paper as wide as 14⅞ inches. And you get all 94 ASCII graphics on a 120 character writing line. The 1240 operates in full or half duplex with Memorex integral modems.

Just as important, the 1240 is easy for people to get along with. It's quiet, even while operating at 60 cps. The operator has maximum print visibility. Print cartridges are completely interchangeable. Paper loading is easy.

The 30 cps model starts at $115 (the 60 cps is $140 per month). And you'll be getting more effective, more reliable communication per dollar than with any other terminal you can buy.

For more information, write: Memorex/Equipment Group, San Tomas at Central Expressway, Santa Clara, California 95052.

Memorex breaks the speed limit with the 60 CPS Communication Terminal.

MEMOREX

CIRCLE 61 ON READER CARD

news briefs...

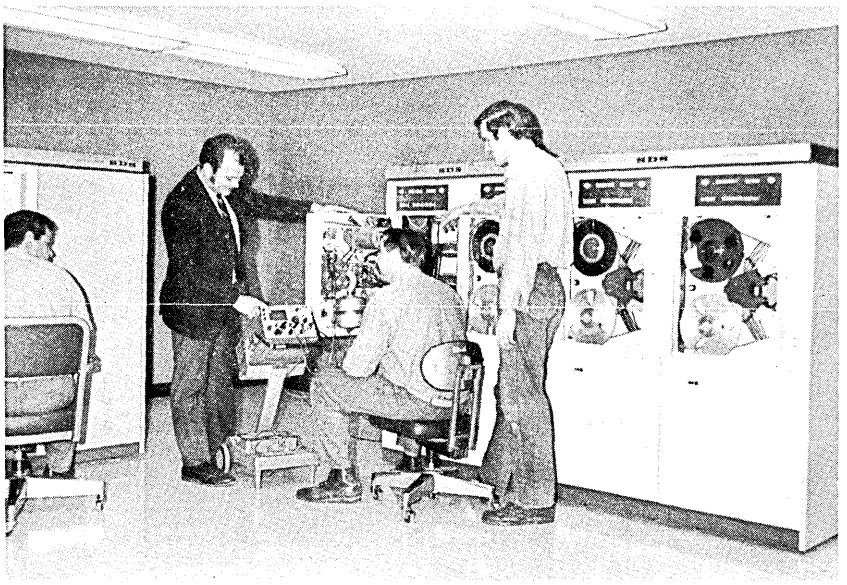
to merge with **Computing & Software, Inc.**, of L.A., pulled a last minute switch and went with **Lynch Communications Systems, Inc.**, in San Francisco, producer of carrier equipment used in cable and microwave systems.... A 60% interest has been acquired in **National Computing Industries,** Phoenix producer of Work 10 and RSVP software, by Continental Telephone Co., which will merge it into a subsidiary, **Continental Data Service Corp.** of St. Louis.... Four companies have been acquired, and two more have agreed to be, by **Arcata National Corp.**, Menlo Park, Calif., and will comprise a new division, Arcata Communications Services. The four: **Communications Consultants, Inc.**, San Francisco; **Westcom Corp.**, L.A.; **Tele-Dynamics, Inc.**, Seattle; and **Phone Consultants, Inc.**, N.Y.C. The two: **National Communications Planning Service, Inc.**, Chicago, and **Phone Consultants, Inc.**, Miami. Hq will be in San Francisco.... After acquiring Telemax Corp. (March, p. 167), **Wellington Computer Systems, Inc.**, has gone on to buy **Aries Data Centers, Inc.**, as a companion facility in the same location, Fairfield, N.J., to enhance it as a reservations processing mecca.... For overseas name collectors: **Elektronische Rechenanglagen gmbH,** more easily known as ERA, is a new acquisition of **General Automation, Inc.**, Santa Ana, Calif. The Aachen, West Germany, firm develops computer-based systems for automated manufacturing, also serves Scandinavia and the U.K.... **Auerbach Corp.**, however, has given up **Bakkenist Auerbach N.V.**, a dp consulting firm in Amsterdam, after two years of operations. But at home it has acquired **Automated Systems Corp.**, Washington, D.C., implementer of applications programs and provider of personnel for them.... In Philadelphia, **Management Data Corp.** completed its agreement to acquire **Gamut Systems, Inc.**, of N.Y.C.-New Jersey, proprietors of the MEDIC timeshared hospital and medical info system.... In Valley Forge, **National Information Systems Corp.** has acquired an 83% interest in **Mastech Computer Systems, Inc.**, a Chicago computer systems design and engineering company. NISC specializes in facilities management.... **Scott Paper Co.** has bought a third interest in **Industry Computing Systems, Inc.**, of L.A., plans to use it as an entree into the facilities management field.... **Heuristic Concepts, Inc.**, Westwood, N.J., consulting firm and peripheral products supplier, plans to become part of **Hallmark Communications, Inc.**, in Abilene, Tex., if it can get an extra million $ in financing. Hallmark already has acquired **Communications Real Time, Inc.**, a systems service firm in Elmhurst, Ill.

• Leasco and Tally Corp. have sued each other. The computer leasing company claims 19 Tally Dartex data terminals are inoperable and incompatible with a system for Louisiana hospitals and that because of this the state government is not making lease payments. Leasco also claims that Tally warranted the units for the Louisiana system and is asking $191,193 — the price of the lease — plus interest from November 9, 1969, and costs for removal, storage and resale of the machines, and damages. Tally claims that the equipment it delivered should have been completely compatible and that the system must be at fault. Its suit against Leasco asks $78,000 for back payments for equipment which it claims the lessor has owed since 1968. None of the equipment is in the Louisiana system.

• Another company beset by the severe price competition in the service bureau battle is Informatics, Inc., Sherman Oaks, Calif., which has sold a major portion of its El Segundo data center (acquired from the Rucker Co. a year ago) and will combine its operation with the San Fernando Valley center. Together with the firm's Oakland facility, the centers will comprise a separate subsidiary called Informatics/Management Computer Services and will concentrate on the facilities management approach in the Los Angeles area, continuing general data services in Oakland, where the firm feels there is a better market for such services. President of the new subsidiary is Ronald S. Freeman, formerly with IBM, who was the founder of Data Station Corp., Los Angeles, where he had served as president since 1967.

• IBM scientists William A. Goddard and John J. Lynott have been awarded a patent on their invention of a movable-head computer disc storage unit, and have been rewarded by IBM with an $80K outstanding invention award, which was in addition to a $20K prize previously shared by the co-inventors. It's the second-largest amount ever bestowed by IBM for an invention. The largest was $180K, showered last year on three IBMers for the development of an I/O channel multiplexor.

• A firm specializing in new product development and marketing has formed a division to promote trade for Japanese edp companies in the American OEM and end user markets. The 15-man two-year old firm, Computer Dimensions, Inc., will assist in penetrating the U.S. market for peripherals, software, and services through the new division, Computer Dimensions,



Xerox Data Systems donated a 910 computer system to Oregon State Prison where volunteers from industry and university conduct daily classes for inmates in computer programming and maintenance. One parolee already has a programming job with the state and another, soon to be paroled, will work in industry. Course was conceived by two former XDS executives (non-inmates) who asked their Alma Mater for the donation, which includes four mag tape drives, paper tape and card readers, two typewriters and 4K of extra memory.

East. In addition to surveying and identifying various U.S. markets, CD,E will provide assistance to Japanese firms desiring to secure marketing, servicing, support, and licensing agreements.

• One of the latest sources of the word on time-sharing and language processors will be at a course on *Advanced Topics in Systems Programming,* to be chaired by Bernard Galler as part of the engineering summer conferences sponsored by the University of Michigan at Ann Arbor, June 15-26. Galler is associate director of the university's computing center and the current president of ACM. Other topics scheduled for the same dates include *Computer Graphics for Designers, Foundations of Information Systems Engineering, Computer and Program Organization,* and *Numerical Analysis.*

• A new computer company in Fort Lauderdale, Fla., has been formed by a group of former SEL employees headed by Ken Harple, an 18-year veteran of the computer planning and production wars. The name of the firm is Modular Computer Systems, Inc., and the product, as the name implies, will be a family of general purpose computers employing LSI and modularized to the point that even the registers will come in separate modules. Another feature is a 200 nsec cycle time read only memory. The company expects prototypes to be ready in July, and first deliveries are scheduled for the fourth quarter of this year. For information:

CIRCLE 401 ON READER CARD

• An effort to collect every authoritative publication on information systems has been undertaken by the library at Florida Atlantic University, Boca Raton, which seeks to become the nation's main such repository. The collection is being made in honor of Boyd Zacharias, who was general director of data systems for the Chevrolet division of General Motors and an executive advisor to the university until his death last July. As a member of the American Management Association, he was an officer of its continuing seminar on management information systems. Contributions to the collection will be adorned with a special bookplate, and may be sent to Dr. John W. Sullivan, committee chairman, or Dr. Hiram W. Axford, university librarian.

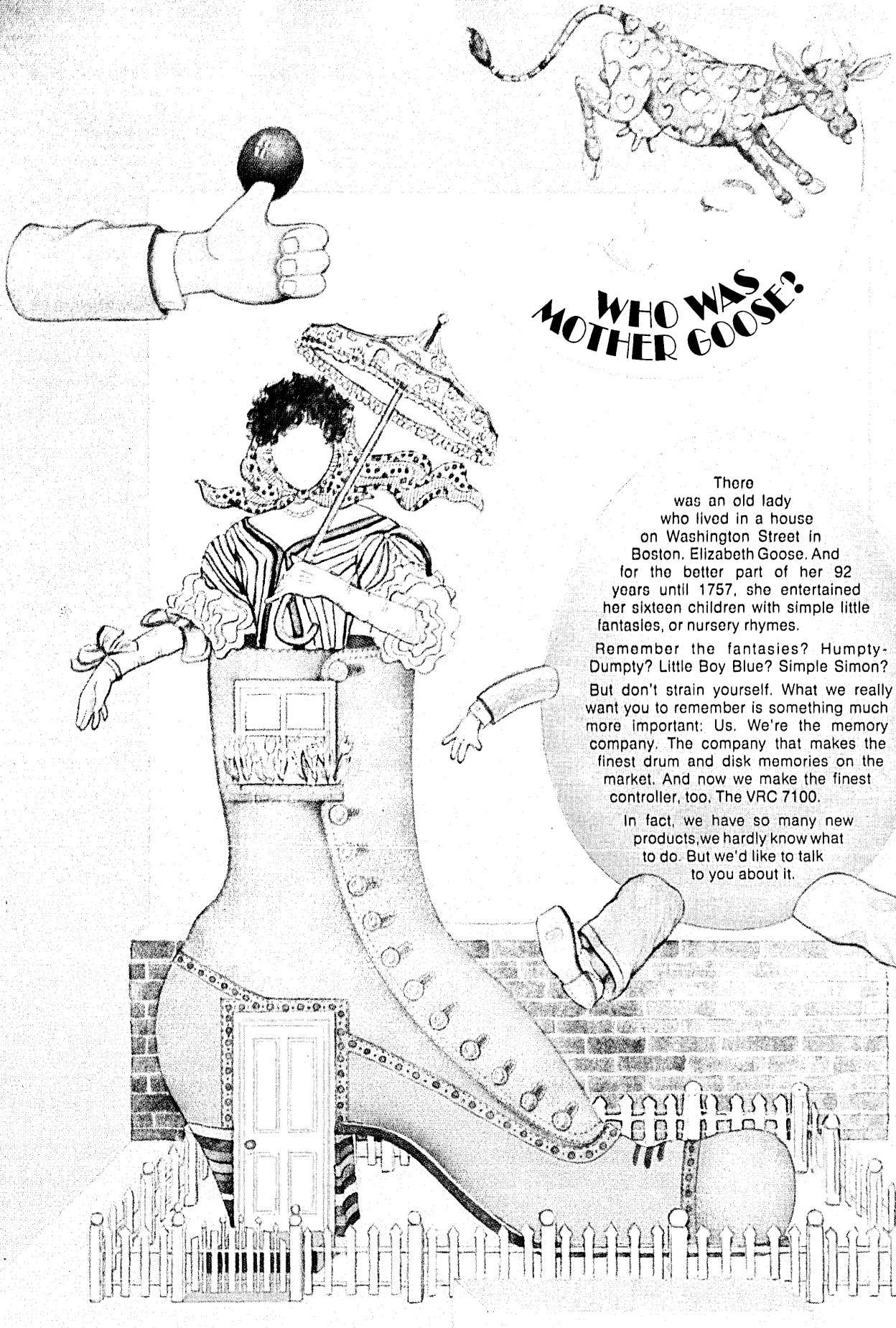
• Another entry in microwave data transmission has been made by United Video, Inc., a Tulsa, Okla., company that applied to the FCC March 31 to establish a network serving the plains states. Subscribers could transmit data, facsimile, control, programming, remote metering and voice communications. Rates would be based on simplex channels, calculated by distance and bandwidths. Cities from Chicago to Dallas would be tied in by 94 relay stations and include Minneapolis-St. Paul, Madison, Milwaukee, Dubuque, Burlington, Des Moines, Omaha, Wichita, St. Louis, Kansas City, Joplin, Tulsa, Oklahoma City, Ardmore, and Little Rock.

• Time-Sharing Terminals, Inc., Washington, D.C., became the first computer terminal service firm to take advantage of the Carterfone decision and offer computer terminals and maintenance service to present Bell System Teletype customers which would give them ownership of their terminals in three years. John C. Young, president of TST, said monthly cost to the customer would remain the same except that it would apply toward equity in the machines. At 100,000 installations, Teletype customers pay an estimated rental of more than $7,500,000 per month to telephone companies.

• Caltech's Jet Propulsion Laboratory will put its capabilities to work for the general public under a new Civil Systems Projects office headed by Howard H. Haglund, former manager of the Surveyor project. The office will "seek to develop applications ... for solution of problems in medical engineering, public safety support, urban land use and transportation." Initial activities are in space technology, transportation technology, and biomedical application of computer technology with emphasis on improving photographic techniques, including medical x-ray.

shortlines ...

The Diner's Club, which admits it has had its billing troubles, has rewritten its programs, gone from two vendors to one, and will use two Honeywell 4200's to implement its new DA2SH system, which includes audio response capability for on-line credit inquiries over voice grade telephone lines ... An antitrust suit against MIT has been filed by Fabri-Tek, Inc., in Minneapolis, charging that the Massachusetts institution has been discriminatory in its licensing of the Forrester patent for magnetic core memories, and has acted in restraint of trade toward Fabri-Tek's customers. The company asks for an injunction and triple damages ... NASA has contracted with PRC Data Services and PRC Computer Center, both subsidiaries of Planning Research Corp., to furnish management systems, programming and dp at Washington hq, and with Computing and Software, Inc., to provide $4.9 million-worth of dp services for its Goddard Space Flight Center at Greenbelt, Md.... Xerox Corp. has opened a research lab at Stanford University Research Park in Palo Alto to advance dp technology and develop new information systems, and has appointed Dr. George F. Pake, a former member of the President's Science Advisory Committee, to run it ... National marketing of a Sigma-7 expanded t-s system has been undertaken by Davis Computer Systems, Inc., N.Y.C., which is contracting with regional computer service firms for chunks of the Sigma's time and capabilities ... Control Data Corp. has made a new software concession to its users: they will have 90 days to accept or reject it before the start of use charges, and the customer can return the software during that period, unless he has used it "for his own productive purposes." ... Nippon Univac Kaisha, Ltd., one of Sperry Rand's two Japanese arms, has opened a $10 million hq in Tokyo that will feature the largest computer center in Japan on the ground floor, as well as data, information and education departments ... Four ancient Italian universities will have a time-sharing network of their own since the installation of a Control Data 6600 at Bologna U. User terminals have been plugged in by telephone line for Florence, Venice and Padua. They all are scheduled to become consolidated in a modern school system, with Parma and Ferrara soon to follow ... Computer Machinery Corp., L.A., has installed its first KeyProcessing system (computer-controlled keyboard data entry) in the U. K., for Computer Data Services' London bureau, and has begun manufacture of the system in Britain at its subsidiary, CMC Ltd.... Three software packages in one are being offered at a special price by ever-competitive Computer Sciences Corp., which has picked those most popular with IBM 360 users: PMI (Personnel Management Information); Payroll, and EPG-II (Edit Program Generator). The whole bundle is 20% less than the individual programs ... The first production model of Honeywell's newest medium-sized computer, the Model 3200, was installed last month at the hq of North Electric Co., Galion, Ohio. ■



WHO WAS MOTHER GOOSE?

There was an old lady who lived in a house on Washington Street in Boston. Elizabeth Goose. And for the better part of her 92 years until 1757, she entertained her sixteen children with simple little fantasies, or nursery rhymes.

Remember the fantasies? Humpty-Dumpty? Little Boy Blue? Simple Simon?

But don't strain yourself. What we really want you to remember is something much more important: Us. We're the memory company. The company that makes the finest drum and disk memories on the market. And now we make the finest controller, too. The VRC 7100.

In fact, we have so many new products, we hardly know what to do. But we'd like to talk to you about it.

Kim Whitesides

EXPAND YOUR MEMORY

Vermont Research
CORPORATION
Precision Park, North Springfield, Vermont 05150
Tel. (802) 886-2256. TWX 710-363-6533

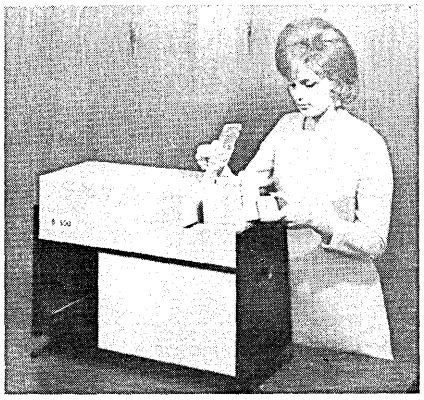
DRUM AND DISK MEMORIES – CONTROLLERS

CIRCLE 124 ON READER CARD

new products

versatile card reader

There is probably no intentional symbolism in the naming of this card reader, but a title like Easyreader is bound to attract attention for awhile. Easyreader is sort of a lazy sounding name, but the card reader will not very likely live up to it (down to it?). The device operates at speeds to 500 cpm and can read both hole punches and pencil marks at the same time—even if they



appear on different sides of an 80-column card.

Some card readers are lightweight and simple. One that we know of has two moving parts. This is not true of the 58 pound Easyreader. This unit's card feeding mechanism is built more like an IBM 1402's, with cogged belts and several sets of rollers. It looks like it will work accurately and stand up well.

The device is versatile. It can be used at speeds down to 10 cps or at its 500 cpm rate, depending on the customer's order. It can provide outputs in Hollerith, BCD, EBCDIC, or ASCII—also according to customer specification. Similarly, it can be built for operation with 202C (105 cps) or 103A (10 cps) Dataphones, with Teletypes (automatically generating carriage return and line feed codes), or on-line to any major brand computer.

The manufacturer expects to sell quite a few of the units configured to read mark sense cards only. We see it as part of a punched card based remote batch terminal. In either guise the Easyreader will lease for $95/month for three years or $125/month for one year and sell for $3500. (A unit to read holes and marks on both sides of the card would go for $4200 to $4500.)

Unlike the movie "Easy Rider" where the main character is attacked by the populace, the versatile and relatively inexpensive Easyreader is sure to be well received. REPUBLIC DATA PRODUCTS, Chatsworth, Calif. For information:

CIRCLE 352 ON READER CARD

large-scale computer

Burroughs has filled in a blank in its 500 Systems family with the announcement of the B4504, which in price and performance fits between the B3500 and the B5500/B6500 computers. The 4504 is intended as a step-up for 3500 users and will compete directly with IBM 360/50's, Honeywell 4200's and RCA Spectra 70/55's. The 4504 is a decimal system, completely compatible with the 3500, including that machine's Master Control Programs, compilers, utility routines, and application programs (all of which will run on the 4504 without recompilation).

The 4504 is oriented principally to general business and industrial data processing and will use COBOL as its primary business language. It also is designed for environments where on-line, real-time, multiprogramming, and data communications operations are used. FORTRAN and BASIC compilers and an advanced symbolic assembler are included.

B4504 hardware utilizes both high speed CTL integrated circuits and MSI devices. Its design is modular, making possible a wide range of configurations, ranging in price from about $1-2.5 million, with rental at $16-55K/month. A "typical" minimum configuration—perhaps the smallest economically justifiable—would run over $1 million and rent at about $21K/month. This would include a cpu with 150K core, console with printer, 1400 cpm card reader, two 1100 lpm printers, a 150 cpm card punch, two free-standing mag tape drives of 96 KC, plus two million bytes of 17 msec disc storage and 100 million bytes of 60 msec disc storage, both using head-per-track hardware.

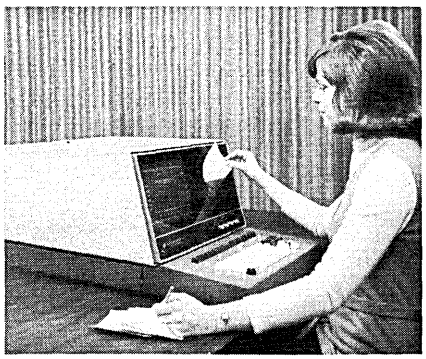
The 4504's main memory, twice as fast as the B3500, operates at 500 nsec per cycle, with a memory word of two 8-bit bytes or four 4-bit digits accessed in one memory cycle. This gives an effective speed of 50 nsec for each byte accessed. Main memory is addressable to the 4-bit digit level. Address memory operates at 50 nsec, again twice as fast as the 3500, using a scratchpad memory which combines with the specially designed logic of the I/O peripheral controllers to allow each channel to function independently. Main memory is modular, with a minimum of 100K bytes. It is expandable to 500K bytes in 50K increments. Disc files make available up to 18 billion bytes.

Included in the standard 4504 system are eight I/O channels, expandable to a total of 20. Each I/O channel provides its own control for accessing main memory, and all 20 may operate concurrently with computing in the cpu. Finally, the 4504 offers single-line and multi-line data communications controls for servicing up to 36 separate lines. First deliveries are scheduled for the fourth quarter of next year. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 355 ON READER CARD

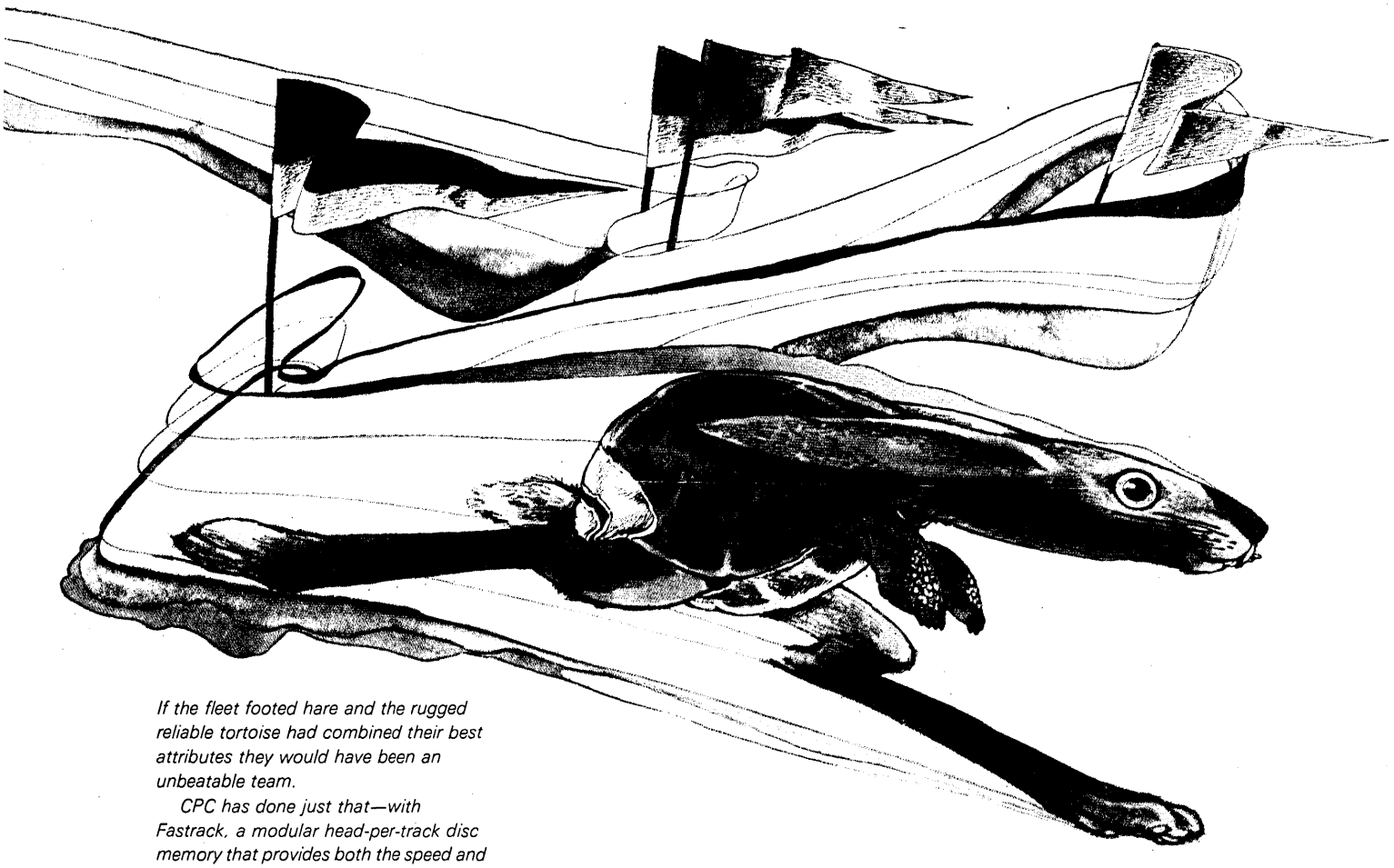
crt with hard copy

Five seconds after the "print" button is pressed, an electro-optical printout process produces a 5"x5" photoprint of the data displayed on the Photophysics '45' desk-top crt terminal. Additional copies are made at two-second intervals. The copy uses an inert white paper of bond-like quality that is not light sensitive, will not fade, and can accept pen or pencil notes. The paper is supplied on rolls capable of 1200 printouts without reloading and will



be priced at less than a penny a copy.

The 9" crt can display up to 1000 characters in 25 lines of 40 characters and can also display bar charts and graphs. Hard copy characters of approximately 10-point size result when a 1000-character display is transcribed. A 78-key solid state keyboard provides 64 displayable 5x7 dot matrix characters and 32 control characters. Seven-bit ANSI code is used in data transfers with rates of 110, 150, 300,



If the fleet footed hare and the rugged reliable tortoise had combined their best attributes they would have been an unbeatable team.

CPC has done just that—with Fastrack, a modular head-per-track disc memory that provides both the speed and the data reliability so necessary in this exploding world of program swapping, time sharing, message switching and real time computing.

It's the head arrangement that does it!

IT'S THE HEAD ARRANGEMENT THAT GIVES FASTRACK™ BOTH SPEED AND RELIABILITY

Fastrack Speed vs. the Disc Pack

Too often, Disk Pack Manufacturers define "access time" as the time it takes the moving head to reach the desired track. They conveniently fail to mention the additional time required for the rotating disc to reach the data point.

In reality, the fastest disc pack takes an average of 30 ms to move the arm plus an additional 12 ms to reach the data. That's an average total time of 42 ms. And typically, disc packs take 70 ms or longer.

This slow access time is just not acceptable in most real time computing applications.

On the other hand, CPC's head-per-track modules gain access to data in 16.7 milliseconds average because hundreds of "fail safe" flying heads hover micro-inches above each track. There is no time lost in head motion. No errors caused by positioning. Data transfer is fast, too — 3 MHz bit serial or 6 MHz two-bit parallel. And a single Fastrack disc module can store up to 48 million bits of data.

Fastrack Data Reliability vs. Disc Pack

Fastrack has a maximum of one recoverable error in every 10 billion bits of data transferred. Compare this with the one in a million error rate of the typical disc pack. This means that Fastrack's data reliability is ten thousand times better! Disc packs may be OK where errors are easily recognized and can be tolerated — but not when the disc memory is the heart of a real-time system where the drop of a bit could be a disaster.

Fastrack also eliminates the possibility of head avalanche. Each disc is sealed. The precision flying-heads never touch the recording surface and automatically retract if motor speed, internal voltages or air pressure varies. The continuous air filtering system makes it impossible for self-generated contamination to accumulate.

There's a lot more to the Fastrack story — the fast modular disc memory which provides from 24 to 96 million very reliable bits in a compact cabinet. Call us today or write for our brochure.

cpc computer peripherals corp.
5037 Ruffner Street
San Diego, Calif. 92111
Telephone (714) 279-7500

600, and 1200 baud (2400 baud optional). The EIA RS 232C interface for serial transmission is standard; parallel data communication can be optionally provided. Transmission is half or full duplex or echoplex.

Standard controls and editing features include cursor position (non-destructive, blinking), carriage return, line feed, clear page, clear line, repeat character, insert or delete character, and double space. Line insert and delete, line recall, blink character, format control, graphic characters, tab position and frame roll are optional. Refresh memory is a 6000-bit (8000 bits optional) MOS shift register, and refresh rate is 60HZ. The digital raster scan technique makes the terminal completely tv compatible, including standard video signals to RS 170 specifications.

The terminal with integral hard copy capability will sell to the end user for $9950 in small quantities. Lease arrangements will be made available for the expected November deliveries. The hard copy module is available separately to OEM's. PHOTOPHYSICS, Mountain View, Calif. For information:

CIRCLE 353 ON READER CARD

disc optimizer

In a rotating memory device like a disc or drum, a good part of the time it takes to get information out is taken up by the memory's latency time, the time it takes the part of the disc or drum that holds the information you want to come under the read head. If the stuff you want just passed the head, the program must wait for a complete revolution. At least that is what happened before the introduction of the B6375 Disk File Optimizer.

The DFO is a hard-wired electronics box that stands between a Burroughs computer and its disc file electronics units. It contains a memory of eight 49-bit words which is expandable to 32 words. The DFO's purpose in life is to accept the disc read/write commands and put them in order so that the maximum number of I/O requests can be processed in a single disc revolution. The unit operates on one request every 4 usec, and is efficient enough that it can increase disc I/O speeds by 10 times. In some applications, it can stuff in 32 accesses in one revolution.

Normally the DFO attaches to up to 20 disc file electronic units, but for fail safe operation a switch is provided to connect it to another DFO.

Burroughs has become a force in the time-sharing computer market largely

PRODUCT OF THE MONTH

conversational terminal

There are thought to be over 100,000 installations using Teletypes, so any product offered as a tty replacement has a large potential market. The Teletypes in operation are of several types, however, ranging from 60 word/minute Model 15's to 1200 wpm Inktronics. The most vulnerable part of the range is probably the group most used as computer terminals, the Models 33, 35, and 37; and this class of tty now has another competitor.

It is a tough competitor, too, offering print speeds to 60 cps (roughly four times the speed of the 37), a 120-character line (compared to 72 characters for most Teletypes and 80 for the Inktronic), and an interchangeable print cartridge. The machine is called the 1240 Communication Terminal. It is capable of operating at switch-selectable speeds from 10 to 60 cps, uses 94 printable graphics, and accepts paper sizes up to 14⅞ inch standard computer forms. The 1240 has a local or computer-controlled horizontal tab set/clear feature, parity checking circuitry, and comes with an optional integrated modem (which can be full or half-duplex, and either a Bell 103A or 202C equivalent).

The 1240's printing mechanism is said to have one fourth the moving parts of similar printing mechanisms, and users with text editing needs will appreciate the changeable print cartridge since it will allow for changing fonts. The terminal speaks ASCII and interfaces to a line through EIA RS232B standard means. Its designers claim that special attention was paid to print visibility and keyboard layout, and this claim appears to be true.

The 1240 is not a cheap product, but its $4200 starting unit price puts it only some $200 over the cost of the top Model 37 Teletype. However, though the 1240 does have much faster printing and transmission speeds and several times the flexibility of the tty it replaces, it does not have the paper tape gear that time-sharing users have come to rely on. This is probably not an oversight. We would expect the vendor to announce some storage medium for the machine by the fourth quarter of this year when deliveries start.

The base rental price of $115 per month will very likely not deter even the most austerity minded dp manager from taking advantage of the 1240's capabilities. MEMOREX CORP., Santa Clara, Calif. For information:

CIRCLE 351 ON READER CARD

The Thinkwriter

The ADS-715 looks like an ordinary typewriter. But solid state microcircuits hidden within its case make it a computer terminal as well. Plugged into a regular telephone line, the ADS-715 will transmit and receive alpha-numeric data in ASCII, BCD and Correspondence IBM codes. Optional telephone couplers and read/write magnetic tape units are also available.

Considering the versatility of the ADS-715 Data Communications Terminal, we couldn't resist calling it the "thinkwriter." Of course, you can use it any time as a regular office typewriter. Send for complete details.

Ads

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• DATA MODEMS • DATA MULTIPLEXERS
• DATA TERMINALS • DATA SYSTEMS

because of its disc power (discs become a critical feature in swapping). Therefore it is fitting this device should come from its shops. The DFO, or B6375, will be leased for around $3000/month or sold for $135,000. Those payments would bring a unit (with 16 words of scratch-pad) capable of handling lines to three or four million bytes of disc storage (which could be in any combination of discs of any size). Deliveries are to begin in the fourth quarter. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 357 ON READER CARD

key-to-tape

The Libra 1 is a single station key-to-tape data recording system. Physically it takes up the same amount of room as the IBM 029 keypunch. Its keyboard is also similar to the 029, with additional switches for mode selection. However, the physical similarity ends with the operator display, a neat, somewhat futuristic module that rises from the ta-

bletop and displays, in English, the alarms and admonitions that guide the operator. The unit has enter, verify and search operation modes for both data and programs.

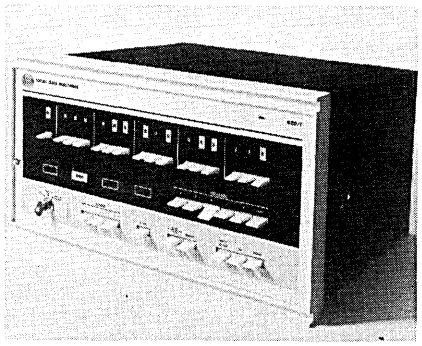
Recording by the unit is either in EBCDIC for 800 bpi, 9-channel or ANSI for 200, 556 and 800 bpi, 7-channel tape. The 7-inch recording reel is contained in a drawer at the operators left hand. Libra 1's input format is variable record lengths up to 160 characters under program control. In addition to such error checks as parity, cyclic and longitudinal redundancy, read/after write, multiple key depression, and blank tape check in search mode, the system permits programmable verification of specific data.

A feature of the Libra 1 is automatic pooling; any single unit can do this for a number of other units. The basic price of the system is $7,500. Several options—zero balance, self check codes, and listing accumulators—are offered. Delivery will start in the third quarter. INTERNATIONAL DATA SCIENCES, INC., Providence, R.I. For information:

CIRCLE 354 ON READER CARD

faster minicomputer

Staying at least one small step ahead of the competition in the crowded minicomputer market is a prudent policy for any vendor these days. With the 620/f, ready for delivery in September, this firm believes it has taken a



giant leap forward in speed and scope.

Like its successful 620/i predecessor (1200 installations) the 620/f is a 16-bit parallel-operation general purpose machine with from 4K to 32K of core. Where the big leap forward comes is in speed—a 750 nsec cycle time, doubling the speed of the "i." Ten new instructions (four of them optional) have been added for a total of 114 and an optional read-only memory is available, installed in the mainframe chassis in increments of 1024 words. The ROM core magnets wired according to a user's program, reduces access time to 300 nsec and processing to 500 nsec.

The basic I/O bus is a party line interconnecting up to 32 peripheral controllers. Parallel lines in the bus simultaneously carry data peripheral commands and interrupts. Priority interrupts are added in increments of eight. Faster data transfer speeds are possible with a direct memory access mode, which is standard, and a priority memory access which is optional. Using the cycle-stealing DMA, blocks of data are transferred in and out of memory at rates of 275K words/sec. The PMA option, utilizing a separate port to memory, transfers data up to 1.3 megawords per second on four separate fixed priority channels. The arithmetic/logic section consists of two elements: the R register which receives operands from memory and holds them during instruction execution and the arithmetic unit which contains gating for arithmetic, logic and shifting operations. There are nine registers: four operational and five auxiliaries.

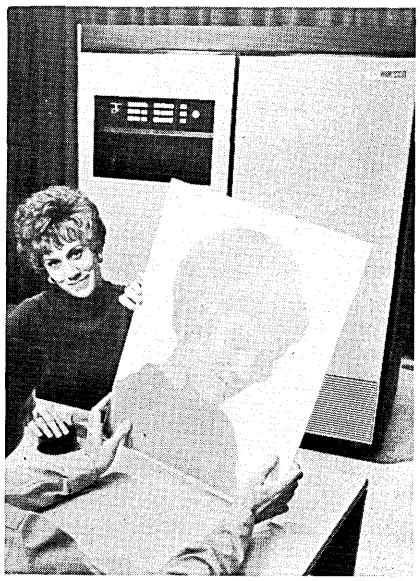
The mini uses the same peripherals as the "i" model, and it will operate with any of the i programs. New programs that include the additional 10 instructions will be limited to the "f." A price was not officially announced, but it's learned a good guess would be 10 to 15% higher than the $9,950 now being asked for the 620/i. Deliveries will start in September with a 30-to-120-day wait, depending on peripheral requirements. VARIAN DATA MACHINES, Irvine, Calif. For information:

CIRCLE 358 ON READER CARD

ibm film reader/recorder

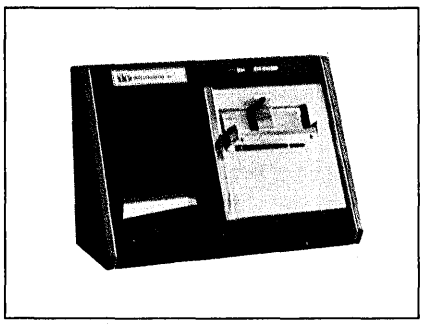
Ha! IBM has recognized finally, a whole new field. Behold the IBM 4481 film reader/recorder, a device which opens the world of microfilm to System 360 users. The I/O unit reads information from film directly into a model 30, 40, 44, or 50 computer, and can also go the other way. For instance, it can be used to speed the transfer of illustrations, photos and other graphics from 35mm film into the machine. Once in, the digitized images can be analyzed, modified, stored, or used to update other images. Then the resultant data can be flushed out again onto film.

The 4481 has a crt which directs a beam of light through a lens at a transparency or at unexposed film. The beam can be aimed at any of 16.7 million points (a 4Kx4K matrix).



When reading, the 4481 senses the amount of light transmitted through the film. Intensity is ranked against a scale of 64 values, and the computer records both the intensity and position of each point scanned. Conversely, a print can be made, but the process isn't cheap. The 4481 sells for

If the mountain won't go to Mohammed Let Mohammed go to the mountain



Which is exactly what a Cardliner does. It moves your mountain of data from a remote source to the computer. It takes 80-column, Hollerith punched cards, translates them into ASCII, correspondence, or BCD code, and sends the data through whatever terminal you use.

Cardliners move molehills of data as well as mountains, and they cost proportionately less for the doing. For example, you can rent a Cardliner 10 (10 characters/second) for 2¢/month/card for the first 5000 cards transmitted, 1¢/month/card for the next 2500 cards, and ¼¢/month/card for the next 42,500 cards. Or if you're really a big sender, you can have unlimited use for a flat $180.00 per month.

Data mountains can walk, run or dash via Cardliners. Model 10 at 10 characters per second, Model 15 at 14.8 characters per second, and Model 30 at 30 characters per second. Regardless of speed, data integrity is maintained. Each Cardliner uses a positive timing pattern related to the trailing edge of the card. Since cards are punched with reference to the trailing edge, reading head timing in the Cardliner is not distorted by punch tolerance variations.

Like to learn more about using Cardliners to move your remote data? Let us come to your mountain. Circle the bingo number, phone or write our principal prophet, Chandler J Williams.

dc *data computing inc.*

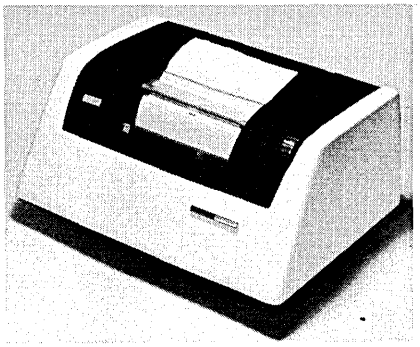
2219 West Shangri La Road
Phoenix, Arizona 85029
602/944-4491 • TWX 910-957-1618

$250,000. Deliveries begin in the third quarter of this year, too. So far so good. Now how about COM? IBM, Gaithersburg, Md. For information:

CIRCLE 356 ON READER CARD

$995 electrostatic printer

The Model 120 electrostatic printer prints 64 upper case characters at asynchronous speeds up to 120 cps, at 10 characters per inch, 80 characters per line, and six lines per vertical inch.



It is intended for use with crt's and minicomputers, and uses bit-parallel data handling for simplified interfacing. The unit has only six moving parts and uses solid state electronics. Dimensions are only 12x16x10 inches, weight 16 lbs. Single unit cost is $995. REPCO INC., Orlando, Fla. For information:

CIRCLE 360 ON READER CARD

multistation key-to-tape

The Keyplex System, designed to replace medium and large keypunch installations, is capable of feeding information simultaneously from up to 64 keystations to 7- (556 bpi, BCD) or 9-track (800 bpi, EBCDIC) magnetic tape compatible with most computers. The subsystems include Honeywell keyboards, 16K processor, disc packs, disc drive, vacuum tape drives, and software.

Record size is variable to 400 characters. Data may be verified immediately after being entered and may be transferred. The basic display is one alphanumeric character and a three-digit-column number/field. An operator can use 400 different program formats per application, regardless of the number of program levels required. Data entered at the station travels through a keystation multiplexor to the processor, which identifies the data with its point of origin and checks its format. When the buffer of each keystation is filled, it is recorded on disc. Data retrieved from disc is transferred to mag tape for processing.

First deliveries of the Keyplex System are scheduled for January of next year. A 25-station system is expected to lease for from $2800 to $3800/month, and purchase price will be approximately $150K. HONEYWELL DATA PRODUCTS DIV., San Diego, Calif. For information:

CIRCLE 359 ON READER CARD

imitation pdp-8/i, l

Such phrases as "plug-to-plug compatible," "System/360 compatible," and "software compatible" fill announcements of new peripherals; but a tiny new company may have come up with the first plug-to-plug compatible *computer*—a replacement for the ubiquitous Digital Equip. Corp. PDP-8/I and L. The DCC-112 is claimed to be 25% faster, more reliable, easier to maintain, and, of course, cheaper than DEC hardware. Who will maintain it? Well, that problem is partially solved by limiting sales to OEM's. And it's unbundled; the only software presently available from its manufacturer is diagnostics. The theory is that there's all sorts of software already developed and being developed for the 112 by DEC and its customers.

The DCC-112 has a 1.5 usec cycle, as opposed to 1.5 for the 8/I and 1.6 for the L. I/O pulses, however, are identical, to ensure compatibility. The new machine uses a buffered I/O control section, is fully-parallel, 12 bit, with 4K word core expandable in 4K modules to 32K, plus 8 auto-index registers, program interrupt, high speed channel, and indirect addressing.

The logic for the computer uses MSI and IC's and is completely contained on two pc boards. The memory subsystem also uses MSI and IC's, with each module of memory completely contained on one pc board. Manufacturing costs are said to be reduced because large volumes of a few types of pc boards can be obtained, the number of connector points is reduced, and back panel wiring is simplified. These features are also intended to increase reliability.

Maintenance is simplicity itself, assuming the failure is not so severe that the diagnostics will not run. Using the diagnostics, the customer determines which pc board is malfunctioning; an unskilled serviceman arrives with spare pc boards in his briefcase; and the defective board is swapped. An independent national service organization is being retained.

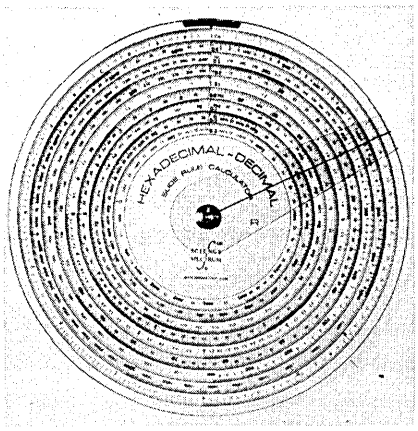
The year-old firm, which now has about a dozen personnel, began test marketing in December and claims a backlog of more than 200 orders for systems averaging $14K each. Basic price of the 112, which can use all PDP-8/I and L compatible peripherals, is $5900, discounted 5% for three or more, and 25% for 50 systems. Savings are said to be greater on more complicated configurations. Delivery presently requires 6-9 months, but the firm intends to reduce this to 30 days. DIGITAL COMPUTER CONTROLS, INC., Fairfield, N.J. For information:

CIRCLE 361 ON READER CARD

sturdier hex calculator

The second version of a hexadecimal/decimal calculator, first introduced last spring, is in answer to complaints it was too thin and didn't last long enough. It now is a sturdier 50-mil thick 8-inch diameter vinyl disc useful for debugging programs run on hexadecimal-oriented computers. Other improvements include an increase of 50% in the number of indicial marks and extended conversion scales.

Now, all hexadecimal numbers between $10_{16}{}^{-FF}$ and $10_{16}{}^{FF}$ or decimal numbers between $10_{10}{}^{-306}$ and $10_{10}{}^{307}$ can be converted to the other base. Also, normal arithmetic op-



erations can be performed as well as straightforward number base conversions. Other characteristics have been retained, including colored tracks which make reading easier, but the price has been increased to $14.95 from $8.50 for the flimsy model. SCIENCE SPECTRUM, INC., Santa Barbara, Calif. For information:

CIRCLE 364 ON READER CARD

output microfilmer

Funny how when one manufacturer breaks through a price/performance "barrier"—one that may have stood unchallenged for years—soon everyone can do it. Such is the case with computer output microfilmers, of which there are now several offered for less than $50,000. This one is the AV-2000, an on-line 16mm device intended for IBM 360 series machines. It can print upper and lower case alpha with lim-

ited graphics at rates to 91K lpm, its maker claims. If the claim is true, the unit is three to four times as fast as other on-line COM units we know of. It can accept input at 500KC and throughput 1200 pages/min.

The 2000 is being built to be hardware and software compatible with IBM 1403 and 1443 line printers, but has overline, underline, special character annotation, and multiple forms overlay as standard functions. It also is advertised with all standard retrieval coding and multiple lens reductions. We haven't seen a photograph yet, but deliveries are scheduled for September of this year. ALPHA-VECTOR INC., New York, N.Y. For information:

CIRCLE 362 ON READER CARD

microfilm retrieval

What does a customer want from a microfilm retrieval system? Bulk storage, fast access and low cost? Then the AV-100 should be just right. The unit has a 12x15 inch rear projection screen, a keyboard, and a capability of working with microfiche or self-loading 16mm film cassettes. Its manufacturer claims it can handle film rolls with up to 300,000 frames and access images in less than five seconds. The device performs a linear search based on frame codes entered through the keyboard and can magnify the images found by 24X or 42X. Operator controls provide for single cycle, horizontal and vertical film movement, and for image rotation. Its price is "under $4000" and deliveries are expected to start in September. ALPHA-VECTOR INC., New York, N.Y. For information:

CIRCLE 363 ON READER CARD

time-sharing cpu

System Ten is a different kind of animal, a computer that can process up to 20 jobs at one time and still not dedicate much of its resources to overhead, and which can compete with an IBM System 3 or an IBM 360/20. The machine is able to cover a broad range of applications by adding or deleting partitions from its core. In a maximum configuration it can handle 20 channels of input, with up to 10 peripherals per channel, operating on all of them independently. The secret of its success lies in the fact that the hardware, not the software, is responsible for allocating cpu time to each partition and for protecting the partitioned programs from each other. The software, in fact, requires only 300 positions of the Ten's 10K core.

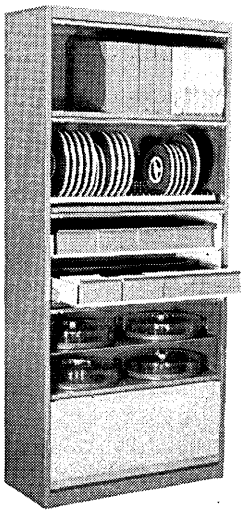
System Ten in its simplest batch configuration—consisting of the 10K of core, a 300 card/minute reader, a 100 card/minute punch (both 80-column), and a 450-lpm line printer—will sell for about $44K and lease for a little under $1400 a month. Core cycle time is 3.3 usec; a typical 4x4 or 5x5 add takes 100 usec. In this type of stand-alone system, the competition would include the Honeywell 115, GE 58, and IBM's System/3. But this is only for one application; with System Ten there's more.

For another $35/month each, 19 more partitions may be added to System Ten. The addition of core in 10K increments up to 110K characters can be leased for $125/month/increment as the increase in the number of IOC's and the complexity of the additional programs require.

System Ten also can compete with, for example, the IBM 360/20 when used as a remote terminal to a larger system or for dedicated applications. It is BTAM-compatible and less expensive than the /20; it can perform the communication function and has the added advantage of expandability.

A Model 70 workstation can be used with any one of the channels. It's a typing unit that may be used as a

Computer Companion #781



Booth 225
DPMA Convention
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New versatility from Tab. The Large Document Spacefinder.
Each cabinet provides enough clear space to store virtually all your computer related media. And the panel doors lift and retract to allow easy access to materials. There are two, three, and five compartment models in your choice of the latest computer colors.
Tab has a companion for everything you need in your computer room.
Write us.

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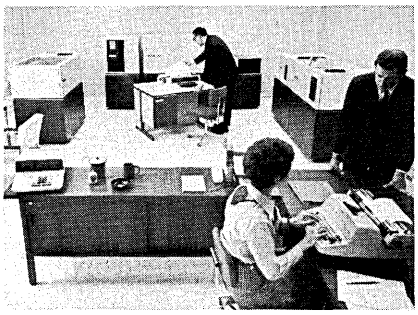
PRODUCTS CO.
2690 Hanover Street
Palo Alto, California 94304

CIRCLE 50 ON READER CARD

regular typewriter when not communicating with the computer. Features include printing speeds of from 15 to 24.4 cps, a 64 alphanumeric character keyboard, operating condition indicator lights, work surface area, and forms storage. The workstation (and also the drum printer, card reader/punch, and paper tape reader/punch) can be placed almost anywhere within 2000 feet of the cpu, connected by a small two-wire, above-the-floor line.

The assembler and coding of the System Ten is said to be so simple that thus far there hasn't been any demand for COBOL (or other) compilers, although these will be offered if the market changes. There are 13 basic instructions, including hardware multiply and divide, in the command repetoire. The internal code is a six-bit ANSI subset. (The processor understands ANSI, EBCDIC, and other standard codes.) The assembler and all



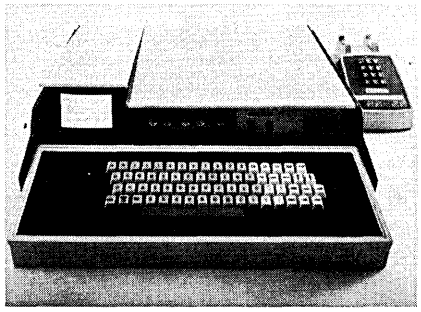
basic utility programs come with the system, but there will be a charge for extensions of these packages.

The machine prices out best when attaching workstations and discs. A typical multi-terminal configuration—comprising a 10K processor, 10 million character disc drive, and five workstations—is priced at $45,250 and will lease for $1355/month. In a multi-partition system, the priority set-up is 1-to-20-to-1. The arithmetic control unit is shared; I/O is multiplexed. Switch-out is accomplished either by I/O or program instruction, or automatically after 37½ msec. The processor then stores all pointers and registers by hardware and resumes processing. The partitions must be serviced to be changed. Software and support, including education, service and field systems engineering will be available with the first System Ten deliveries in September. SINGER FRIDEN DIV., San Leandro, Calif. For information:

CIRCLE 365 ON READER CARD

portable crt terminal

The 30-pound ENVOY, designed for use with Teletype data communication systems, is a ruggedized crt terminal that transmits and receives data over ordinary telephone lines at either 10 or 30 cps (switch selectable). The crt is a 5″ diagonal commercial TV monitor which displays black characters on a white page centered on the screen. The ENVOY-600 has a 512 character display capability (16 lines of 32 characters). ENVOY-640 displays twice as much information on 16 lines and also



has character insert/delete and formatting features.

ENVOY is easy to use. Just plug it into an ordinary outlet, fold out the keyboard, pop up the screen, put the telephone handset into the built-in acoustic coupler, and dial your computer. The coupler transmits and receives data at either 110 or 300 baud (switch selectable) and can operate on 40db attenuated lines in half duplex. The user can transmit data in any of three modes—conversational, page, and message. ENVOY-600 sells for $3200; ENVOY-640, for $3700. Delivery is 90 days. APPLIED DIGITAL DATA SYSTEMS, INC., Hauppauge, N.Y. For information:

CIRCLE 368 ON READER CARD

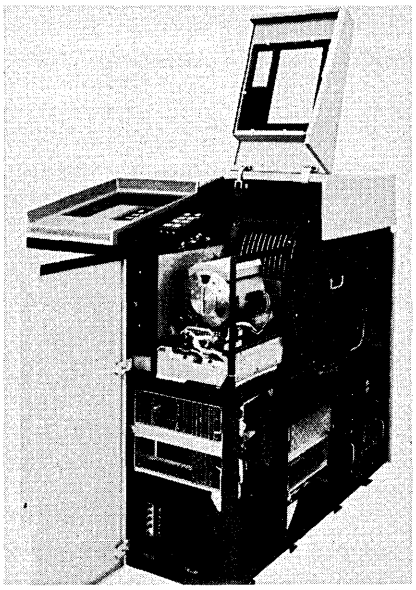
large scale disc

The Large Disc Stores are difficult to talk about. For beginners, the systems provide up to two billion bits of storage each, data which can be accessed at an average of 60 usec and transferred at up to 262KC. And they are small, taking up roughly 3x4½x4½ feet of space. That's the easy part.

The difficult part comes in describing how they work. Each unit is composed of two modules, and each module has eleven 24-inch discs. There is one head per disc surface used (a total of 40 heads) and 203 tracks per head (plus spares). The positioning elements on each side (each module) work independently of each other. To complicate things, up to 30 fixed heads can be incorporated into each module; these read from the "control" disc and can access an additional 4 million bits. Further, there is a two-channel option so that the same disc can be used by two cpu's, and another two-frequency option which allows for storing data on the outside tracks at twice the inner packing density.

What's really important is that the LDS comes in models to compete with the IBM 2314 disc subsystem and with the Univac Fastrand II drum. One of the IBM compatible units, however, stores as much as an eight-spindle 2314; and one of the Univac-compatible units stores as much as two Fastrands.

Although the 2314 competitor, called the 7314, gives away some advantages to the original including removable media and a faster standard transfer rate, it is $97K cheaper on purchase or $2K less per month. (Also,



another option allows for parallel transmission from 2, 4, 5, 8, or 10 heads simultaneously, increasing transfers by a factor equal to the number of channels used.) The 7314 is priced at $152K with one controller and leases for $3305. The 7714, the Fastrand II replacement, goes for $147,000 with a controller and $2905 per month. There is also an oem offering priced at $60K in quantities of 50. DATA PRODUCTS, Woodland Hills, Calif. For information:

CIRCLE 366 ON READER CARD

high speed datasets

This vendor seems to have started in business backwards, putting out a difficult and unusual product first—the Optran infrared-sending dataset replacement—and a more standard looking product second. However, though a dataset which operates over phone lines seems more mundane, Intertran is not really conventional in most senses of the word. For instance, though it is available in slow and fast versions, even the slow Model 915 version is good to 20,000 bps. The fast version is good to 250,000 bps.

Both models operate in full- or half-duplex modes over four-wire (twisted pair) phone cables and send data syn-

chronously after instantaneous synchronization. The 915 uses an EIA RS 232C interface. Both have built-in local and remote loop-back test capabilities. The 915 sells for $1875; the 916 for $1925. Deliveries take 30 days. COMPUTER TRANSMISSION CORP., Los Angeles, Calif. For information:

CIRCLE 367 ON READER CARD

key-to-tape

Data entry onto cassette and conversion to computer-compatible tape is available through the Keymatic Series K-100 encoders and Series K-200 pooler/converter.

The encoder series has three models: Model K-101, a typewriter keyboard with capability to record 102 EBCDIC codes serially on a cassette; Model K-102, a keyboard and function control panel with capability to record 162 codes; and Model K-103, a keyboard, auxiliary keyboard, and function control panel with record capability of all 256 EBCDIC codes.

Similar to Keymatic's earlier encoders, the Series K-1000 which record on regular 7- and 9-track tape, these new units are not billed as keypunch replacements. Recording is in upper and lower case characters; record lengths can be virtually infinite and completely variable between consecutive records; and a single key depression can record all of the EBCDIC codes. Also, certain codes can be established as field identifiers for recurring data to allow macro keyboarding. The company considers its encoders best suited for jobs that have a high degree of alpha content and long, varied length fields and records.

The pooler/converter series consists of two models; the K-290 for conversion of cassette recording to 9-track, 800 bpi tape and the K-270 which puts cassette records on 7-track, 556 bpi tape.

The Series K-100 units will sell for $6,500 to $7,500 and rent for $169 to $251 a month on a minimum two-year contract. The pooler/converter price is about $15,000. Both will see first deliveries in October. KEYMATIC DATA SYSTEMS CORP., Bayshore, N.Y. For information:

CIRCLE 370 ON READER CARD

16-bit mini

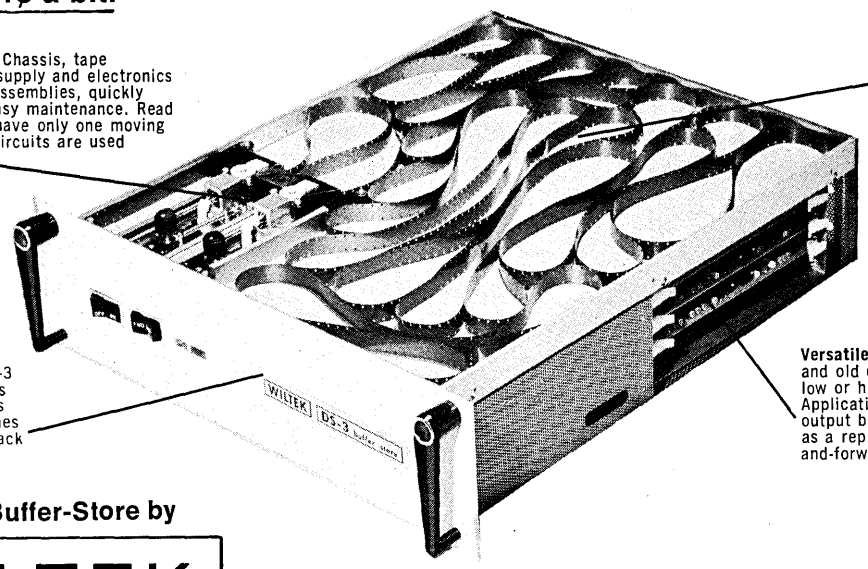
It has been in the works a long time and there was speculation that this 16-bit mini would be ready for introduction at the last FJCC. But General Automation decided to wait until spring to blossom out with the SPC-16, the firm's first offering in the popular 16-bit market, after success with previous 12- and 8-bitters. The 16 has a 4K to 32K core memory and a 960 nsec cycle time. Its read only and read/write memories are interchangeable; the ROM, with a 480 nsec access time, may be expanded in 512, 1K or 2K word increments.

The computer is designed as a dedicated automation machine for manufacturing and production environments but also will find use in laboratory and scientific data acquisition, data communications and process and control. It provides both on-line and off-line operation with up to 64 hardware priority interrupts.

Of interest is the instruction set which provides a claimed 16-fold expansion of memory effectiveness. With 11 classes and a total of 63 instructions, it will individually address bits to 512K, bytes to 65K and words to 32K. Discrete bits, bytes and complete words can be stored or operated upon with a single command. There are 67 registers; 25 are hardware and 18 are programmable. Eleven addressing modes include base-relative/program relative instructions to take advantage of both memory types. A standard (cycle stealing) direct memory access

the buffer

Wiltek's unique new DS-3 stores data at speeds up to 333 characters per second for less than 1¢ a bit.



Easy to maintain. Chassis, tape transport, power supply and electronics are all separate assemblies, quickly replaceable for easy maintenance. Read and write drives have only one moving part. Integrated circuits are used throughout.

High capacity, low error rate. The DS-3's endless loop of magnetic tape holds more than 50,000 characters of 5, 6, 7, or 8-level code. The DS-3 has simultaneous input and output capabilities at independent speeds. Error rate is less than one per million characters.

Compact. The DS-3 is only 5¼ inches high, 20½ inches deep and 19 inches wide. It can be rack or desk mounted.

Versatile. The DS-3 can be used in new and old data systems and can handle low or high speed communications. Applications include use as a CRT output buffer for off-line data entry, and as a replacement for paper tape store-and-forward devices.

The DS-3 Buffer-Store by

WILTEK

59 Danbury Road Wilton, Conn. 06897 Tel: (203) 762-5521

bus, which is expandable to multi-channel operation with priority interrupts, transfers data out of memory at a rate of one megaword per second. Arithmetic is parallel binary, two's complement, fixed point. The price of approximately $10K includes a one-pass conversational assembler, and a basic utility system for correcting and modifying programs and computer test programs; it does not include the FORTRAN IV compiler with in-line assembly capability. Delivery takes 30 days. GENERAL AUTOMATION, INC., Orange, Calif. For information:

CIRCLE 371 ON READER CARD

ocr terminal

Recognition of OCR "A" and 12 line per second scan rate are capabilities of this hand fed document reader. Combined with a crt/keyboard unit and IBM compatible magnetic tape output, it permits error corrected data encoding.

The terminal is a line scanner under wired program control. Spacing is adjustable and line length can be set by tabs, masks or delimiter marks. Its combination with the crt reflects the vendor's system design capabilities and philosophy of mixing products to expand markets. The display was introduced last October. The bottom of a series, it has a 12 inch diagonal screen that can show up to 320 characters.

Price for the ocr/crt/tape unit is $1,000 a month or $32,000 purchase. The scanner with tape output alone is available at $30,000. Shipment of the unit is 90 days ARO. INFOTON, INC., Burlington, Mass. For information:

CIRCLE 372 ON READER CARD

mag tape for minis

A triple-drive tape cassette unit is the basis for this on-line magnetic tape operation system for minicomputers. The package is designed as a direct replacement for the standard paper tape operating system. One cassette carries the standard software system; the second handles the user's source information; the third carries the object program. Each has a storage capacity of 180K characters. The system has I/O speeds of 500 cps and start and stop times of less than 15 and 10 msec, respectively. The end-of-tape to beginning-of-tape rewind time is less than 60 seconds; the forward tape speed is 10 ips.

The system is offered with three levels of software. XCOS-1 (Xebec Cassette Operating System-1) in a complete package for the end user includes I/O software, functional diagnostics, interface controller, cable, the three-cassette recorder, and operator's manual. It costs $6200. XCOS-2 comprises the features of XCOS-1, plus binary loader, keyboard controlled operating system for the absolute assembler, the editor and file handling routines, and is priced at $6350. XCOS-3 includes XCOS-1 features, plus binary loader and keyboard controlled operating system for both absolute and relocatable assembler, editor, file handling routines, FORTRAN, and ALGOL. Its price is $6650.

The system is available 60 days ARO for use with DEC and Hewlett-Packard minicomputers. Varian and Data General versions are in the final stages of development. Off-line capability, other higher level languages, and other options are presently available. XEBEC SYSTEMS, INC., Mt. View, Calif. For information:

CIRCLE 373 ON READER CARD

remote terminal printer

The Typeliner is a 100 lpm multiple copy printout unit which can be used as an output device for CRT terminals and for stand-alone remote printer applications. It is available with 80 or 132 column capacity. An ANSI 64 character set is standard; lower case alphabet is an option.

The mechanical printing mechanism with a "Crosspoint" impact print

the brochure

Gives you all the facts about the unique new Wiltek buffer that can store data at speeds up to 333 characters per second for less than 1¢ a bit.

Step-by-step instructions for operating the DS-3 include connecting for parallel and teletype operation, baud rate and code level selection.

Complete specifications, electrical and mechanical.

Range of options is described in detail.

Diagrams and tables illustrate DS-3 versatility, describe input and output control signals and connections with interface PC boards.

The DS-3 Buffer-Store by WILTEK.

Wiltek, Inc.
59 Danbury Road
Wilton, Conn. 06897

WILTEK

Please send me your new brochure on the DS-3 Buffer-Store.

Name_____

Firm_____

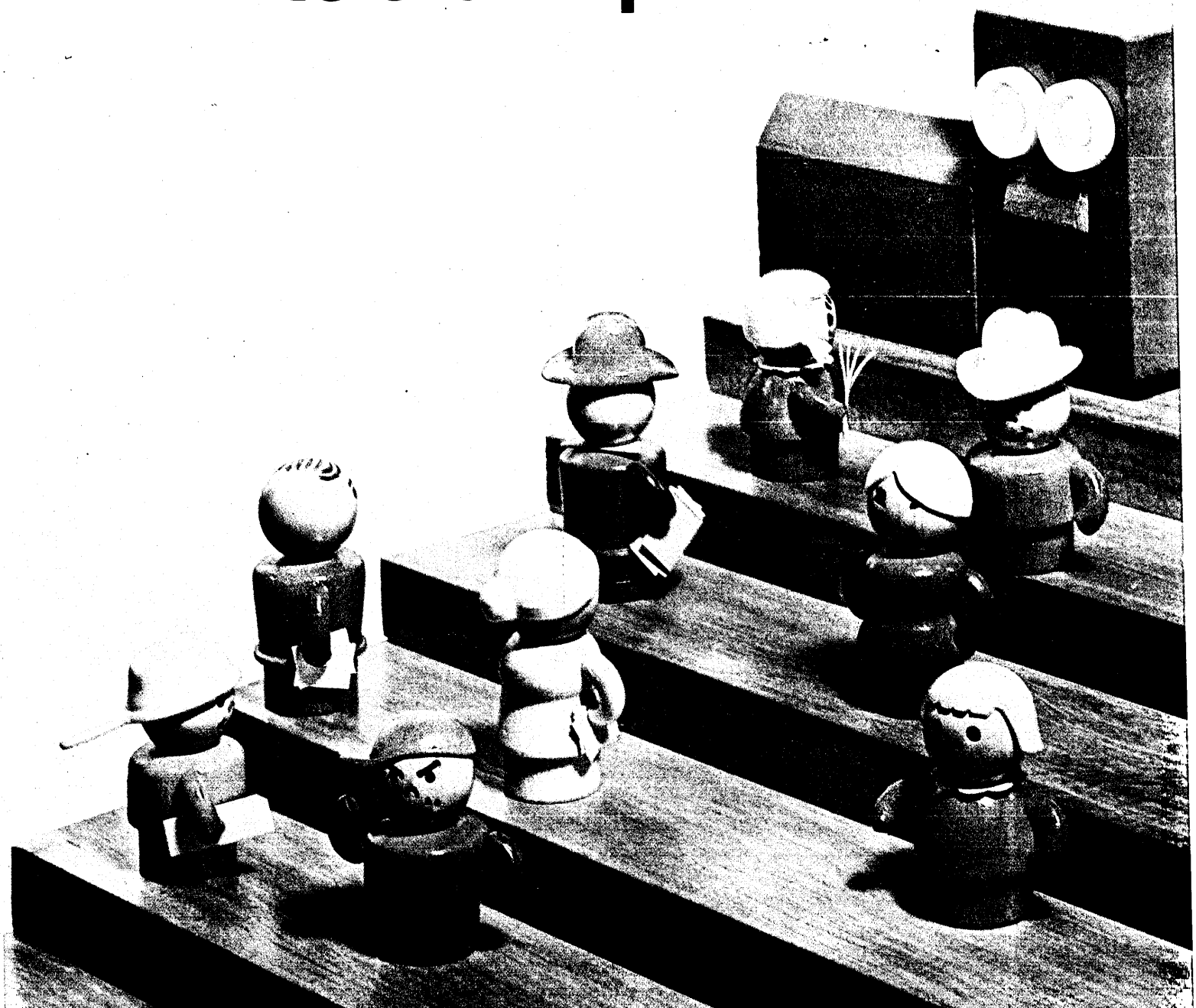
Street_____

City_____

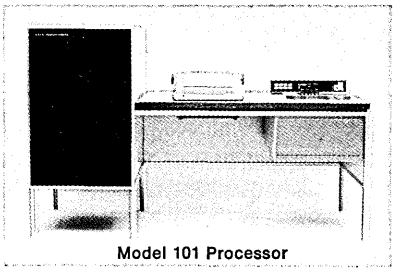
State_____ Zip_____

CIRCLE 199 ON READER CARD

It usually takes 4 steps to get information to a computer...



With DATAPLEX™ you can do it in one.



Model 101 Processor

Model R30 Recording Typewriter

Business paperwork must be transformed into something a computer can understand. It usually takes four steps... steps such as batching, coding, keyboard entry, verification, and pooling.

Now there's a system that does the whole job in *one* step. It's a new approach to data handling called DATAPLEX.

The approach is simple. As standard office forms are typed—anywhere in your company—all computer data is captured off-line as a by-product of this normal office routine. The DATAPLEX System then readies it for computer entry... automatically. Unraveled to fit your software. In one step.

Eliminating steps reduces costs dramatically. Unit records costs are a good example. Usually, they range from 2¢ to a more typical 5¢... depending on whether key-punch, key-to-tape, CRT or on-line equipment is used. But with the one-step DATAPLEX System, each unit record costs about 1/5th-of-a-cent... at least a ten-to-one cost reduction.

Your present, proven office procedures and computer software can continue to work with DATAPLEX. Without change. If you ever want to change a form or add a new one, no problem. DATAPLEX easily handles it.

As your needs grow, DATAPLEX can grow with them. To start, buy or lease only as much equipment as needed, and expand the basic system as simply buying a typewriter.

Who can use DATAPLEX? Anyone that's taking more than one step to get information to a computer. And that's everyone not using DATAPLEX.

DATA INSTRUMENTS COMPANY
16611 ROSCOE PLACE • SEPULVEDA, CALIFORNIA • 91343

NEW YORK OFFICE: 342 MADISON AVENUE, NEW YORK, NEW YORK 10017

CIRCLE 164 ON READER CARD

two thousand

Introducing the IODISC series 2000:

probably the world's most advanced disc drive systems.

IODISC* series 2000 data storage systems are probably the most advanced systems available for mini and midi computers. They are also the most usable. And the most flexible.

The 2000 series includes *five* new disc drive systems with capacities ranging from 24 to 96 megabits. Each with a data transfer rate of 1.56 megabits per second.

IODISC series 2000 systems are complete memory systems, with interface controller / adaptor and integral power supply unit. And everything is housed in a single console, in your choice of style and color.

The new IODISC series 2000 includes:

IODISC 2011: 24-megabit capacity on one removable disc cartridge.

IODISC 2012: 48-megabit capacity on one removable disc cartridge and one fixed disc, both operating on the same drive.

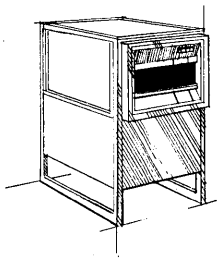
IODISC 2022: 48-megabit capacity on two removable disc cartridges operating on two separate drives.

IODISC 2023: 72-megabit capacity on two removable disc cartridges and one fixed disc, operating on two separate drives.

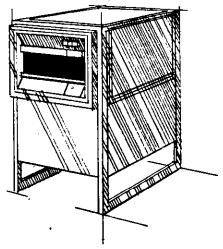
IODISC 2024: 96-megabit capacity on two removable disc cartridges and two fixed discs, operating on two separate drives.

As a result you can now buy the exact configuration that fits your needs. In capacity, and in system flexibility. And get the same high performance features found in the popular IODISC series 1000 data storage systems—70-ms average access time, extended operating temperature range, voice coil head actuator, absolute air filtration system, and mechanical simplicity. IODISC removable cartridges, common to all five new systems, give you unlimited off-line storage.

This is part of the IODISC series 2000 story. We'll gladly send you the rest. IOMEC, INC., 345 Mathew Street, Santa Clara, California 95050. (408) 246-2950



IODISC 2011



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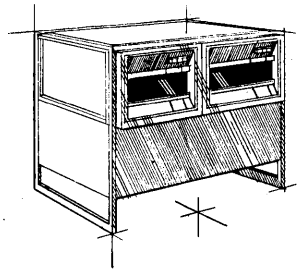
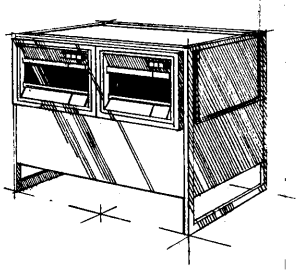
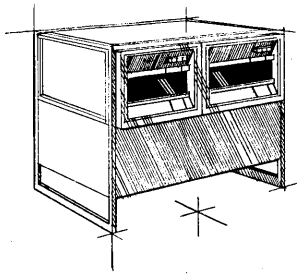


IODISC 2022



IODISC 2023



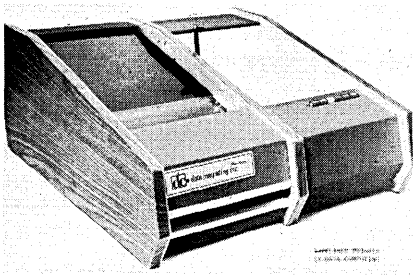
IODISC 2024

iomec inc

* A TRADEMARK OF IOMEC, INC.

head developed especially for the unit utilizes a matrix technique to form characters. Minor changes in electronics can give it a graphics capability. The design also provides automatic multiple copy compensation.

The printer is plug-to-plug compatible with CRT terminals and any mo-



dem. It uses the standard EIA RS-232B interface which is included in the purchase price of $8250 and the rental of $245 per month. Maintenance is included in the rental, and a separate maintenance agreement is available with a buy.

The unit prints on pinfeed, fanfold paper in multiple sets up to six, and in widths of 9⅞ in. for the 80 column model and 14⅞ in. for the 132 column model. DATA COMPUTING INC., Phoenix, Ariz. For information:

CIRCLE 369 ON READER CARD

dec disc

At last! You can get a low cost, random access disc pack system with software monitor for your PDP-8 or -12 minicomputer. Called the RK08, the system provides up to three million words of storage in removable 831K disc files. Up to four discs can be handled by the system controller. Average access time to locate data is 154 msec; in an additional 80 msec, 4K words can be transferred between core and a disc. Moving heads positioned by stepping motors are used. The disc itself is a single aluminum platter coated on both sides with magnetic oxide, and is permanently mounted inside a protective case that opens automatically when inserted in the drive.

The monitor allows the user device independent access to as many as 15 I/O devices. User programs may call on various monitor services, including file manipulation and program chaining. The user also has access to all standard DEC programs and a conversion program to put existing mass storage files into the new format. The monitor requires 8K core and either a high-speed paper tape reader or mag tape storage. It can also be used with other mass storage devices, such as the vendor's fixed head disc and mag tape units. Price of the disc drive and first control unit is $16.5K. Each additional drive is $8.5K. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 376 ON READER CARD

mos memory

Mostak I, first in a new series, consists of a single 6¾" x 4½" board. It is a 512 (4-bit) word random access read/write memory with a one usec cycle time and .8 usec read access time. Mostak I uses monolithic MOS devices for the data storage elements and most of the address decoding. Features include non-destructive readout, expandability to 16K words, and TTL I/O levels. In quantities of 25, the basic unit price is $400. ELECTRONIC ARRAYS, INC., Northridge, Calif. For information:

CIRCLE 379 ON READER CARD

accounting computer

Although earlier machines offered by this vendor, including the L2000, were suited for billing and accounting applications, the L4000 is being sold as the "first in the 'L' Series designed specifically for accounting applications." The 4000 is a self-contained system that handles wide-format printing or ledgers, stores applications software on a 1K 40-track disc, and speaks COBOL. Its bent for accounting results from the 255 print position carriage and from the peripherals which can be supplied with it.

The L4000 is not, as its name might imply, twice as fast or as capable as

the L2000 which preceded it. It has basically the same hardware and speed (accepting I/O at 2000 bps, accessing disc in 5 msec). Like the 2000, its operations are stored on disc as strings of microinstructions, it uses 64-bit words, and has two 256-word buffers. Unlike the 2000, the machine's paper tape capability is not implemented through a cartridge tape loop, but through a separate reader/punch. Other peripherals include one for edge-punched cards and another for 80-column cards.

The accounting machine was built to sell for between $14,290 and $26,000 depending on options. Software packages will be priced separately, and although software prices were not included in the announcement, the $900 per routine price for the L2000 series package is probably close. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 375 ON READER CARD

25 lb portable tty

This firm's portable terminals continue to get lighter, although in this case the terminal does not have the automatic answering feature found in its heavier predecessors. But the Dataport VI does weigh only 25 lbs. and is designed to fit underneath standard airline seats in its attache-type case. The unit is Teletype compatible, has a data rate of 110 baud, uses 8-level ANSI code, prints 10 cps, and uses a 96-character set. It includes an integral acoustic coupler and plugs into AC electrical outlets. Fanfold paper is used for printout. A switch permits selection of full duplex operation for simultaneous transmission and reception of data.

Sound dampening insulation for the telephone handset and noise-suppressing electronic filters facilitate operation under high ambient noise levels and poor telephone line conditions. Error detection is through character-by-character parity checking. The price of the Dataport VI is $2850. VERNITRON CORP., Farmingdale, N.Y. For information:

CIRCLE 374 ON READER CARD

business machines

Take a minicomputer designed for doing business dp, add an IBM Selectric typewriter modified to take ledger cards and a Hermes front-feed business form peripheral which automatically positions the cards and, presto, you have the Datacomp 2.0 business accounting system. Or take the same computer, add the typewriter and an MC-10 magnetic card handler, and you're in business with the Datacomp 3.1 bookkeeping and accounting system. Going a step farther, add to the 3.1 a display and a one-, two- or three-deck mag tape cassette input system, and you have another version of the 3.1 (as yet to be named, but probably the 3.12 or 3.13).

These are some of a series (which will go up to 3.7) of business dp configuration scheduled for installation in June. They are built around this firm's Datacomp 404 computer (Dec., p.

In remote batch processing

The name of the game is COPE®!

If you're remote batching with such big computers as the 360, 1108, 6000, or B5500, the name of the game is thruput and flexibility. COPE terminal systems lead the industry in both categories.

Consider thruput. COPE gives you more of the things that make it happen — data line optimization, large data blocks and high-speed peripherals. Six of the seven COPE terminal systems operate in the full-duplex mode over voice-grade telephone lines, at 4800 and 9600 bps. Data is transferred in blocks of 3072 bits in both directions simultaneously. And as for high-speed peripherals, how about a 1500 CPM reader and dual 1250 LPM printers?

COPE flexibility is achieved first by the Communication Controller. Located at the central computer site, it can handle up to 30 peripherals and/or terminals. With a COPE Controller, you can reduce the use of systems resources, core storage and data channels and still expand the number of readers, printers and remote terminals.

COPE terminals are flexible, too. They're field upgradable to COPE .45 status (see chart), and they can simulate such counterparts as the IBM 2780, Univac 1004 and CDC 200 UT. Optional peripherals include magnetic tape drives, plotters and card punches. Others are on the way.

Efficiency, thruput, flexibility. That's COPE's remote batch game.

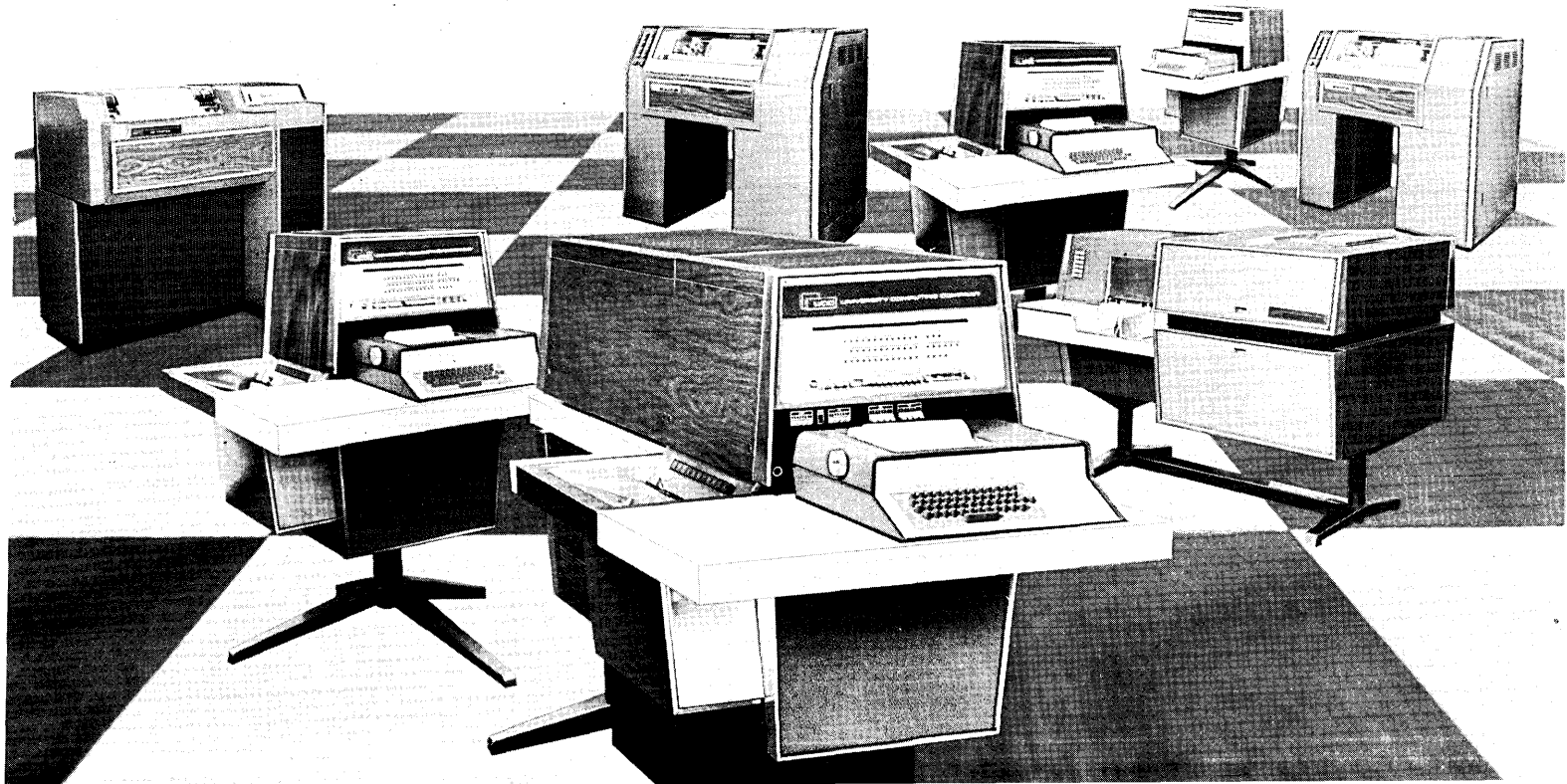
Wanta save dollars? Contact: Marketing Coordinator, Data Communication Systems Division, 2659 Nova Drive, Dallas, Texas 75229, (214) 241-3501.

Terminal Type	Communications Mode		Input/Output Device Speeds (Maximum)	
	Half Duplex	Full Duplex COPE	Reader C.P.M.	Printer L.P.M.
C.30	ATT 201A/B	No	200	240
C.32	No	Yes	200	360
C.34	Option	Yes	300	360
C.36	Option	Yes	300	480
C.38	Option	Yes	600	480
C.41	Option	Yes	600	1,250
C.45	Option	Yes	1,500	1,250

UCC

UNIVERSITY COMPUTING COMPANY
DATA COMMUNICATION SYSTEMS DIVISION
2659 Nova Drive / Dallas, Texas 75229

CIRCLE 69 ON READER CARD



237) which does automatic code conversions and formatting, has 16 addressing modes including double-index and relative, and can work with word lengths of 16, 32, 48 and 64 bits. Its standard software includes a single-pass assembler which can generate relocatable machine code, a tape editor, diagnostics, and a time-sharing exec. Including software for basic accounting functions, the 2.0 will be priced at $16K and the 3.1 will carry a $24K price tag. For the crt display, add $6,500 to the 3.1; for the cassette, add $6K. CLARY DATACOMP SYSTEMS, Inc., San Gabriel, Calif. For information:

CIRCLE 378 ON READER CARD

tape pooler

Data collection on tape from remote source stations can be accomplished with the Data-Verter central magnetic tape terminal. It can communicate

with acoustical or unattended transmitters and records the data in ANSI or EBCDIC code on 9-channel tape. Error check includes parity, format and read after write. The tape terminal, designated Model 5237, will be available in early summer. DIGITRONICS CORP., Albertson, N.Y. For information:

CIRCLE 377 ON READER CARD

peripheral controller

With the DATAFLO-1 magnetic tape-to-printer media adaptor, IBM 360 users can employ an IBM 2400 mag tape-unit and 1403 printer as an independent off-line print station. (Shades of the second generation!) The equipment can be interfaced without tying up the normal on-line operation of the cpu, main memory, or associated controllers. In most cases, installation of the unit and operator training can be accomplished in one day. An optional switch allows the 2400 peripherals to be returned to 360 control. DATAFLO-1 will rent for about $1000, depending on options ordered. Purchase price will be around $40K, and deliveries are scheduled for the third quarter of this year. DATAFLO BUSINESS MACHINES CORP., El Segundo, Calif. For information:

CIRCLE 380 ON READER CARD

3200 bpi tape

True, computer systems now being sold do not handle tapes recorded at 3200 bpi (1600 bpi or 3200 *fci* is about as far as we go), but when they come, the Audev 6400 tape will be waiting. The vendor wants to be first when the fourth generation tape drives arrive. In addition to the higher density recording ability, the tape offers a new coating formulation with a high-efficiency binder-oxide system and a price tag of about $20 per reel in unit quantities. AUDIO DEVICES, INC., Glenbrook, Conn. For information:

CIRCLE 381 ON READER CARD

audio response units

The latest addition to audio response is a modular system that stores speech in "phonems" in addition to words and phrases. The storage medium is core or MOS, practical because the phonems permit placing larger vocabularies in less space.

The basic system contains controls for accessing what amounts to 50 words of vocabulary and five phrases. It has two-channel access and costs $15,000. A larger system, 200 words of vocabulary and 25 phrases with multiplexing over two telephone lines, costs $21,000. Even larger systems are possible. The manufacturer takes care of software. INSTRUMENT SYSTEMS CORP., Huntington, N.Y. For information:

CIRCLE 382 ON READER CARD

output error detector

The 1800 SENTINEL is a monitoring and warning system for detecting output errors from IBM 1800 computers that could cause damage to process equipment. Three common types of computer output errors can be detected: more than one ECO output signal on within a group; a difference between two digital-to-analog converter outputs that is larger than a programmable limit; a digital-to-analog output that is less than a programmable limit. Both operator and the computer are instantly warned. The warning outputs can send a process-interrupt signal to the computer, activate an annunciator, switch all controllers to manual, and operate a panel lamp indicator. The 1800 SENTINEL costs under $3500, including installation instructions and a five-year parts warranty, and is available on 60-day delivery. HOUSTON ENGINEERING RESEARCH CORP., Houston, Texas. For information:

CIRCLE 383 ON READER CARD

data collection terminal

First product, family of products, of a new firm composed of a handful of ex-DEC personnel is a small terminal for data capture and retrieval. It is intended to be custom configured to user requirements for such applications as

inventory reporting, credit and point of sale, payroll-time clock, etc. Special function keys are used in conjunction with a numeric keyboard and readout tube display, with the user specifying options for his application.

Options include variations in the number of keys, size, color, grouping, and key top designations; 6-, 20-, or 80-column printout; displays including message words and numerics; badge readers; tape cassette; and even a cash drawer. The unit may include stand-alone logic and processing capability or be linked to a minicomputer through parallel bus or Bell 103 Data-Phones.

Maximum display is 14 numeric characters and a message word of up to 12 characters. Prices start at $1500; a unit with 80-column printout runs $3K-$3,500. Software now includes a PDP-8/L polling program and a time clock program; and the firm is ready to write custom software. Delivery requires two to six months. DATA TERMINAL SYSTEMS, Maynard, Mass. For information:

CIRCLE 386 ON READER CARD

a/d multiplexors

The series MADC and DSM boxes are used in series to perform analog to

digital conversions and multiplexing. The MADC is the a/d converter box. It can accept analog signals at up to 200,000 samples/sec from up to 400 lines, multiplex them, and deliver them to the DSM. The DSM can accept up to 1008 lines (at one bit per line) from a number of MADC's and multiply them into a single digital bit stream.

The DSM can also accept control bits from time sources or from a computer and shoot them back along the lines in reverse. Therefore, the dual component system is expected to see service in process control applications as well as analog data acquisition installations. Resolutions for the MADC are given as 12 bits, and prices range from $5000—for a 24-channel set—up. The DSM, which can handle single bit event-counting lines or groups of up to 16 bits in parallel, is priced at under $9000. Deliveries on the units take from 60 to 120 days. STELLARMETRICS INC., Paramount, Calif. For information:

CIRCLE 387 ON READER CARD

disc

Plug-to-plug compatibility with the 2311, 16-bit word orientation and a $20,000 single unit price distinguish this entry in the disc drive market. The model 816 is the controller component; it can handle up to two model 716's, the disc drive. The drives have hydraulic head positioning and use the 1316 disc pack. Maximum capacity is 116 million bits.

The vendor sees the disc storage being linked to small and medium computers due to its 16-bit orientation. It will be marketed for use in special storage systems with reduced prices for quantity orders. PERIPHERALS GENERAL, INC., Cherry Hill, N.J. For information:

CIRCLE 385 ON READER CARD

core memory

Flat-Store provides from 1K of 8-bit words to 4K of 9-bit words, plus data register, single rail address, timing and control, sense amps, and all the needed goodies that make a core memory system work on a single 8½x13½-inch card. Access time is given as 600 nsec; full cycle time is 1.8 usec, and the memory can be operated on half cycles, too. Unit prices run from $695 for a 1Kx8 to $1175 for a 4Kx8, but larger sizes may be configured by using more than one board. STANDARD LOGIC, INC., Santa Ana, Calif. For information:

CIRCLE 388 ON READER CARD

communications computer

This computer system is designed for preprocessing, communication concentration, data direction, message switching, and use as a remote terminal. It is also its manufacturer's first effort to compete in an area that is fast attracting users and suppliers. (Reportedly 60% of installed computers have some communication requirement.)

The system has 252 communication channels and memory capacity that ranges from 8K bytes to 64K bytes. Memory cycle time is 1.2 usec and data transfer rate is 200 Kbps over direct memory access channels. Its software complement includes operations programming and such applications packages as terminal device I/O routines, a communications logical routine for message switching, a real-time relocating loader/monitor, a secondary physical and logical I/O routine for tape and disc devices, and a dynamic overlay with priority handling for mass storage.

National marketing for the system began in April. Its price is $35,000. DEVONSHIRE COMPUTER CORP., Dedham, Mass. For information:

CIRCLE 384 ON READER CARD

Computer Companion #788

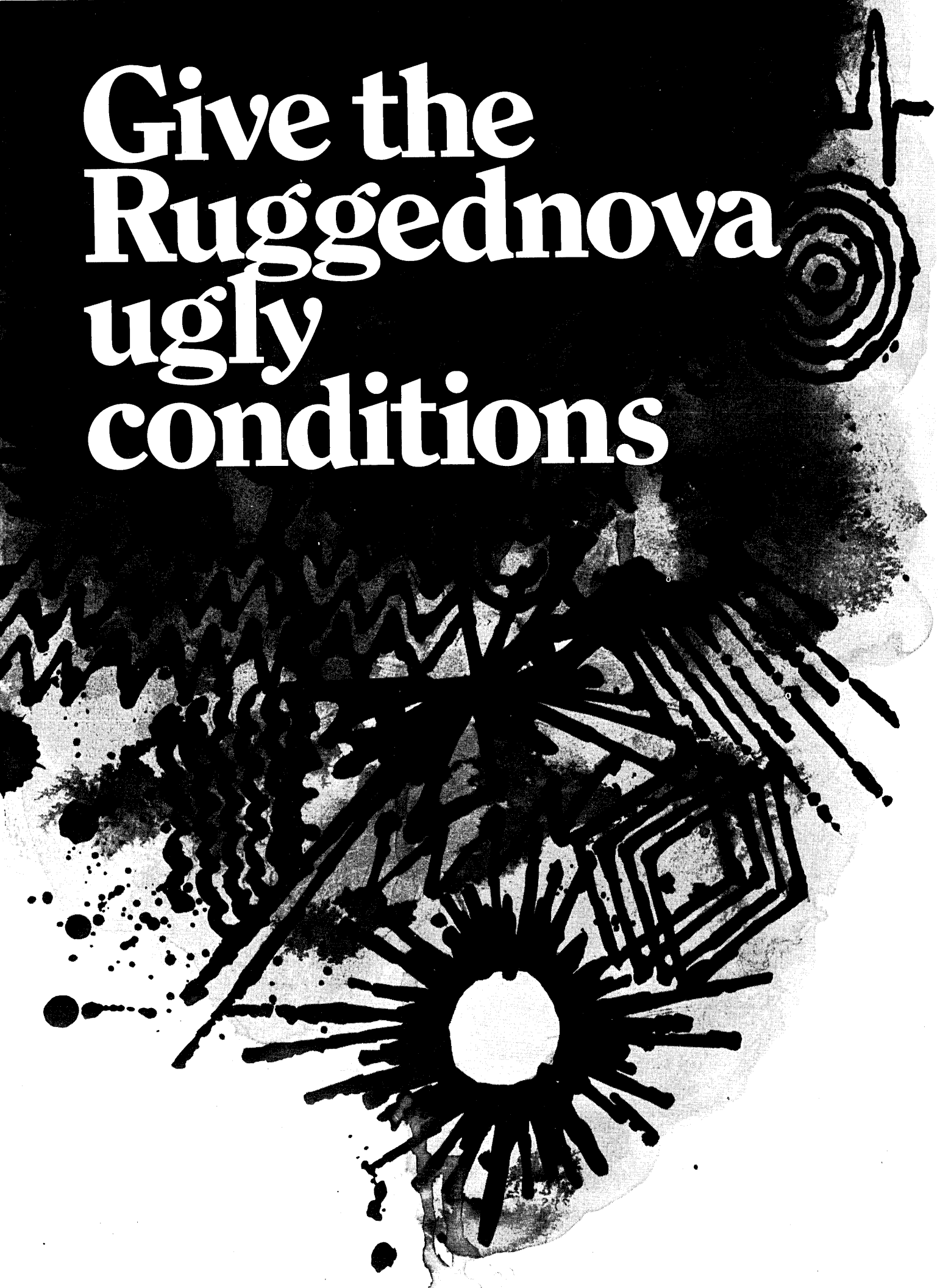
Booth 225
DPMA Convention
June 23, 24, 25, 26
Seattle, Washington

New Tab Data Display Desk. Who says optimum function and versatility have to mean "ugly"? Slim, strong series 500 Data Display Desks have cantilevered aluminum frame that dresses up with optional two or three drawer pedestals. Walnut top with black trim or light grey formica with dark grey trim. Desk top and front edges are beveled to protect shins and elbows. 45" and 62" models in calculator and desk heights. Ideal for CRT units, microfilm readers, or whatever you want done with style and efficiency.

TAB
PRODUCTS CO.
2690 Hanover Street
Palo Alto, California 94304

CIRCLE 49 ON READER CARD

Give the Ruggednova ugly conditions



and it will perform beautifully

This general purpose digital minicomputer can really take it. The 16-bit word Ruggednova is a supermini for severe environments. 80,000 feet altitude. Explosive atmosphere. Sand, dust or salt spray. RFI/EMI. −55°C to +95°C operating temperature range. It can even take 15 Gs of shock, 10 Gs of vibration and keep functioning.

The architecture is Data General's Nova with identical instructions, software and I/O. The similarities end there. We designed a totally new package that meets Mil Specs E-5400, E-16400 and E-4158, and Mil Std. 461A for RFI.

The 1601 is packaged in a standard ATR box (7⅝" x 10⅛" x 15¾") or it can be mounted in a 19-inch RETMA rack. Sells for "off-the-shelf" prices of under $20,000.

From its wide-temperature range 4K memory modules to its highly reliable LED panel indicators, the Ruggednova is the beautiful machine for ugly places. If you know of any such places, we'd like to hear about them.

ROLM CORPORATION 10300 N. Tantau Avenue, Cupertino, California 95014
408/257-6440

CIRCLE 97 ON READER CARD

system spotlight

information for this series is invited applications submitted must be installed and operational

TRAFFIC CONTROL SYSTEM

queuing

Have you ever driven down a major street and been stopped at the end of every block for a red light? Even when there were no cars on the secondary streets waiting to cross? Drivers in some U.S. cities like Charleston, S.C., are being relieved of some of that kind of frustration through the agency of computer-controlled signal networks. Controlled traffic flow is not a new thing, but the Charleston system is thought to offer some "firsts," including self-checking operation and a hybrid computer base.

computer and peripherals

DEC PDP-8/L with 4K (12-bit) words of core storage; 1.5 usec cycle time
DEC DF-32 32K word disc pack drive; 16 msec access time
23 LFE-designed analog controllers plus an 8-channel analog-to-digital converter, tty, line sensors, and I/O interfaces, etc.

application

The traffic signals at 86 intersections in Charleston are being tied on-line to a hybrid master control system in a downtown dispatcher's office. From there the traffic flow in the busiest parts of the city will be monitored. When the system is switched into operation, existing streets are expected to be able to handle 15% more capacity, vehicle stops should decrease by 30%, average travel time by 20%, and driver frustration by some unmeasurable but significant quantity.

The system that will be required to accomplish these improvements is being installed under a $515,000 contract by Automatic Signal, a division of LFE Corp. In some ways it is a pilot study. If it goes, there are 120 more cities with populations over 50,000 that could use it.

computer and peripherals

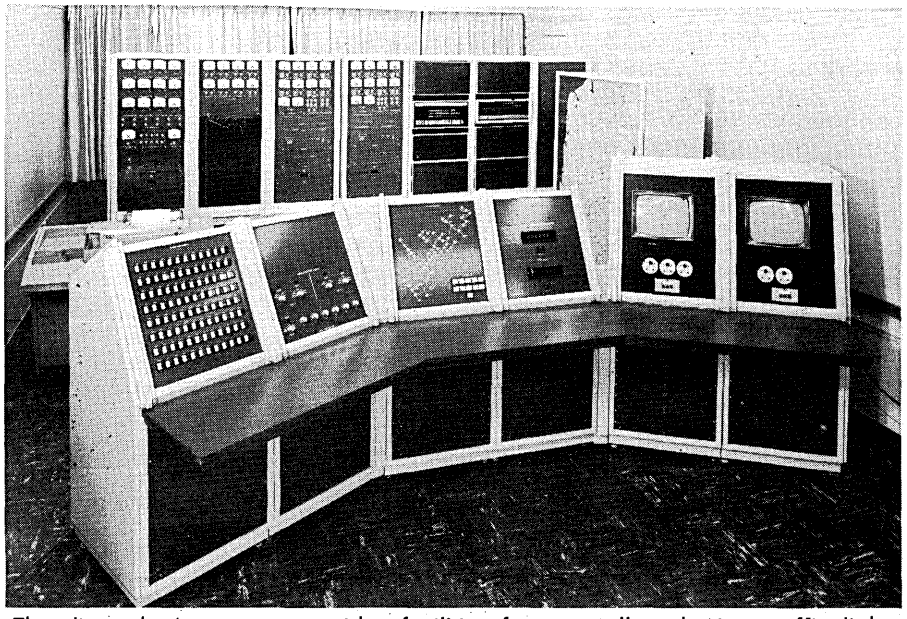
The idea behind traffic control is not difficult. A system must be able to sense and evaluate the traffic going in all directions and then give precedence to the heaviest traffic by appropriately timing the lights. The problem is complicated, however, by the interdependence of successive signals and the conflicts of traffic going in different directions.

Charleston's traffic control system is centered around a dispatcher's office with map displays, tv monitors, alarm readouts, and phone lines to local fire stations and emergency vehicle depots. That installation is supported by what is thought to be the first hybrid computer configuration to be used in traffic control, and the hybrid is supported in turn by another level of remote controllers. Analog systems have long been employed in traffic control because the primary problems of speed and flow are analog functions. In this installation, the digital components have been added to perform the jobs they do best, like collecting and storing data, monitoring system performance, detecting failures, and reporting.

hardware

The digital hardware selected by LFE to perform these functions is composed of a Digital Equipment Corp. PDP-8/L minicomputer and a 32K disc. The 8/L augments 23 special-purpose analog boxes which actually perform all the control functions.

The 23 analog boxes are directly connected to electronic sensors at 23 sensitive intersections. The sensors are magnetic loops buried in the pavement. As cars pass over them they produce two inputs. First, each car's presence is detected as a new event, causing a counter to be updated. Second, the length of time required for



The dispatcher's console provides facilities for manually selecting traffic light timings and for visually monitoring the most critical intersections.

the car to pass over the loop is measured and an estimate of the vehicle's speed is made. (To derive speed from the duration of an impulse requires that the lengths of all cars be identical, but the error that this false assumption introduces is pretty well canceled out by the time a half dozen vehicles have passed.)

The 63 intersection loop detectors that do not have an analog computer associated with them are those whose actions are largely determined by the timings of the first 23. Their inputs are recorded for historical purposes, but their cycles are not determined by the on-line hardware.

A function called density is computed from the volume counter and speed information by simple division, and is used to represent the number of vehicles per roadway mile. The duration of traffic light cycles—the time to go from green to green again on the same signal—is determined for each of the 23 on-line signals as a function of the density. Two other functions are important to traffic control—offset and split. Split is the ratio between the time the signal remains green for cars going in one direction (say for the north-south lanes) to the time the signal remains green for cars going the other way (east-west in this example). Offset is the delay between green lights at successive intersections (and what we think of when we see signs like "signals set for 30 mph" on non-controlled streets).

Some of the loop detectors are used for measuring density only. They are placed in density-critical locations (meaning bottlenecks). Loops to read speeds are placed in spots where the traffic is free-flowing, so that they will give readings which are representative of over-all traffic patterns. Both kinds of analog inputs eventually find their way through an analog-to-digital converter for recording by the PDP-8.

Digital inputs come from many sources, including status indicators at the railroad crossings, traffic volume counters and pushbuttons at the local firestations. (Conveniently, there is a pushbutton to control emergency routes at the central fire station too, in case it is the dispatcher's office that catches fire.) The digital transmissions are intercepted by an LFE I/O interface before they reach the PDP-8.

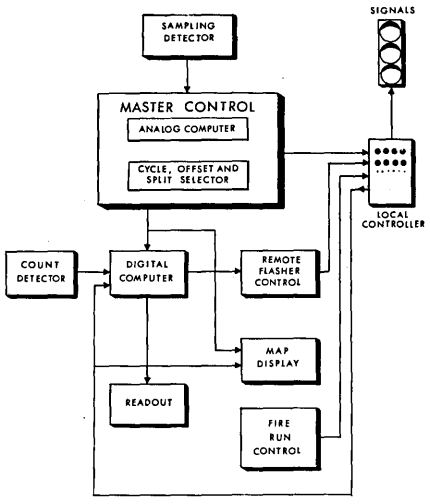
Several useful by-products result from the detection and control scheme. Emergency vehicles can choose from 10 preselected routes through the city and never hit a red light. Faulty signals are detected immediately (without the system, the first indication was likely to be an obscene phone call). Traffic reports are produced in such detail, hour by hour, that it becomes easy to show how such things as train schedules interfere with auto movements. In addition, the alarm messages that are automatically printed when traffic speeds do not conform to predicted values can implicitly inform dispatchers about accidents and tie-ups that might require special police attention.

The primary job of the digital computer is to compare the calculated density, volume, and speed data with an internal space-time diagram, and to change that stored representation to conform to changing traffic conditions. As mentioned, the machine also accumulates the traffic flow totals, monitors local signal light controllers, gives printed and audio alarms, drives the various dispatcher displays, and causes "yellows" and "reds" to flash in case of controller failures.

Normally the signal light controllers at the intersections rely on the central cpu for synchronization inputs, but they can also work independently of the computer should the master go down. In this case they automatically revert to preset timings.

software

Basic software consists of a real-time executive, utilities, a symbolic editor, and a one-pass assembler (as opposed to DEC's standard three-pass program). The control programs, which are all coded in PAL III assembly language, are divided into four groups. Of these, only the exec is core resident at all times (other than when the system is off-line and the utilities are being used). The other routines are overlaid as called for. Some of the programs are executed as often as every two seconds (status control scans are taken this often). Others are called in at times ranging from once every 40 seconds (local faults evaluation), to once every hour (volume checks and recaps), to every 24 hours (summaries). A few routines are called in as a response to operator demand. These include programs for manually changing cycle, split, and offset, for changing responses to fire alarms and railroad crossing blockages. ■



Block diagram for a single intersection controller.

new software

flowcharter plus

The words "automatic flowcharting" are sweet to any programmer's ears, so LOGIGRAM will probably come in for a good deal of attention. It may well deserve popularity, for the program can operate on several business oriented languages, including COBOL, RPG, ALC/BAL, and AUTOCODER, to produce line printer flowcharts, source listings, cross reference listings, and debugging keys. It will run on any 360 series computer with 32K of core, and can be modified for use with other major brands such as the RCA Spectra series or the Univac 9000 line.

The program operates under DOS or OS in a multiprogramming environment, or can go under its own built-in monitor. Its proud possessors claim that it produces ¼ the printed output of other documentation systems (which we take to mean SCERT and AUTOFLOW). It is built in modules and can be assembled in pieces if required. For instance, the full blown all-language version runs $8000, but a single-language version can be bought for as little as $1800 (RPG or AUTOCODER). The COBOL-only module runs $3000; ALC/BAL sells for $2500. In each case, the program product is delivered on its own disc pack, with its own supervisor. A test data generator ($1500) and an RPG to COBOL converter called COVCO ($3500) are also available. CTSS, INC., Los Angeles, Calif. For information:

CIRCLE 321 ON READER CARD

remote entry cobol

Since it is a remote job entry system rather than a conversational compiler, TOCAP (for Terminal Oriented Business Applications Programming system) should make fairly efficient use of its host cpu. Written in COBOL, the package is a pre-compiler which accepts shorthand statements, free format decision tables, library subroutines, and source language debugging statements, then translates them all into ANSI COBOL. The program sets up files in a job stream which are then called into execution from the originating teleprinter terminal.

TOCAP consists of four separate modules, each about 20K to 40K bytes, which are called into execution separately. The integrated system requires a machine of 65K bytes or more to operate, and should work on any machine that supports ANSI COBOL. Its price varies from $20K to as much as $30K (in unusual circumstances), depending upon the amount of custom tailoring required for the user's operating system. The price includes three days of user training plus installation. DATA TECHNOLOGY, INC., Alexandria, Va. For information:

CIRCLE 322 ON READER CARD

i/o optimizer

Power Pak is designed to increase throughput in System/360's using standard DOS by maximizing use of the cpu. It performs all I/O functions initiated by the system, and makes maximum use of spooling and read/write buffering for all unit records (reader, punch and printer) as well as tape data sets. All tape and card input and printer output is processed independent of the executing program, and data requested by the executing program is provided from 2314 disc files. The system is transparent to user and operator, and assignments and cataloging of I/O files and data sets are handled automatically. Price is $20,000 for a 128K version. COMPUTER GENERAL CORP., Wash., D. C. For information:

CIRCLE 324 ON READER CARD

sigma 7 operating system

Under control of the Universal Time-Sharing System (UTS), one XDS Sigma 7 computer will be able to perform three tasks concurrently: on-line time-sharing for up to 128 users, local and remote batch processing, and real-time processing. UTS requires two RAD discs and a minimum of 64K words of core, although the average user will need about 80K.

Compilers and subsystems operational under UTS include BASIC, FOR-

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April 6, 1970.

CIRCLE 73 ON READER CARD

TRAN, META SYMBOL, COBOL, MANAGE, FMPS (a linear programming package), and SL-1 (a simulation language). Utility processors will include a terminal executive language an assembly language debugger, a language for translating data among peripherals, FORTRAN debugger, EDIT and other subsystems. Compatible on-line and batch versions of many of these packages will permit users to work in two or more operating modes interchangeably, regardless of the mode in which the programs were developed.

UTS will be offered without charge to Sigma 7 users. The first phases, to be delivered this fall, include capabilities for time-sharing and batch processing. Other improvements, including real-time capability, will be delivered early next year. XEROX DATA SYSTEMS, El Segundo, Calif. For information:

CIRCLE 325 ON READER CARD

cross assembler

Minicomputers are not limited to the solutions of miniproblems; enterprising owners put them to work doing large and complicated jobs. But those owners run into difficulties when it comes to assembling large programs, for they are limited both by core space and assembly speed. This cross assembler alleviates those problems for Varian 620i users by enabling them to assemble code on larger machines, including the IBM 360 series, the IBM 7094, CDC 6400 and 6600, and the Standard Computer IC 6000. Varian users realize several advantages. One is time; a 6000 card source deck that requires six hours of assembly time on a 620i might require only 15 minutes on a 7090. Other advantages include an extended set of diagnostics and in-line error messages, its supplier claims, as well as an option for 16- or 18-bit word sizes, and alphabetized symbol table listings.

The package is coded in FORTRAN IV and works with Varian DAS language statements in card formats, outputting on paper tape. A 360 version is available for $750, and that price includes a source deck, source listing, and user instructions. CODE, INC., Los Angeles, Calif. For information:

CIRCLE 327 ON READER CARD

360 operating system

A large IBM 360 series machine which has a workload composed predominantly of FORTRAN and BAL jobs can be turned into a pipeline processor through the use of CAOS (Computer Application's Operating System). The vendor claims that by operating in a pipeline mode, in the manner of an IBM 7094 IBSYS job stream, huge gains in performance can be achieved. Benchmarks run on a 360/91 reportedly showed CAOS outperforming IBM's OS/MVT by a factor of five to one. A particularly spectacular run of 700 FORTRAN compilations that required three hours under MVT supposedly required only seven minutes under the replacement monitor.

The package requires a large system, either a /75, an /85, a /91 or /95. Although it can be constrained to operate in as little as 500K bytes of core, it is being distributed in a form that needs two million bytes. CAOS multitasks as much of each job as it can, and drives I/O devices simultaneously. Except for the I/O routines, it is dedicated to processing one job at a time.

In case such a large program is frightening to potential customers, the vendor is quick to point to proprietary use of the monitor for three years, and that the designers are said to be the people who built CALL/360 BASIC and CALL/360 OS FORTRAN.

Leases run $10K/month for the program plus maintenance. Maintenance runs $5K for a /91 version or for a /95. Although those figures would add up to $180K/year, the system would be cheap if it could always produce the five to one performance improvement. COMPUTER APPLICATIONS, INC., Palo Alto, Calif. For information:

CIRCLE 326 ON READER CARD

data management

DS/2, a general purpose data management system, gives the user an extension of his existing capabilities and requires no reprogramming to fit the user's equipment. It is designed to run under DOS on IBM 360/25's and up using standard 2311/2314 disc files. DS/2 accepts commands typed in standard English. The system can prepare management reports and stores report formats. It can also compare records based on several values by manipulating the data arithmetically. File updating can be done on-line, and the user receives a printout detailing any changes to the data so he can then back up his file on tape.

DS/2 is written in MOL, a higher level language developed by SDC. Using a standard DOS partition, the system can operate in three modes: remote, operator console, or card batch. Each allows output either on-line or on tape for delayed printing. The remote version requires a 34K partition, or a special 10K partition remote version is available to make nondedicated on-line operation possible on a 65K machine.

File security is maintained with all applications of the system. A basic text scanning feature and scope capability are available optionally. DS/2 has a base lease price of $450/month, which includes maintenance. The basic purchase price is $13,500. Installation help and training are available. SYSTEM DEVELOPMENT CORP., Santa Monica, Calif. For information:

CIRCLE 328 ON READER CARD

os sort

The COBOL SORT verb, as implemented under the IBM Operating System, forces its user to use whatever size sorting area was specified when the last sysgen was run. This can be an unnecessary restriction or unnecessarily expensive. UNISORT is an assembly language subprogram which allows the user to dynamically allocate a sort area size (thereby getting around his dp manager's arbitrary ruling, right?) It also allows the user to perform a sort within a Level E COBOL program, to call other subroutines from within COBOL input and output procedures, and to call the SORT routine from FORTRAN, PL/I, or assembly language programs.

UNISORT comes with source and object decks, with programming and installation instructions, and with a price tag of $350. UNITED COMPUTING CORP., Carson, Calif. For information:

CIRCLE 329 ON READER CARD

1106/1108 debugging

Program Trace, a debugging package for the Univac 1106 and 1108, generates printed outputs of the logical paths taken by a user program during execution. The package monitors the execution of each instruction and identifies logical errors which lead to program failure. Specifically, it prints the last address after a branch and the first address before a branch. While it is intended primarily as a debugging tool for programmers, it can also be used as a training aid which will enable students to locate their own errors. Trace's price is $950. CYBERMATICS INC., Ft. Lee, N.J. For information:

CIRCLE 330 ON READER CARD

payroll

A payroll package is a payroll package is a payroll package, and this is a big one. Designed for banks providing customer payroll processing and for industrial use with multi-state payrolls, it takes a 196K 360/50 system and four disc or tape drives. One pass of the master file will execute a normal payroll. The modular system includes a $20,000 basic payroll package, a $3,000 labor distribution package, and a $2,000 special report package. The $20K price includes installation, three man-weeks of training, sales aids and technical and operational documentation, descriptions and layouts.

Because its present size limits its

market, the vendor is planning to overlay the package to a 128K environment opening up a market of small banks with Mod 30's. Written in COBOL, the payroll package handles normal payroll functions. The labor distribution package can generate up to six separate reports; and the special reports package, tailored to the customer, takes care of such things as union dues, medical insurance and voluntary deductions. UNITED CALIFORNIA BANK, Los Angeles, Calif. For information:

CIRCLE 331 ON READER CARD

os/mvt accounting

SYSMAC monitors, accounts, and controls the major computer activities under OS/MVT. A 600 to 4K byte region contains OS/MVT interface programs which record the computer resources actually used for each job, including cpu time, accountable core time, core size, number of job steps, connect time, number of tape and disc I/O events, number of tape and disc mounts, number of cards read and punched, and the number of lines printed. This data is used to develop the logical billing for each job as if it were running in the computer by itself.

All collected data is logged by time of day and may be used by the installation to develop computer utilization analyses. A package of seven application programs also produces four monthly reports. SYSMAC imposes installation developed standards for validating computer users and their projects. It can establish financial authorization for each use of the computer. Installation standards are also checked before memory is allocated and the job assigned a priority. The system sells for $4900. It was developed by a university and has been in use since March, 1969. HYGAIN TECHNOLOGIES, INC., Westport, Conn. For information:

CIRCLE 332 ON READER CARD

ansi cobol for 360/25-30

This ANSI COBOL, primarily designed for 360/25 and 30 users, requires only 32K bytes of core. Actually a subset of ANSI COBOL, it also will run on Models 40 through 75; the full ANSI COBOL for DOS/360 requires 64K. The language processor offers enhancements including segmentation, table handling, cross-reference listing, and condensed procedure map listing, in an effort to make it easier for users to write larger programs while maintaining economy of core. The new program product is scheduled to be available under license in the second quarter of next year at $150/month. IBM, White Plains, N.Y. For information:

CIRCLE 335 ON READER CARD

meta-assembler

SYM/BOL is a symbolic COBOL generator, as opposed to a shorthand COBOL pre-compiler. Although the two types of programs both make a programmer's job easier and are less tiring on his writing hand, they differ in execution. A symbolic generator like this one uses short notation for COBOL words, but these notations are related to the original source language in an operator/operand way rather than through simple abbreviations. This means that SYM/BOL code looks a little more like assembly language code (with MOV for "move," etc.) The language uses fixed input fields and the user writes on preprinted tabular sheets rather than a coding pad.

The programmer benefits from having all COBOL features at his disposal (except for a few lesser used verbs like CLOSE unit). He, in turn, is encouraged to keep his programs orderly. Coding comes easier (for instance, all file descriptions—including SELECT's—are listed in the same place on one of the four input pads). Linkages can be

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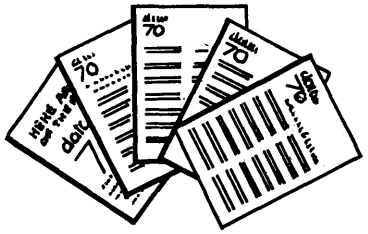

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provided to other programs, and in-line COBOL statements are okay. The meta-assembler is said to be very useful as a source language, too. The user need never get COBOL cards back.

The program lists for $2100 for the first installation. It requires a 360 series machine with 32K bytes, and contains a few ALC routines imbedded in its largely COBOL structure. For the price a user receives an object deck tailored to his computer. Installation and training are available optionally. MANAGEMENT INFORMATION SYSTEMS, Amarillo, Texas. For information:

CIRCLE 333 ON READER CARD

file management

Starting with simplified tabular forms, a user can create specialized COBOL programs for file creating, updating, and reporting through the JFMS file management system. The JFMS programs consist of a file definition module and three compiling modules. Their purpose in life is to make the world look a little better to those COBOL programmers who get tabbed with the responsibility for writing the utility and "one-time" report programs for their shop.

JFMS can juggle up to nine subfiles, sorting all of them independently if desired, and those subfiles can be defined on the basis of up to 150 selection criteria. Handles are provided within the system for performing the normal report writing tasks, like page breaking and subtotaling, and for some extras like figuring averages and maxima and minima for any numeric fields. (The user requests the additional information by checking a single column on the input forms.)

The supplier claims that JFMS will operate more efficiently than interpretive compilers being offered to do the same jobs since a new program object is produced for each run. This claim seems reasonable enough for repetitive applications anyway, or for those which can be accommodated by the selection criteria.

A 3500 source statement package, JFMS was originally coded for an EXEC II Univac 1108 with 65K; but since it is written in COBOL, conversions should not be difficult. The purchase price of $10,000 includes installation, training, and a maintenance news letter service. SEIDEL COMPUTER ASSOC., Northridge, Calif. For information:

CIRCLE 334 ON READER CARD

accounts payable

Since accounts payable practices in industry are fairly uniform, this package has been developed as a generalized program in modular form. It may be altered to accommodate individual coporate requirements or to fit the needs of service bureaus and banks with many users.

Written entirely in COBOL, the program runs on a 65K IBM 360 under DOS. Minimum operator intervention is required in a six tape drive, four disc configuration; but as few as six tape drives or four disc drives or any combination of four drives in a mixed system will do the job.

Weekly and monthly cost distribution reports with five levels of cost distribution summaries can be generated. Breakdown may be by department, subdepartment, contract, or whatever is useful in a particular operation. The program contains modules for determining and reporting cash requirements through a selected future date. Accounts would generally be aged by discount date. Input data is completely edited, and explanations of rejected data are printed. Following approval, checks and statements are printed, with a cash disbursement report. Facilities for maintaining and updating vendor names and addresses, commitment and distribution are provided. A listing of active vendors, on mailing labels if desired, can be printed. Other features include a report of all outstanding commitments, invoice trial balance reporting, and

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Reader—read (cpm), read stack select (cpm)
Punch—punch (cpm), punch stack select (cpm)
Console—numeric (char/sec), alpha (char/sec), alphanumeric (char/sec), carriage return
CPU—base instruction execution time (microseconds)

2. Based on your specific configuration, estimate the average number of machine hours lost due to inefficient peripheral performance (as calculated above).

3. Estimate the cost per hour for your computer site. (Include machine rental, personnel, fixed overhead, maintenance costs, etc.)

4. Multiply the results of questions 2 and 3 to arrive at:

a. dollars spent for performance not delivered
b. cost of wasted machine time and manpower
c. EDP budget dollars which could be used more productively
d. cost of overtime production as a result of inefficient performance

Peripheral Monitor*, a software package, was developed so that this information would be available to your installation. P.M. uses the speed and accuracy of the computer to measure and document the actual performance of Systems/360 peripherals and compares them to the manufacturers rated speeds. P.M. addresses itself to the most basic level of systems performance measurement, *the operation of the peripheral devices!* When peripherals are not performing near rated speeds, no matter what techniques are used to improve operating system performance, equipment utilization or software/hardware interactions, your system will *still perform only as efficiently as the peripherals!* For a brochure describing the Peripheral Monitor System, please call or write:

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control and balance totals for a complete audit trial of the system. Provision for historical analysis by vendor has not yet been included.

The accounts payable program may be purchased for $6K. It may also be leased—for $200 a month—and 75% of the monthly payment can be credited toward purchase. Both prices include five man-days of technical installation support. URS SYSTEMS CORP., San Mateo, Calif. For information:

CIRCLE 336 ON READER CARD

letter writer

It seems that college fraternities could do themselves a favor by pooling enough funds to buy a product like PROFILE Letter Writer. The vendors of the product claim that it can be used to create "person to person" letters, and in a single pass can print out up to 255 different letters with innumerable variations in each one. Think of the possibilities. *"you won't believe this dad, but* I need some more money" or *"had some troubles with the car again, so* I need some more money" or *"tuition costs are up again,* so I need . . . "

PROFILE merges extracted file data with coded message specifications to produce "fund raising" letters, or direct mail ads, government mailers, etc. It is written in assembly language and requires at least a 35K partition on a 360 series machine. Its price is $5000. COMPUTER DYNAMICS INC., Berkeley, Calif. For information:

CIRCLE 337 ON READER CARD

code and go fortran

IBM Code and Go FORTRAN, previously announced as a Time-Sharing Option processor (Feb., p. 219), will now operate as a batch processor under other options of OS/360, such as MFT and MVT. The new capability is designed to speed throughput for users who process small jobs. It requires a minimum of 88K bytes of available core storage under OS/360. As previously announced, Code and Go FORTRAN will be available under license in the first quarter of 1971 at $275/month. IBM, White Plains, N.Y For information:

CIRCLE 339 ON READER CARD

file compile

ASAP (As Soon As Possible) is a file management and retrieval system based on the ASAP compiler, designed for 360 OS or DOS with minimum 40K partition. For use in data management and multi-report generation, ASAP works in a load-and-go environment, and does not require the programmer to be concerned with JCL for either files or sort control records. (All JCL is defined once for master files, unit record files, sort work areas, and is submitted once for a multi-program ASAP run.)

No modifications are made to operating systems, and ASAP installation time is claimed to be less than an hour. During a single pass of the master file, ASAP updates and performs multiple report generation. Security protection is maintained for files and for sets of records within the master files. Its price is $500/month rental or $20K for purchase. INFORMATION ASSOCIATES, INC., Fairport, N.Y. For information:

CIRCLE 338 ON READER CARD

job cost system

Job Cost System is just what its name implies, a cost accounting system which will interface with this vendor's general ledger system or will provide cost accounting information for any existing general ledger.

It provides cost information for multiple levels of project management and automatically generates accounting information for the general ledger. Manual coding of accounting distribution for purchases, labor distribution or materials issues is eliminated. The sys-

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OVERVIEW OF THINGS TO COME—Presently, plans call for the delivery of over 150 technical papers at the Simulation Conference. The broad range of subjects covered in the program include: Earth Environment, Civil Systems, Process Industries, Aero-mechanical Industries, Hybrid Applications, and Continuous and Discrete Simulation Languages. Complete Conference Proceedings containing all technical papers will be available.

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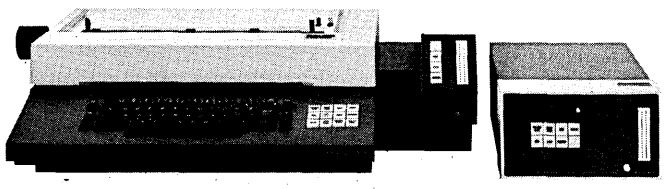

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tem, by interfacing with other administrative systems, automatically produces the accounting distribution codes based on job number, work order or purchase order number. It also can calculate and apply overhead and generate all entries for clearing accounts. Costs of products and services are isolated and are maintained and reported at four levels.

The system operates on the 360/25 and up and, like the general ledger system, is written in COBOL and requires 32K of storage. Also like the GL system, it can handle multiple companies and does not require a predetermined numbering structure. All account numbers, organizational coding and their descriptions can be assigned by the user and can be changed without any additional program. Price of the job cost system is $2,500 when purchased with the ledger program. Alone it sells for $3,500. Both prices include installation and training. ANCOM SYSTEMS, Los Angeles, Calif. For information:

CIRCLE 340 ON READER CARD

dec cobol = dibol

A new business-oriented language called DIBOL, for Digital Equipment Business-Oriented Language, is designed to extend the market for PDP-8 minicomputers to smaller businesses. DIBOL is a COBOL-like language made up of three distinct components: a language processor that enables a user to state the problem in a simple manner; a data management system that operates on business files and permits a user to do input operations, sorting, and file maintenance without additional programming; and a monitor that ties the components together and enables the user to operate the system easily. DIBOL will be available this summer. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 341 ON READER CARD

nova fortran, algol, dos

FORTRAN IV, ALGOL 60, and a disc operating system have been announced for the Nova and Supernova minicomputers. The disc operating system will be device independent and provide a complete file system for manipulating data by name. A series of complex overlay routines will allow the system to provide "virtually unlimited" address space. The DOS is not expected to be released to users until sometime this summer.

The FORTRAN IV compiler will meet ANSI standards and will allow double precision complex arithmetic. The design goal was for the optimum coding, with some sacrifice of speed. A faster but less optimal FORTRAN will be available later, and will require only 4K core.

Both new compilers are described as "full-blown," require 8K core and are core resident, using overlays. They are table-driven, and coding is tightly packed, resulting in compilers that actually occupy about 7K. Object code produced by the compilers is compatible. Syntax-checking aids are not provided, on the theory that FORTRAN and ALGOL users are more interested in code optimization. DATA GENERAL CORP., Southboro, Mass. For information:

CIRCLE 343 ON READER CARD

payrolling

In San Diego, employers have been offered a chance to have their payroll processing done for them, from time card preparation to sending checks. If Southern California is too far from your office, the service firm offers to sell its payroll program for use on your own cpu. The software/service vendor claims that in-house conventional payroll systems cost at least 50 to 60 cents per check, and that their program can cut this cost to 35 cents.

The unnamed FORTRAN program figures payroll, deductions, year-to-date earnings, etc., for salaried, hourly,

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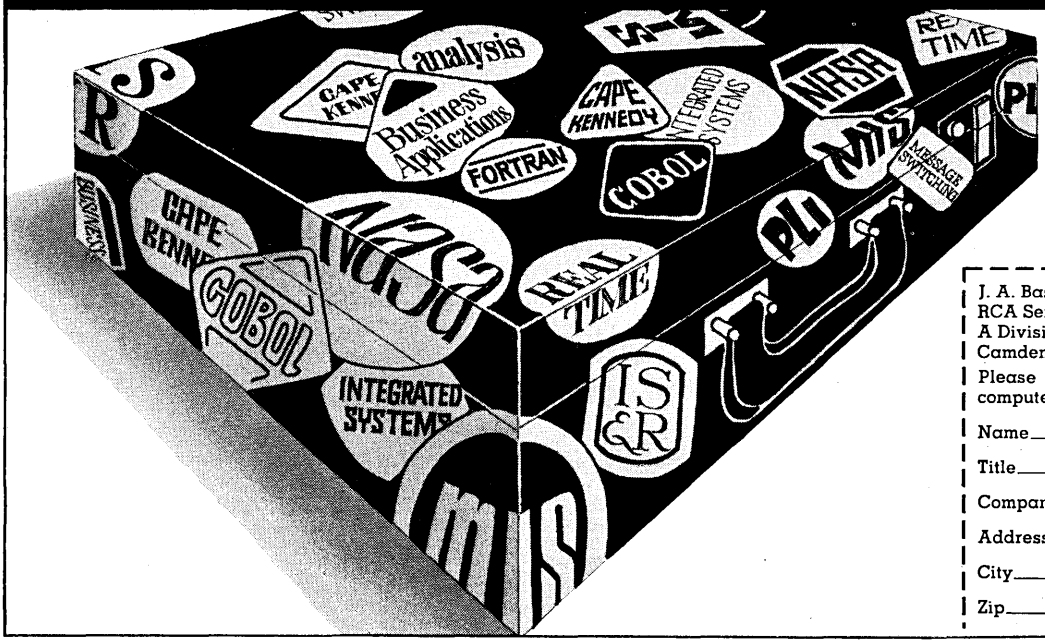

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CIRCLE 82 ON READER CARD

or piece work employees. It then can be used to automatically transfer funds to savings accounts or bond programs. The user firm receives a disbursement journal, personal payroll journal, payroll summary, plus reports of labor distribution and pre-punched time cards.

Priced at $10K plus installation costs, the program requires a 64K machine with disc or four tape drives. PROCESS CONSULTING AND COMPUTING, San Diego, Calif. For information:

CIRCLE 344 ON READER CARD

360-time-sharing pl/i

SYSTEL is a low overhead, interactive time-sharing software system which incorporates a dialect of PL/I. It provides terminal I/O and interactive file handling, and may be used with most t-s monitors available for byte-oriented computers. It is designed for OS/MVT with minimum 64K core for a single user; additional users require 3.5K more per user up to a limit of 64 simultaneous users. SYSTEL's price is $6800. The system was developed by a university and has been in successful operation since 1968. HYGAIN TECHNOLOGIES, INC., Westport, Conn. For information:

CIRCLE 345 ON READER CARD

ansi cobol

This COBOL compiler works under the EXEC 8 operating system and conforms with ANSI standards (American National Standards Institute, formerly USASI). It operates in the sign-over-punch mode and includes indexed sequential file access capabilities as direct COBOL verbs. Univac is also developing aids for conversion from competitive to Univac data formats, and from competitive to Univac ANSI source code. The compiler is free to Univac 1100 series customers. UNIVAC, Philadelphia, Pa. For information:

CIRCLE 342 ON READER CARD

inventory forecasting

EMPHASIS, Evaluation Management using Past History Analysis for Scientific Inventory Simulation, is for use by Century 100 and up users with minimum 32K. The system is designed in two phases, the first of which is presently available. Phase 2, to be released later this year, will add automatic preparation of purchase orders to present capabilities.

EMPHASIS is addressed to the manufacturing, food, and hard goods distribution fields. It analyzes the historical movement of inventory items, taking into account annual usage, seasonal effects, etc.; selects an optimum mathematical model for the forecasting of future demands; calculates economical order quantities and reorder points; and analyzes discounts and other vendor pricing variables in order to determine the best replenishment strategy for each item. And if there's any disagreement, an override capability is provided for the organization's buyers.

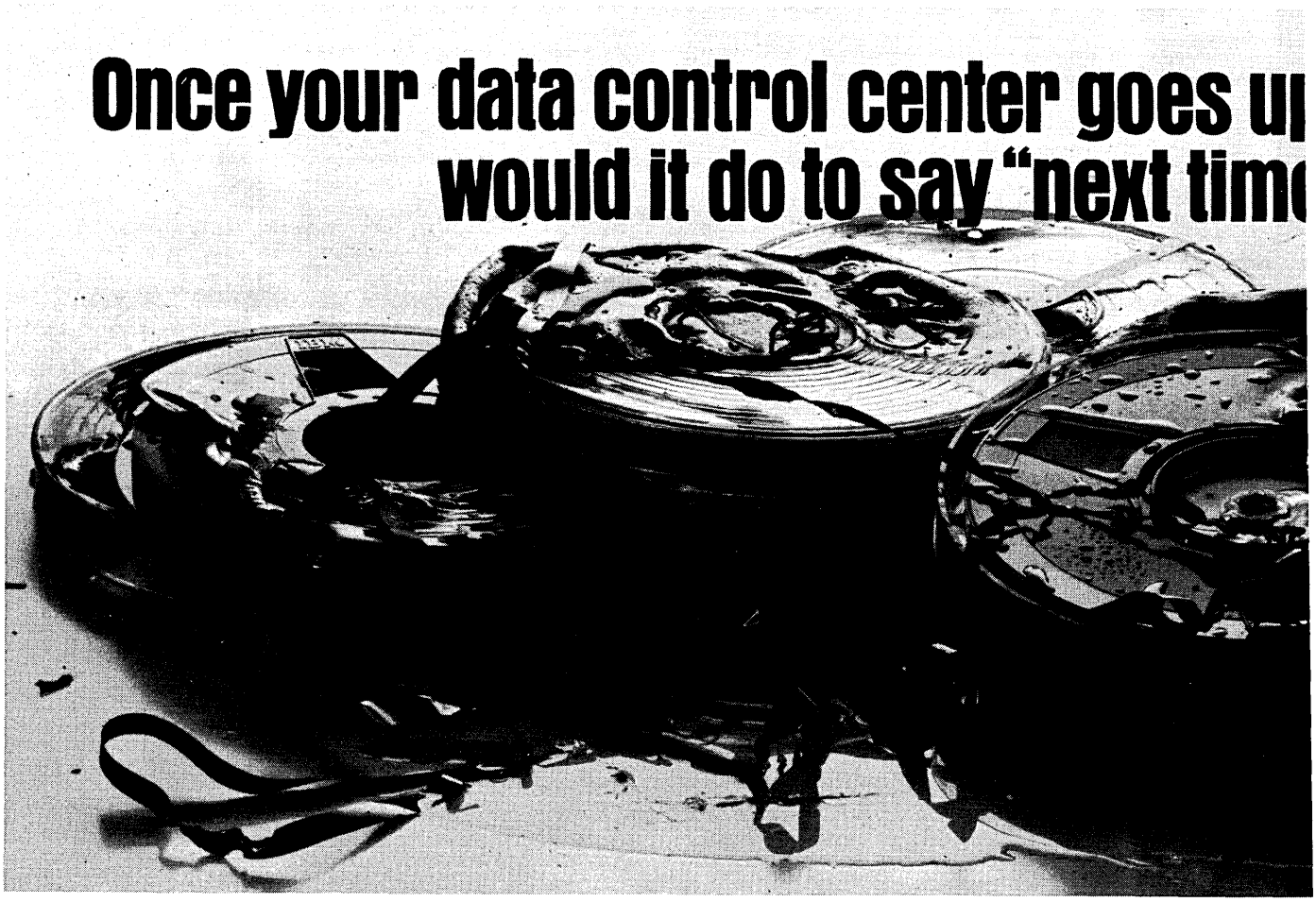
The system is written in NEAT/3 with some FORTRAN. And it's still bundled (i.e., free) at present. NCR, Dayton, Ohio. For information:

CIRCLE 346 ON READER CARD

os/200 data base subsystem

A data base subsystem that can index and retrieve information from millions of records stored on discs has been developed for the Honeywell OS/200 operating system. The subsystem is organized into two major units that are physically separate on discs.

The first, a directory of the files, stores all descriptive information about the file and subfile and the location of data within them. The second, the



data element, organizes data in a hierarchial fashion into master records, detail records, and data items. A data item is the smallest recognized element of information in the system and is roughly associated with the concept of a field, such as age, height, economic level, salary, etc. A detail record, which can be repeated many times within a master record, is formed by combining a fixed number of data items. A master record, the sum of its detail records, is identified by a unique primary key and may have up to six formats within a single subfile. Any number of secondary indices are maintained by the system to allow fast retrieval on the basis of the value of any data item in a subfile.

The OS/200 data base subsystem will be available in the third quarter to users with a Model 1200 or larger cpu. HONEYWELL, Wellesley Hills, Mass. For information:

CIRCLE 347 ON READER CARD

accounts payable

First package from this firm is an accounts payable system, written in COBOL for System/360 configurations having at least 32K of core and either disc or tape and disc external storage. Features include extensive editing of all input data, manual or automatic due date calculation, pre-payment audit ability, automatic check writing and reconciliation, and multi-level expense analysis. The $5K purchase price includes documentation, but installation and special customizing, if necessary, are additional. The firm was formerly in the "systems advisory" business, and has over 100 consultants on its staff to do the customizing. KEANE ASSOCIATES, INC., Wellesley Hills, Mass. For information:

CIRCLE 348 ON READER CARD

file management

SCORE-III, an expansion of the SCORE COBOL generator system, is intended to extend the package's capabilities into the area of file management as well as information retrieval. The SCORE system is designed to facilitate accessing and retrieving of information from large files of stored data. It generates as output a COBOL source program which may be either compiled and executed or punched, depending on user needs.

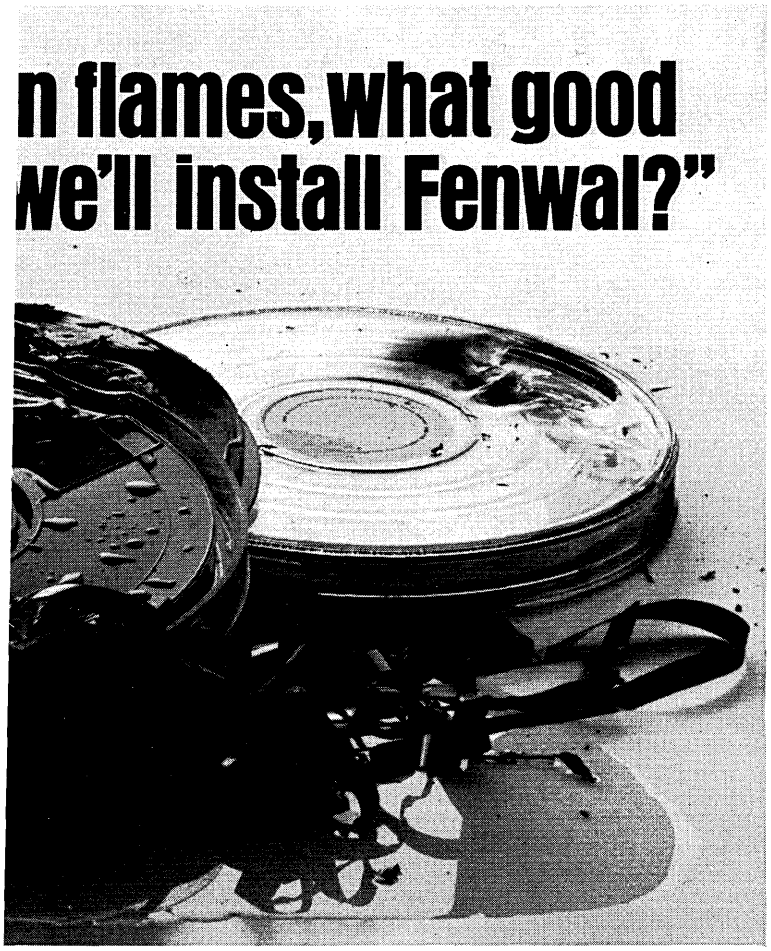
New capabilities include extension of multiple file processing, provision for entry points by users in their own code, and a variety of new retrieval and formatting options. SCORE can be used with 360/25's or larger under both DOS and OS, using a minimum of 32% of primary core storage in the former, a 65K minimum in the latter. It is also available for Honeywell 200 and Spectra 70 series, the Univac 1108, and the B-5500. Its price is $12,500. Version III joins a popular family. In the two years since SCORE's introduction about 100 packages have been sold. PROGRAMMING METHODS, INC., New York, N.Y. For information:

CIRCLE 349 ON READER CARD

configuration management

Configuration Management Status Analysis and Reporting System, designed in accordance with Military Standards 480-483, can be used by defense contractors to provide configuration management support on military procurements. Written in COBOL, it requires 64K on System 360's with standard peripherals. Reports produced by the system include baseline configuration lists, generation breakdown lists, where-used lists, and various change impact and analysis reports. Military provisioning data and document retrieval equipment outputs can be incorporated in the basic system. The program's price is $50,000. DELTA DATA SYSTEMS, INC., College Park, Md. For information:

CIRCLE 350 ON READER CARD



The time to prevent the loss of invaluable records or the ability to process data is now. Today. Before a fire wipes out your computer, payrolls, production control or customer orders.

A Fenwal Fire Suppression System prevents just that. Fenwal, the only producer of explosion suppression systems, uses the same high speed technologies to extinguish fires instantly, safely and cleanly.

Using a variety of sensors, a Fenwal Fire Suppression System can detect and extinguish fires long before other systems begin to react to the flames! Instantly, chemical suppressants knock out the blaze without endangering personnel or causing equipment shutdown. Downtime is eliminated, equipment left clean, your records intact, because the entire area is left dry.

Isn't it time you called in Fenwal to look over your plant? Write today for Fenwal brochure "Engineered High Speed Fire Protection Systems." Fenwal Incorporated, Main Street, Ashland, Mass. 01721.

Fenwal®

CIRCLE 189 ON READER CARD

new literature

1969 DATAMATION INDEX: 16-page subject index to DATAMATION, Vol. 15, 1969, includes references to material in feature articles, conference reports and particulars, Editor's Readout, The Forum, Books, News Scene, and System Spotlight. DATAMATION, Pasadena, Calif. For copy:

CIRCLE 301 ON READER CARD

THE WHOLE SYSTEM: Annotated bibliography, with separate title and author index, amounts to 183 pages. Sections include abstracts of books on dp (hardware, software, applications), information storage and retrieval, systems analysis techniques, management information systems (data base, bank and management analysis) and selection and training of systems personnel. The bibliography also lists related articles that have appeared on the various subjects covered in *The Journal of Systems Management* and *Ideas for Management*, from 1960 to date. Price to members: $3.50; others, $5.00. ASSOCIATION FOR SYSTEMS MANAGEMENT, 24587 Bagley Road, Cleveland, Ohio 44138.

SEMINAR DIRECTORY: More than 220 organizations that offer seminars, workshops, short courses, conferences and home study courses in dp or related technology are listed in *Computer Seminar Directory*, 60-page, softcover publication. Represented are colleges and universities, professional societies, trade associations, private educational companies, government agencies, and industrial corporations. Specialized subjects (165, from concepts to marketing applications, COBOL to time-sharing) are indexed, with the name and address of each pertinent educational organization given. Price: $3; payment must come with order. EDUCATION AND TRAINING ASSOCIATES, P.O. Box 304, Dunellen, N.J. 08812.

SIMULATION AND SIMSCRIPT: Two companion brochures, 12 and eight pages, explain the principles of simulation and advantages thereof—i.e., predicting amount of financial risk, evaluation of new processes and equipment—and the characteristics of Simscript II Plus, a simulation language that is similar to English. This language operates on a System/360, features fast assembly and a self-correcting compiler. It can be rewritten for other dp systems. The introductory brochure also offers seven simulation/language courses. SIMULATION ASSOCIATES, INC., White Plains, N.Y. For copies:

CIRCLE 302 ON READER CARD

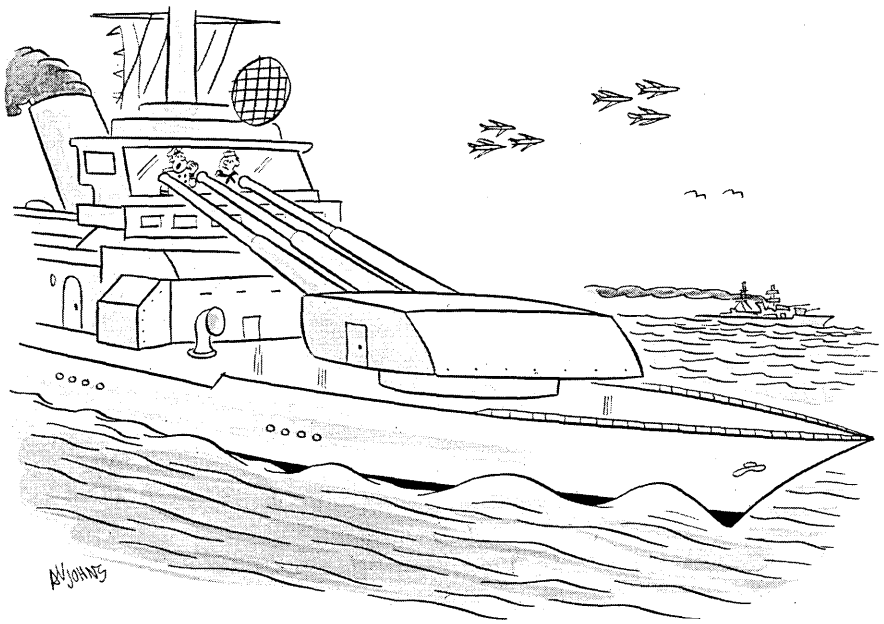
HANG IT OR SLIDE IT: 28-page color catalog itemizes dp storage and reference equipment in compatible modules, featuring Hang-A-Ref binders and Slide-A-Ref connectors used with control rack units for transferring and storing data reports. Data and ring binders aplenty accompany them. A separate section is devoted to products for programmers, including documentation kits and systems sets with preprinted tabs for standard needs such as flow charts and block diagrams. NATIONAL BLANK BOOK CO., Holyoke, Mass. For copy:

CIRCLE 303 ON READER CARD

MSI IN YOUR POCKET: A guide that can fit in a small pocket (it's less than six inches long, ¼ inch thick) contains 100 close-packed pages of information on MSI circuit functions, pin-out and loading rules, with basic descriptions of simple bipolar integrated circuits used with MSI. Among the 56 devices listed—including some products not yet introduced—are counters, multiplexors, encoders and decoders (9300 series); and in support functions, memory cells, gates and flip-flops (9000 and 9600 series). An index by function is also included. FAIRCHILD SEMICONDUCTOR, Mountain View, Calif. For copy:

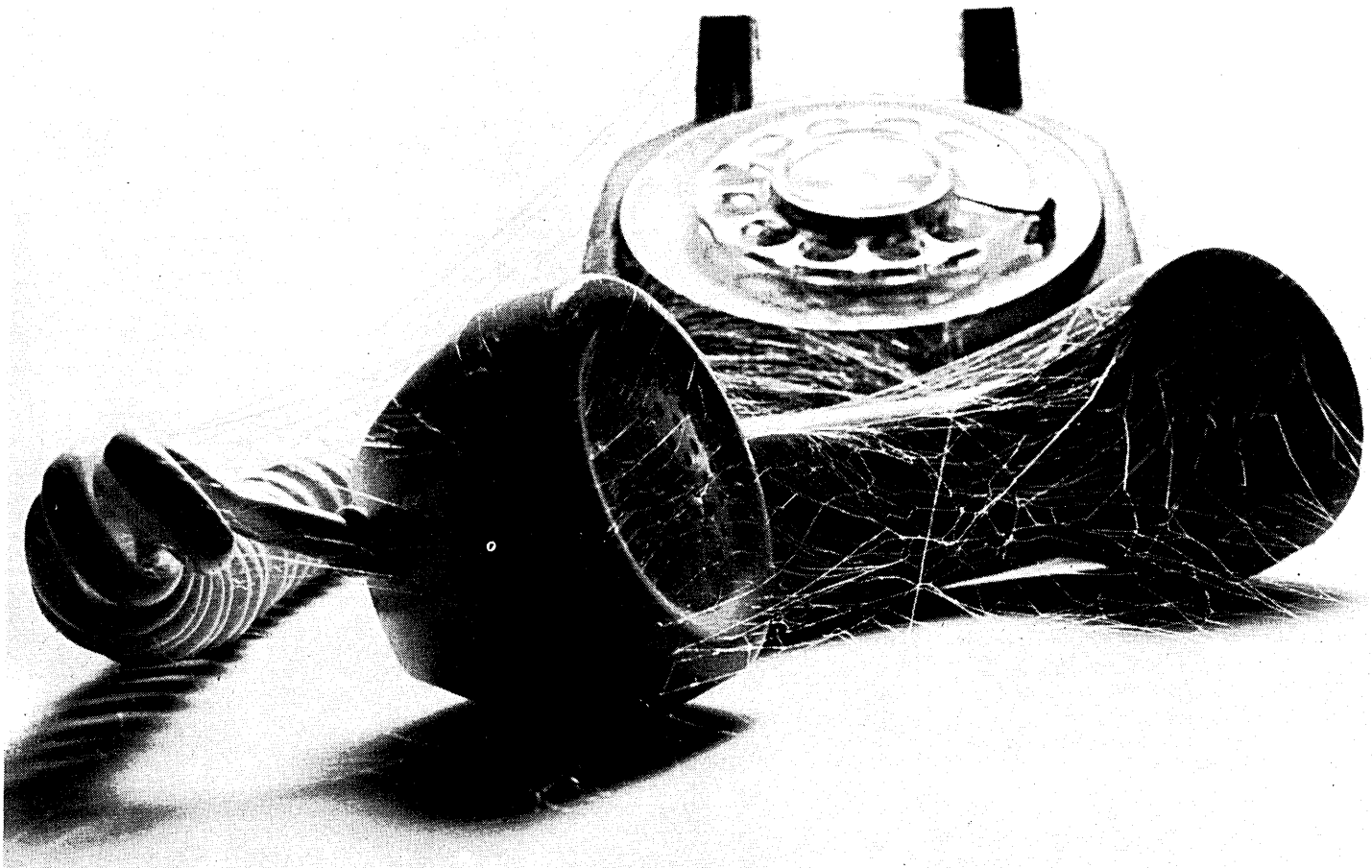
CIRCLE 304 ON READER CARD

MULTI-LINGUAL OCR: An OCR system capable of reading, displaying and converting any printed or typewritten material, even that with intermixed fonts or foreign language symbols, is described in eight-page brochure with insert, listing special capabilities of the



"This is the bridge! Abort computerized firing! Abort computerized firing!"

© DATAMATION ®



Time-sharing is like renting your very own busy signal.

If your service bureau keeps you waiting, it's probably because somebody else is getting served first.
But now there's a different kind of time-sharing that only you can use.
It's called the Interplex System I. It's an in-house system with a 12K general-purpose computer, hard-wired to as many as 16 specially designed terminals. So you don't need phone lines.
And because it's your own in-house system, you can use it as much as you want without paying an extra cent for it.
It's easy.
Our new time-sharing terminal is the first to combine BASIC language programming with an electronic calculator in a single desk-top unit. So you can do up to 90% of your time-sharing jobs in BASIC without leaving your desk. And for a lot less than you're paying now.
You won't need any more equipment, because the terminal's also an electronic calculator. So you can even stop in the middle of your own program to run your calculations. And you don't have to wait for anybody else.
The Interplex System I. It's a different kind of time-sharing. You share it with yourself.

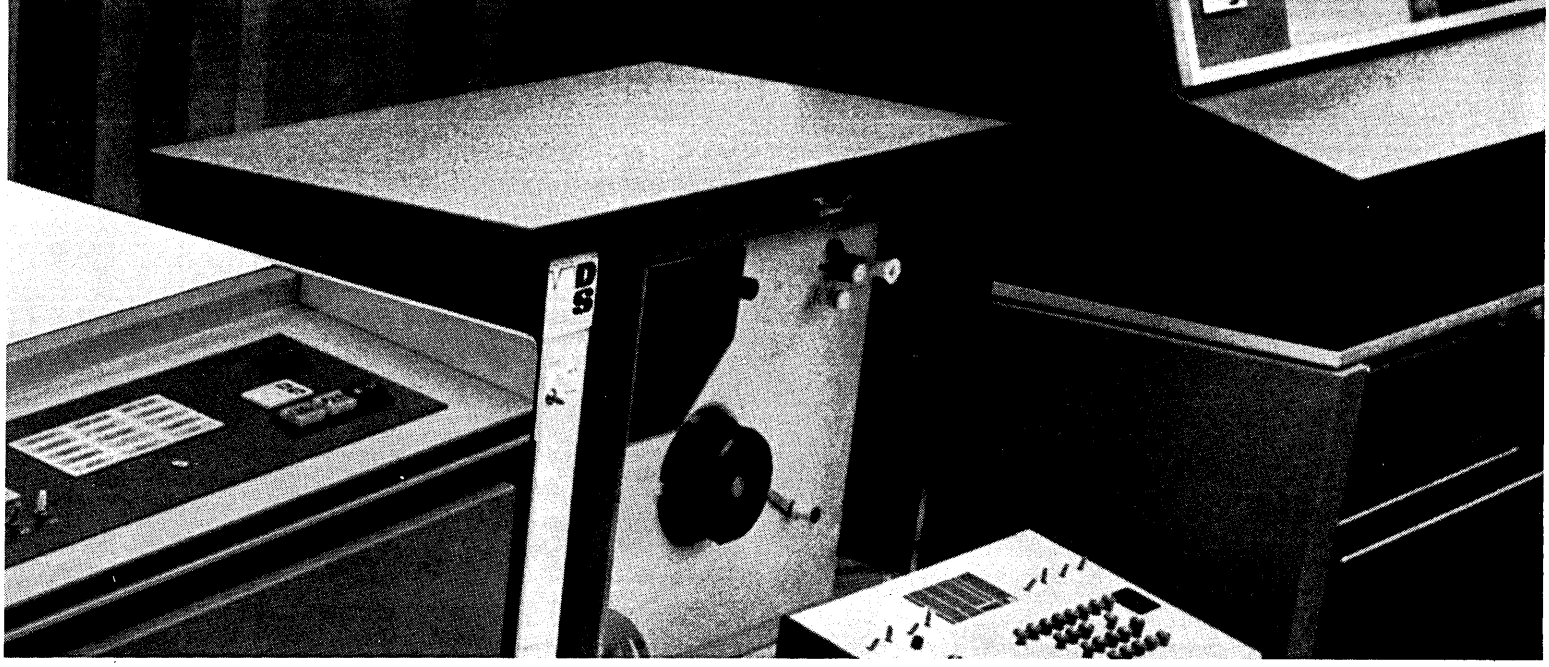
interplex

Interplex Corporation
400 Totten Pond Road
Waltham, Mass. 02154

CIRCLE 168 ON READER CARD

"Starting now, when Mohawk speaks, IBM listens."

New product talk by Pat Smith, Vice-President, Product Planning.



"You need to send data from Salt Lake City into an IBM 360 computer in Brooklyn, let's say, and you want to talk mag tape on-line. Practically speaking, the only way you could do this would be to set up another 360 out in Utah.

"Well, not any more. We've built a black box called a Binary Synchronous Communications Adaptor that lets one or more of our Data-Recorders talk directly on-line to most IBM 360 configurations.

"You can talk mag tape from Data-Recorder to 360; you can have the 360 talk back to the Data-Recorder; you can have the 360 talk to a printer. You can poll your remote stations, and then select the ones you want to talk with.

"The Bi-Synch box can be used in a point-to-point system, or a multipoint system. The second one gives you station addressing capabilities. You can use permanent connections, or a leased line, or a dialup switched network setup. The possibilities are wide open.

"IBM gave Binary Synchronous Communications its Flash Gordon name. We'd prefer something simpler, but since we're talking to their computers, we might as well stick with their names, too.

"We're very pleased with one fact: there's no need to modify operating systems software. You can use ordinary BTAM or QTAM.

"About forty per cent of our business is in data communications. It's an immense area that's hardly been scratched. We like it for two reasons, really. It opens up new markets to us, which means more sales. And it lets us offer our present clients greater systems possibilities, which means better service. Paying attention to both is what has made Mohawk."

Mohawk Data Sciences Corp.
Herkimer, New York

MDS

new literature ...

Model 370. The scanner/reader can digest Greek, Cyrillic or Hebrew characters (it only gives up on Chinese), and can automatically adjust for character size, skew, displacement and variations of line thickness. It can read up to 16 fonts and point sizes in one go-through and identify them; additional fonts can be stored. It also recognizes editors' handwritten marks. The entire system consists of scanner; film transport; general purpose computer that provides flexible page formatting and outputs to mag tape, punch cards or display; and recognition display units. COMPUSCAN, INC., Leonia, N.J. For copy:

CIRCLE 305 ON READER CARD

DATA PLOTTING: Information sheet describes Speedplot II data plotting program for those who do not normally have access to a digital plotter, but can submit jobs for a computer run. The program, written in COBOL, features up to six curves per plot, with an execution time of two seconds for an 8½" x 11" sheet, including a data tabulation list. Speedplot also can be used for teaching elementary programming, because its source deck can be duplicated, then modified to solve individual problems. PACIFIC SOFTWARE SERVICES CO., Bellflower, Calif. For copy:

CIRCLE 306 ON READER CARD

VOICE RESPONSE: Fold-out six-page brochure describes voice response systems using telephone terminals converting tones to digital data to access computers for entry or retrieval. Output is in the form of up to 256 prerecorded words or phrases selected by the computer from a storage bank. Multiplexing allows simultaneous communication in up to 64 channels. These systems come with required software, and can be used on a stand-alone basis or to front-end a dp system. Specs and a block diagram are included. DATATROL, INC., Hudson, Mass. For copy:

CIRCLE 307 ON READER CARD

COMPUTER LINE: Four-page brochure describes line of general purpose computers with 300 interchangeable software programs and subroutines available off the shelf. Cpu's come with 900 nsec, 1.5 usec, or 1.75 usec cycle times and 74 instructions. Memories run from 4K expandable to 32K. Interfaces, peripheral equipment and other accessories are also listed. RAYTHEON COMPUTER, Santa Ana, Calif. For copy:

CIRCLE 308 ON READER CARD

HUMAN ERROR: 246-page publication examines ways to detect and correct input data errors made in the original collection and recording of the data by humans. Procedures for the optimum elimination of error from data fed to computerized information systems are detailed. Order AD-689 365. Price: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPARTMENT OF COMMERCE, Springfield, Va. 22151.

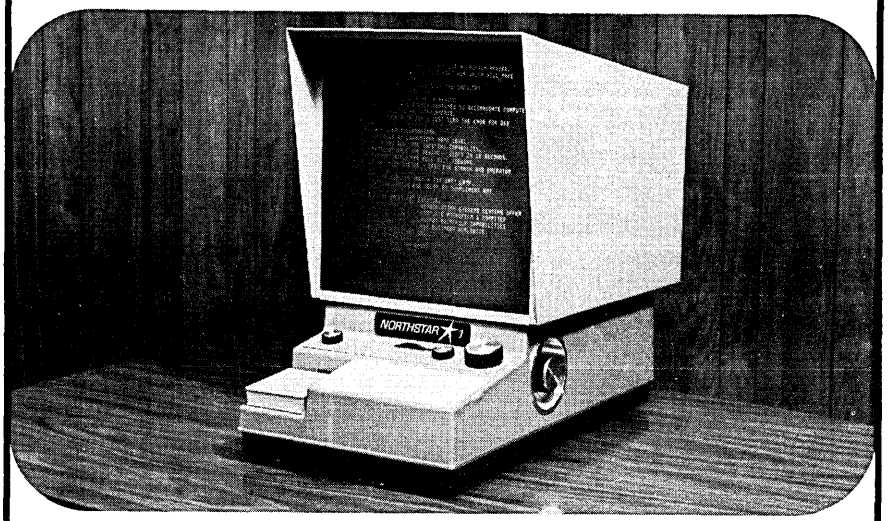
REDUCING DATA: 12-page brochure describes mag tape recorder/reproducer for data reduction. Main features are dual inertia drive, which permits selection between two torque-to-mass ratios, and a wide range of flutter correction. Plug-in heads may be removed and reinstalled without loss of azimuth adjustment. The VR-5000 Datalock also has a bi-direction 7-speed tape drive. BELL & HOWELL, Pasadena, Calif. For copy:

CIRCLE 310 ON READER CARD

UNRAVELING UNBUNDLING: 200-page manual goes into what has happened and what will probably happen in unbundling since January 1, 1970, and

NORTHSTAR 1 . . . bright new cartridge microfilm reader. . .

shows the way



NORTHSTAR 1 is showing the way in cartridge microfilm reader performance. It is the ideal reader for most commercial, industrial and institutional needs—combining ease of operation, wide capability, and economy.

Here are ten points which make *NORTHSTAR 1* really shine:

- ★ 14" by 14" high resolution, non-glare screen
- ★ takes both 16mm COM or conventional 16mm cartridges
- ★ simplest loading; automatic self-threading
- ★ automatic cartridge ejection
- ★ finest optics; 24X magnification
- ★ 360° optical image rotation
- ★ variable lamp illumination
- ★ both odometer and bar code index
- ★ minimum of controls — all on front console
- ★ rugged construction

Now let us show you the way to *NORTHSTAR 1*. Call or write

Reproduction Systems Inc

1399 South Seventh East, Salt Lake City, Utah 84105, (801) 487-0785

A Business Service of Transamerica Corporation

Other RSI Computer Microfilm Service Centers in:
San Francisco • Minneapolis • Denver • Tulsa • London
And soon in Los Angeles • Omaha • Frankfurt • Paris

CIRCLE 139 ON READER CARD

How to save your paycheck from you.

It's great to have a pocket full of paycheck. But temptation being what it is, things happen to the part of it you intended to save. It disappears.

That's why the Payroll Savings Plan for U.S. Savings Bonds works so well. It gets to your money before you do. You just decide how much you want to save out of each paycheck and it's taken out automatically. And painlessly.

Your money goes into U.S. Savings Bonds and that means a lot to you. It means you get $4 for every $3 you invest—5%—when held to maturity which is now 5 years/10 months.

You work for your money. Let the Payroll Savings Plan make sure some of it works for you.

... a message from Xerox Corporation in behalf of the 1970 Payroll Savings Plan.

CIRCLE 92 ON READER CARD

new literature ...

how the user can best take individual advantage of the developments. Unbundled effects are discussed on personnel training, support services in hardware and software, management planning and the consultant's role. The manual also gets down to the nitty-gritty of prices and comparatively selecting computers, products and services, as well as giving guidelines on federal income tax. Price: $65. OYER PROFESSIONAL COMPUTER SERVICES, INC., New York, N.Y. For information:

CIRCLE 309 ON READER CARD

SEA MONITOR: Sonar is attended by CPMS-216 computerized data acquisition system for monitoring either ship or shore-based array systems, as described in four-page bulletin. Frequency range runs from 1 to 20 KHz; data can be accessed on real-time, or is processed and analyzed with report by printout or mag tape. The monitoring device provides for automatic self-checking and calibration. OCEAN DATA EQUIPMENT CORP., East Providence, R.I. For copy:

CIRCLE 311 ON READER CARD

WIDE VS. NARROW: A comparison of wide band and narrow band data transmission—as it affects supervisory control systems in relation to time required for polling, interruption and differential delay distortion, and sapping of quality through channel loss—is given in a two-page bulletin. Depending on the number of stations and the ratio of constant to intermittent speed, the point of diminishing returns is calculated. Illustrative figures show bit length as a function of frequency, and frequency vs. the relative effect of differential delay distortion at various transmission rates. QUINDAR ELECTRONICS, INC., Springfield, N.J. For copy:

CIRCLE 312 ON READER CARD

STRIPS FOR ACTION: Printout speeds of up to 200 cps asynchronously are reached by Model SP-1 strip printer, described in four-page data bulletin. The unit is portable, designed for desk top, requires only data signal input and 115 VAC power, and is all solid state, including the print head. Applications vary from paper tape punch to communications terminal. Descriptive drawings are included with general specs. KDI ADTROL, INC., Broomall, Pa. For copy:

CIRCLE 313 ON READER CARD

STORAGE CONTROL: Four-page brochure describes storage control unit (Model 728), that together with the 11-high Model 714 disc storage drive is plug-for-plug compatible with IBM's 2314 selector channel for the System/360. The controller and drive are stand alone units. Storage capacity relative to the number of drives is given (in millions of bytes), and a graph shows drive access time according to the number of cylinders traveled. INFORMATION STORAGE SYSTEMS, INC., Cupertino, Calif. For copy:

CIRCLE 314 ON READER CARD

KEY-TO-TAPE-TO-VOICE: A communications option which permits data stored on mag tape to be transferred over voice grade lines is presented in information sheet. Fitted to a KDR key-to-tape data recorder, it transfers data over standard transmission systems to a similar terminal. It employs data compression and binary synchronous communications techniques to increase throughput and reduce line costs and has its own error detection. POTTER INSTRUMENT CO., INC., Plainview, L.I., N.Y. For copy:

CIRCLE 315 ON READER CARD

OVERSEAS TRADE: To aid the U.S. businessman selling overseas, the new edition of *Checklist of International Business Publications* itemizes more than 350 overseas business reports along with 19 U.S. trade mission reports and identifies customs journals and trade lists containing names and addresses of firms handling specific commodities in foreign countries. Free reprints available from SUPERINTENDENT OF DOCUMENTS, U.S. Government Printing Office, Washington, D.C. 20402.

ANGULAR CONVERTER: A solid state synchro-to-digital converter which accepts angular data from remote synchros and resolvers and converts it to true digital display is summarized in bulletin sheet. Its manufacturer claims the device will obsolete electromechanical angle indicators. It can be used with air-data, navigation and guidance computers. Characteristics are compared with those of conventional servo repeaters, and specs are listed. THETA INSTRUMENT CORP., Fairfield, N.J. For copy:

CIRCLE 316 ON READER CARD

ENGINEERING AIDS: 32-page catalog offers engineering and drafting aids, such as slide rules, templates, magnetic visual control boards, fitting detail guides, English-metric converters and French curves. Also listed are manuals like the *Human Factors Engineering Handbook,* giving anatomical measurements, lifting and force factors, visibility and audition data that are used in designing devices for man's use. TAD PRODUCTS CORP., Beverly, Mass. For copy:

CIRCLE 317 ON READER CARD

TYPESETTING: The basics of computerized phototypesetting are explained in six-page brochure, accompanied by a flow diagram of procedure. The difference between raw and justified tape methods, and the role of the computer in typesetting instructions, is clarified. Heart of the system is a phototypesetter which can set 40 newspaper-width lines per minute, as opposed to 5 or 6 lines per minute turned out by the regular linotypes. Transmission of copy in tape form over telephone lines is also explained. COMPUTER TYPESETTING CO., Louisville, Ky. For copy:

CIRCLE 318 ON READER CARD

WIRY PROGRAM: Seven-page application abstract explains use of a program enabling circuit designers to determine where to place components and how to route conductors on IC boards. Input and output for the program (called PWR, for Placement and Wire Routing) are described, and an illustrative sample program plus a facsimile of a plotted circuit board mask are reproduced. The time taken to complete various kinds of circuit analyses is also tabulated. REMOTE COMPUTING CORP., Los Angeles, Calif. For copy:

CIRCLE 319 ON READER CARD

WHAT'S IN A ROOM: Particulars on floors, walls, ceilings, air conditioning and lighting—everything but the equipment and people—for a computer room are given in four-page brochure. Total environmental control is offered, from raised floors to plastic-laminated surfaces. Walls are movable; ceiling spans of up to 60′ can be installed without support. The whole facility can be obtained in a package, or components ordered and assembled separately. WESTINGHOUSE ELECTRIC CORP., Grand Rapids, Mich. For copy:

CIRCLE 320 ON READER CARD

IMAGE PROCESSING: Capabilities of the computer in image processing are described in 84-page report on progress in that field, prepared for the Advanced Research Projects Agency at the Scripps Institution of Oceanography. Image restoration as a function of noise level in the degraded image and noise characteristics of different sensors used for recording images are compared. Order AD-698 359. Price: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPARTMENT OF COMMERCE, Springfield, Va. 22151.

PDP-8/L is the best small computer ever made. Bar none.

More than 6,000 of these, and predecessors in the PDP-8 family, are already installed.

We have the peripherals that go with them. The software libraries are bulging. More experience has been accumulated, more application data gathered, more service records, more of everything -- than has ever been accumulated, exchanged, applied to any other small computer in history.

And more PDP-8/L's have been installed in other people's equipment than any other computer. By far.

12 bits. 4K core memory, expandable. Teletype. $8,500. Quantity discounts. Off the shelf delivery.

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COMPUTERS · MODULES

Digital Equipment Corporation
Maynard, Mass.

PDP-11 is the best small computer ever made. Bar none.

PDP-11 is more than a new computer. It is a new idea in computers. Its secret is an architecture which makes it more powerful than any other 16-bit computer.

Everything is attached to a single high speed, asynchronous UNIBUS.® The processor, the memory, the peripherals—everything.

And because of this, peripheral registers are accessible as part of memory. Peripherals talk to peripherals without bothering the central processor.

But that's not all. Interrupts are multi-level, automatic. There are eight MSI general-purpose registers. Fast single and double operand addressing. An instruction set so powerful that you'd think it belongs to a giant computer.

And PDP-11 handles bits, bytes or words with ease.

16 bits, 4K core memory expandable to 131K. Teletype. $10,800. Quantity discounts. Thirty to sixty day delivery.

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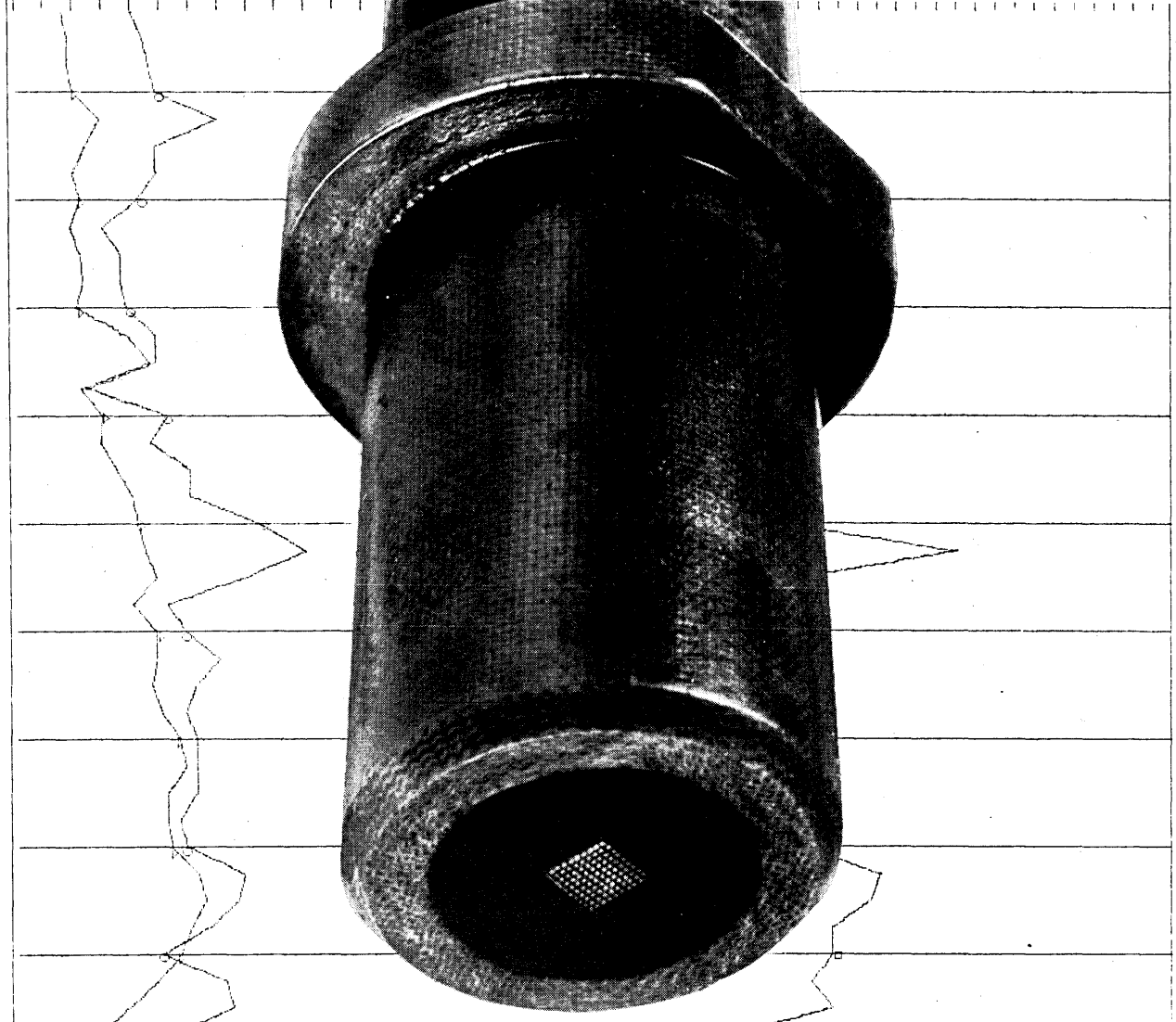
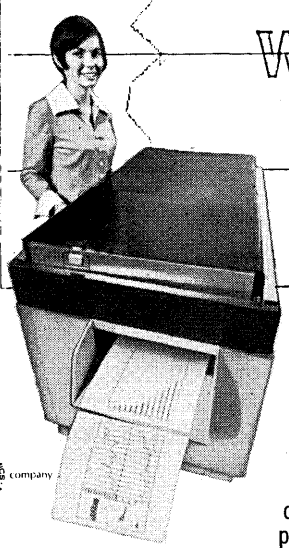
COMPUTERS · MODULES

Digital Equipment Corporation
Maynard, Mass.

CIRCLE 113 ON READER CARD



We make the paper work!



Pen and ink were fine for signing the Declaration of Independence . . . but they certainly aren't the way to do your plotting in the 70's. This is the age of electrographic paper.

Our new second-generation plotting system, to our knowledge the best-balanced and most-comprehensive available, features an electronic writing head and electrographic paper . . . an inexpensive commercial product . . . which give you the capability of writing electronically at microsecond speed. The resultant image is of the highest contrast and best quality available from any computer graphic system.

Major features of the new plotter, in addition to its unique writing head and electrographic writing, are its vector and character generators and fully automatic operation. Its major advantages are in the generation of alphanumeric characters and symbols . . . at speeds from 10 to 60 times faster than pen and ink methods. This second-generation plotter also provides low cost computer utilization, less complex programming, and practical on-line operation.

All the work of going modern has been done for you with this Graphic Data system. Complete interface and software is available either for on-line or off-line operation. Why not see the 70's in with a second-generation plotter by calling (617) 272-4445.

GRAPHIC DATA, INC. 169 Bedford Street, Burlington, MA 01803

CIRCLE 89 ON READER CARD

operating system, there reportedly will also be application programs for commercial dp, time-sharing, and data management. Word leaking out is that the system will have smaller memories than existing 7000's and "significantly" smaller price tags than the $10 million-or-so biggies. There may be a new 6000 line configuration in the works too, but sources were unsure as to whether it would be a stand-alone or an I/O front-ender.

TRANS-SIGMA
TRANSLATION
TRANS-GENERATION
TRANS-TECHNOLOGY

XDS will try out new technologies for its next generation of equipment in a transition system called the Trans-Sigma, now in design stages and due out next year. But word is that in a "peculiar strategy" reflecting the Palevsky concept, the microprogrammed system won't use any real architectural advances. It'll be compatible with the Sigmas in instruction set, have a performance fitting between the Sigma 7 and 9 (now developing), and a price between that of the 5 and 7.

Sources say LSI probably won't be used because of doubts about reliability. The 360/85 cache memory is being investigated; the slow braided core memory may be used as control store; and ECL and a circuit family of internal design are in contention.

UCC MAY DEVELOP
UTILITY SYSTEM

University Computing Co. may begin development of a computer utility system in the next several months, according to outside sources. Soothsayers read a hint of what might come in a speech given by UCC's John Coleur at the Interdisciplinary Conference on Multiple Access Computer Networks in Austin last month. Among requirements for a successful system, as outlined by the GE-600 series designer: 360-compatible, a simplified control language as exemplified in GECOS III and EXEC 2, modular operating system, 48-bit floating point number (vs. IBM's 32), paging with an associative memory. Coleur envisions a four-processor system (two for backup), a laser write-once memory for archival storage and some business data, system software storage in drum, mass core, or I.C. shift registers, and 128 I/O channels with a transfer rate of from 4K to 10^6 bps -- among other things.

PRINTED WORD IS
A THOUSAND HEADACHES

Service bureaus in text-editing and/or text processing businesses are finding them increasingly overcrowded and underfed. Data Dimensions, Inc., Stamford, Conn. multi-services firm, originally planned to devote a 360/50 to text editing but watched the market glut after SBC announced its withdrawal from Datatext services last September (six on-line firms formed since then and VIP Systems opened six new offices, including two that are now closed). So DDI decided wisely to take a seat in the bleachers for now.

DDI also took a look at text-processing, a possible complement to the editing business, and found a worse situation. Since December, it says, at least 14 new service bureaus materialized, three of them on-line. The number of "generalized" software packages also has jumped to 12, partly a product of the costly realization that one package can't serve all printing jobs.

Alphanumeric Inc., which has its own high-speed photocomposition system in three U.S. centers, is finding the going rough. It admits to some regrouping in the centers and its NY headquarters. Says regional marketing manager G. L. Griffith, "We've let a lot of good people go, but we're getting rid of duplicated jobs," and Alpha will come up with a "solid package."

(Continued on page 243)

One problem built into computer terminal systems is getting hard-copy readouts out of them.

Until now, available devices have been too costly. Or too bulky or immovable. Or too slow, tying up the computer for too long.

But that's all over. The new CU-5 Hard Copy Land Camera from Polaroid has arrived.

You take a shot in a split second. And with Polaroid instant photography, in just seconds more you have a copy in your hand.

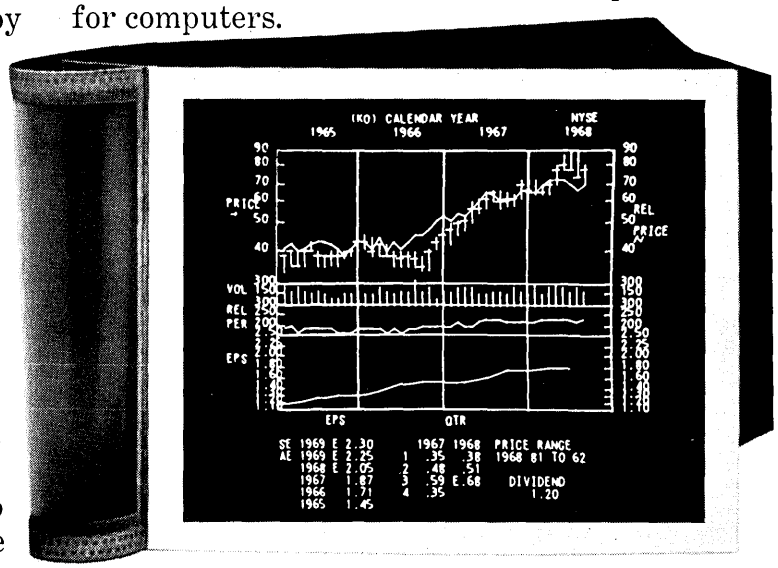
You don't have to be a photographer to use it. The hood positions the camera for sharp focus, frames the image, and blocks out ambient light. All you do is hold the camera against the display and pull the trigger. The CU-5 does the rest.

It's rugged and built to take abuse. But it's hand-held, light and easy to carry. So using it for a number of screens is no problem.

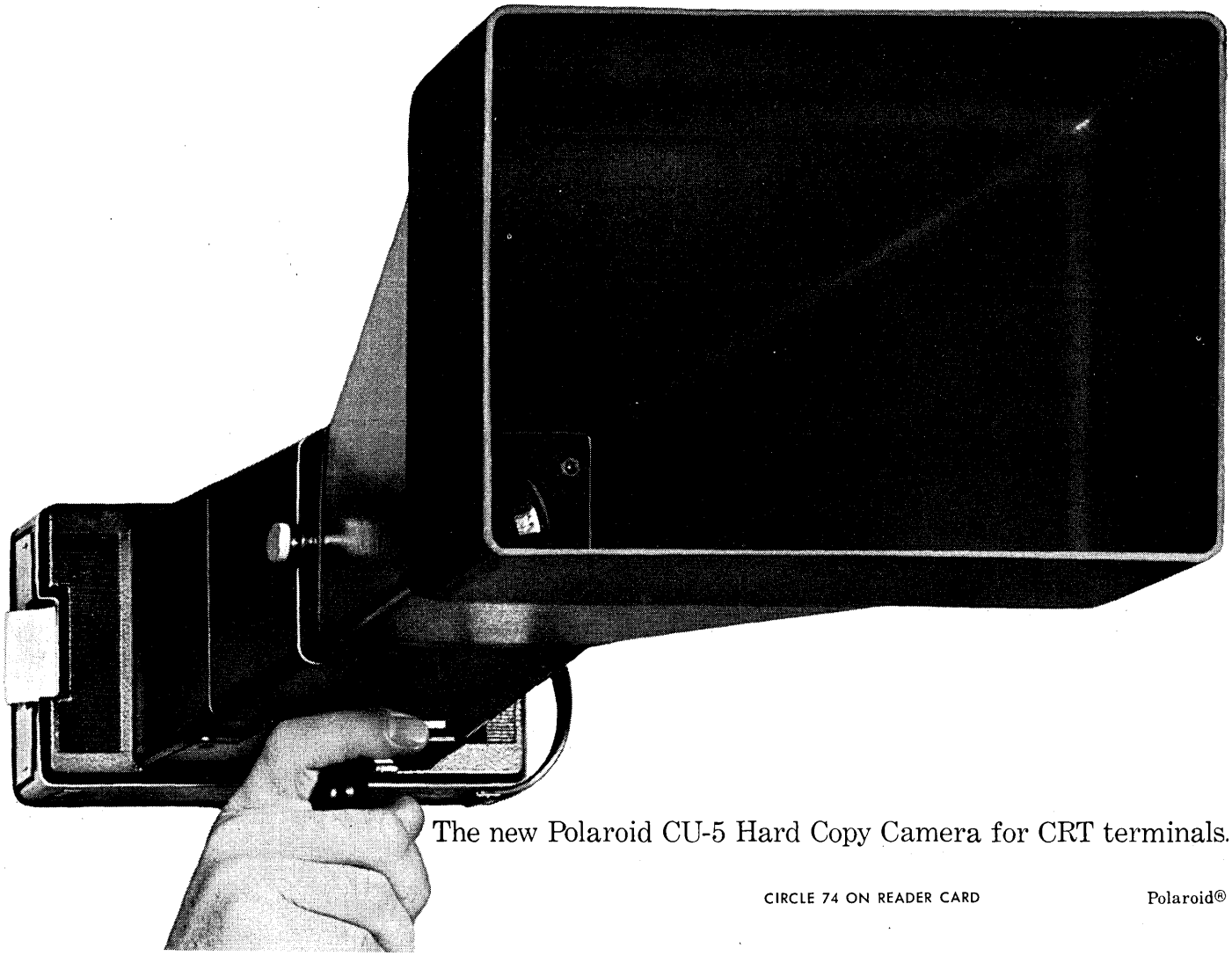
And you don't have to shoot the works to own it. It's under $300. A fraction of the cost of other equipment.

If you'd like more information, or a demonstration, write to: Polaroid Corporation, Dept. 88-163, Cambridge, Mass. 02139. (In Canada: 350 Carlingview Drive, Rexdale, Ont.)

We'll show you how Polaroid solves problems for computers.



For the record, nothing else can deliver hard copies for under $300.



The new Polaroid CU-5 Hard Copy Camera for CRT terminals.

CIRCLE 74 ON READER CARD

Polaroid®

That will be a complete system including everything from keyboard input to final typesetting, which will be offered as a service or sold as an Automated Publication System.

Photocomp system sales are not doing so well either. Alphanumeric was hard hit when IBM stopped taking orders on the 2680 crt-printer last fall -- a system based on Alpha's product. Sources say IBM had had about 30 orders but trimmed out the less firm ones, leaving 15 for delivery. Further evidence: RCA set a quota of 60 orders for its Videocomp system this year, but the first quarter has turned up only four.

MR. SWISS WATCHES OVER NEW COMPUTER FRANCHISE

Franchising will take another new twist this month when Mr. Swiss of America, Inc., Oklahoma City franchisor, opens in Dallas with the first in a planned series of 45 regional computer franchises across the nation. The mother firm will be known as North American Computer Association, Inc., and 45 Univac 9400's have been ordered to equip the outlets. The software to be provided the franchises was developed by Computer Management Corp., also of Oklahoma City, and consists of a group of business oriented programs, including a CPA audit level accounting structure "that will handle just about anything connected with business," according to a Mr. Swiss spokesman. So, if you've ever wanted to run a computer and a business at the same time . . .

RUMORS AND RAW RANDOM DATA

Users with a 360/65 running under the HASP operating system (most are) and linked to a 360/20 terminal can save $500-1,000/month. How? By hooking the /65 to the cheaper Univac 9200, say Univac salesmen. Univac has bought an interface package developed by John Deer & Co. to do the job, and the Univ. of Rochester and Xerox are both said to be using it . . . Stromberg-DatagraphiX is evidently no closer to finding a suitor. Talk of an acquisition by University Computing is dimmed by that firm's sagging stock. Although talks have allegedly been conducted with NCR, Ampex and others, it looks as if there'll be no merger for several months . . . We hear Recognition Equipment next month will debut three products, one of which will put REI in a field other than OCR for the first time. No details. Second is a low-cost unit to read hand-printed data at decentralized installations, the first from subsidiary Recognition Terminals Inc. Third is a page reader for the high-volume market . . . The minicard may have a brighter future than now meets the naked marketing eye. Decision Data Corp., Warminster, Pa., has just signed International Logic Corp. to work up the software necessary to interface DDC's new line (Oct. delivery of first high-speed reader) with any 360 operating under DOS or OS. Though prime target for the mushrooming minicard peripheral makers is still System/3 users, horizons appear to be broadening rapidly . . . Filling the service gap between its conversational Rush and remote batch services is Allen-Babcock Computing Inc., which next month announces the first major component of its RAIR (Remote Access, Immediate Response) system. IPC (Inter-Program Communications) allows a Rush program to communicate with, say, a PL/I object program operating under OS/360 MVT . . . A conversational version of ASI-ST, the file management package, is under development at Applications Software Inc. . . . In California (where else), there's a 1401 service bureau called 21st Century Computer Corp. . . .

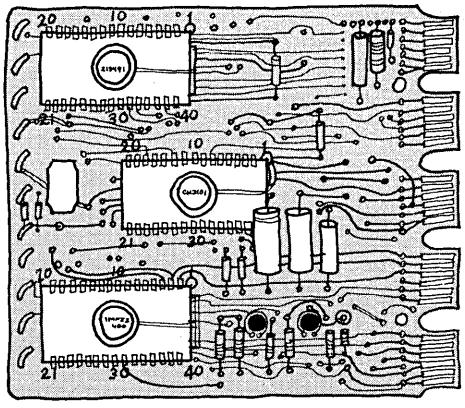
GENERAL ELECTRIC'S

TermiNet

Fast and Quiet

10, 15, or 30 characters per second...more than twice the speed of conventional equipment, so you get the most from today's high-speed data generation and communication equipment. This can mean big savings — in your office, in computer time and in the use of communication lines. This extra quiet impact printer makes less noise than an office typewriter, so it can be where it is needed... where your people are.

...Highly Reliable



The TermiNet 300 printer is basically an electronic device with a minimum of mechanical parts. There is no moving carriage and the electronic keyboard has a light touch for rapid, accurate typing. You also get high reliability and compactness by the use of large-scale integrated circuitry.

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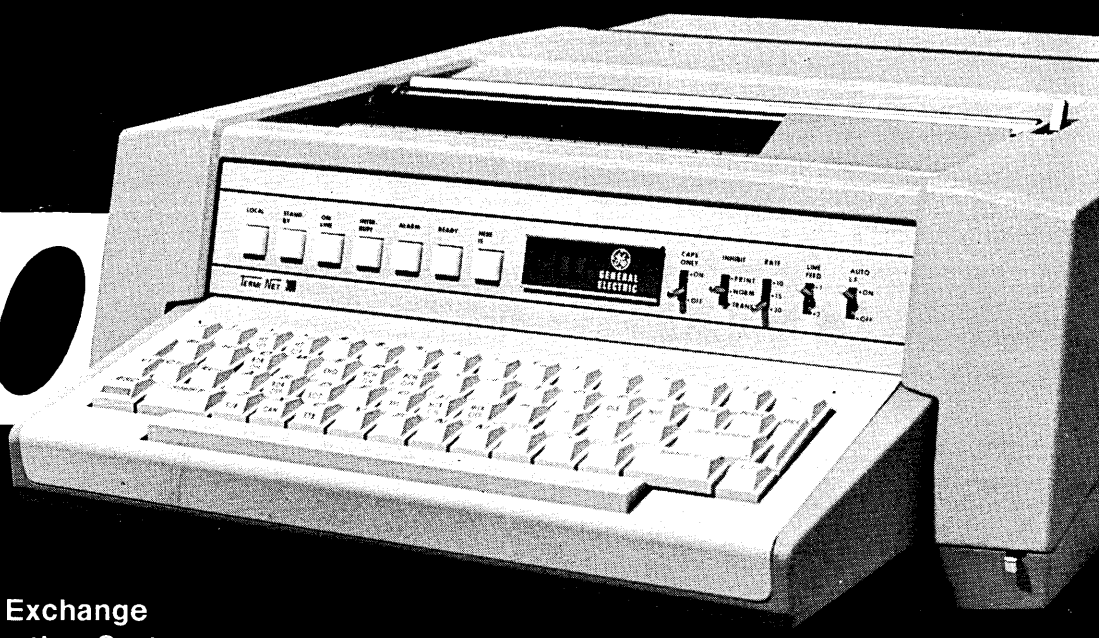
*300



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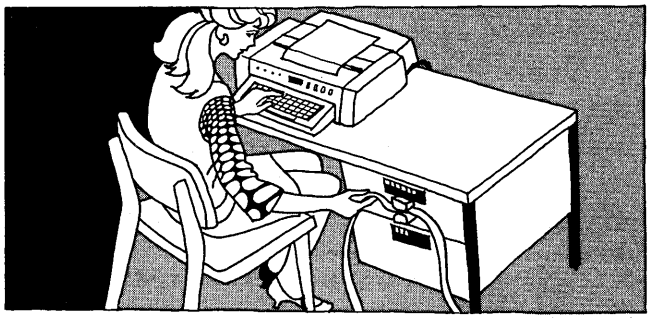

Whatever your application, this highly versatile data communication printer has a lot to offer. Impact printing can give you clear, multiple copies. Fast printout and a full ASCII character set means less time spent on communication lines.

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Many options are available to tailor GE's TermiNet 300 printers to your specific requirements.

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That's just a few...there are many more. Even if you don't want or need all of the available options now, most can be added at a later date.

TermiNet 300 data communication printers are now in full-scale production. Want more information? Write Section 794-01, General Electric Co., Schenectady, New York 12305

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CIRCLE 152 ON READER CARD

world roundup

PARLIAMENT PROBES INDUSTRY STRUCTURE

Britain's International Computers, Ltd., has been advised to go out and head-hunt a few IBM executives to vitalise its management ranks. And preferably to take on-board a mixture of the Big One's talent from the States, France, Germany, UK and so forth to develop into a really broadspan European concern.

These pearls of wisdom have been proffered indirectly by Leasco's whiz kid, Saul Steinberg, in evidence to an inquiry into the UK computer industry by a Parliamentary body, Subcommittee D of the Select Committee on Science and Technology. After collating evidence from governments, industry and independents, the all-party committee of Members of Parliament will submit their proposals to government for restructuring of the industry. And it should reflect their anxieties --if they have any--on the influence of government procurement policies, the effects of intervention in the marketplace by foreign manufacturers, the prospects for inter-company mergers across Europe, the staff shortage, the progress of software development, etc.

Their recommendations will ultimately thud onto the desk of Britain's Minister of Technology, Anthony Wedgwood-Benn, whose department overlords the local computer scene and was responsible for the shotgun marriages that eventually gave birth to ICL. If past form is any guide, Tony Benn will do a supreme job of slipping out from under those recommendations that his advisers find distasteful. Unkind words maybe? But this was just what happened recently when a first class report from the Select Committee came up with proposals for restructuring of the atomic energy industry.

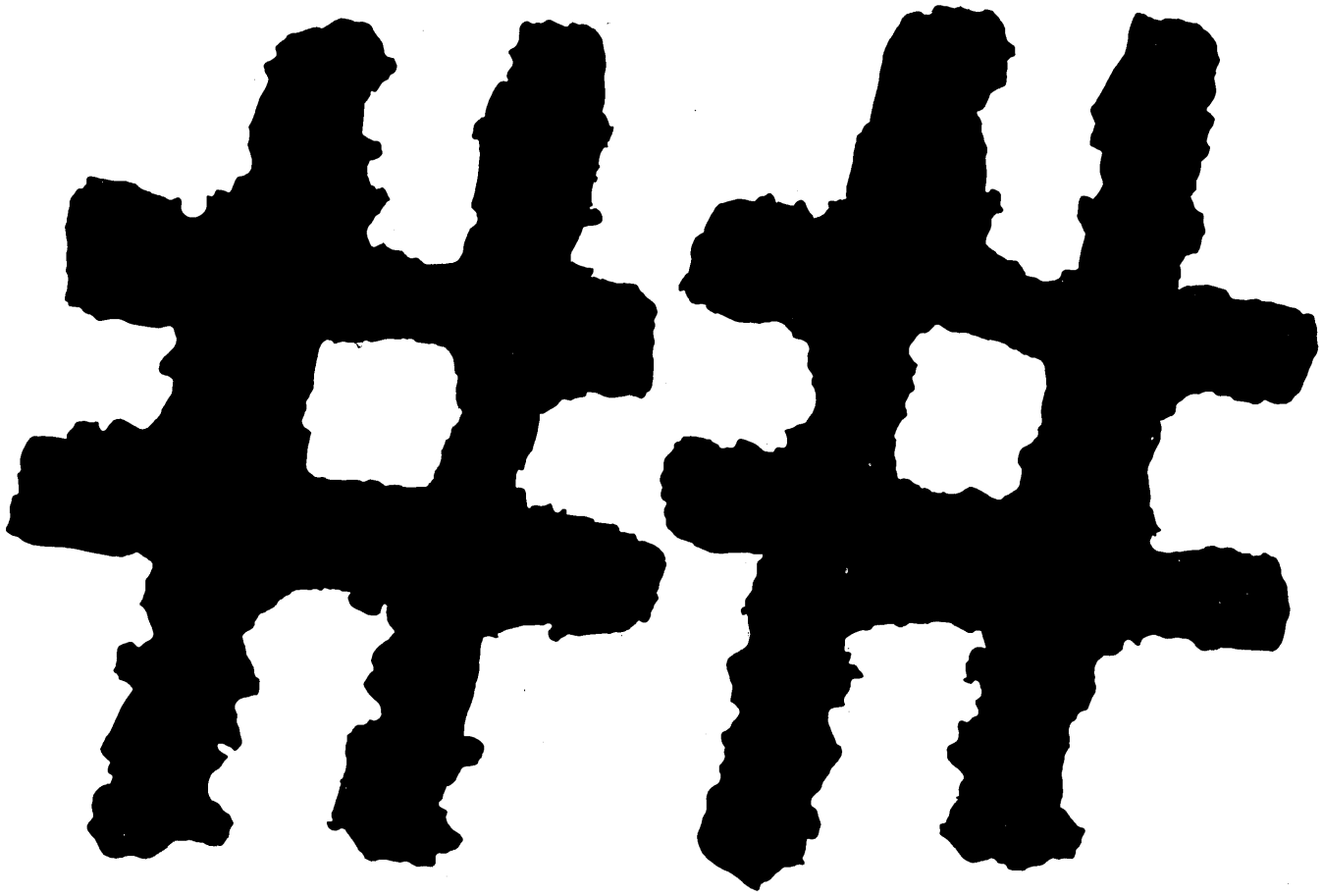
The latter weeks of the inquiry have begun to show a marked shift in interest of the committee from the point-scoring cracks made by mainframe houses, intent on protecting their slice of the market, to the more entrepreneurial independents bent on developing the industry.

Some of the home truths seemed to be emerging after Prof. Stanley Gill, Imperial College, and Alex d'Agapeyeff, Computer Analysts and Programmers, faced the inquiry, first as representatives of the 20,000-strong British Computer Society, and then with their own views. D'Agapeyeff baldly summed up government procurement policies as ignoring software factors and as exercising a hypocritical policy over hardware. It was only when government faced the political embarassment of an American takeover of the British hardware industry that the realisation dawned that there was more to the computer industry than just hardware. His suggesions were:

Government should invest more in R&D for projects of future economic importance (an apparent swipe at funding of projects doomed to early obsolescence);

Purchase of services and products should favour local suppliers only when dictated by national security, or when there was not material advantage from buying foreign;

Government should plan future needs further ahead; at the moment, barely any information exists about the intentions of government departments over future exploitation of computers, or of the developments for



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Mailing was never so simple, fast or economical. Our smallest unit will process your mail at approximately 2 pieces per second. With zip separation, you can take advantage of the lowest postage rates.

No matter how many computer-generated labels you run through a Mod III, the last label is as clear, clean and legible as the first. You rent or buy to fit your needs. Either way it's a small price to pay to make your computer more effective.

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existing installations, for that matter.

Gill thought figures presented earlier to the committee by manufacturers might have been on the conservative side. He said the rate of investment in hardware over a 10-year period had been 40% per annum. It had shown signs of levelling down to 20%, but he thought this was a temporary phenomenon and through the rest of the '70s it would be at least an annual 30 to 35% increase, with a proportionately higher increase in the software industry. He thought there was still a tremendous difference in potential customers between the UK and the States. In America customers were much more willing to try to understand new technology and experiment with it.

This seems to bring us back to the somewhat later observations of Mr. Steinberg. However, all this sincere, purposeful and dynamic advice may be to no avail. One of the most obvious of four partners (the others being Dutch Philips, France's CII and Italy's Olivetti) with whom ICL could establish a liaison is the German Siemens company. But it seems the coming of spring turned Siemens' fancies elsewhere, for there is to be a merger of the computer interests of Siemens with those of another German electrical and electronics giant, AEG-Telefunken. In addition, the senior management of Siemens made it plain to a group of visiting editors recently that they would not be interested in joining with ICL. Their main objection lies in the vulnerable nature of ICL's product line, the mainstay of which is still the word-based 1900 series.

Siemens' product line stems from a license for RCA's Spectra 70, and the company is committed to shadowing every IBM move. And whereas five years ago Siemens was taking less than 1% of the market against IBM, today it is more like 25%.

UNBUNDLING GAP CLOSES IN EUROPE

Apart from technology gaps, management gaps and all those other gaps that allegedly exist between the States and Europe, there has also been a breathless pause while IBM decided whether it was going to treat its foreign customers to unbundling on the same terms as its domestic customers, or to something different (see News Briefs, p. 179). Most of the users had spent so long scrutinising the information percolating across the ocean that the eventual announcement could not be said to have had earthshaking repercussions.

To a large extent it's business as usual, since the bulk of customers will not face the cold wind or stern challenge (or whatever else it might be) until mid '72. With the exception of System/3, all existing IBM customers will continue in the same old way. Program Products would be sold now for new products and after '72 for existing products. IBM would collect its monies on a monthly period, and the programs and services would be contracted on a licensed basis.

With all its goods stamped "IBM property" and "copyright subject to use under licensed agreement," all should be sweetness and light. Each little cpu would have its own license, and that means one each for a multi-cpu installation. A check on the issuing of copies plus the natural self-righteousness of 360 users are adequate safeguards, according to the giant's spokesmen. Though maybe the user needs a little guidance of pitfalls--e.g., a new processor in the 360 range or alterations to library programs will incur immediately the new charge. Oh yes, assemblers are chargeable program products too!

Johannes Gutenberg could hardly have imagined that his wooden blocks of movable type would someday be re-created as flashing electronic signals in a computer-controlled information processing and typesetting system. Yet the concept remains the same; only the medium is different.

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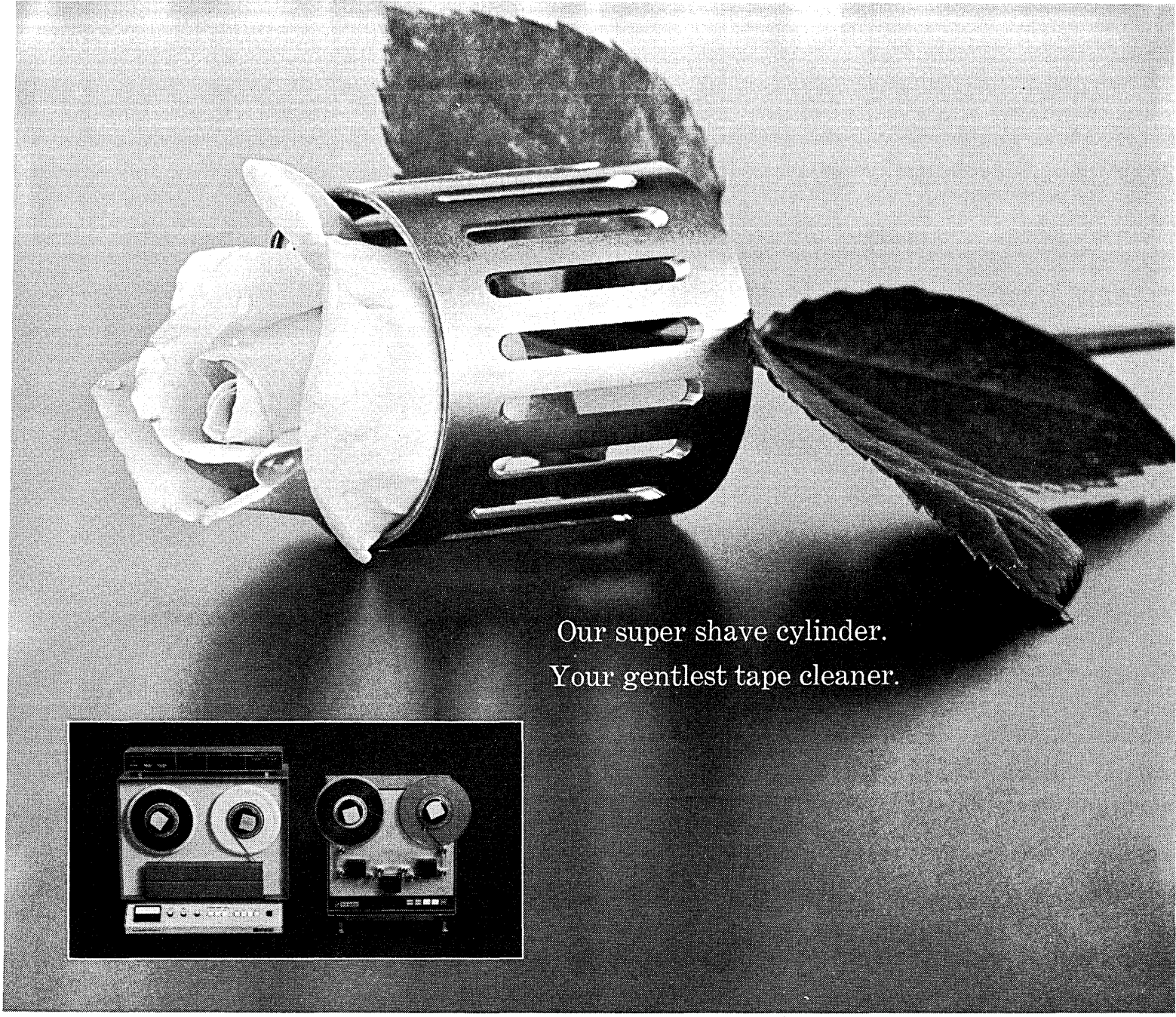

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CIRCLE 182 ON READER CARD

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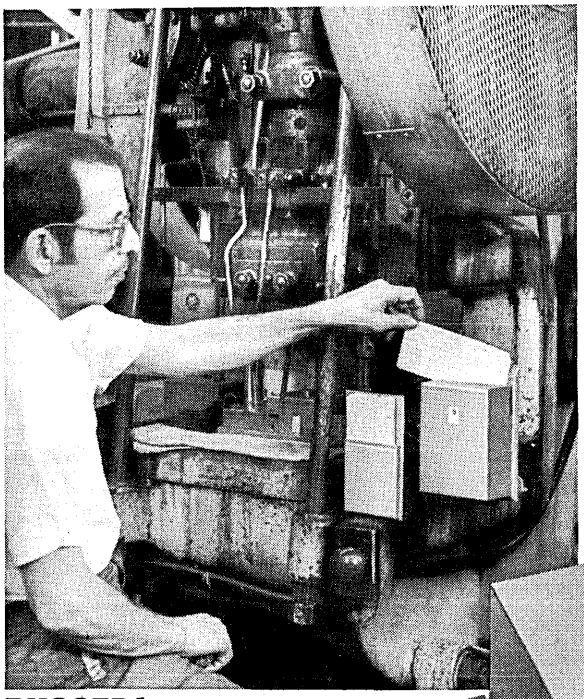

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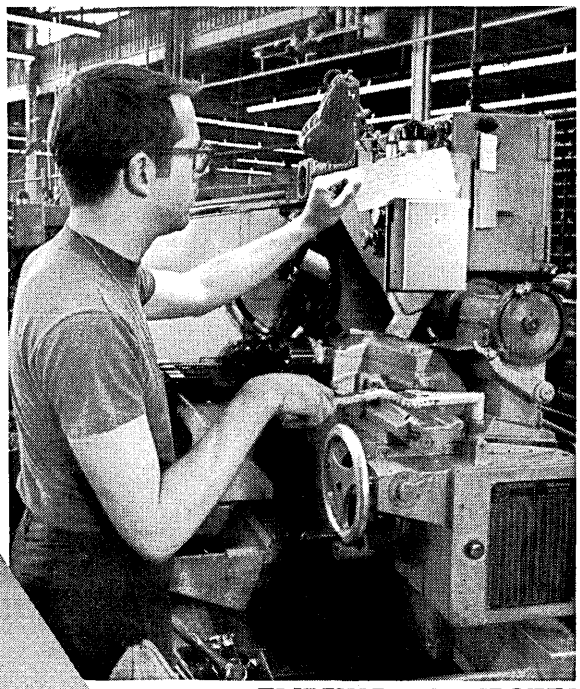

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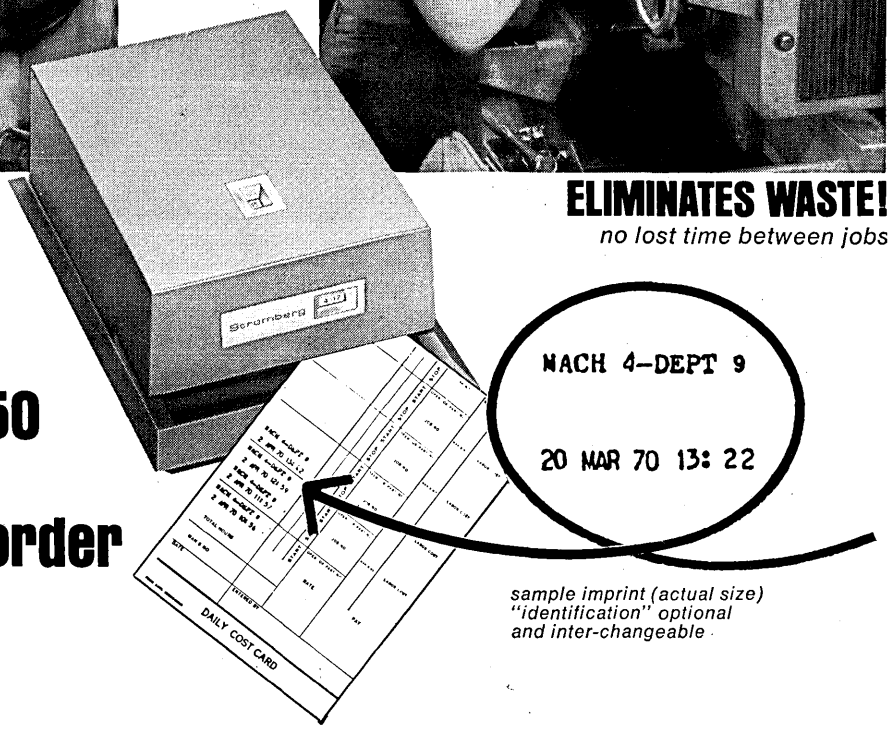

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A prime function of job recording, aside from the actual records established, is to help management effect greater efficiencies and savings. A simple, low cost change in the job recording procedure, itself, is a first step for management to achieve both. That change is to "DE-CENTRALIZATION"—replacing a main "travel to" job recording center with compact, highly efficient, individual job recorders at each work station or area. Stromberg, pioneer in time instruments for industry, has created not only the recorder plus such advantages as registering true hundredths and tamper-proof supervisor lock-and-key control—but has created it at a price to make it practicable for factories of every capacity. Incomparable at $134.50. Contact the Stromberg representative listed in the Yellow Pages.

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washington report

FEDERAL SUPPLY SERVICE HEAD RELATES COST DATA

FSS Commissioner Hy Abersfeller recently told the House Appropriations Committee that:

Agency purchases of dp hardware and software from the Federal Supply Schedule in FY '71, beginning next July 1st, will total about $640 million, versus $600 million in FY '70 and $520.7 million in FY '69.

Test use of in-house dp maintenance crews indicates they cost 26% less than outsiders and provide 98.3% uptime. The test is currently restricted to H200's and GE400's operated by GSA here. Late this summer it probably will be extended to other local agencies' second generation gear, and then to additional users. In five years, GSA aims to be maintaining most federal dpe in-house.

In upcoming FY '71 FSS negotiations, GSA will push for separation of hardware maintenance and lease charges; reduced maintenance fees in areas with many installations; automatic installation and delivery date confirmation, and guaranteed repair parts availability. Also, after a leased system goes down, GSA wants free machine time to reconstruct lost data. And, in systems supplied by more than one vendor, the agency wants to levy a "malfunction credit"--when the system goes down --against the supplier who is responsible.

GSA's revolving fund will purchase $10 million worth of dp hardware and software in FY '71 for transfer to, and repayment by, federal agencies. In FY '70, the figure was $6.9 million, and in FY '69, less than $2.5 million.

INTERFACES, STANDARDS TO AID INDEPENDENTS

Development of a card-programmable tape drive adapter, enabling independent manufacturers to get a bigger piece of federal business, is likely to begin shortly at NBS, possibly with outside help. The adapter may be finished by the end of '71; hopefully, it will allow agencies using CDC's Mod 606 and 607 drives, RCA's 3485 and 581, Univac's 1071, and Honeywell's 804 to acquire independently made units, and will reduce, substantially, federal lease payments to the four firms. They now collect roughly $17 million/year from tape drive leases.

Meanwhile, GSA is developing plans to procure replacements for IBM 729 drives now in the federal inventory; this project may encompass other IBM tape equipment, as well as other periherals (such as disc drives). GSA may release an RFP within a month, or it will allow using agencies to obtain their own (the Air Force, Navy, and Marine Corps have already received delegations).

NBS is also preparing specs for a study of a proposed tape drive interface standard, to be submitted to Ansi's X3.9 group, which has been sitting on the I/O interface problem for more than two years. If X3.9 didn't act--a likely possibility--the standard would be adopted independently by the federal government.

The projected standard would permit any cpu within a specified size category to be mated with any generally-available tape drive of corresponding capacity. Later, additional standards would be developed encompassing other tape drives, discs, line printers, card readers, and other commonly used peripherals.

Lean Mama

RCA announces a low cost 4K x 18 expandable memory system.

Our new one-microsecond-or-faster system plugs into mini-computers, data buffers, terminal devices and specialized industrial processors. And RCA's famous reliability and flexibility plug in with it.

The heart of the system is our Lean Baby, a planar 3-wire, coincident-current memory stack with continuous stringing for greater reliability.

But there's more. Byte operation. Built-in timing and registers. Three operating modes: clear/write, read/regenerate, and read/modify/write. 7400 series T^2L logic. All standard.

Words can be 8 to 19 bits long. And modular construction permits expansion to 32K. Whatever system size you need, it fits a standard EIA 19-inch rack.

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Expand your computer's mind. Write RCA Memory Products, Needham Heights, Mass. 02194. Or call 617-444-7200.

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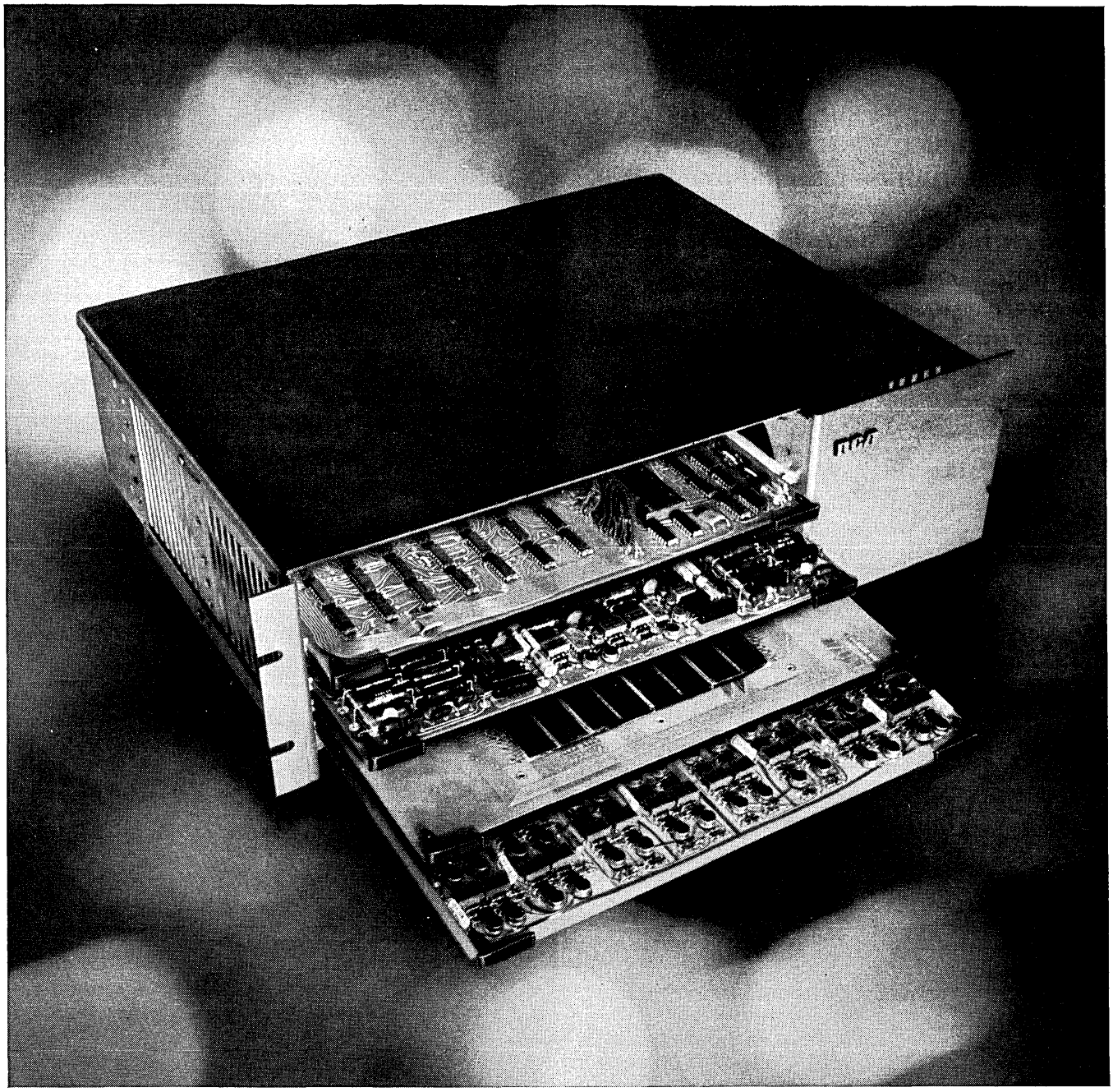

If you put our plotter alongside what's their name's, you'd choose ours every time.

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The "how comes?" are many. Here's eight.

1. Our Delta Control.* An exclusive feature that allows us to plot up to 1023 steps in X and Y from a single command.
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3. We've got the only incremental plotter available on-line or with three off-line modes of input: mag tape, punched tape or punched cards.
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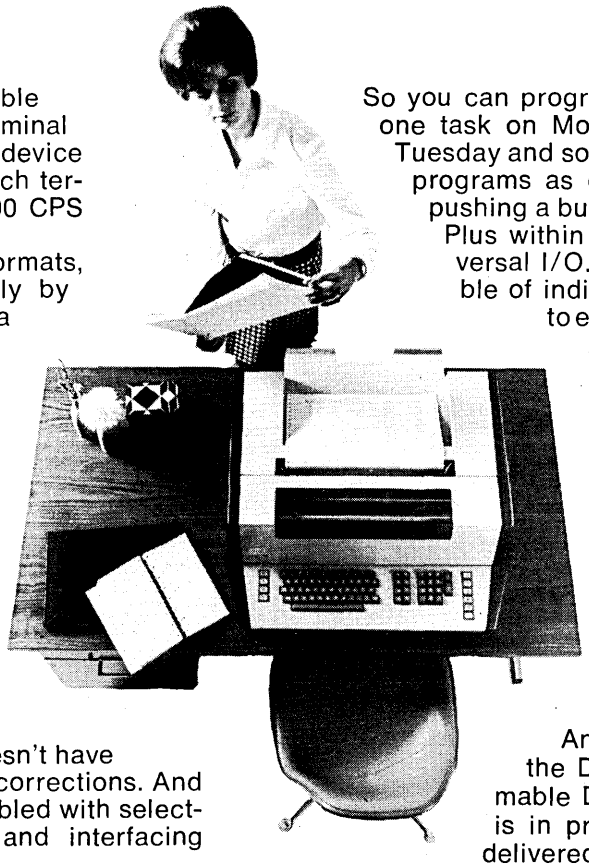
Finally. A remote batch terminal with a built-in modem.



The Daedalus 711 Programmable Data Terminal. Here's the terminal which can be a data acquisition device during the day and a remote batch terminal at night transmitting at 100 CPS via its own modem.

It's also the terminal which formats, edits and verifies data remotely by means of stored programs at a practical, nearly-errorless speed over standard voice grade lines. Which means our terminals will provide your communications system with a number of economies. First, the Daedalus 711 Programmable Data Terminal transmits only pertinent data. So your CPU doesn't get bogged down doing routine tasks. Secondly, it shortens your transmission time and reduces your transmission costs. Third, it means you transmit correct concise data that doesn't have to return to the terminal site for corrections. And fourth, you don't have to be troubled with selecting and purchasing modems and interfacing them into your system.

Our modem, by the way, is in the bottom drawer next to the memory. The memory that makes the Daedalus 711 Programmable Data Terminal programmable. The memory we use for storage of programs and data.

So you can program this terminal to do one task on Monday, another one on Tuesday and so forth. And then change programs as often as necessary by pushing a button.

Plus within this terminal is a Universal I/O. Which makes it capable of individually addressing up to eight peripheral devices.

And there's dual magnetic tape cassettes to provide you with an economical, reusable medium for your message.

Another medium, hard copy, comes out of our simple, computer-type printer which is twice as fast as the typewriters you find in other terminals.

And the best part about the Daedalus 711 Programmable Data Terminal is that it is in production and is being delivered. Contact us for more information about the 711: Daedalus Computer Products, Inc., P.O. Box 248, North Syracuse, New York 13212, (315) 699-2631.

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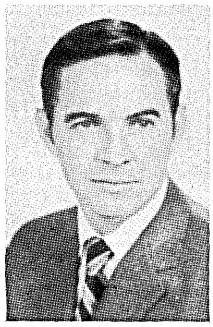
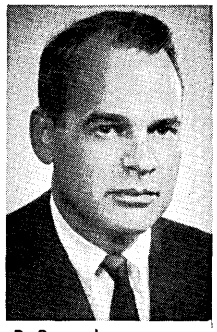
people

The problem of the computer's invasion of privacy, brought into sharper-than-ever focus by the census data collection, will be worked on by **Roy Nutt,** vice president of Computer Sciences Corp., who has been appointed a member of the 23-man investigative group sponsored by the National Academy of Sciences (April, p. 211). Other appointees include **Nicholas Katzenbach,** now an IBM vp, **Rep. Cornelius Gallagher,** naturally, and yes, **Ralph Nader.** Nutt, a co-founder of CSC, has worked long on programming systems and languages, notably FORTRAN. . . . Compute America Corp., which recently took over most of Univac's remaining dp centers, has named **Thomas M. Sloan** president. Comerica, which has grown from a six-man outfit in Oklahoma City to a 100-people one in eight states—all within seven months—found Sloan in El Paso, where he had directed dp for the public school system while consulting as a member of a CPA firm. But his experience includes an IBM beginning, a management services post with Arthur Young, and presidency of his own dp service bureau (EDP, Inc.) until its merger with University Computing. . . A real pro, **William R. Lonergan,** has been recruited from a vice presidency in RCA's information system division to be president of International Reservations Corp. He is a veteran of Burroughs and Univac, and has been in the forefront of systems development at RCA. IRC, one of the undertakings of L.A.-based Planning Research Corp., still will have **Jack Graham** as chairman of the board, but he will be more free to oversee development of other proprietary systems projected at PRC. . . . In the same field, Ticket Reservation Systems, Inc. (Ticketron), has named **Jack H. Flachsbart** as financial vp to help that company cope with its Penn Central Metroliner ticket dispensing system, among others. . . . **Richard R. Douglas** has been promoted to vp/gm of Honeywell's information services division, to fill the vacancy left by **Claude H. Smith,** who resigned to go with Dictaphone Corp. Douglas has been with the company for 10 years, joined as a systems analyst, then went into marketing. A new post in the division, that of national manager of consulting services, has been created for **Jerome Tagg,** old-line dp expert (25 years) who was brought back from Europe where he was director of Honeywell's info services there. . . . **Robert E. Snavely,** formerly marketing vp for Com-Share, Inc., has become president of Virtual Computer Services, Inc., Union, N.J., supplier of shared-system services, which has been in operation with a 360/67 since early '69. Com-Share, in turn, has promoted **Lawrence F. Byrnes** to fill Snavely's place at that financially reorganizing concern, and has named **Frederick E. Paul** vp of operations. Paul was mainly responsible for improving Com-Share's t-s network, now consisting of three regional centers servicing 35 cities, coast to coast. . . . AFIPS elected **Dr. Robert W. Rector,** vp of corporate relations at Informatics, Inc. (Sherman Oaks, Calif.), as treasurer to fill out the unexpired term of the late **Dr. Walter Hoffman.** The new treasurer is not new to AFIPS or other computer industry societies; he was chairman of the '65 Fall Joint computer conference, and has served in various representative capacities with ACM. . . . **Lloyd O. Ireland's** long-standing post as financial vp at Viatron Computer Systems Corp. has been taken over by **Richard Bowen,** a vp from the National Bank of North America. Ireland is no longer with the company, plans unannounced. Viatron stated that "company growth dictated that a new financial management team be formed." . . . After joining Synergistics, Inc., Natick, Mass., just last year, **Irwin D.**


T. Sloan

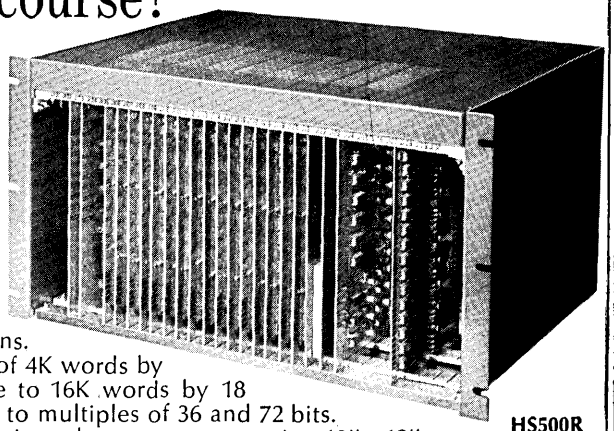

R. Snavely

W. Lonergan

R. Douglas

What Memory-System Maker Is Speeding Up the Cycle Time— But Holding Down the Price?

Toko. Of course!


HS500R

Beef up your technology with Toko's 500 nanoseconds Memory System without raising your costs.

Now rolling off the production line, Toko's HS500R Memory System offers the following key features:

* Access time of 250ns.
* Memory capacity of 4K words by 18 bits expandable to 16K words by 18 bits, rearrangeable to multiples of 36 and 72 bits.
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Toko's advanced electronic technology also enables it to provide computer components, such as memory stacks. Contact Toko today for details.

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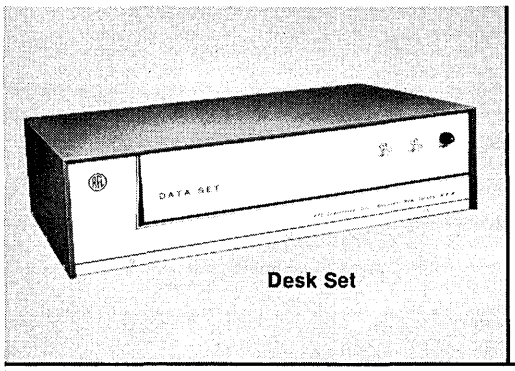
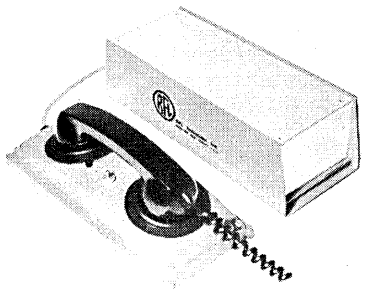
CIRCLE 183 ON READER CARD

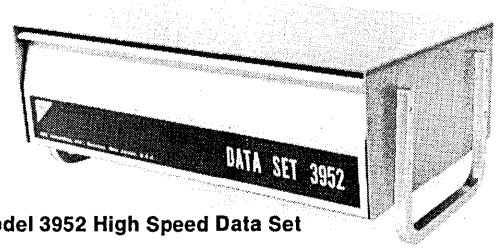
RFL Builds Data Sets to meet every need



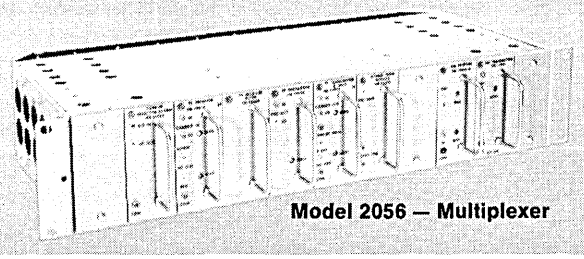
Desk Set



Hardwire/Acoustical Coupler



Model 3952 High Speed Data Set



Model 2056 — Multiplexer

No matter what your data communication needs, look to RFL for the ultimate in dependable high-speed data communication equipment. RFL Data Sets handle computer, telegraph and telemeter data in combination or on an individual basis. The Model 2056 series provides the latest in transistorized multiplexing equipment — permitting the use of up to 23 channels over a single circuit, and RFL's "Plug-in" interchangeability feature gives you a choice of data speeds up to 2400 bits per second.

Rack mounting or desk type models are available . . . of course all are Bell compatible.

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Communications Div.· Boonton, N.J. 07005

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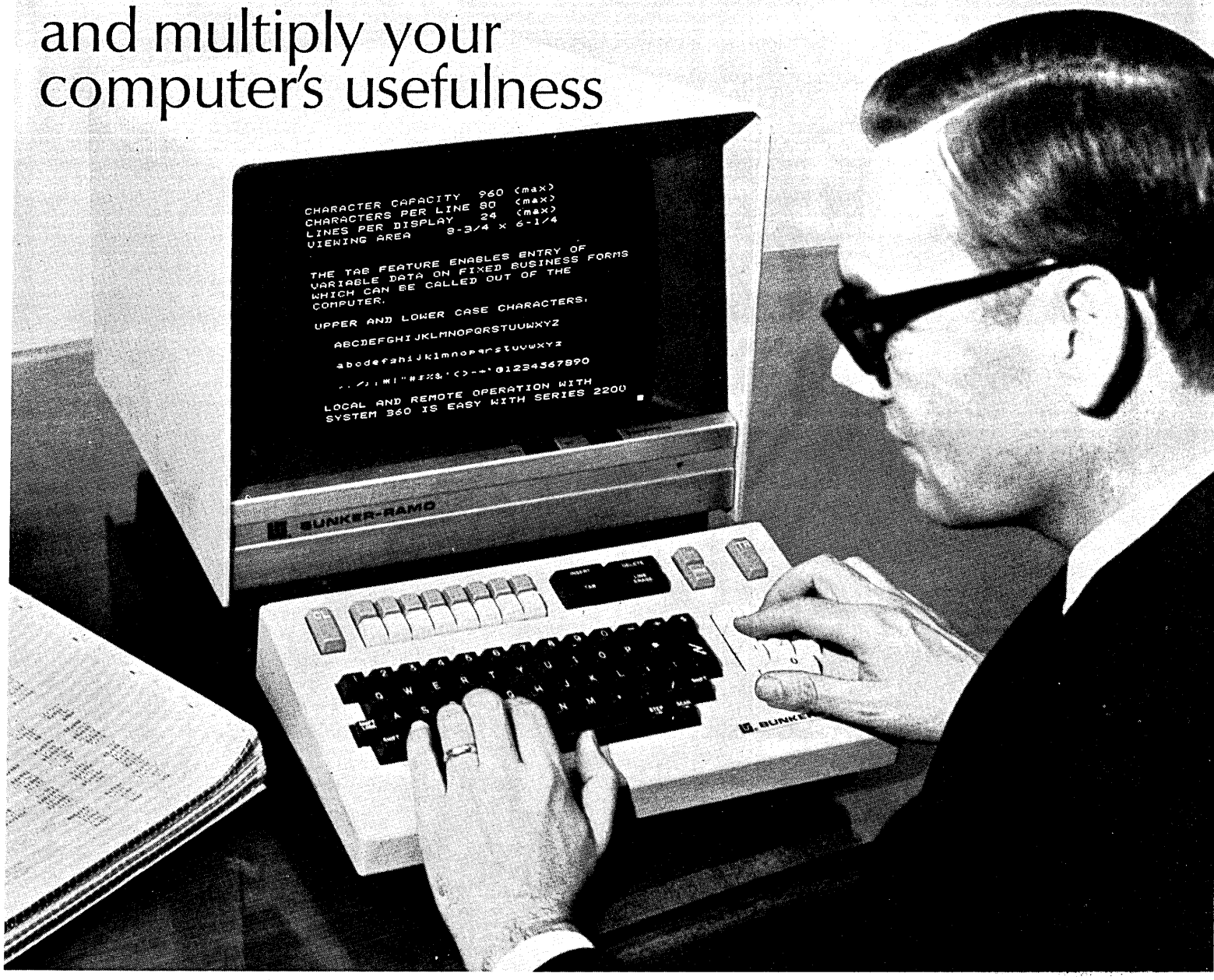
people . . .

Baumel has been elected president and chief operating officer. He has also served as president of American Data Machines, Inc., has been in dp for 19 years, came to Synergistics from Sanders Associates. He succeeds **William M. Tetrick,** who remains board chairman of the systems and peripherals firm. . . . Back at Sanders, the formation of Sanders Data Systems, Inc., will be supervised by **Raymond A. Zack,** who has been appointed a vp of the parent Nashua, N.H., firm. Zack came all the way from Motorola's control systems division in Phoenix, where

he was vp/gm. . . . Itel Corp., San Francisco-based diversified dp firm that finally consummated its long-negotiated merger with Intercontinental Systems, Inc., has designated **William H. Bird** to be president of its data processing division. Formerly president of Computer Technology/East, Bird previously had 11 years of marketing experience with IBM's dp division. **Gary Friedman** continues as Itel's exec vp. . . . **Harry S. Gaples,** formerly with Control Data in varied executive positions, has left to become president at SCM Melabs, Inc., Palo Alto, Calif., which has a new industrial products department operating from its facility to develop its OEM marketing position. . . . At its latest general meeting in New Orleans, the Data Processing Supplies Association elected **John H. Dunham,** of Datafold Forms, Inc., president, succeeding **Thomas R. Evans,** of Baltimore Business Forms, Inc. The DPSA also created a new division, memory products, which will have **Austin Nester,** of Information Technology, Inc., as chairman. . . . **Donald W. Fuller,** former president of Redcor Corp., is heading a new minicomputer manufacturing venture in Santa Ana, Calif., Omnicomp Computer Corp., with two vp's formerly with Microdata Corp., **Allen L. Shapiro** and **Robert D. Oak-**

add 2200 to 360
and multiply your computer's usefulness



The Bunker-Ramo Series 2200 Multi-Station System has a theoretical hardware limit of 4,608 local terminals on a single 360 channel—or an astounding 8,928 terminals from a single channel on remote phone lines. So, the number of terminals in your system is dictated by your traffic and response time requirements—not by a communications bottleneck in the transmission control. There's no need to buy an outsized computer to secure additional terminal capacity.

Increased system flexibility. Each station of a Bunker-Ramo Series 2200 System can be customized to the functions of the department it serves. The shipping department can transmit delivery information or receive routing advice; personnel can file employment forms or check medical records, and sales can enter orders or get market trends—all from one Bunker-Ramo input/output system operating from a single computer channel.

And there's no hidden programming cost. Series 2200 terminals use the same software provided by the computer manufacturer—DOS, OS, BTAM, GPS—a capability that has been fully documented.

Proven performance. Bunker-Ramo's Business and Industry Division has more experience than all other manufacturers combined in linking man and computer through CRT display and keyboard. In the brokerage business alone, 21,000 Bunker-Ramo CRT units perform reliably, day in and day out.

Availability. *They are available now!*

If it's your job to provide the best computer access at the lowest cost, make it your business to get the facts on Bunker-Ramo's Series 2200. Write Mr. Guy Mallery, Vice President, Marketing, Business & Industry Division, The Bunker-Ramo Corporation, 421 Fairfield Avenue, Stamford, Connecticut 06904. Or call (203) 348-4291.

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THE BUNKER-RAMO CORPORATION
BUSINESS AND INDUSTRY DIVISION

CIRCLE 91 ON READER CARD

people...

ley. They expect to launch their first Omnus-1 system this month. . . . A new position at Univac's data processing division, vp of manufacturing, has been taken by **Paul J. Spillane**, who will work from hq at Philadelphia to "enable our company to utilize its worldwide commercial product manufacturing resources with maximum efficiency and productivity." . . . **Jack Veale**, ex-Univac general manager, has become president of Optical Scanning Corp., Newtown, Pa. . . . And **Rudolph J. "Bud" Klein**, formerly Univac director of engineering at Philadelphia, has been named general manager of Cogar Corp.'s information systems division. . . Another recruit for recently-formed Xerox Computer Services is **Christopher J. Shaw**, longtime expert with System Development Corp. . . . Darus Dat-Com Ltd., Wayne, N.J., data communications consulting firm, has secured the services of **Paul B. Alper** as president, who came from Western Union where he was director for commercial systems project management. . . . In Dallas, **Richard Lee** has been appointed vp at Mustang Computing, Inc. He had been programming manager since the software company's formation two years ago, and before that was associated with Mustang president **J. B. Harvill** when they were at Southern Methodist Univ. Computing Lab. The new head of SMU's computer sciences-operations research, incidentally, is **Dr. Robert R. Korfhage**,

who came from the faculty of Purdue. One of the books he authored is on logic and algorithms. . . . Communications firms in Dallas reported major appointments: **Robert Pierson** is now president and chief exec officer of Carterfone. He was formerly with Texas Instruments, and succeeds **David Francis**, who will be vp of the company's data communications division. At Remcom Systems, Inc., **Robert G. King** has come from the Texas Bank & Trust Co. to be vp of finance, and **Donald R. Fagin**, who previously headed his own consulting firm, will be administration vp. . . . Some leavings: **Joseph Davis** has left a vice presidency at Inventory Management Systems, Inc., in L.A., and will go into business for himself, with a vending machine monitor. . . . Along with the reorganization at Scientific Resources Corp., **Jack L. Wolgin** has retired from the chairmanship, will only be active in the land resources subsidiary. **Robert K. Stern** has been named president of SRC's new subsidiary, Digital Resources Corp. He is a two-decade pioneer in process control and analog computers, previously held major executive positions with SRC. . . . **Eugene Cuba** resigned as president of Alphanumeric, Inc., Long Island computerized typesetting firm, and was succeeded by **Solomon Manber**. . . . In Minneapolis, **W. F. Foss** resigned as president of Fabri-Tek and **T. E. Brady**, financial and administrative vp, was elected to succeed him. Both men have helped the company turn the profit corner. . . . **Lawrence P. Doss**, who headed the Washington, D.C., data center of the Internal Revenue Service, left before income tax time to go to work for the Detroit board of education. ■

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Teletype Model 33ASR

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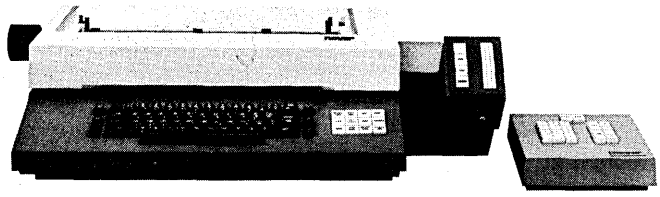

The Novar 10 key numeric input on the right can be added to Novar tape terminals by plugging it in. Greatly speeds up the terminal's capability to handle numeric data for computer processing. Does columnar tabbing too.

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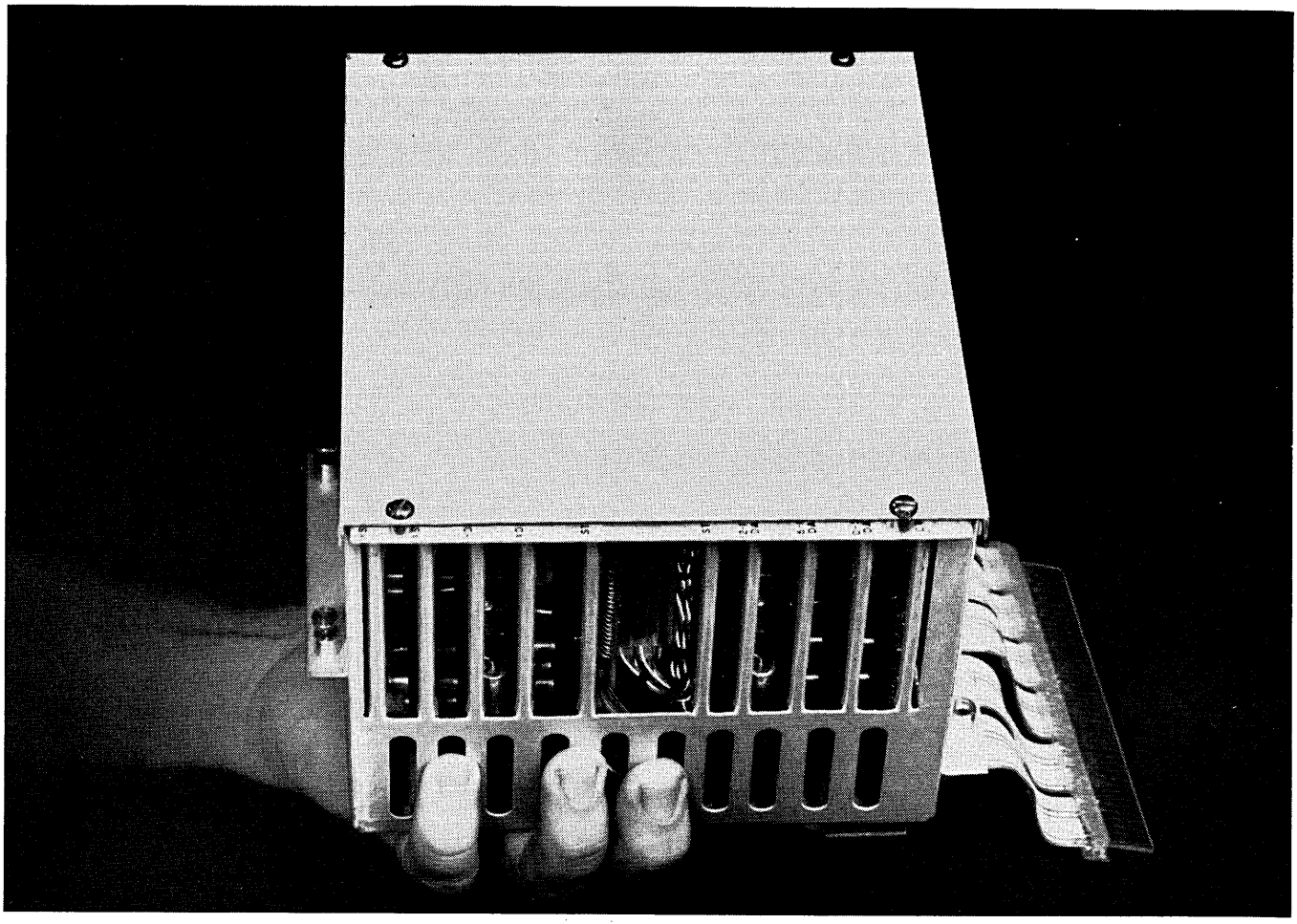
novar

CIRCLE 120 ON READER CARD

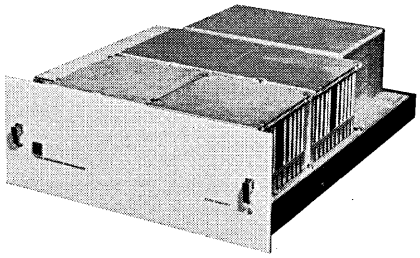
Who Needs A Used Memory?



...You Do!

You need a memory that will always work in your application. That's why it's best to use only those that have been burned in. TI's Model 900 Magnetic Core Memory systems are burned in under worst-case signal conditions—100 hours under temperature stress from 25° to 50° C. The burning-in process rids our units of "infant" failures and assures you a reliable, failure-free system.

The 900 is a modular memory system with 4K x 17 or 18, 8K x 17 or 18, 12K x 17 or 18 or 16K



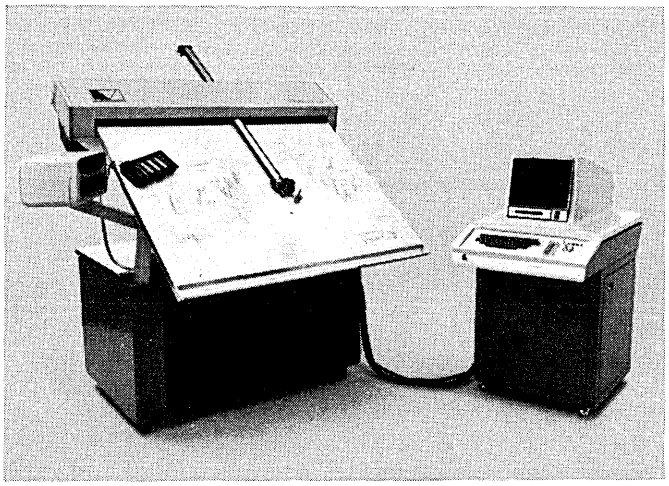
x 17 or 18 options. You can add or subtract memory capacity up to 16K with plug-in modules and increase total capacity to 65K through extra series-cabled units. Memory system chassis include the modules you need, the interface circuitry, power supply and cooling system. Model 900 has 900-nanosecond total cycle time, read-access time of 400 nanoseconds, 3-wire 3-D design and advanced electronic components. Control and timing adjustments are permanently calibrated to provide consistent signal conditions without "tweaking".

For more information, write to Texas Instruments, Digital Systems division—Houston, P.O. Box 66027, Houston, Texas 77006, or call 713-526-1411.

TEXAS INSTRUMENTS
INCORPORATED

319

Our new machine is sort of a combination Leonardo da Vinci and Ebenezer Scrooge.



Our inspirations may seem like strange bedfellows. But the product makes a lot of sense.

The idea is an interactive computergraphic system with Leonardo's genius and Ebenezer's stinginess.

We invented the machine because we knew the main problems of product development. What was needed was a machine that could make your engineers more productive, and still save money.

So that's what it is: INTERACTgraphic 1, $1200 a month.

Our machine does amazing things. It digitizes, displays and plots on a four foot interactive surface.

And it saves money a very simple way. It allows you to reduce the number of people and hardware peripherals on your project.

Cost/effective computergraphics, we call it: INTERACTgraphic 1.

You can see our machine in action in one of the places we've already delivered it. You can see it cutting costs in custom LSI design, IC mask layout and printed circuit production as well as architectural and civil engineering design.

You can see our new machine at Booth 4932 Nepcon east, or if you can't wait: call or write Computervision Corporation, Northwest Industrial Park, South Avenue, Burlington, MA 01803, (617) 272-7240.

Computervision Corporation

Look. If you've got the computer, we've got the vision.

have been used.
PROF. ARRIGO L. FRISIANI
Genova, Italy

Editor's note: CII markets the Sigma 7 in Europe under the name CII 10070. Everybody's right.

invention contention

Sir:
It seems that T. L. Dempsey and Phil Hirsch (March, p. 37) are unaware of the fact that the invention of the device we call "transistor" was by a certain "Julius Edgar Lilienfeld of Brooklyn, N.Y." Filing was in 1926 and patents granted in 1930. Hence, the illustration of the transistor is a case of "was" rather than "would be" developed without the telephone company.
CLAUDE A. ROICHEL
Pennington, N.J.

acronymrod

Sir:
I am gathering information for a book on acronyms and abbreviations in data processing and information science. It is scheduled to be published later this year.

I am interested in acronyms or abbreviations relating to both hardware and software. They might be of the FORTRAN type in which the entry has become, for all practical purposes, a word, or the cpu type in which the entry is standardized but not in itself pronounceable in English.

If any readers have information of this type, I would be grateful if they would send it to me at the following address:
DAVID BADERTSHER
University of Chicago Law Library
Chicago, Illinois

pos it on

Sir:
I read with obvious interest the News Scene story on the recent NRMA convention in the March issue (p. 137). Frankly, I'm amazed and puzzled that our Modular Data Transaction System is hardly mentioned, and where it is, the information is incomplete or incorrect.

Your grouping of Friden in the category of manufacturers "in the position of offering on-line systems but not having any installed to talk about" is completely in error. First, we offer a family of systems ranging from a completely free-standing cash register to a terminal recording on its own magnetic tape; to multiple terminals recording on an in-house disc or tape (and having credit authorization capability); to multiple terminals operating on-line real time with a remote computer.

Second, a six-month pilot installation of five MDTS terminals was conducted in four Singer stores in northern New Jersey during the last half of 1969. Data was transmitted from the terminals to the Singer data center in Syosset, Long Island for processing at the end of each day. Singer will have MDTS installed in all 1,500 stores across the U.S. by mid-1972 with installations scheduled to start this fall. Also, a half dozen terminals have been in use by a national department store chain for close to six months now.

These terminals are operating in an on-line, real time environment to a remote computer and providing credit authorization. The data captured is being used to bill customers and automatically replenish merchandise. Also, a major discounter has two terminals capturing sales data in a check out environment. The data is recorded on an in-house MDTS disc and transmitted to their computer at the end of each day. Also, seven other pilot installations are scheduled to start within the next few months with a variety of retailers representing a cross section of the industry.
ED WARABOW
Friden Division, Singer Company
San Leandro, California

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The Model 815 GATES ACOUSTINET

The Model 815 GATES ACOUSTINET is bringing peace and quiet to many an office as it dramatically reduces the decibels of those noisy Teletype terminals. Comparative tests have proven that nothing quiets like this new Gates Acoustinet, Model 815.

No time-consuming installation is required! Your operator will love the accessibility to vital areas of the terminal-the punch, the reader, platen knob and the paper roll (An optional 2-door model permits access to the right hand panel). The paper print-out remains unchanged.

In addition to the QUIET, your Teletype runs cooler with our standard built-in fan.

If your own terminal supplier doesn't already have full leasing details on this, have him contact us. Or you supply his name and we'll handle the details.

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THE QUIET SOLUTION FOR NOISY BUSINESS MACHINES
BOX 1406 D5, SANTA ROSA, CALIF. 95403 (707) 544-2711

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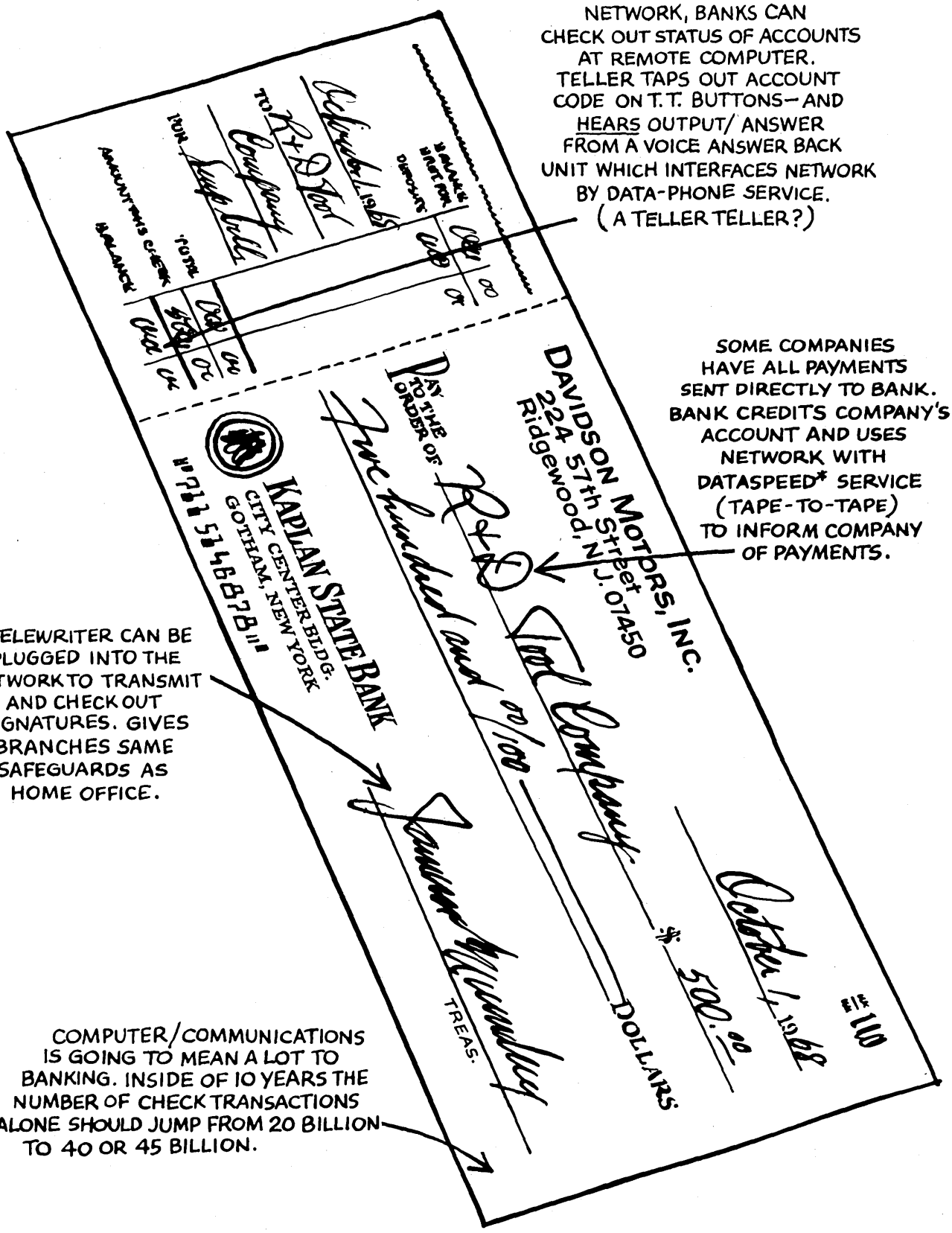
THANKS TO OUR NETWORK, BANKS CAN CHECK OUT STATUS OF ACCOUNTS AT REMOTE COMPUTER. TELLER TAPS OUT ACCOUNT CODE ON T.T. BUTTONS—AND HEARS OUTPUT/ ANSWER FROM A VOICE ANSWER BACK UNIT WHICH INTERFACES NETWORK BY DATA-PHONE SERVICE. (A TELLER TELLER?)
SOME COMPANIES HAVE ALL PAYMENTS SENT DIRECTLY TO BANK. BANK CREDITS COMPANY'S ACCOUNT AND USES NETWORK WITH DATASPEED* SERVICE (TAPE-TO-TAPE) TO INFORM COMPANY OF PAYMENTS.
TELEWRITER CAN BE PLUGGED INTO THE NETWORK TO TRANSMIT AND CHECK OUT SIGNATURES. GIVES BRANCHES SAME SAFEGUARDS AS HOME OFFICE.
COMPUTER/COMMUNICATIONS IS GOING TO MEAN A LOT TO BANKING. INSIDE OF 10 YEARS THE NUMBER OF CHECK TRANSACTIONS ALONE SHOULD JUMP FROM 20 BILLION TO 40 OR 45 BILLION.
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TREAS.

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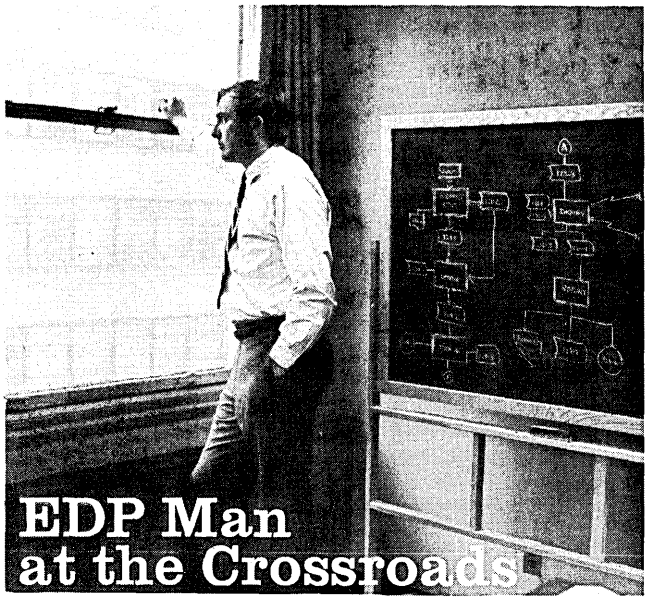
Next time you're moving information, remember—no one knows more about moving it than the people who run the world's largest communications network.



EDP Man at the Crossroads

EDP has been good to him. He finds the work stimulating and his compensation more than adequate. However, something is missing. Call it the desire for greater independence, or the need to face his own challenge, to realize his own potential, to grow, to build. Something.

He has been thinking about establishing his own business. He's young enough and he has put some money away—an investment in the future. But, he wonders, what about the investment in his EDP career? If he enters business, will all that time and experience be wasted? It's a tough decision. He's at the crossroads.

If you are that EDP man, Wells Recruiting Systems, Inc. offers a possible solution to your dilemma. After a decade of achieving one of the highest profit margins of any national company in the personnel recruitment and placement industry, Wells for the first time will establish franchises in selected cities. And because we are leading specialists in the recruitment of EDP personnel for major corporations, **we will give high consideration to applicants for these valuable franchises who have been professionals in the EDP field.**

Of course, EDP experience alone will not qualify you for a Wells franchise. A college degree or its equivalent is also necessary. And Wells will want to determine your suitability for a people-oriented business in which you must maintain day-to-day contact with both individuals and companies. Moreover, a Wells Recruiting Systems franchise requires you to make a minimum cash investment of $14,300, plus an additional $6,850 for minimum working capital.

Wells Recruiting Systems minimizes your investment risk with a superb training program for franchisees; with a year-round, tested system of parent company support, and, finally, with a turnkey office in a leading metropolitan area—ready to produce revenues the moment you open the door.

If you would like to explore the new direction of a Wells Recruiting Systems personnel office, we welcome your inquiry.

Write or phone Mr. Arthur Ross, (212) 964-0211.

Wells Management Corporation
CORPORATE DEVELOPMENT DIVISION
170 Broadway, New York, New York 10038

CIRCLE 28 ON READER CARD

recruitment advertisers' index

For the convenience of those readers interested in professional opportunities, we have gathered in this and the following pages the advertisements of these industry firms and professional placement agencies:

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Wells Recruiting Systems, Inc. 276

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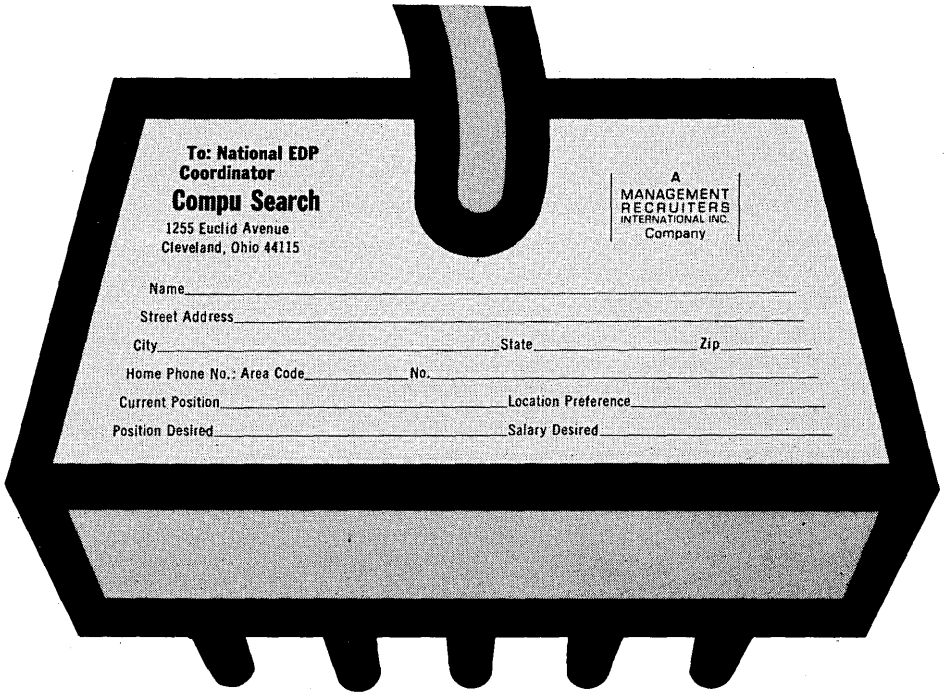

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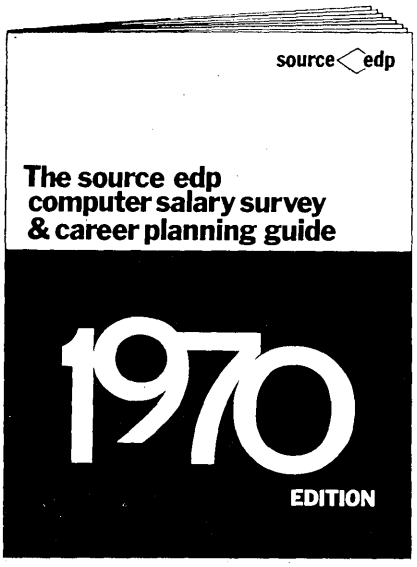

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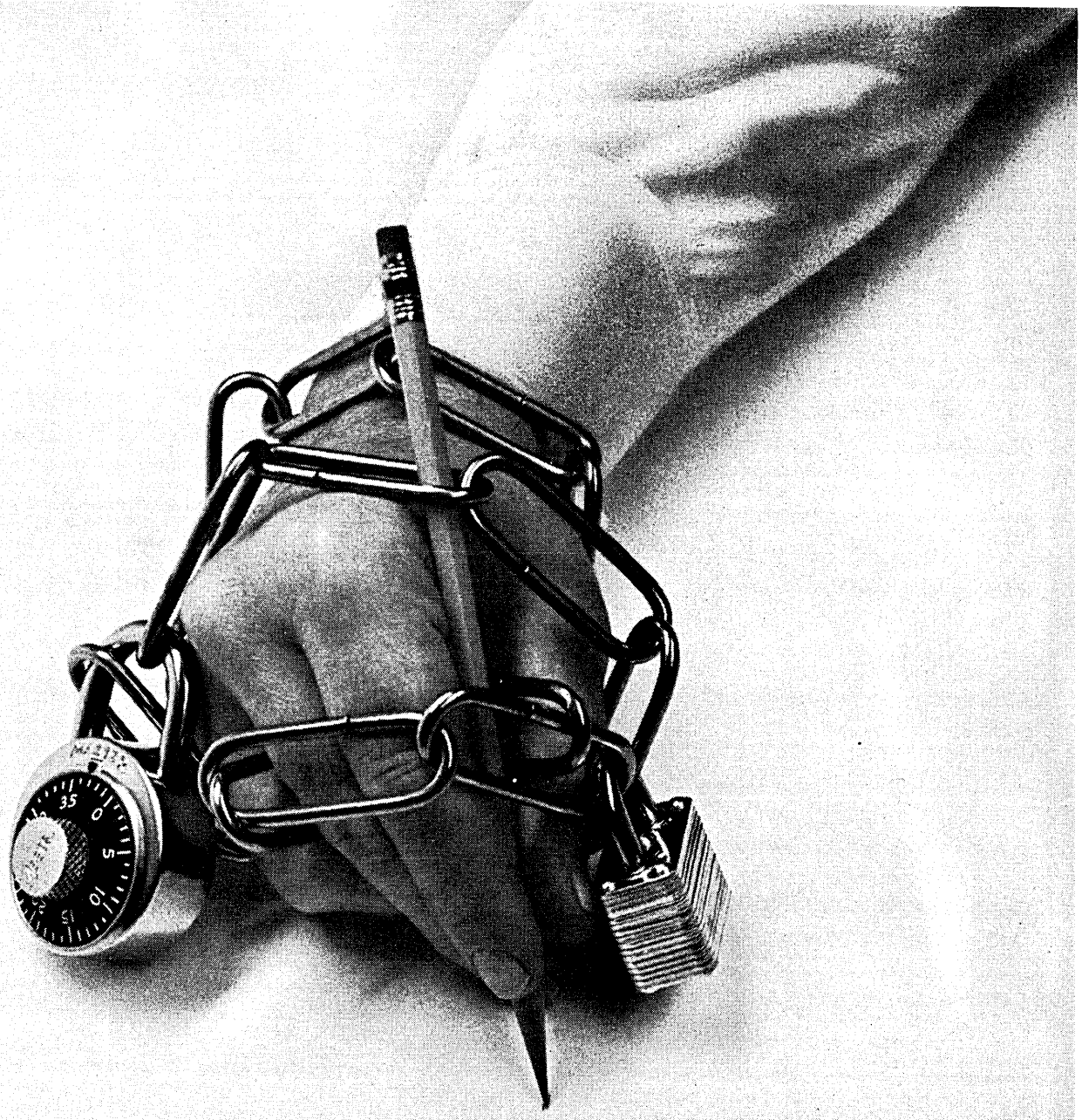

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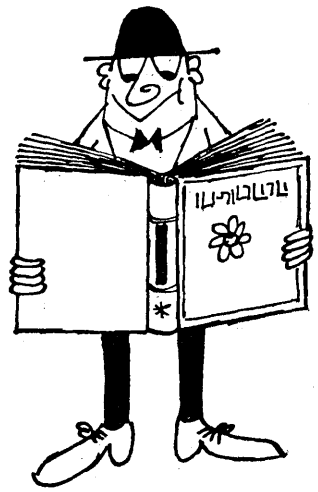
books

***Library Effectiveness: A Systems Approach*, by Philip M. Morse. The M.I.T. Press, Cambridge, Mass., 1968. 214 pp.**

This book has two stated objectives in subject coverage. First, theoretical models of selected library functions are developed. Then, their validity is tried by application to a specific library.

The book is organized in two parts. Part 1, the second through fifth chapters, contains an exposition of theoreti-



cal models for activities common to most libraries. The mathematical techniques of probability distribution, Poisson distribution, queuing, and the Markov process are suggested as useful to the analysis of library use patterns, peak loading, book circulation, and prediction of probable future demand for a book.

Part 2, the sixth through ninth chapters, builds on the first part by demonstrating applications of the theoretical models. A body of data, collected as a class project, on the operation of the MIT Science Library, is analysed for possible useful content. A description and brief history of the operation is given, and then the problems of book circulation and storage are dealt with to the extent that the data at hand allows.

The book succeeds notably in providing an orderly development and explanation of mathematical models. The non-systems analyst reader needn't be put off because the text is structured around mathematical formulae —the development of thought flows around them—and the earnest reader will find much to help him understand, or at least decipher, the math.

Some thought-provoking statements are included along the way on the economic problems of gathering sufficient accurate and pertinent data on which to build valid models of library functions. Particularly striking to this reviewer is: "In the end it will be better to buy fewer books, for the time being, in order to collect the data." Generally, the anguish to a librarian of quantifying intangibles of service stands in the way of taking systems analysis seriously as a library management technique. This difficulty is acknowledged. Examples of economic trade-off given in this book should be useful to the librarian in evaluating the usefulness of this method of analysis.

This is an exploratory work, emphasizing concepts, rather than completeness of coverage; hypotheses rather than conclusions. As stated in the book, libraries are largely unexplored territory for systems analysts, chiefly because of the difficulties in obtaining operational data. The author's skill in deriving useful models from inspection of very limited data suggests that more attention is due systems analysis of library activities. Subsequent work will need to emphasize data-gathering technology.

—HUSTON DENSLOW

book briefs

(For further information on the books listed here, please write directly to the publisher mentioned.)

• *Bright Future Careers with Computers*, by Robert Laskow and A. N. Feldzamen. Chilton Book Co., 401 Walnut St., Phil., Pa., 1969. 215 pp. $5.50; $3.95 paperback.

This book discusses the growth and employment potential in the computer field; the types of jobs available; and how to go about getting them. It provides specific details on how to evaluate yourself; how to go about getting training; the various types of training that are available; and how to evaluate them. It even gives the headings in the telephone directory under which various pertinent government agencies are listed.

• *Business Decisions and Technological Change*, by John Diebold. Praeger Publishers, New York. 1970. 281 pp. $10.00.

Mr. Diebold, president and chairman

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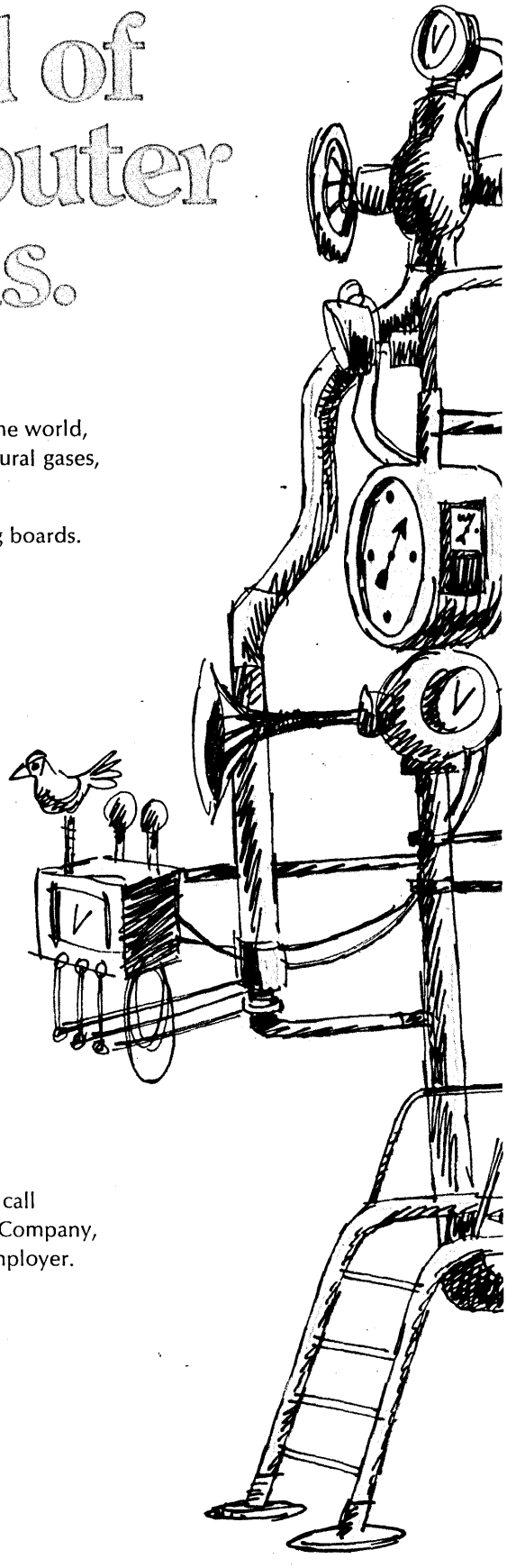

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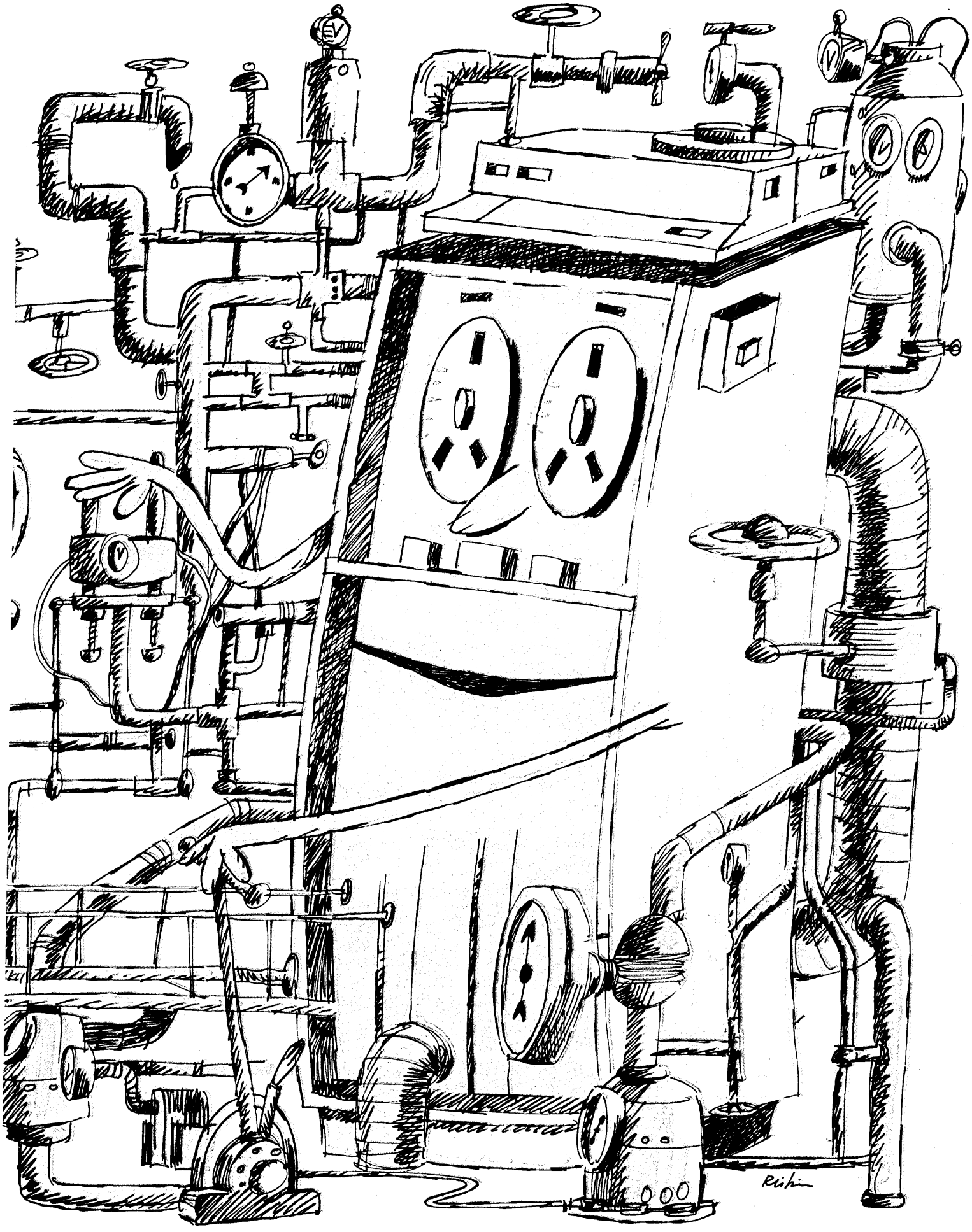
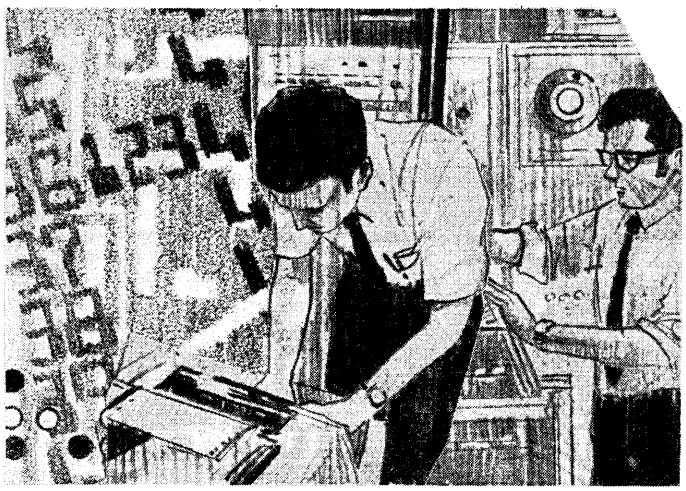


of the board of the Diebold Group, Inc., has had many years of experience in the dp industry and its management. The ideas and case studies presented in this book have been developed by him over a period of years, and have been presented in numerous speeches and articles, twelve of which form the basis for this volume. The material has been divided into the following parts: "Business Responds to Technological Change: The Computer as a Case Study"; "Managing a Business to Benefit Most from Technological Changes: Three Case Studies"; and "Using Technological Change to Create New Opportunities for the Enterprise: Four Case Studies."

• ***Computers 70; A Census of Computer Installations and Directory of Computer Service Companies in the San Francisco Bay Area*, edited by Edmund C. Salaverry. KLH Associates, 552 Mission Street, San Francisco, Cal. 94105, 1969. 200 pp. $10.50 ($9.00 with orders for three or more copies).**

This book is an up-to-date and comprehensive information directory covering all aspects of the dp field in the San Francisco Bay Area. It claims to cover every data center in private industry, in addition to federal and state installations. Over 700 computer installations are listed by name, address, and phone number; it also gives a breakdown of the equipment and languages used, the size of the staff, and the manager of dp at each center. In addition, some 200 companies are listed that provide specific services to the dp industry in this geographic area.

The publishers say that a similar volume for the Los Angeles area is due imminently, and a New England directory is planned for the spring.



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Datamation, 35 Mason St., Greenwich, Connecticut 06830

• ***Computers, Systems, and Profits*, by Paul T. Smith. American Management Association, Inc., New York, 1969. 200 pp. $10.50.**

This book intends to show the reader how the computer can best serve his company; how to maximize its effectiveness; and how to release its profit potential. It examines the use of orderly systems in the solution of managerial problems and in the creation of successful systems ventures. Extensive case studies are presented, both to provide initial shock treatment, and to set down guidelines for the correction of faulty systems.

• ***Computers: A Self-Teaching Introduction*, by Mario Farino. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 1969. 234 pp. $6.95 cloth, $4.95 paper.**

This is the latest in a series of books by Mr. Farino on the simplified teaching of computer languages and usage.

It assumes that the student has no previous computer knowledge, and no mathematical prerequisite is required other than the ability to do simple mathematical calculations.

The book includes three chapters on a subset of FORTRAN, and those students who have access to a computer can thus get actual computer experience. A comprehensive index is included.

• ***Centralized Systems Planning and Control (With a Management Search Pattern)*, by Adrian M. McDonough. Thompson Book Co., Information Industries Inc., Wayne, Pa., 1969. 274 pp. $12.95.**

The problem of centralization, with the accompanying fear that decision-making responsibility will be reduced, is examined in this book, with emphasis on the impact of electronic computers on the shape of modern organization structure.

Since the state-of-the-art in information systems is changing rapidly, the book goes beyond the analysis of single or isolated systems, and attacks some of the problems of coordination among the variety of systems and among the varied content of positions in the organization. An in-depth case study is an integral part of the text.

• *Digital Simulation of Continuous Systems*, by Yaohan Chu. McGraw-Hill Book Co., New York, 1969. 44 pp. $14.50.

The purpose of this book is to teach students or professionals how to use a digital computer for problems which previously could be solved only with an analog computer. The book has three objectives: (1) to teach digital simulation of continuous systems by MIMIC programming to people with little or no programming background; (2) to teach simulation with the three languages, MIMIC, DSL/90, and FORTRAN IV; and (3) to present the logic and construction of a simplified version of the MIMIC processor, called the SIMIC processor, which consists of less than 500 cards and is a working program.

• *Introduction to Nonlinear Network Theory*, by Leon O. Chua. McGraw-Hill Book Co., New York, 1969. 1014 pp. $22.50.

This undergraduate text covers with a single unifying approach both the theory and techniques for the analysis and synthesis of practical large-signal circuits, i.e. nonlinear circuits. Rather than be a collection of "recipes" for the analysis of the various types of networks, this book emphasizes the principles involved in composing the recipes, not the recipes themselves. Therefore, most of the methods developed are device-independent.

The book is divided into three parts. The first contains four chapters of foundation material, including the definition and characterization of nonlinear elements and general procedures for writing the equations of motion. The second part contains eight chapters devoted to resistive nonlinear networks, and the last eight chapters deal with dynamic nonlinear networks.

Most chapters start with elementary and basic concepts and are followed by more general theories, algorithms, and their applications. Exercises are included after most sections, and problems appear at the end of each chapter.

The book is virtually self-contained. All prerequisite material is developed as needed, and no mathematical background beyond basic calculus is assumed.

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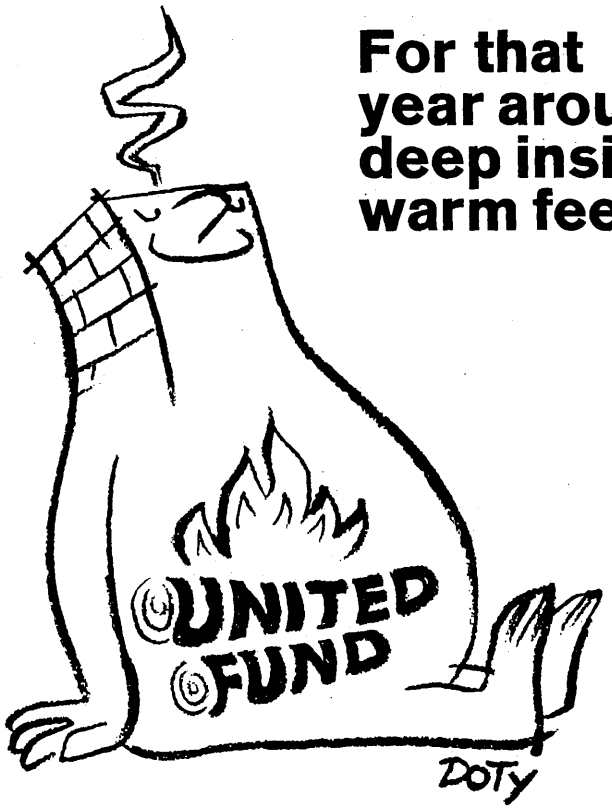

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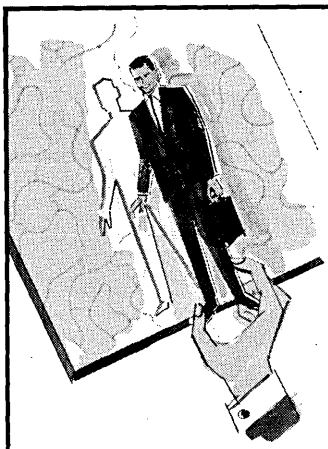

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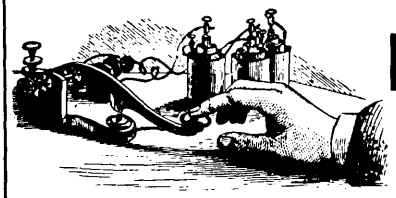

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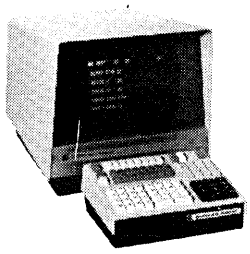

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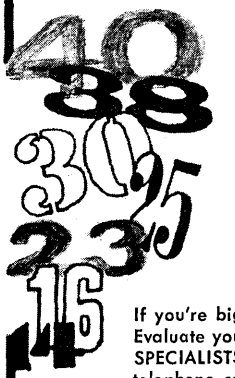

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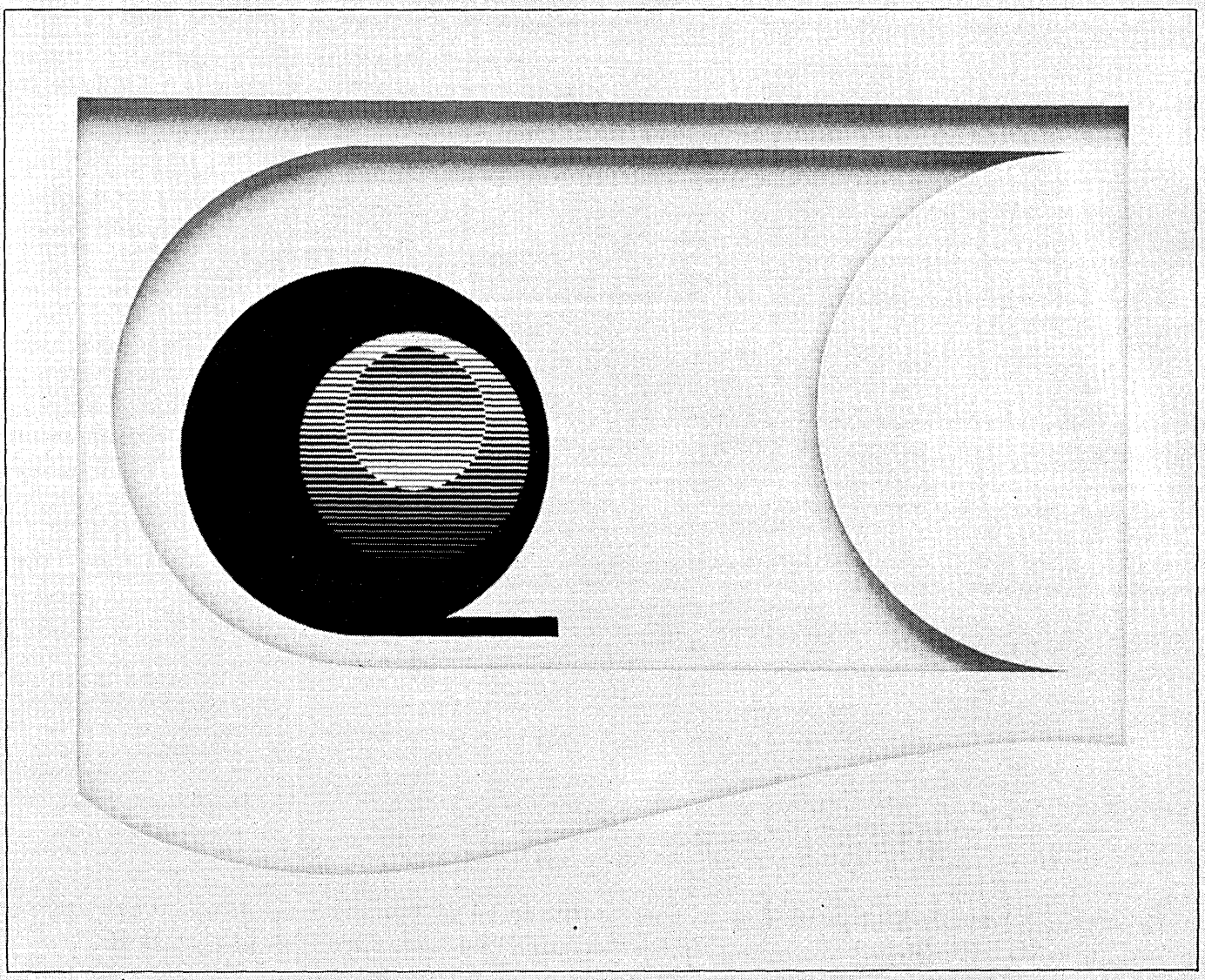

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GOVERNMENT INQUIRIES— U.K. STYLE

For all the shortcomings we ascribe to and irritations we suffer from the U.S. government machinery, there are some aspects of our imperfect democratic system that we may value too lightly. The subject in mind is the round of Congressional hearings and committees at which subjects as diverse as aerospace, nuclear energy and computers can be debated in the public domain as informed (and not so well informed) politicians, experts and anxious public have a go at influencing national policies.

There is no other country in the world which enjoys quite the same variety of channels through which to try and modify policies concocted in some of the great bastions enjoying government protection. This piece of idle philosophising has been prompted by the circumstances surrounding an inquiry into the workings of the British computer industry and the policies of a government department, the Ministry of Technology, that has a large financial stake in the biggest local manufacturer, International Computers Ltd., and that also overlords procurement policy for equipment purchased with public funds. Inquiries are being made by a group of Members of Parliament drawn from the three main political parties, and it is a subcommittee of a body known as the Select Committee of Science and Technology. (Select Committees are a device enabling British politicians to investigate the machinations of the government departments and they have powers to subpoena Ministers to answer for the actions of their civil servants. But these hearings are private.)

The current inquiry is important because it is open to the public. Indeed, the whole idea is to try and model some of these investigations more along lines adopted in Washington. If successful, the pattern may be adopted in other fields (defence, for instance). Invitations to give evidence have included International Computers, IBM and Honeywell; so a number of these meetings contained good knockabout stuff with the U.K. manufacturer crying over big systems orders given to U.S. manufacturers. IBM resiliently responded with some hard facts amply demonstrating that there was indiscriminate discrimination against all comers other than International Computers, and Honeywell modestly stated that it didn't worry unduly so long as someone would tell them, please, what was the policy.

This is all well and good since all the machine makers on the computer scene in Britain are entitled to courtesy at the very least from the government. But these quibbles are merely symptoms of more important underlying issues which may be submerged by such bickerings. Observers in the U.K. have good reason for believing that the future for Britain's computer industry lies with links with other European industries; this may provide a viable base but it won't make IBM, Honeywell, Univac, and Burroughs go away.

Almost in spite of the government, the software industry is flourishing in the U.K. and contains some perfect examples of the benefits to be gained in European cooperation. But the software voice is barely heard in the maelstrom generated by the big guns from the main frame houses.

Officials from government agencies accustomed to the veil of secrecy are showing an extraordinary ability to prevaricate. One irritated member of the computer investigation committee complimented a witness from the U.K. Atomic Energy Authority on his semantic acrobatics. But more than verbal dexterity should be expected from the biggest single purchaser that is not prepared to give even a general outline of its plans nor share its accumulated software knowledge, largely emanating from unclassified work, with industry and commerce at large.

The erstwhile body of investigators hope eventually to prepare a report on their probings which could provide useful guidelines for rectifying some of the more unsatisfactory aspects of computer development. They deserve better help than they are getting in performing this service.

—PEARCE WRIGHT

A VOTE AGAINST CENTRALIZED STAFF

I read Dr. Solomon's article on Economies of Scale and Computer Personnel in the March issue and frankly I am appalled. First, the theory that to minimize hardware and personnel cost by concentrating edp in a giant monolithic structure in the corporate headquarters is to my mind more responsible for the failure of the large corporation computer installation to pay off in services rendered than any other common mistake in computer management. While physical centralization of hardware can minimize payments to IBM and central-

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ization of staff *might* save personnel expenditures, this is suboptimization of total corporate needs. The goal of data processing should be the optimization of services provided the user (corporate, subsidiary and division) rather than the minimization of the two most visible costs.

The prime fault of the approach in the article is ignoring the needs of the user. Under the complete centralization advocated, any user not located at corporate headquarters will have a weak voice indeed in exerting influence to have the computer working to meet his individual needs. In addition, the user will not have available systems analysts intimately familiar with his divisional needs or familiar with the individual personality and idiosyncracies of the division that must be understood for proper systems development.

The fact that centralization of hardware and of staff are two separate questions is not made clear. While I believe that both subjects should be viewed as controversial, the arguments for physical centralization of hardware seem much more valid to me because the needs of the users (including proper response time) can be met by telecommunications. Decentralized systems staff does not invalidate the concept of centralized computers. Too many division managers put their priorities on obtaining a computer to meet their needs. While often valid, it really doesn't matter a tinker's damn where the central processor is located if proper response time is provided. Divisional management should care very much about having a systems/programming staff at their disposal to meet their systems development needs.

Arguments for decentralization of computer personnel were not included in the article to provide balance to the dollar justification of centralized staff as proposed. These arguments include:

1. Better service, involvement, response and sensitivity to the user's needs in a geographically distant location.

2. Systems development is often less massive and less prone to serious problems if broken down into manageable chunks.

3. Travel expenses of a central staff offset much of the apparent cost savings.

4. If salary levels are competitive and hiring standards are high, there is much greater job satisfaction for the computer professional with a small or medium size system staff. To be one of 10 or 20 instead of one of 200, to be better able to see the benefits and results of his work, to have more management contact, etc. are advantages of being on a divisional staff.

5. Involvement of the user is difficult for the corporate central staff to achieve.

6. The argument for staff centralization as a method of not reinventing the wheel and maintenance of common standards does not hold water. If standards are not maintained and duplication exists with decentralized staffs, this is a weakness of corporate edp, not of the concept of decentralized staffing.

7. Span-of-control problems are minimized with smaller staffs. Poor performance does not go unnoticed as easily in a small group. Evaluation of performance is more accurate in a small group.

8. Turnover in the small group is less. There is less seeking of jobs because of being buried and unnoticed in the large staff. More supervisory and management opportunities exist if divisional staffs exist.

10. If there is a scarcity of computer professionals in the area of the corporate office, then these problems are more serious with centralization.

11. Decentralized staff in no way invalidates the concept of central *control*. A strong vp for MIS is a necessity, but this is also a requirement of centralization.

This list of arguments for decentralized staff can be expanded even more. However, my purpose is to emphasize that centralization vs. decentralization of computer personnel is hardly a one-sided argument, as Dr. Solomon's article would seem to indicate. The answer must be tailored to the organization. However, it seems to me that decentralized staffing provides for greater return in performance and benefits to the total organization for additional personnel costs that are at worst only slightly higher. This conclusion from looking at the total picture is totally different than Dr. Solomon's conclusion when he looks at computer personnel costs in isolation.

Finally, for a balanced appraisal of this question I recommend Chapter 9 of Joseph Orlicky's book "The Successful Computer System."—PETER BERMAN

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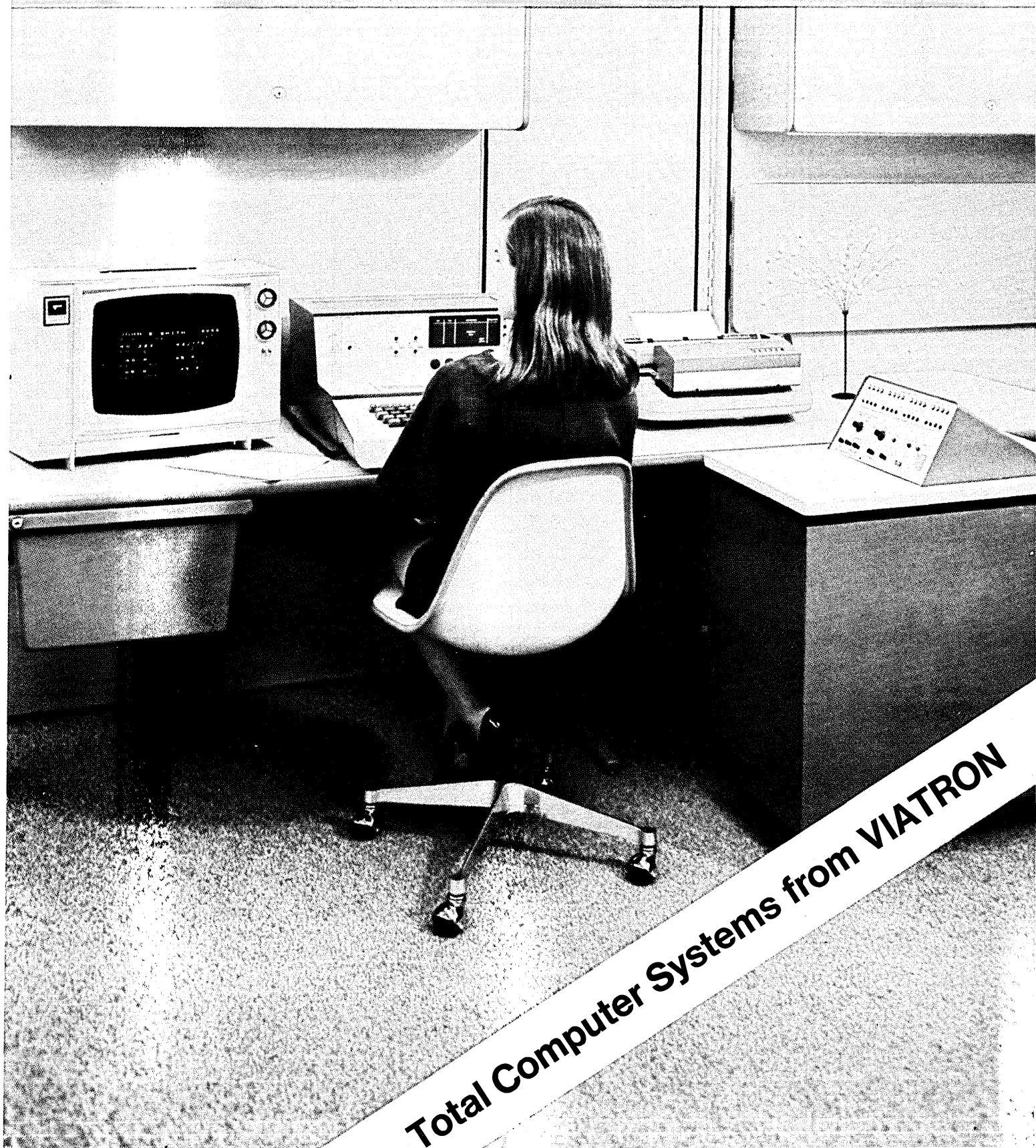

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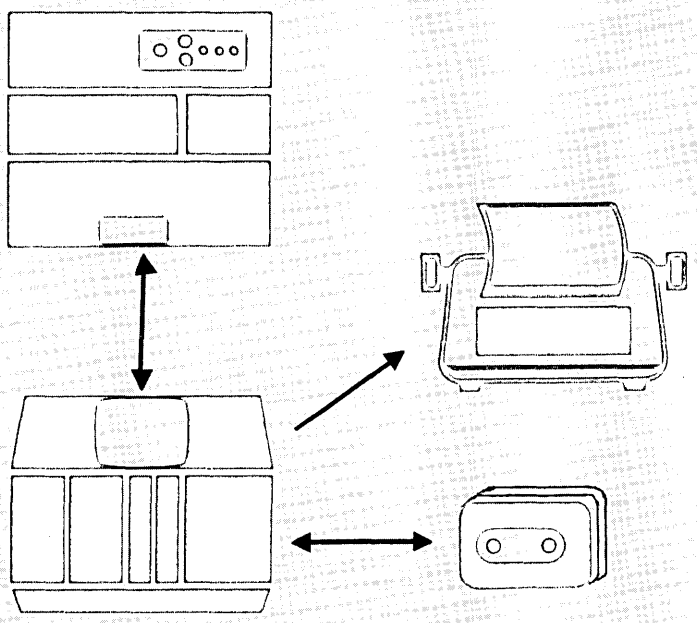

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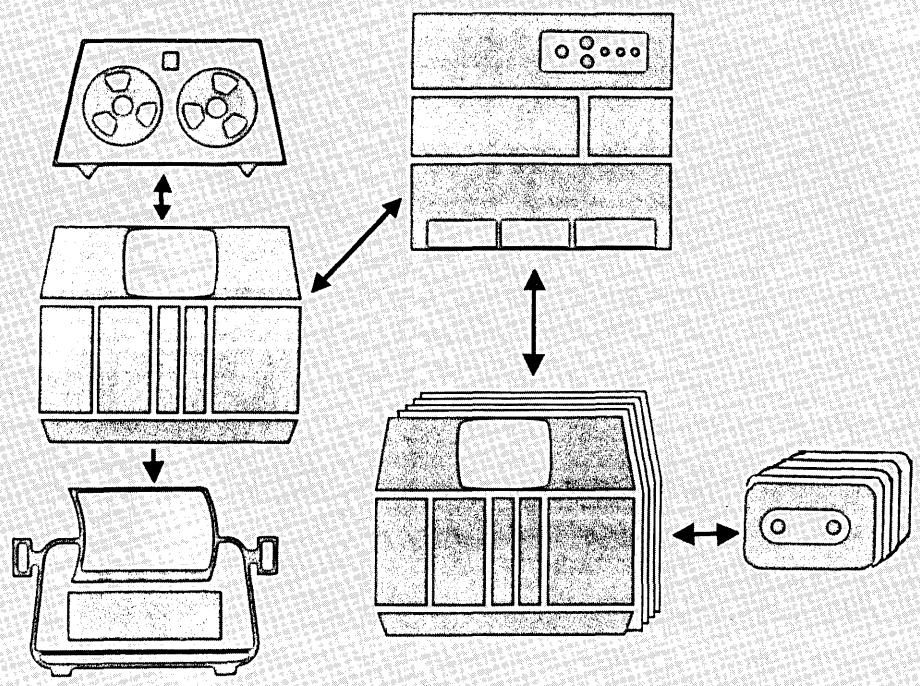

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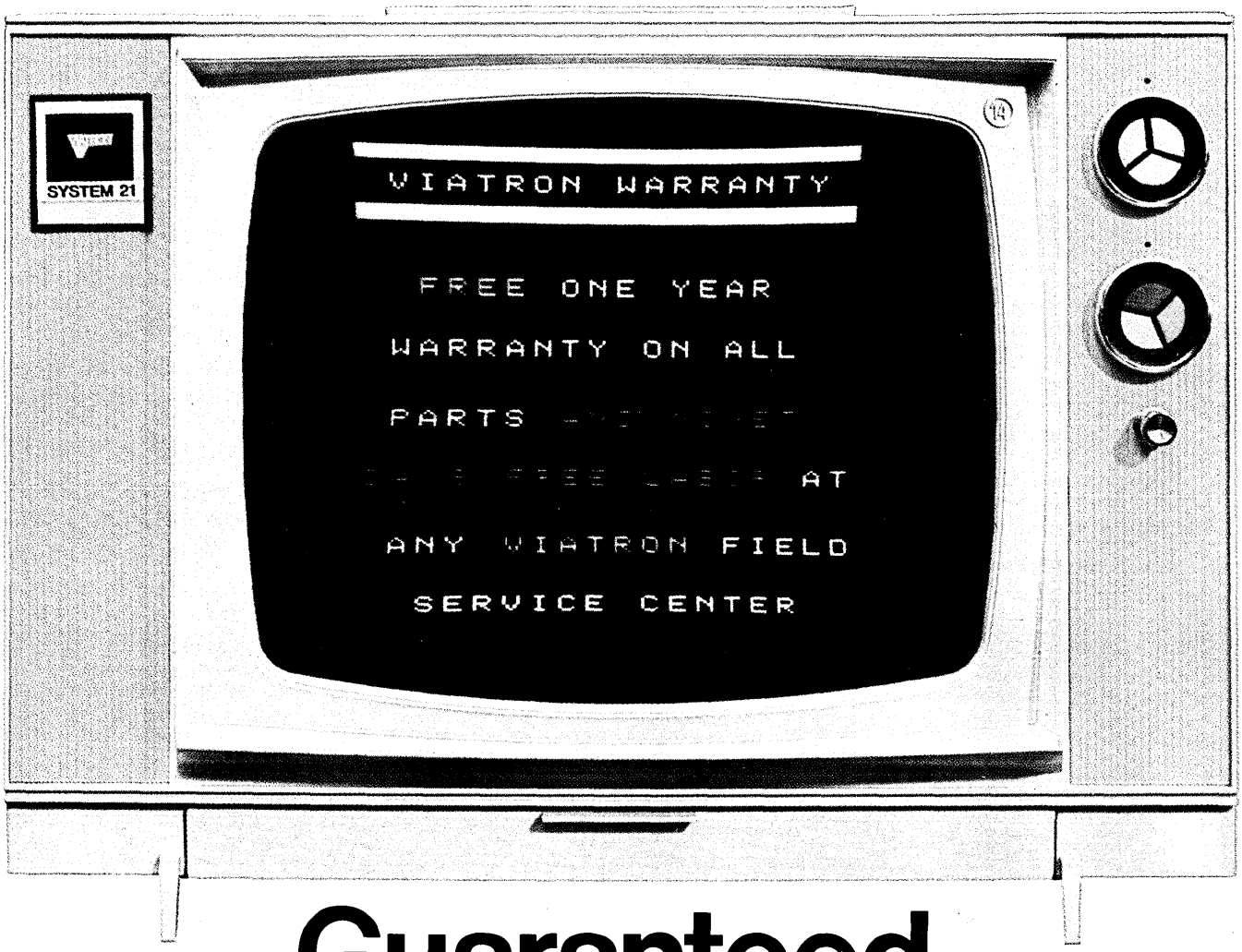
- upper and lower case
- full format control
- up to 130 character line
- continuous forms
- multiple copies



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For more information

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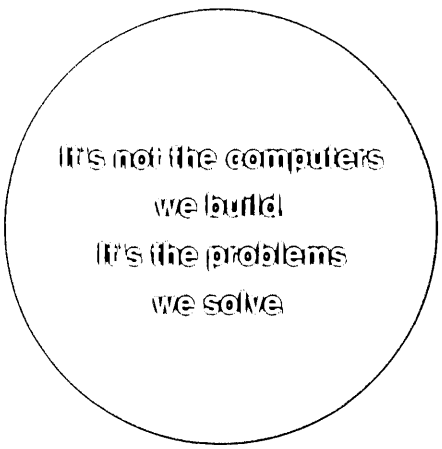

REDCOR has delivered, or has on order, more computer-controlled MOS test systems than all other manufacturers combined. In fact, nearly 80% of all MOS LSI/MSI devices produced in the upcoming years will be REDCOR-tested. Surprising, perhaps, but true. Why this vote of confidence from so many industrial giants? One reason is that we design and build, using state-of-the-art techniques, all the system components, including the computers. And we provide the systems engineering, the software, and the field service . . . a "one source, one responsibility" commitment. MOS testing may not be your application, but whatever your systems requirement, let a REDCOR Systems Pro solve it for you.

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See last four pages

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