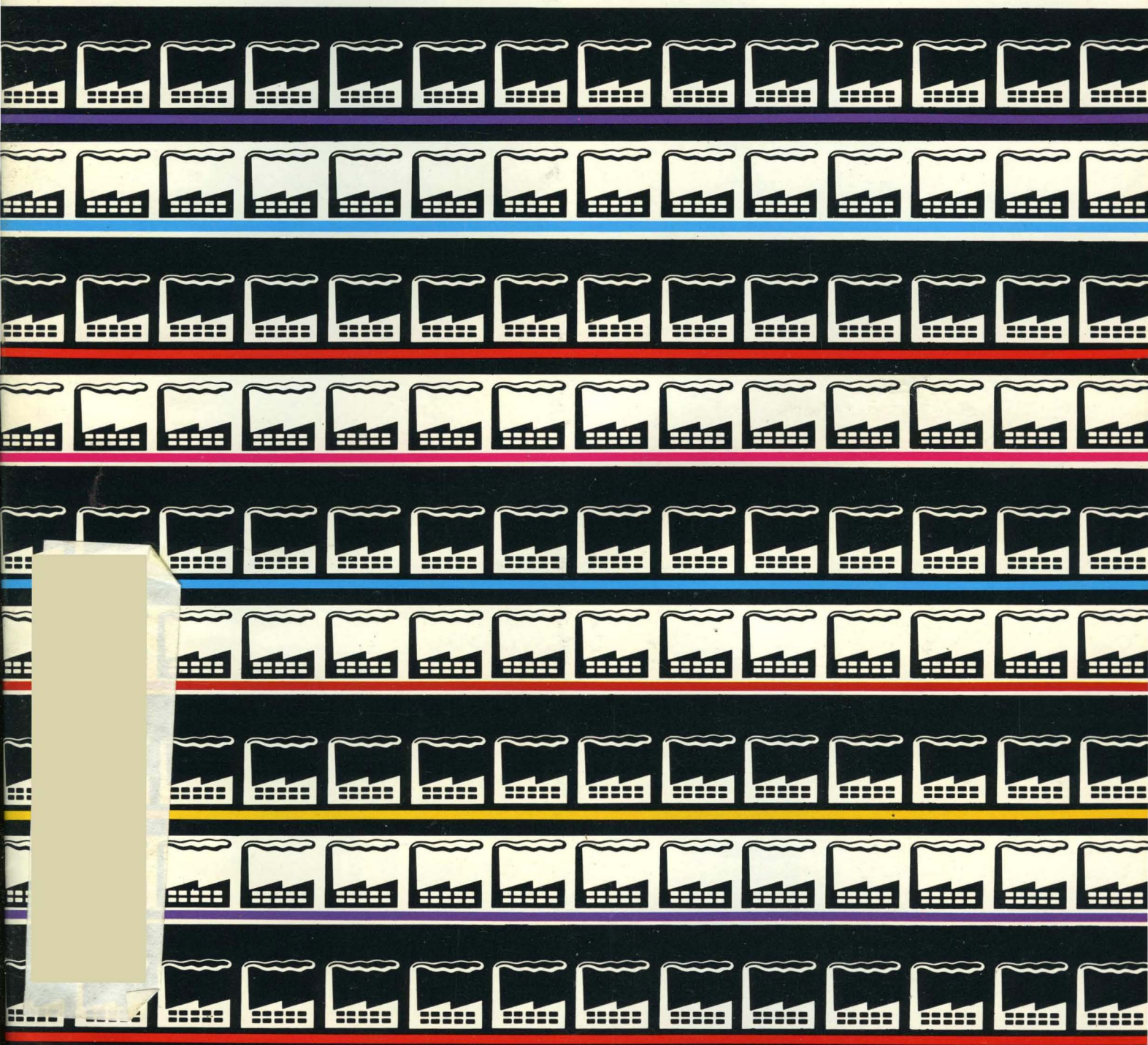
DATAMATION '72®

December



AUTOMATION OF MANUFACTURING

...plus an interview with IBM World Trade's president... part 3 of communications planning... taking advantage of lease credits... Don Knuth on sorting...

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The Twin Mini doubles throughput for just a few dollars more

Put two microprogrammable CPU's with separate control memories and I/O facilities into a Micro 1600 cabinet where they share a common core memory. That's the idea behind the Twin Mini. And it works wonders. For the first time, core memory is used so efficiently that your throughput rate is more than double that of other CPU's. Applications which normally call for much larger or more expensive computers can now be handled simply and economically by this effective combination of Micro 1600 parts.

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CIRCLE 60 ON READER CARD

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Because of Tally's exclusive data compression system, the Tally Datascribe will dramatically increase throughput using your existing modems. In fact, the Datascribe far outperforms any other terminal on the market. Using 200 character records, compare these average throughputs to what you're getting now:

150 records per minute with 1200 Baud Modems
200 records per minute with 1800 Baud Modems
300 records per minute with 3600 Baud Modems
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But that's only part of the story. Because Tally now offers three different line printers, you can mix and match printers to get the most cost-effective package for each individual terminal in your system:

Tally's 100 lpm printer for small volume terminals.
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Data Terminals • Printers • Disc Memories • Card Reader Terminals • Paper Tape Peripherals

CIRCLE 4 ON READER CARD

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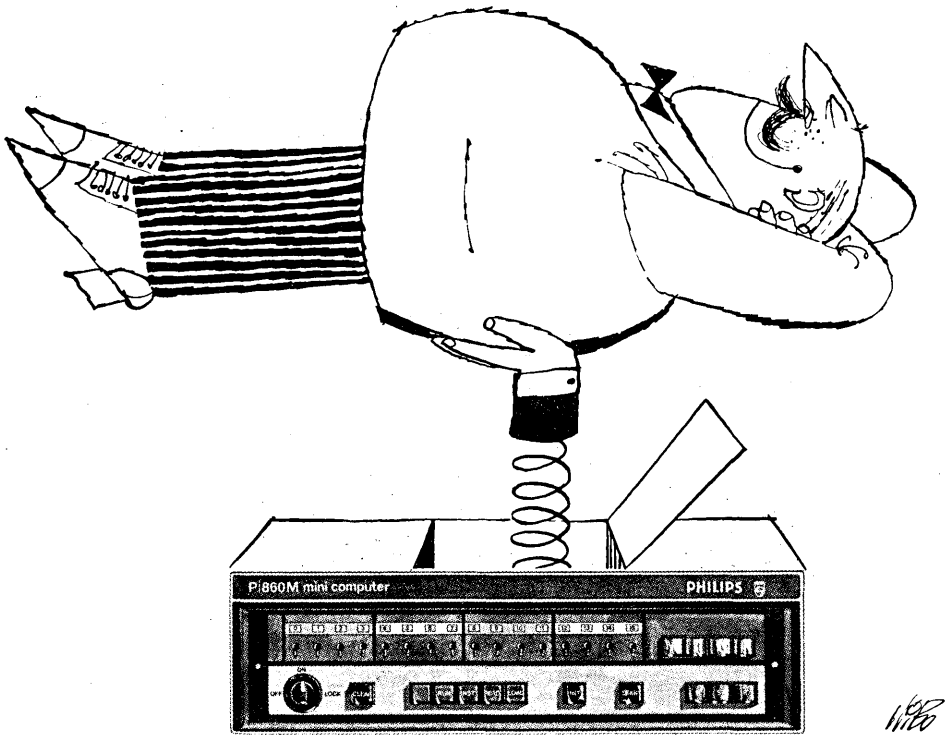
For OEM's who like someone to rely on!



If you are one of the many OEM's that accept out of the ordinary problems, then you need to work with a computer company whose resources are out of the ordinary. And reliable.

Philips mini computers offer an extraordinary and reliable combination of features:

- DMA PLUS genuine multiplex channel with 15 subchannels
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CIRCLE 51 ON READER CARD

DATAMATION®

DECEMBER, 1972
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360/CORE FROM CAMBRIDGE MEMORIES IS WINNING ALL THE BIG ONES.

Our *compact* 360/CORE replacement or expansion memory for System/360 computers offers you more and saves you more than any other system. That's why our *compact* 360/CORE is winning big government contracts, lessors' contracts, and with individual users as well.

IT'S COMPATIBLE-PLUS.

360/CORE is fully 360-compatible – plus it's upward and downward compatible and model to model compatible, all in the same box. That means fast on-site installation, fewer spare parts and minimum servicing and interruptions.

RECENT 360/CORE WINNERS

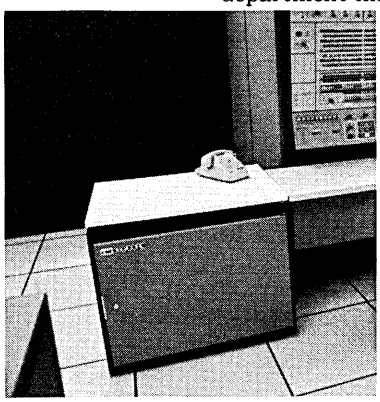
*U.S. Army BASOPS	37 Models 30s (16-128K)
U.S. Navy	8 Models 30, 40, 50
Leasing Companies:	
Randolph	Multiple Models 30, 40, 50
DPF	Multiple Models 30, 40, 50
Diebold	Multiple Models 30, 40, 50
EDP Resources	Multiple Models 30, 40, 50

And a growing list of individual 360 users.

*Largest add-on core award in history

IT'S ULTRA-COMPACT.

360/CORE is available in a desk high unit, as well as in a 5-ft. high "tall boy." In one desk high cabinet we store 128K bytes plus "bump" (auxiliary) storage. And our desk-high is available for all models – 22, 30, 40 and 50. That means we take less floor space, provide your operators with precious counter space, and increase the efficiency of your computer room operations.



IT'S COVERED.

360/CORE uses the latest advanced core technology. That means more core in less space, plus maximum reliability. Then we back that with the best, most qualified field maintenance available. Fast. Knowledgeable. Expert coverage. In addition to our own 360/CORE specialists, we also have contracted with *both* Comma Corp. and Honeywell to give the best and broadest national maintenance coverage available.

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Expand or **replace** memory on your System/360 whether it's owned, rented or leased:

CMI Model	IBM Model	Expansion to:
CC22	360/22	64K bytes
CC30	360/30	128K bytes
CC40	360/40	448K bytes
CC50	360/50	1024K bytes

IT'S FROM CMI.

360/CORE is a product of Cambridge Memories, Inc., a company young enough to care, but old enough to have over 5,000 memory systems in operation. Our products include add-on memories for minicomputers (we were first), MOS semiconductor memories (again, CMI was first) and a full line of advanced memory systems in wide use by OEM manufacturers. We have a fully staffed R &D department that has developed some of the newest, most advanced technologies available, including a domain tip technology we call DOT. This promises low-cost, high-speed, all-electronic mass memory for future computers.

360/CORE is the winner in the 360-compatible core market. Contact our nearest sales office and let us tell you why.

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in business mini-computers

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Burroughs most powerful mini-computers use MOS/LSI circuitry for both logic and memory. You get up to 48 KB of modular semiconductor program memory. An important new feature—Dynamic Memory Overlay—serves a function similar to Virtual Memory in our larger systems.

Flexibility and responsiveness to change result from the L 8000's new cassette tape subsystem . . . new high-output line printers . . . new magnetic memory unit record processing and handling capabilities . . . computer-compatible magnetic tape data collection unit . . . 96- or 80-column punched card equipment . . . edge-punched card and paper tape equipment. When you add data communications, your L 8000 can be a powerful terminal computer.

Burroughs L 8000 Series. For the professional business manager.

Burroughs

CIRCLE 9 ON READER CARD

Look Ahead

IT'S NOT PATENTLY CLEAR

The Supreme Court's ruling last month that computer software is not patentable (see p. 97) left holders of existing software patents wondering what it is they have. Even before the ruling some felt their patents were, at best, "deterrents," and now they're not convinced they're even that. Attorney Roy Freed said he felt the negation of existing patents was "implicit" in the Supreme Court ruling. Other attorneys, who hadn't studied the full decision, weren't so sure, but they agreed existing patents are considerably weakened by the ruling, particularly in light of the fact that some 70% of patents of other types which have been litigated have been declared invalid. There appeared little feeling that Congress would act on the issue soon or at all. A bill before the 92nd Congress to revise and reform patent laws does not exclude software as does previous legislation, but attorneys call its wording "ambiguous" enough to exclude it, and "we'll have a new Congress after Jan. 1." And that is where industry lobbyists will start putting pressure.

THE 115 AND A NEW DISC

It shouldn't be long before IBM fills the last gap in its 370 line with the 370/115. And many look for IBM to announce a low-priced disc drive at the same time--either a 3330 deriviative or, more likely, a System/3 disc cartridge using 3330 recording techniques and substrate. The latter would yield about 20 million bytes per cartridge--four times the storage of the S/3 cartridge.

The marketing strategy is explained this way: Model 125 users still have only the 3330 now, and that adds up to an expensive system--too expensive for many customers--so the speculation is that the 115 and the new disc will be out before the winter is over. IBM once again makes life difficult for the beleaguered independent peripheral manufacturers whose 2311- and 2314-like discs, coming off lease, are piling up in the warehouses. It's impractical to attach them to 125s, and with a new disc IBM would also lock them out of the 115 market.

HIGH DENSITY PLANS

A 12-year old drum memory manufacturer in search of a new product and a fledgling disc drive maker in search of a marketing arm were about to merge late last month. Vermont Research Corp., Springfield, Mass., will acquire OMI Memories, Inc., the two-year-old Los Angeles subsidiary of Energy Conversion Devices that once planned to make a 3330-like disc drive having 10 times the IBM density. The Los Angeles company becomes VRC California, a subsidiary. Its first product, a disc device with three times the recording density of IBM's 3330 discs (Nov., p. 112), soon may be followed with one seven times the IBM density.

KEY-DISC: CROWDED BUT SPECIALIZED

The next generation of key-to-disc data preparation offerings are being geared to specialized applications. Cummins-Chicago is introducing Keyscan 4400, a hybrid keyboard and scanning system for banks and retailers to be offered in configurations of up to 12 keystations. Inforex early this month announced a new system that is similar to the 4440 and for the same markets. Data Input, Minneapolis, "seriously" considers entering the shared processor market. It's completed feasibility studies showing it can make a

keystation with crt for $360. But it too, says president David Malmberg, will concentrate on a few vertical markets, as yet unannounced.

TELETYPE TESTING MOBILE TELEPRINTER

Teletype Corp. has been field testing a half-size, 40-column impact printer that would receive data transmitted over radio frequencies and be used in vehicles. The "high-speed compact printer," as it's reported to be called in-house, would run at 1,200 wpm and sell for under $1,000. A Federal Communications Commission ruling this year opened the frequency spectrum to all forms of mobile teleprinting (it previously was restricted to public safety vehicles). Some market studies indicate as many as 500,000 units could be installed by 1980, with law enforcement and fire fighting accounting for only 10%. IBM, Xerox, and Motorola offer teleprinting receivers, but the Teletype device would be the only impact printer and, at 1,200 wpm, have the highest speed.

GAME SHOWS UP BIASES OF CITY PLANNERS

The Los Angeles Department of Redevelopment, a joint city-federal government agency, is going to play a computer game this month to determine the personal biases of its staff in community planning. The game is called Trade-off (see p. 104). Some of the department's staffers played it at a recent conference on Shelters for Mankind. "They were surprised to learn they had biases," said Ruth Baker, president of Art and Technology in California, one of the game's designers. The surprise was translated to action when the department contracted to use the game. After staff biases have been identified, the game will be taken into highly Spanish speaking areas of East Los Angeles, scheduled for redevelopment, where it will be used to identify and quantify needs and desires of residents. For this designers are reworking the APL-based game so its questions can be posed in Spanish.

ACADEMY'S COMPUTER BOARD DISBANDED

Put into hibernation last May when it ran out of contracts, the five-year old Computer Science and Engineering Board has now been disbanded by the National Academy of Sciences. Staff director Warren House is now a part-time advisor to the Academy and an independent consultant the rest of the time. The board's demise is blamed on many things, one of them its failure to establish priorities acceptable to its sponsors, starting with the Advanced Research Projects Agency which sponsored it for three years.

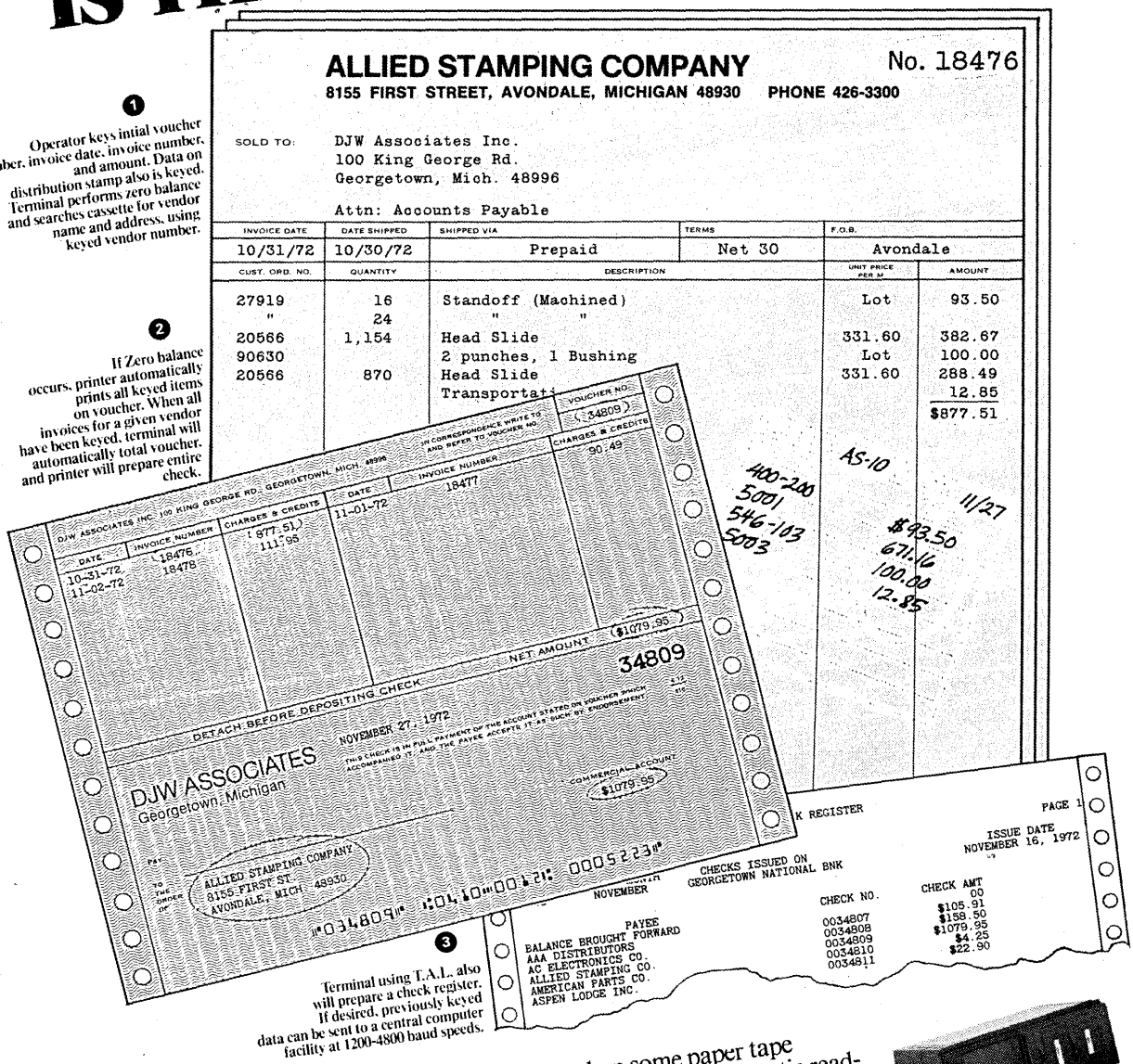
Some blame the chairman, Anthony Oettinger, who allegedly "made commitments to the sponsors, collected money on the strength of those promises, and then failed to deliver...(and) refused to let the Academy review the board's work." What happens now is anybody's guess. The National Research Council, another arm of the NAS, is now being reorganized and may take over the CSEB's computer-related research mission.

FEDS HELP PROMOTE RETAIL AUTOMATION

The federal government is putting money into retail automation. The National Bureau of Standards (NBS) and the National Retail Merchant's Assn. (NRMA) have embarked on a joint reorder automation program for department stores. It will be partially federally funded, but the amount hasn't yet been determined. First step will

(Continued on p. 139)

THE BEST THING ABOUT OUR ACCOUNTING MACHINE IS THAT IT ISN'T ONE.



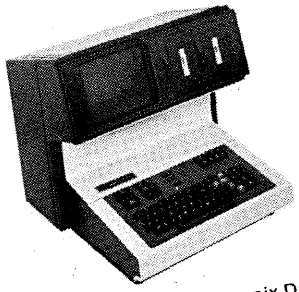
It's Sycor's Model 340 Terminal—the most widely used intelligent order-entry terminal in the world. But in addition to providing error-free order-entry, it can be equally effective in many accounting applications—like the accounts payable example above.

In fact, Sycor's 340 terminal is superior to conventional accounting machines in a number of ways.

It is much easier to program because of Sycor's powerful Terminal Application Language (T.A.L.). Its cassette tapes write at 1000 cps (100 times faster than some paper tape devices) and perform an automatic read-after-write check. And the 340 also has a CRT for visual verification and correction of keyed data.

Sycor's 340 can also be equipped with a wide variety of peripherals—three types of printers (30 cps, 165 cps, and 200 lpm), 7 or 9 track magnetic tape drives, a card reader, and binary synchronous communications (1200-4800 baud).

To find out more about the versatile 340 and all it can do, simply write or call for our free brochure.



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The Sycor 340 Intelligent Communications Terminal.

CIRCLE 66 ON READER CARD

the peripheral company showcases advances in the state of the art

Telex brings the peripherals of

Within the next few months, the TELEX roadshow of advanced computer peripheral systems will be playing to an audience of more than 5,000 EDP managers and engineers from Boston to San Diego. This beautiful new traveling exhibit has a complete TELEX Off-line Printer System; 6420 and 6410/6411 Tape Drives; and a 6316 Disk Drive . . . each fully operable, and all contained in a plush, 40-foot van.

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We're bringing you this "galaxy of computer peripherals" on wheels to prove a point. And that point is simply this: there's not only an alternative to IBM in the area of peripheral and supporting subsystems, there's a *better* alternative. A complete line of computer products which saves you money. And more importantly, a line of products which actually *outperforms* their IBM counterparts.

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Sept. 15 & 18	Minneapolis	Nov. 13 & 14	Atlanta
Sept. 19-22	Chicago	Nov. 15	Chattanooga
Sept. 25	Louisville	Nov. 16	Nashville
Sept. 26	Cincinnati	Nov. 17	Birmingham
Sept. 27	Columbus	Nov. 20	New Orleans
Sept. 28 & 29	Detroit	Nov. 21	Jackson
Oct. 2 & 3	Cleveland	Nov. 22	Memphis
Oct. 4	Pittsburgh	Nov. 27	St. Louis
Oct. 5 & 6	Buffalo	Nov. 29	Denver
Oct. 9	Rochester	Dec. 1	Salt Lake City
Oct. 10	Syracuse	Dec. 4	Spokane
Oct. 11	Albany	Dec. 5	Seattle
Oct. 12 & 13	Boston	Dec. 6	Portland
Oct. 16	Hartford	Dec. 8	Sacramento
Oct. 17	Westchester Co.	Dec. 11 & 12	San Francisco
Oct. 18	Long Island	Dec. 13	Oakland
Oct. 19	New York City	Dec. 15 & 18	Los Angeles
Oct. 20	New Jersey	Jan. 8	San Diego
Oct. 23 & 24	Philadelphia	Jan. 9	Phoenix
Oct. 25	Allentown/ Bethlehem	Jan. 11	Albuquerque
		Jan. 12	Amarillo
Oct. 26 & 27	Wash. D.C./ Baltimore	Jan. 15	San Antonio
		Jan. 16	Austin
Oct. 30	Richmond	Jan. 17 & 18	Houston
Oct. 31 & Nov. 1	Winston Salem/ Charlotte	Jan. 19 & 22	Dallas
		Jan. 23	Oklahoma City
Nov. 3	Jacksonville	Jan. 24	Tulsa
Nov. 6	Orlando		
Nov. 7 & 8	Miami		
Nov. 9 & 10	Tampa		

tomorrow right to your door!

Research, Engineering, Service

Until now, many computer peripheral manufacturers have chosen not to meet "the number one" in direct battle. Some opted for specialized equipment, which IBM didn't offer... others, for lower prices on equipment which was essentially a carbon copy of a dated IBM original . . . or sell-it-and-forget-it arrangements, dependent on somebody else's service organization.

TELEX decided to take the leader head on. Complete subsystems, containing original advances in the state of the art... timed for introduction close to that of "the number one" ...engineered and built with a quality control that meets any standard, anywhere in the world. Priced to save money. And backed up by the most experienced, most extensive peripheral service organization in the industry and the world.

Last year, 40%*
Tomorrow, a new number "one"

After many years of intensive research and development, engineering excellence and investment in service, TELEX is now beginning to reap the fruits of its efforts. In the twelve months of 1971, fully 40% of all IBM replacement tape and disk subsystems sold or leased in the U.S. were TELEX systems. And we don't intend to stop there. We're aiming for "the number one." Have we got what it takes to move up ahead of the world's most powerful data processing giant?

You'll never know till you've heard our story and seen our equipment first hand. So drop in and take a seat at one of our roadshow performances. We'll be playing your neighborhood soon.

*Source: International Data Corp. (IDC), an independent computer industry research firm.

A great microfilm name is now a great name in micrographics systems.

Great diazo microfilm has been Bruning's little specialty for years. Today's Bruning dry diazo film is a better value than ever; it's easier to use than silver-halide film, images have better resolution, costs are lower, and throughput time is sharply reduced.

Bruning offers a complete line of microfilm in fiche and roll form, in a variety of sizes, for duplicating both camera- and computer-generated film. In black, blue, or sepia images. You'll find it doesn't cost a cent extra to get Bruning's superior quality and service.

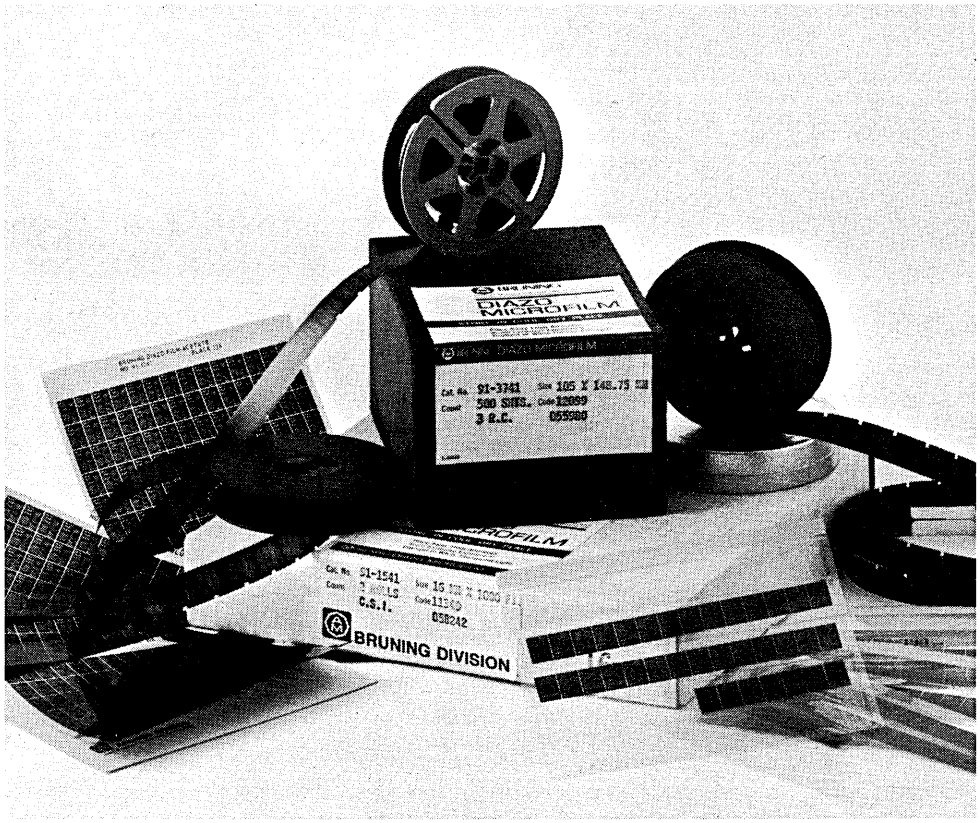
And now Bruning is a single source for assured micrographics duplication quality. In addition to film, we offer a remarkable array of enlargers, duplicators, printers, readers, and collators. Many of these machines perform several functions in space-saving, time-saving, and cost-cutting combinations.

The Bruning Micrographics Systems Specialist in your area is ready now to demonstrate the superiority of Bruning diazo microfilm. And to tell you about other Bruning hardware and software that makes up our systems capability in micrographics.

Call your local Bruning Sales Office today. Or write Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

The bold new force in micrographics.

The best microfilm is diazo. The best diazo is Bruning.



BRUNING

DIVISION OF ADDRESSOGRAPH MULTIGRAPH CORPORATION

If you're using more than a single data terminal, you need a centralized terminal support system.

How else can you know the status of your entire system?

And that's one of the key jobs of Termicare—to detect system problems and inform you of them. We do it by monitoring all your terminals in one place, our Termicare Center (shown below).

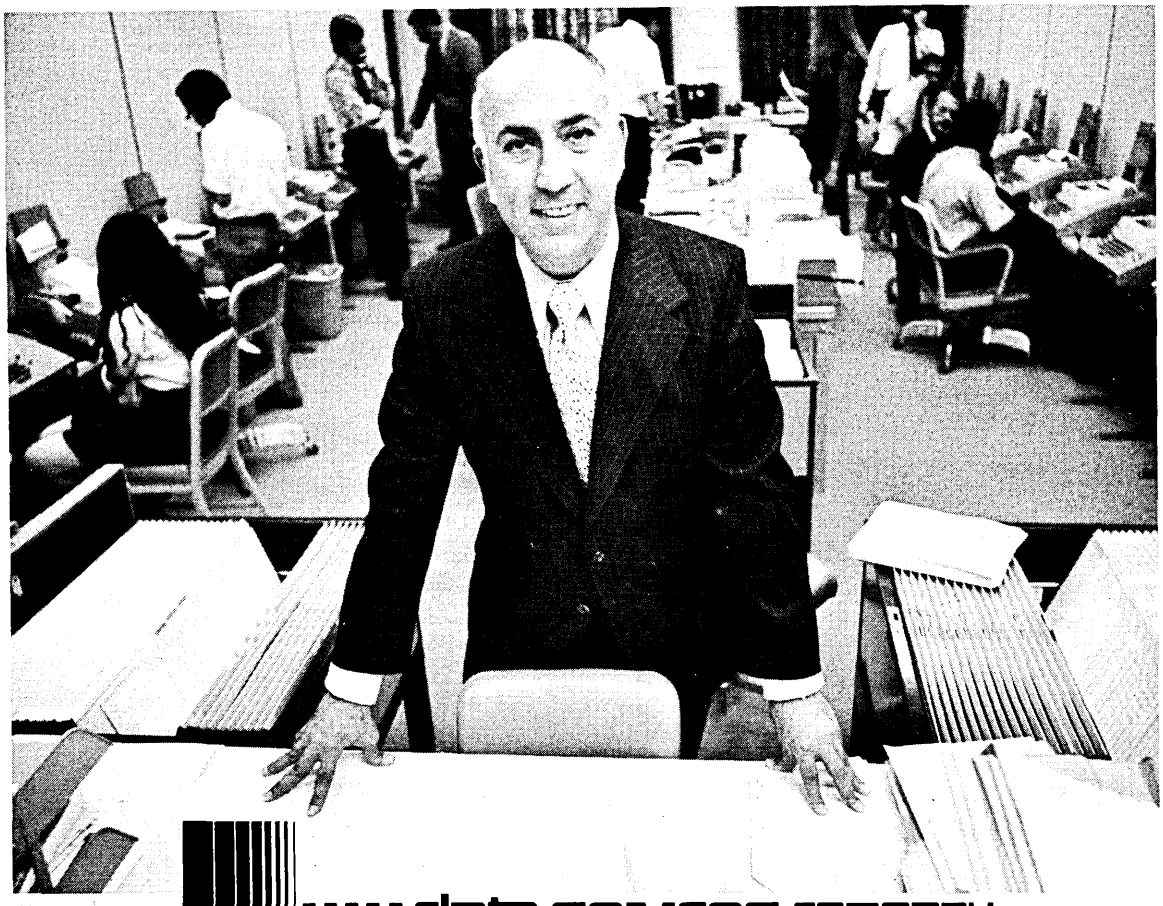
At the Center we maintain files on all terminals leased from us. So when you call in we know who you are and what equipment you have. A pool of experts is on hand to test your terminals and diagnose problems.

We can dispatch field technicians from 457 service locations. And from our Center we follow up each service call. And because we have centralized record-keeping we're able to analyze terminal performance and use this information to improve terminals.

Termicare is just one aspect of the services we offer for your terminal system. And your system is our major concern. We do everything we can to support it. We make certain you get the optimum terminals, out of our selection of 62 models with 112 options. And we install them right by testing them at our Termicare Center.

So if you are a multi-terminal user, we can be your single terminal source. Find out by contacting me at 800-631-7050 (N.J. 201-529-1170) or write to 16 McKee Drive, Mahwah, N.J. 07430.

"And we have it for you with our Termicare system."
Z. V. Zakarian, president



western union data services company

Calendar

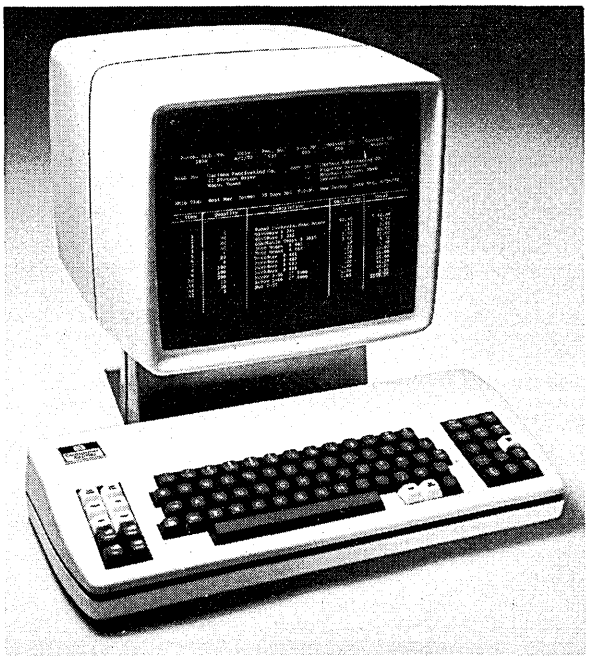
EVENT/SPONSOR	DATE	LOCATION	CONTACT	COST
	JANUARY			
Sixth Hawaii International Conference on System Sciences	**9-11**	Honolulu	HICSS-6 2565 The Mall Univ. of Hawaii Honolulu, HI 96822	$40
ACM/AIIE, IEEE, SHARE, SCi, TIMS Winter Simulation Conference	**17-19**	San Francisco	TIMS One California St., 2425 San Francisco, CA 94111	$70, advance $90, at door
National Microfilm Assn. Mid-Winter Meeting	**17-19**	Phoenix	NMA 8728 Colesville Rd. Silver Spring, MD 20910	$60, members $75, others
Hospital Information Systems Sharing Group Seminar on Information Science and the Health Care Institution	**17-19**	Las Vegas	Dean R. Cannon P. O. Box 305 Bountiful, UT 84010	$190
ACM, IEEE Second Annual Computer Communications Conference	**24-25**	San Jose	Jan C. Master Informatics Inc. 3971 E. Bayshore Palo Alto, CA 94303	$20, general —$2.50, members —$2.50, advance
Tenth Semi-Annual World-Wide ICES Users Conference	**24-26**	Atlanta	Dr. Leroy Z. Emkin School of Civil Engrg. Georgia Inst. of Tech. Atlanta, GA 30332	$50
Assn. for Development of Instructional Systems Meeting	**30-Feb. 1**	San Francisco	Dr. Peter Dean ADIS Secretary-Treasurer Monterey & Cottle Roads San Jose, CA 95114	$15, members $20, others $5, students
ADAPSO 37th Management Conference	**31-Feb. 2**	Bal Harbour, FL	ADAPSO 551 Fifth Ave. New York, NY 10017	$90, members $150, others
	FEBRUARY			
IEEE Winter Convention on Aerospace and Electronics Systems	**13-15**	Los Angeles	H. J. Delaney 1101 Linda Vista St. Orange, CA 92667	$20, members $25, others $10, one day
IEEE International Solid-State Circuits Conference	**14-16**	Philadelphia	Lewis Winner 152 W. 42nd St. New York, NY 10036	Advance: $30, members $35, others
Computer Science Conference	**20-22**	Columbus	Dr. Marshall Yovits 101 Caldwell Laboratory 2024 Neil Ave. Columbus, OH 43210	$10 $3, students
ACM SIGCSE Third Technical Symposium	**22-23**	Columbus	Gerald L. Engel Computer Science Dept. 426 McAllister Bldg. Pennsylvania St. Univ. University Park, PA 16802	$15, ACM SIGCSE $25, ACM, ASEE $30, others
ACM Special Interest Committee on Measurement and Evaluation Symposium	**26-28**	Palo Alto	David H. Brandin SICME P. O. Box 9295 San Jose, CA 95157	$40, members $50, others
Seventh Annual IEEE Computer Society International Conference: COMPCON 73	**27-Mar. 1**	San Francisco	The Warr Department 1020 Corporation Way, 213 Palo Alto, CA 94303	Advance: $40, members $50, others

Computer Optics customized information display systems for NBC, Seiko, Aspen Systems Corporation* and the states of Minnesota, Nebraska and New York.

Now, what can we do for you?

Computer Optics has been building sophisticated information display systems for years. And because we specialize in one area, we have the experience and versatility to meet the specific requirements of our customers.

Take our newest model, the CO:75 Display System. It's designed to handle a wide range of business applications. Everything from simple data inquiries to the most complicated text editing procedures. In fact, the CO:75 has been used extensively for order processing, production control, legislative bill drafting, newspaper editing, educational instruction, and much more.



The CO:75 Pedestal Display and Keyboard.

Program editing. Information can be edited by character, field and line. Inserting or deleting, in any of these modes, automatically opens and closes the text. Lines automatically "wrap around" as information is inserted.

Movable keyboard. The streamlined, compact keyboard permits the operator to position it for maximum comfort and convenience.

Versatility. The CO:75 Information Display System can operate with IBM 360/370 Systems and many other major computer systems.

Hard-copy options. A valuable option of the CO:75 is the Video Image Printer. It enables you to make a permanent record for future reference. Just press a button, and in seconds you have a clean, clear copy on 8½" x 11" paper.

Another option is a character printer that functions as an automatic typewriter. It records data directly from the display or computer. And you'll find it perfect for preparing invoices and/or documents in final form with mono or variable spacing in single or multiple carbon sets.

Special features of the CO:75.

Easy-to-read display. A true upper and lower case alphabet plus high definition characters make the CO:75 very easy on the eyes. This helps reduce the fatigue that can cause errors and results in greater operator efficiency. The display even pivots on its base for easy adjustment to the most convenient viewing angle.

Wide variety of display formats. The CO:75 can display from 240 to 3,000 characters per screen. It can also show forms, charts and diagrams. And the standard 90 character set can be expanded to over 200 characters for handling multiple type fonts and/or foreign language alphabets.

Computer Optics' customer service.

We have a thorough knowledge of a wide range of display applications because of our experience in working with many different businesses, industries and government agencies. And we'd like to put our knowledge to work for you. Our staff of highly trained engineers will work closely with your organization in customizing display systems to meet your specific requirements.

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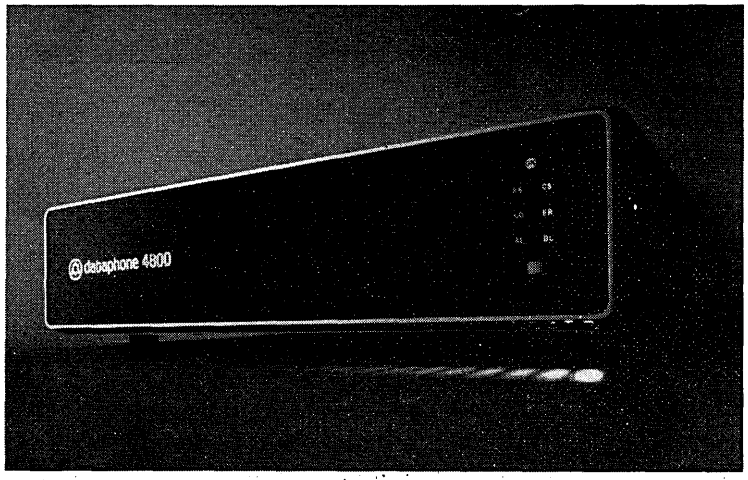
For complete information, write to:
Mr. Larry Mitchell, Vice President, Marketing

COMPUTER OPTICS, INC.

Berkshire Industrial Park,
Bethel, Connecticut 06801.
Phone: (203) 744-6720.

Introducing the 4800, first in a new family of data sets from the Bell System.



The Bell System's new solid state 4800 data set is designed for transmission at 4800 b.p.s.—and it's economical.

This set cuts transmission costs three ways. First, the charge for the set itself is low.

Second, an automatic equalization feature makes it possible to transmit at 4800 b.p.s. over basic, *unconditioned,* private-line facilities.

Third, it features rapid startup and turn around—ideal for polling applications.

This new, compact data set also offers the convenience of local and remote loop-back testing as well as status indicating lamps.

For details on the new data set, including its low price, call your local Bell System Data Communications Consultant, or mail our coupon.

AT&T and your local Bell Company.

DATA SERVICE DEVELOPMENT
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Dear Sirs: I am interested in "dataphone 4800."
☐ Please send me additional information.
☐ Please have a representative contact me.

Name_____ Title_____

Company_____ Tel._____

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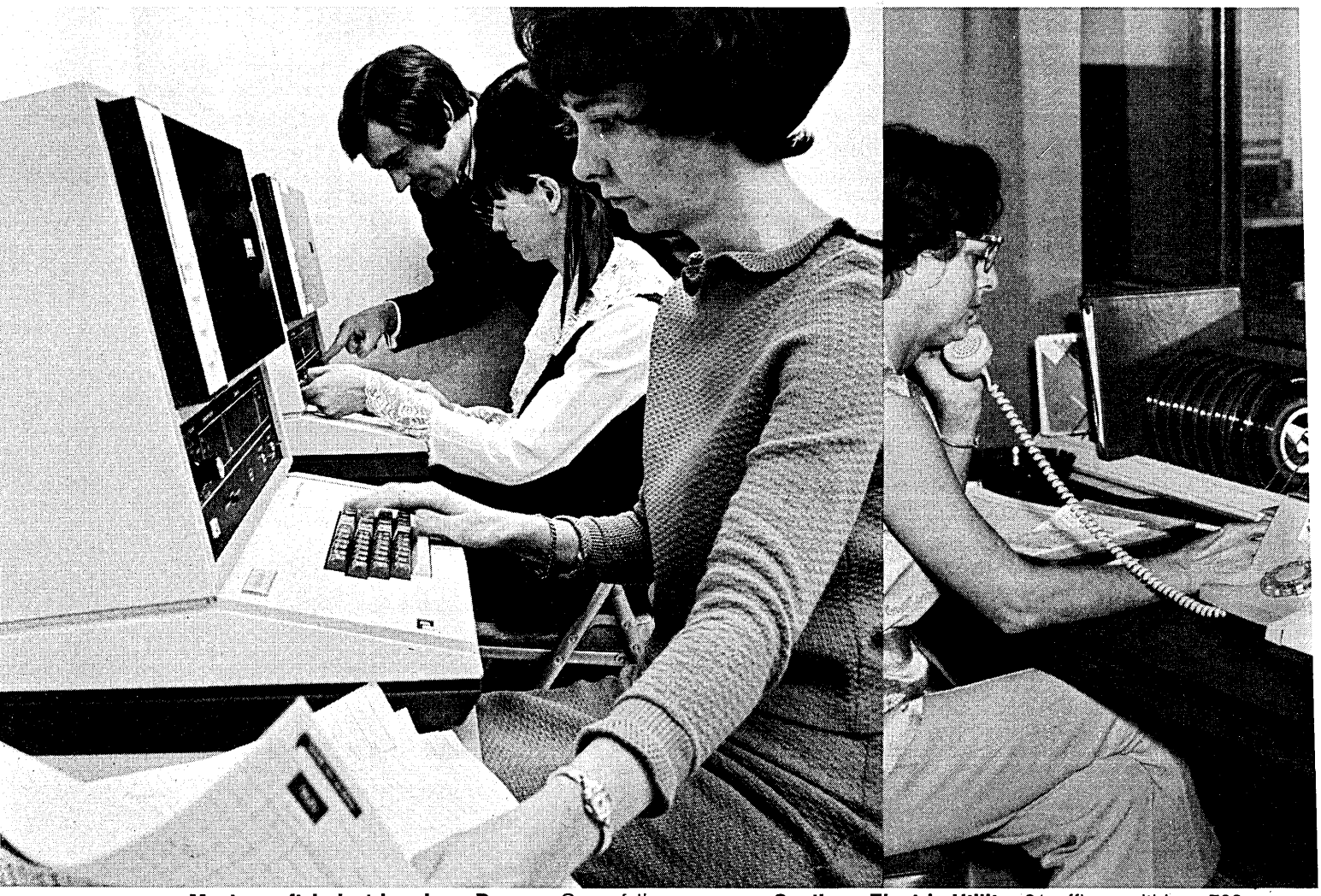
City_____ State_____ Zip_____

A Singer 4300 key-to entry and transmission



Mastercraft Industries, Inc., Denver. One of the largest manufacturers of kitchen cabinets, with facilities and sales offices in Dallas and Phoenix.

Mastercraft's present configuration in the Denver office includes a 4311 Magnetic Data Recorder for data entry and transmission, a 4301 for data entry and a high speed line printer. Both branch plants have installed 4311 terminals and high speed line printers.

Ken Sandoval, Mastercraft's controller, says the company switched from an on-line system using a Data-Phone to the Singer* system because it provides precise quantity-item inventory control. However, it is also being used for accounting functions at all locations, including accounts receivable, accounts payable and payroll. And they're considering adding a magnetic data central pooler for inventory tracking.

Has it made a difference? Sandoval is delighted. "Tape input is much faster . . . We realize quite a savings in expensive CPU time alone . . . and the absence of problems has alone justified the change to the 4300 system."

Southern Electric Utility. 21 offices within a 700-mile radius using a central Data Center for billing, accounting, labor distribution, materials and supply inventory.

The offices and the Data Center are each equipped with a 4311 Data Communications Unit. Data is transmitted over the dial-up telephone network daily.

The average office transmits 156,000 characters—or 8400 record blocks—to the Center every month. The average office can transmit a whole day's transactions to the Data Center in 15 minutes or less: eight times faster than with the previous punched card system. The Data Center recorder is now receiving over 200,000 records per month, and has the capacity for over one million records during any given month.

A printout is produced and mailed to each office daily from the Center.

Input into the Center's IBM System 360 is 45 times faster than with the former card system, which used both a keypunch and card reading terminal at each office. Costly mainframe sorting and conversion has been eliminated.

-tape system makes data this easy for you too:

L. L. Ridgway Enterprises, Inc., Houston. Manufacturer of architectural supplies. 30 retail-wholesale outlets in 15 branches, from Denver to Atlanta.

At each branch, accounts receivable, cash receipts and adjustments are recorded on a 4311 Magnetic Data Recorder. It also creates invoice input and verification for computer invoice printout via a Univac 9300. A branch can transmit its weekly transactions by telephone in 45-90 minutes.

Management indicates that the new 4311 terminals were justified on cash flow alone.

4300 Series Magnetic Data Recording System equipment is designed and manufactured by PERTEC, one of the largest manufacturers of key-to-tape systems in the world. The product line is a result of high technology engineering and extensive product testing. Each unit is manufactured in PERTEC's ultra-modern electronic manufacturing facilities under stringent quality controls which assures high quality reliable performance.

For further information, call your nearest Singer Business Machines representative, or write Singer Business Machines, San Leandro, California 94577.

Business Machines
that help you get
down to business.

SINGER

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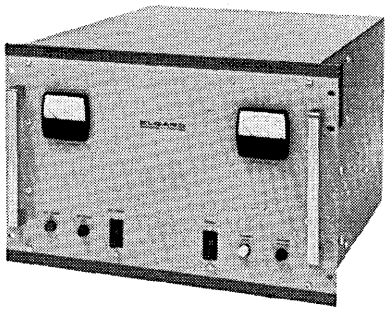
An Elgar UPS will protect any minicomputer operation from a lot of surprises.

Some clown pops a utility pole down the street and every minicomputer in the neighborhood loses its brains.

But with an Elgar Uninterruptible Power Source acting as a buffer between the minicomputer and the outside world, all computing tasks are spared disaster.

Should the AC power cut off for any reason, the solid-state Elgar UPS continues to supply AC power from its internal reserve up to ten minutes. Using a static by-pass switch (also solid state), the switching time is only one millisecond. (Not enough for a minicomputer to ever notice.) With our static by-pass switch, Mean-Time-Between-Failure for the UPS is 39,000 hours.

Should the AC power *never* cut off, the Elgar UPS still continues to serve the minicomputer operation by constantly furnishing a 40 db ac line transient reduction and ±2% voltage regulation.



Prices start at $1500 and the units come in four sizes: .5kVA, 1kVA, 2.5kVA and 5.0kVA. Ideal for DEC PDP/8, PDP/11, Data General Super Nova, HP 2116 series, IBM Systems 3 and 7, Varian 620i, et al.

Equally important, the Elgar UPS, with its sealed lead calcium batteries, is totally maintenance-free. (Over two years of diverse field experience underscores this claim.)

Like to hear more? Talk to Wally Foy collect, (714) 279-0800, 8159 Engineer Road, San Diego, California 92111. After all, you know what kinds of idiots there are on the roads these days.

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VISTAR... Henry would have been proud of it.

We've got a brand new display terminal called VISTAR. It's in the tradition of the Model T. Durable. Reliable. Low priced. And mass produced with all the necessary features built-in at no extra cost.

The list price is $2,295 and we think it's the best value around in the Teletype© compatible market. It's got everything that most users need and want... complete, but no frills.

Here's a partial list of standard features:

- **buffered/unbuffered operation**
- **80 characters x 24 lines**
- **75-18,000 bps asynchronous data rates — switch selectable**
- **compressed data transmission**
- **printer interface**
- **only two P.C. boards**

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Here are 12 questions you may have to answer (and the facts you need to answer them).

What is Easytrieve? Easytrieve is an easy-to-use information retrieval, file maintenance, and report generation system written for the IBM Systems 360/370 and RCA Series 70.

How is Easytrieve used? A few punched cards containing free form English statements are input to your card reader. These cards become simple parameters to the Easytrieve program which, in turn, immediately executes against any of your data base files.

Are any special forms or coding sheets necessary? No. You can even write your first Easytrieve program on the margin of this ad!

Is it necessary to "compile" or "assemble" when using Easytrieve? Never. Easytrieve is a "load and go" system.

Can Easytrieve process files that contain different record formats? Yes.

What kinds of outputs will Easytrieve generate? It will produce:

1. Automatically centered and formatted reports on up to five keys with subtotals on up to five different levels,
2. automatically formatted mailing labels with complete flexibility regarding number across, size and shape,
3. test files on cards, disk or tape (You can select every Nth record, reblock, shorten or lengthen record size, and reformat records),
4. punched cards (automatically or user formatted), and
5. multiple output subfiles and/or reports from a single pass of a master file.

How fast is Easytrieve? Easytrieve operates at I/O speed. It normally executes 3 to 4 times faster than tailored COBOL programs, and executes faster than most assembler programs written for general or specific applications.

How much core does Easytrieve require? It requires 24k for DOS and 45k for OS.

How much specialized training do Easytrieve users need? Since Easytrieve has English language statements, non-technical people can perform basic tasks with just a few hours training. Trained programmers need only a brief introduction to Easytrieve's capabilities.

Is Easytrieve available on a free trial basis? Yes. A demonstration, an introductory training session, and a 30 day trial are free and without obligation to prospective users.

How does Easytrieve compare in price to packages with similar capabilities? It's about half the price of most comparable packages, yet it has more features and capabilities than many of its higher priced competitors. The single-file-input version sells for $4,800, while the multi-file-input version sells for $6,000. Lease arrangements are available for both versions.

What's the best way to take advantage of the free trial offer? Fill out the form below and mail it to our corporate headquarters in Silver Spring, Maryland. We'll arrange to have our local representative demonstrate the Easytrieve retrieval and reporting system on your computer and leave it with you for testing.

RIBEK Corporation
Montgomery Center
8630 Fenton Street, Suite 615
Silver Spring, Maryland 20910
Phone: (301) 587-0115

☐ Please have your Easytrieve engineer call me.

☐ Please send me information on Easytrieve.

Name _____

Title _____ Computer System _____

Employer _____

Street _____

City _____ State _____ Zip _____

Business telephone _____ Date _____

D-1

Letters

At last

I would like to express my gratitude for your article on our visit to China (Oct., p. 109). It was the most sensible one I've read and reflected the trouble you took in putting it together. We have been beset by overenthusiastic and sometimes inaccurate press coverage, and it was therefore a delight to read, at last, an article that I feel accurately reflected our impressions. Thank you for an excellent job.

SEVERO M. ORNSTEIN
Cambridge, Massachusetts

Liberal comments

The article on FORTRAN documentation by Messrs. McCracken and Weinberg (Oct., p. 73) was greeted with applause at ETS. There is scarcely a FORTRAN programmer here who has not inherited an undocumented, unreadable program.

Recognizing the need for such documentation, a set of standards was instituted in July requiring FORTRAN production programs to use most of the techniques recommended in your article. For programs written before, only modifications are required to strictly conform, and an editing program has been written to insert blank COMMENTS cards where required, resequence statement numbers, etc. A review procedure for programs being released into production allows a programmer who may very well later inherit the program to check and approve the readability, but often the workload pressure to get the data processed takes precedence over thoughtful coding.

However, with the requirement of liberal commenting, it now becomes necessary to allocate development time to it, which brings up questions of expense vs. value or cost justification. Programmers can easily see the value in reduced frustration and time saved in modification, but management asks whether the greater development cost will actually be offset by more efficient machine use and fewer production firefights.

The Systems Div. of ETS will attempt to evaluate the benefit of its FORTRAN standards and would be interested in knowing of any similar efforts among DATAMATION readers.

RICHARD J. MARTZ
Educational Testing Service
Princeton, New Jersey 08540

Completely looped

I would like to add the following to the excellent article by Messrs. McCracken and Weinberg. A handy technique is to incorporate the index of a DO loop into the logical naming of the loop variables. For example:

```
      DO 20 I20=1,80
      X(I20) = 0.0
      DO 10 I10=1,81
            A(I20,I10) = 0.0
10 CONTINUE
20 CONTINUE
```

This makes nested loops easier to follow and ensures uniqueness of loop indices, permitting each loop to be checked for completion when debugging FORTRAN programs.

KENNETH SPERKA
Annapolis, Maryland

The authors reply: This looks like a good idea to us. Our only reservation is that it defeats the use of service programs for reassigning statement numbers into ascending sequence, since it involves embedding statement numbers into the program semantics. On the other hand, if all loop indices were required to be so named, such a routine could also check for correct usage of loop indices. This is a matter that most compilers do not check as thoroughly as one could wish, sometimes leading to object programs that are terribly difficult to debug.

Stranger than fiction

Regarding your October issue, it is interesting to compare the chief design engineer on the Phuttz Project and his opinions on ordinary compiler languages ("Also Sprach von Neumann," p. 84) and the aerospace giant now into small business dp with its stated preference for assembly language programming (News in Perspective, p. 136).

Would DATAMATION care to comment on the relative strangeness between the world of current news and the fictional world of Eric Blodax?

JACK L. ALEXANDER
Palos Verdes Estates, California

Point of no risk

Mr. Erdei's chart comparing IBM's fixed-term lease plan to IBM's standard rental rates (August, p. 59) does an excellent job of clarifying a set of complex alternatives. But the text fails to stress that the chart's greatest value is in making a point-of-no-risk analysis.

The classic trade-off of the rental vs. leasing decision is that the lessee gets savings in return for giving up flexibility (thus incurring the risk of being unable to make changes in equipment as promptly as he might later desire).

The amount of savings offered by IBM's fixed-term plan can be quantified. It then becomes necessary to quantify the risk—to see if it is justified by the savings. Mr. Erdei's chart allows us to do that.

Turning to the chart, we see that in the case of tapes and disc drives, which do not normally accumulate extra-shift charges, the point of no risk under a one-year fixed-term plan comes at the 11th month. In other words, if the customer, having signed for 12 months, releases the unit before the 11th month, he loses money—pays more than he would have under IBM's normal rental plan. So the customer who enters into a one-year fixed-term plan must realize that for all practical purposes he is making a commitment for 11 months.

Once he realizes that he is in fact making a commitment for 11 months, this raises a new question: Is the price offered by IBM—92% of normal rental—the best deal he can get for that piece of equipment in exchange for an 11-month commitment? Hardly. We or any of our competitors in the computer leasing business would offer him the same IBM tapes or discs for a term of 12 months at 75% or less of IBM's normal rental.

When we plot this alternative on the chart, we find that the point of no risk has moved back to 9 months. So, while the customer is still ostensibly making a commitment for 12 months, he is really depriving himself of only 9 months of flexibility, as compared to IBM's 11 months.

It follows that the customer can achieve both significantly larger savings than those offered by IBM, and more true flexibility, since the point of no risk is so heavily influenced by the amount saved.

So much for the units which normally do not accumulate extra-shift rental. Separate consideration must be given to other categories of equipment. IBM's extra-shift hourly rate system for System/360 and 370 equipment is:

1. 10% for cpu's and memory (on which no fixed-term plan is offered). These run up heavy extra-shift charges and thus the savings offered by a leasing company are most dramatic.

2. 10% on most peripherals, which means that for the monthly cost to aggregate 30% of normal rental (Mr. Erdei's upper curve), the unit would have to clock 704 hours in a 720-hour month—a virtual impossibility.

3. 30% on the 1403 printer (which means that the monthly cost in a three-shift operation—528 hours—can easily be 60% more than prime-shift).

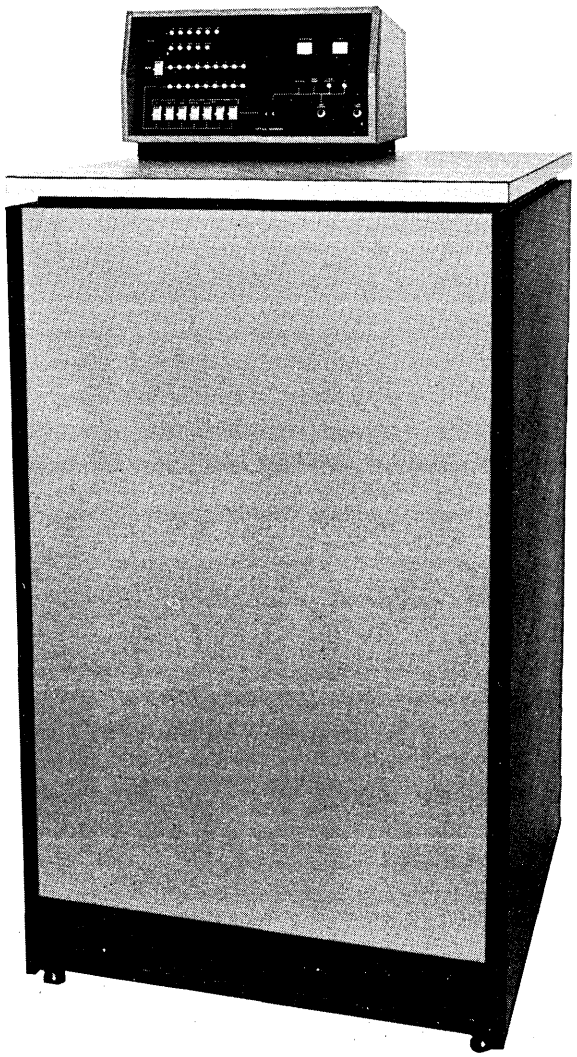
It is evident that IBM's two-year fixed-term plan on the 1403 (30% of prime shift) can cut its cost in a busy shop almost in half! The point of no risk comes before the ink is dry on the contract. Consequently, we don't hesitate to point out to our customers that the IBM fixed-term lease on their 1403 printer is a real bargain.

ARTHUR F. PHINNEY
Sr. Vice President
Computer Leasing Co.
Arlington, Virginia

Yoga

Whatever happened to Frank Marchuk and his laser computer?

You have had your readers hanging



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PIX is the revolutionary new communications product that allows 360's or 370's to talk to remote I/O devices as if they were right in your computer room.

PIX extends standard IBM line printers, card readers, card punches, or computers to remote sites and drives them with standard IBM unit record software.

And PIX saves you money in the process. PIX eliminates teleprocessing hardware and software including modems, terminals, BTAM and 270X.

PIX supports remote processing on your system regardless of configuration or core size.

Go remote. Put your card reader and line printer out where the application is, and let PIX handle the communications. Your system won't even realize the peripherals have been moved.

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letters

on the brink for a year now, following publication of his lawyer's letter to you in your Oct. 1, 1971, issue.

Reader Ronald W. Delporto had a letter in your Dec. 1, 1971, issue saying he was on the edge of his seat to learn more details, and you promised to supply more information as it became available. Since then, the silence has been deafening, and I am worried about Mr. Delporto sitting so long in the same position.

B. W. TALBOT
Dayton, Ohio

We haven't heard much lately, either. Laser Computer Corp. still has a phone being answered in Orange Co., Calif.; in Phoenix, Marchuk has a listing under his old company name of Computer General, but several recent calls yielded lots of rings and no answers. A few months ago, we were told that Marchuk had been seen in Las Vegas. When he emerges, we will let you folks know.

Perfectly clear

I have no strong opinion vis-à-vis one "m" or two in program(m)er (October Letters, p. 25), but I do in a matter from the Editor's Readout (p. 47). Many politicians are certainly opposed to busing, but I have yet to meet one opposed to bussing. Indeed, most say they do not want to bus little children, but they are quite willing to buss little babies (and big babies, too, I suppose).

JOHN D. STACKPOLE
Silver Spring, Maryland

Wrong anyway

Some of my best friends spel "programmer" with one "m," like Ned Chapin does in his books, but they are wrong anyway.

DANIEL D. MCCRACKEN
Ossining, New York

Program er

As a practitionner, reviewwer, reportter, workker, designner, and interpretter in the computer field—as well as being a readder of DATAMATION—I'll claim Pia's nickel for "programer." Just because IBM writes it with two "m's" is no reason why I have to!

If Pia likes appeals to authority, let's try another dictionary or two, such as p. 1045 in the *American Heritage Dictionary*, or p. 1149 in the *Random House Dictionary*. In some words, like "planner," a doubling of the final consonant serves a useful role—but not in "programmer" unless you are British.

The real issue probably is how we pronounce "programmer": Do we start the final syllable with an "m" sound, or without? I do not. Do you?

Now, how about a prize to Dan McCracken for "spel"?

NED CHAPIN
Menlo Park, California

The "mm" spelling won by a landslide—58.3%; 25% of the voters didn't care; 8.3% suggested other alternatives, like "prog"; 8.3% favored one "m." Our vote goes to Truly A. Donovan of New York City, whose charming essay on the subject we hope to publish in an upcoming issue.

Virtual measurement

Mr. McLaughlin's article explaining virtual memory on the 370 (Sept., p. 58) was of interest but raises more questions than it answers, particularly for the non-IBM user, such as our company.

While I realize this particular article was intended to briefly summarize the new operating systems and hardware, it also increases the controversy surrounding IBM's sales dominance of the industry. Whether or not IBM is good for the industry may be a question without an answer—at least an answer that will be of practical use to the data processing community. In any event, it ought to be the user who decides whether any manufacturer is good or bad and then buy accordingly.

However, the small- and medium-size system user may well not have the wherewithal to adequately evaluate different systems and consequently makes do with IBM just to be with the majority. On the other hand, the large system user may consider the cost of changing systems to be so prohibitive that this possibility is excluded without further analysis.

I believe competition is necessary for the advancement of the data processing industry, but unless the users are aware that there really is competition, sooner or later it won't exist.

I think DATAMATION would and could provide a genuine service by objectively evaluating and comparing similar types of hardware, their performance, operating systems, etc. Too many publications either consider IBM only or are so general in their articles that they become of little value. Give the users some objective information and hopefully they will decide for themselves what is best in their particular situation.

DONALD STROUD
Manager, Data Processing and Systems
The Tremco Manufacturing Company
Cleveland, Ohio

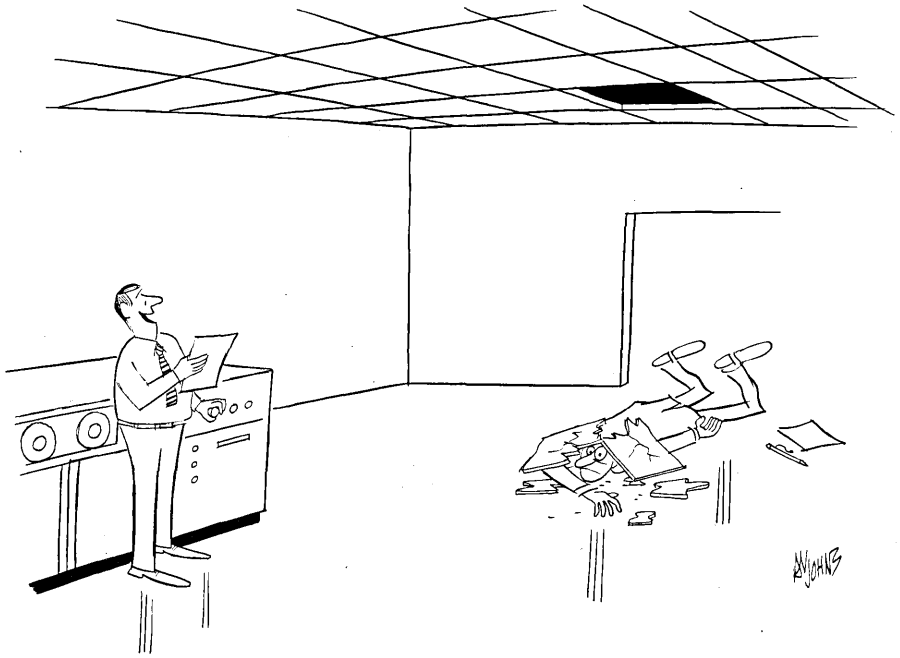
Sympathizing completely with what we believe to be your main point (last paragraph), we can only say that we do try to compare and evaluate competitive equipment and systems. But you must realize that the "objective information" you seek (and beloved by all) is not always readily available. As the dark art of metrics staggers toward the Hall of Science, we can only hope that it will become easier to do what we all want to do. In the meantime, we suggest that, along with us, you follow or work with the ACM's Special Interest Committee on Measurement and Evaluation. And let us know when you find that magic marker that will let each user make the perfect choice for him.

Faint praise

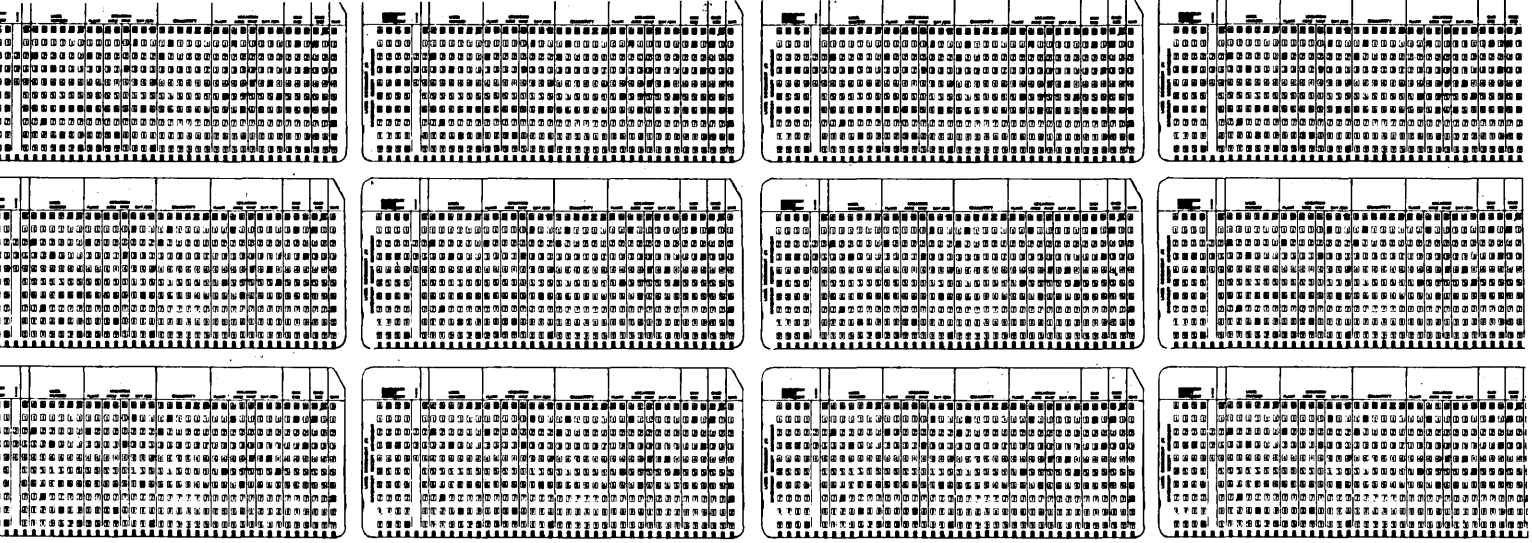
I would like to extend my thanks for Thomas Broce's article on "Extending the Life of DOS" (Oct., p. 65). I have scanned DATAMATION from time to time, and this is one of the few articles that has practical application and meaning that I have read.

I am not certain whether this is a change in your attempts to enable your magazine to make greater contributions to the data processing community, or whether this is just one of the few articles that creeps in occasionally. I personally think the data processing community needs communications that have practical application versus

(Continued on page 136)

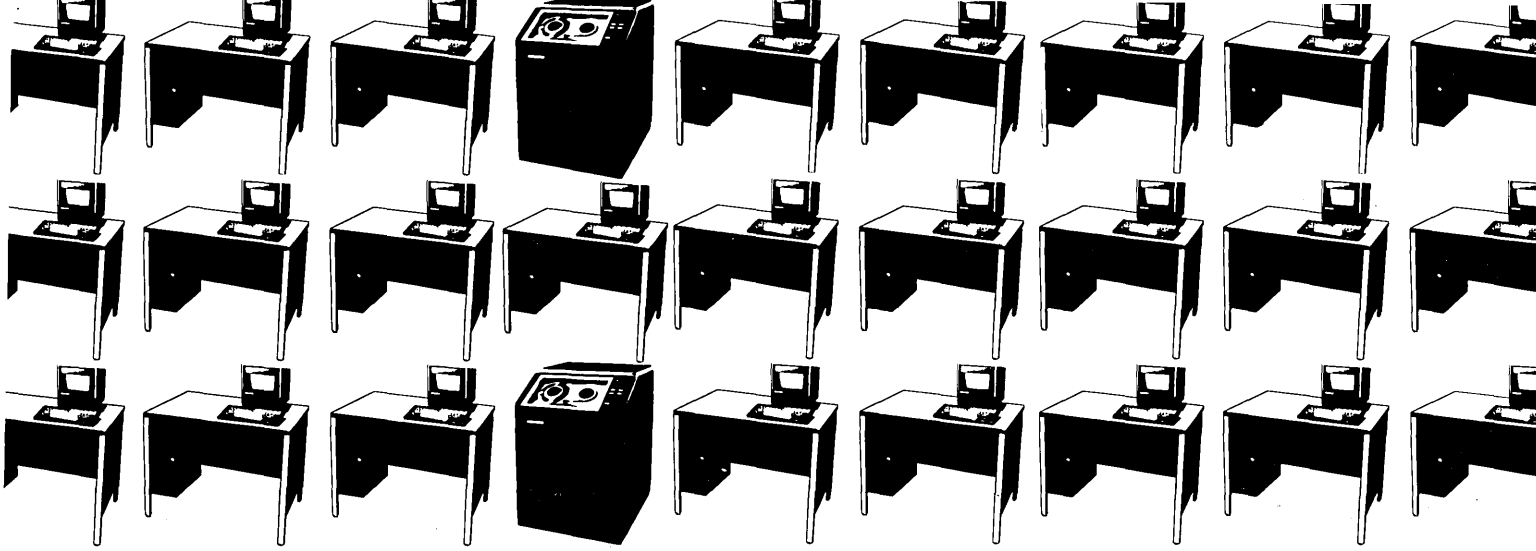


"Hey! Would you like to hear what the odds are against that ever happening again?"



Think of The Computer Maker.

What's he really done to improve your data entry?



Think of Inforex.

What we've done makes us Number One in key-to-disc systems.

Data entry for computer manufacturers is strictly a sideline.

Not at Inforex.

It's our specialty. Our full-time specialty. Which helps explain why our key-to-disc systems provide the most advanced key entry of all.

Consider. You get CRT display at every keystation, an Inforex first. Makes data entry virtually goof-proof. Discs store up to 128 four-level program formats. And over 2 million data characters. You get concurrent data entry and verification. Balance totalling. Check digit comparison and calculation. Automatic pooling on 7- or 9-track compatible tape.

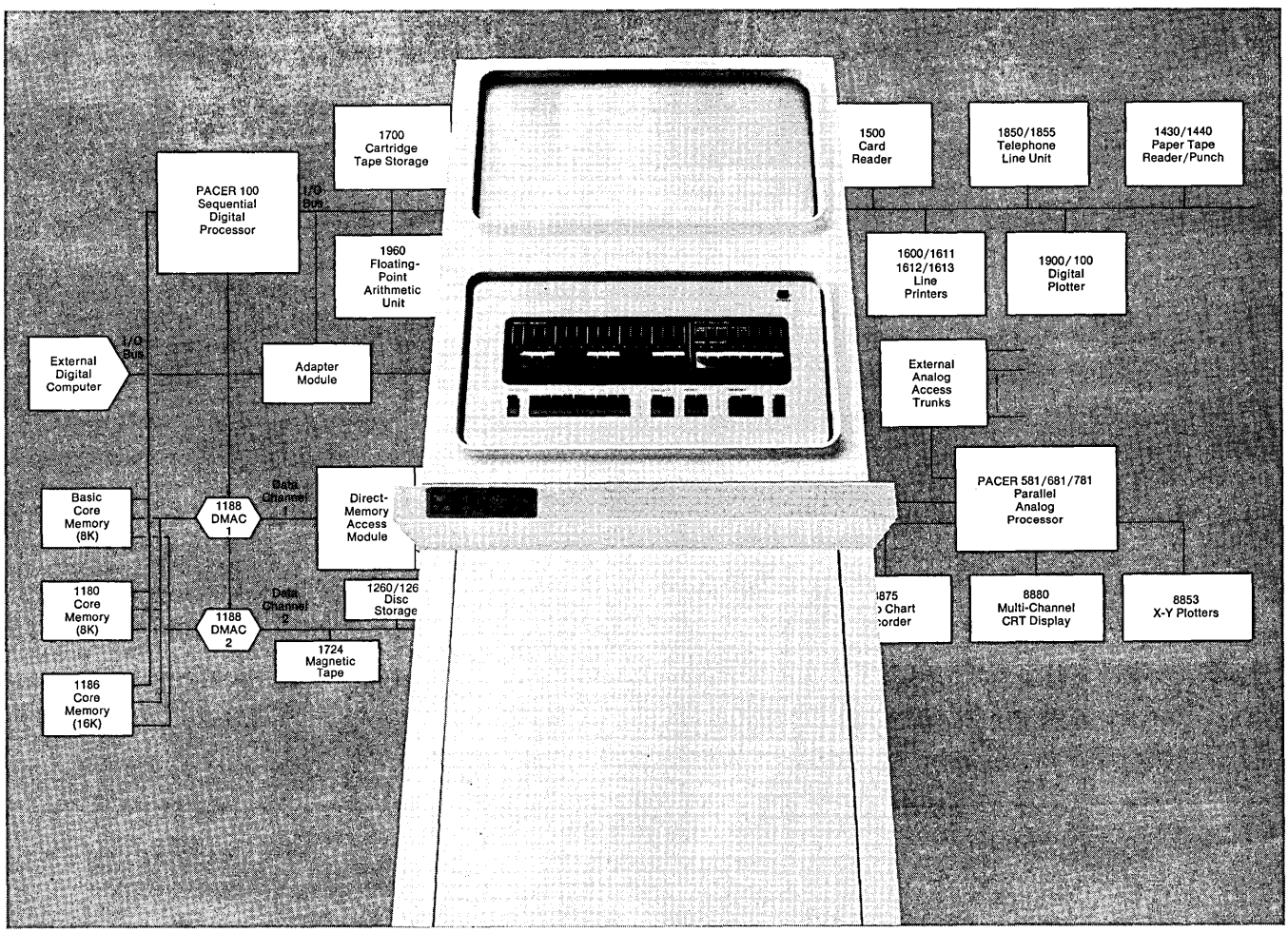
You get data management like you never had before.

All of which sounds expensive. But isn't. Basic system rentals start as low as $101 a month per keystation. You can also add system-expanding options, like On- and Off-Line Communications, Line Printing, Reformatting, to name a few.

Our customers include many of the country's largest companies. Companies that take a long, hard look at price. And performance. And supplier stability. And service. What they find has made Inforex key-to-disc systems the most widely used in the world.

When you think of data preparation, think Inforex. The leading specialist in the new and different world of data entry. Contact your Inforex representative. We have offices in major cities throughout the United States, Canada, and Europe. Inforex, Inc., 21 North Avenue, Burlington, Massachusetts 01803.

INFOREX



PACER 100
What a Way to Grow!

It's EAI's digital cornerstone. Our PACER™ 100 is no ordinary computer. It's the beginning of a new growth story, a digital especially designed to work with our new parallel processors. And work it does in expandable systems that provide unequaled throughput in scientific and engineering problem solving.

We put the PACER 100 at the digital corner of three different series of new PACER systems, each larger than the next: PACER 500. PACER 600. PACER 700.

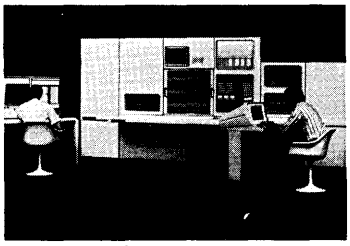
Then we provided options to help you grow, to let you fine-tune your system to exactly the type and scale of problems you face. Up to giant-sized.

At each level, your PACER system can deliver far more scientific and engineering design-problem solutions—per day or per dollar—than any other system available.

Meanwhile, your techniques and solutions will be state-of-the-art in the areas you choose: Optimization. Simulation. Control. Design. Data Reduction.

Further, we have a huge library of software to help you—including a foreground/background Real-Time Operating System. And we have more than 5,000 case histories of applications to prove our software expertise.

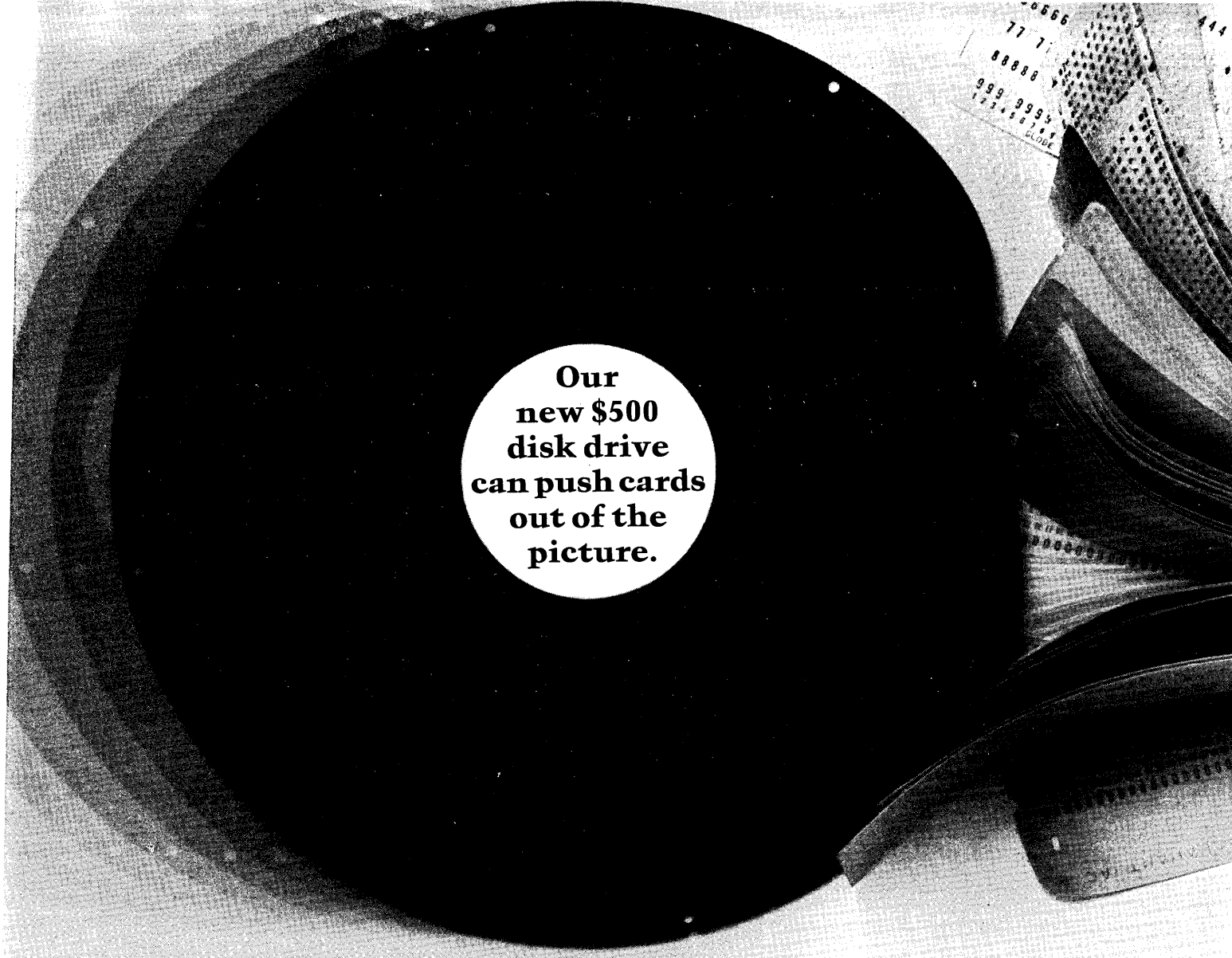
As you can see, we make no ordinary claims. Now, thanks in part to our new digital, we can make one more dramatic assertion: PACER systems can offer you performance/price ratios that run to over 100 times those of conventional digital systems.



That's the sort of efficiency that's worth writing home about or, more to the point, worth writing to us. The faster you do, the sooner we can send you more information to help you start a new growth story of your own.

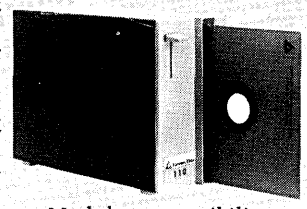
EAI

Electronic Associates, Inc.
185 Monmouth Parkway
West Long Branch, New Jersey 07764
(201) 229-1100



Our new $500 disk drive can push cards out of the picture.

Take a look at our new CDS-110 Floppy-Disk Drive. It's the newest memory device for low cost computer applications. The Floppy-Disk Drive is fast, reliable, and accurate without the problems inherent in cards, cassettes, or punched tape. It can replace whichever you're now using in your system for computer program loading, data entry, terminal communication, or auxiliary storage. With all the basic advantages of any disk drive, the CDS-110 provides random access to drastically reduce your search and retrieval time. It offers unmatched reliability and convenience.



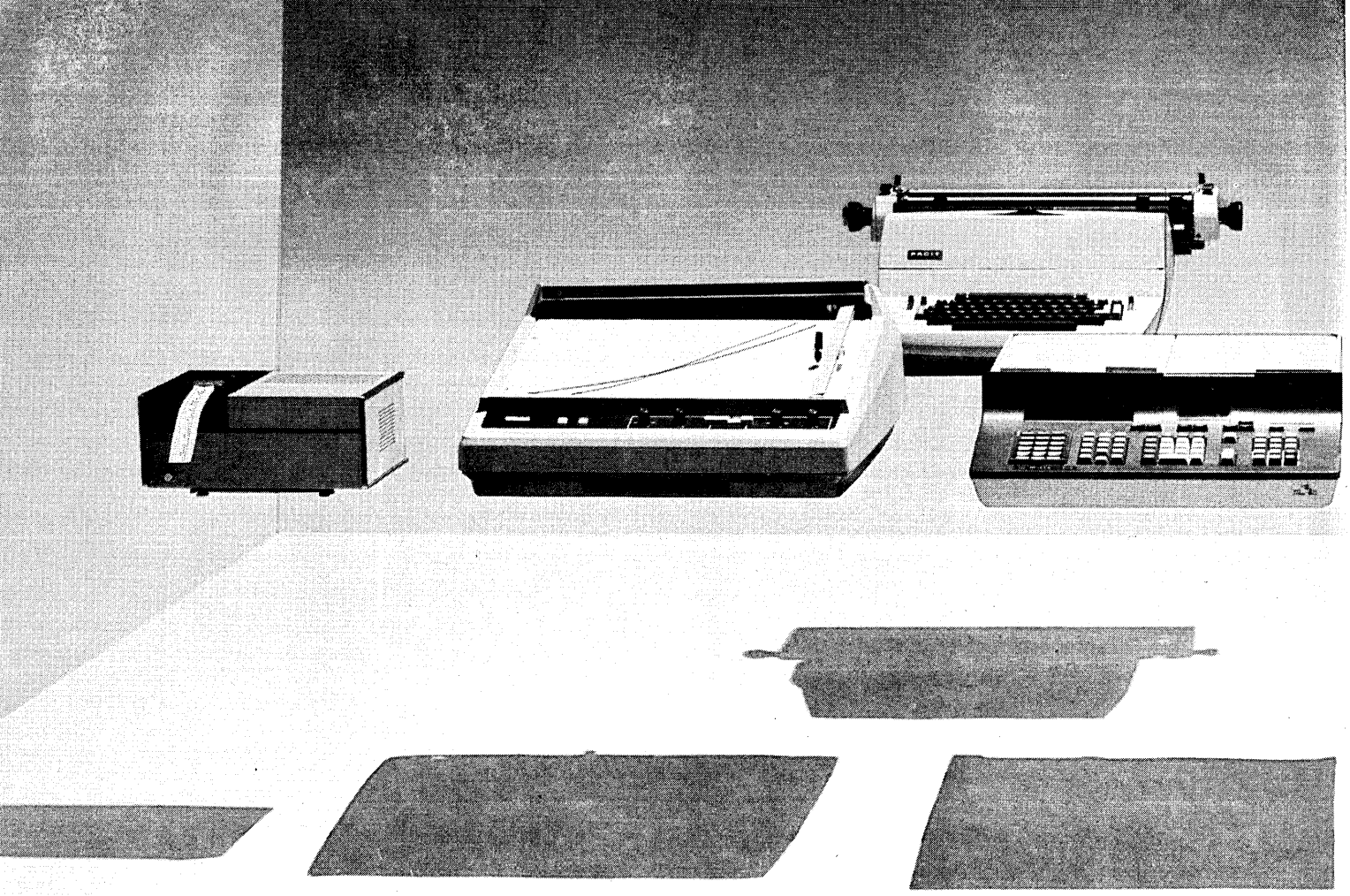
Modular compatibility with RETMA 19-inch racks: stack two horizontal drives, or group three vertical drives side-by-side.

And the Floppy-Disk Drive is OEM-priced below $500 to substantially reduce your total system cost. Now, look at these performance specs! 1.4 Mbit storage capacity. Up to 64 tracks with read/write electronics. 33.8 Kbit/sec. transfer rate. 6 msec. track-to-track access time. The removable recording medium is a 7½" oxide-coated mylar disk, jacketed in an 8" square envelope. It's mailable, storable, and comparatively inexpensive. To learn more about the Floppy-Disk Drive, write to Century Data Systems, Inc., 1270 N. Kraemer Boulevard, Anaheim, Calif. 92806 or call (714) 632-7111.

Century Data SYSTEMS, INC.

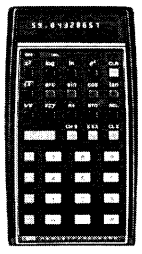
A subsidiary of California Computer Products, Inc.

CIRCLE 12 ON READER CARD



Hewlett-Packard Series 9800. The Name And Number Mean More Than Calculators.

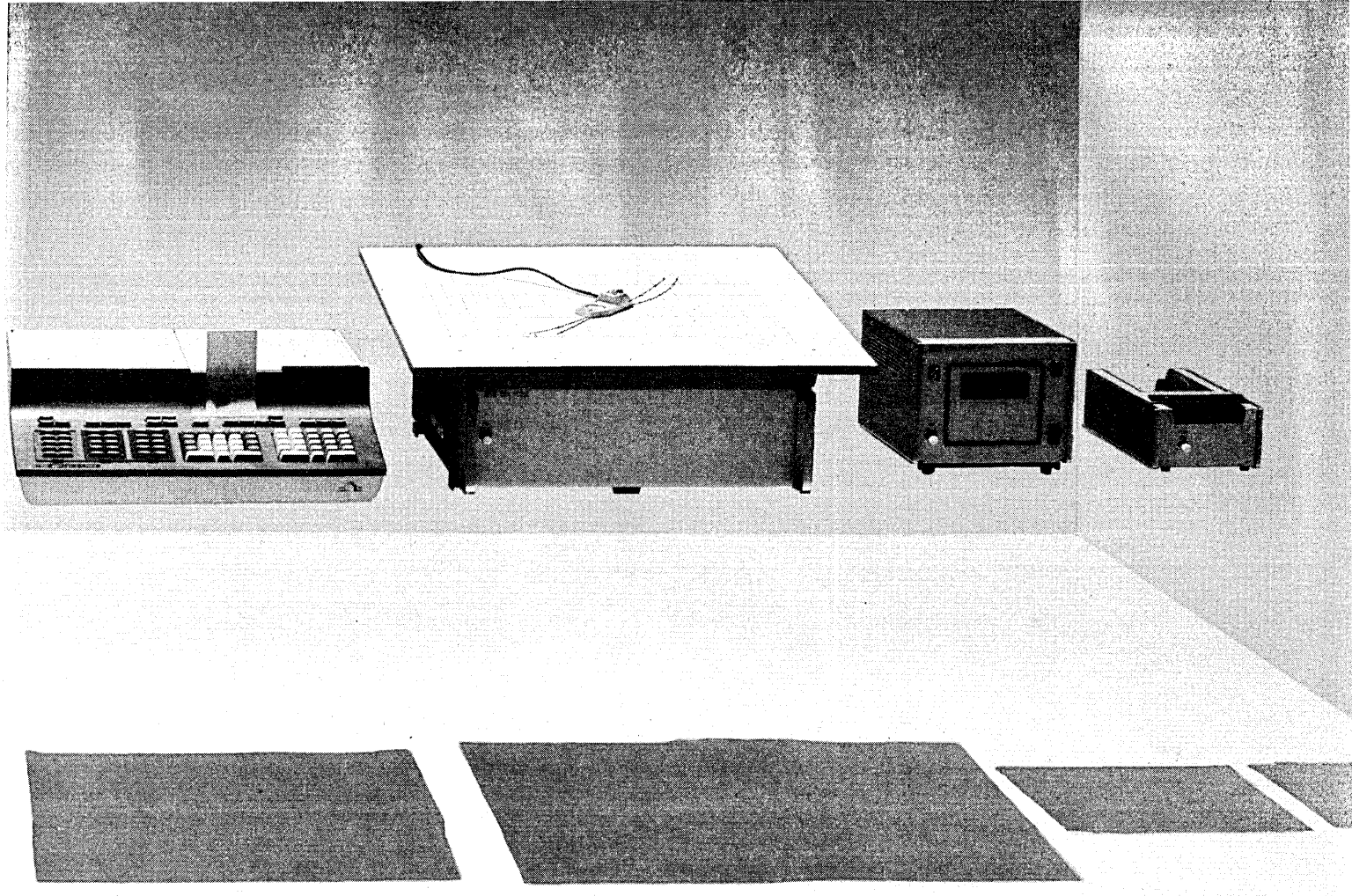
Computing Power Is One Thing.
The most striking example of computing power, that we know about, is our HP-35 Calculator. At nine ounces, this *shirt-pocket powerhouse* marvelously challenges a computer in handling problems from simple arithmetic to complex mathematics. And costs $395.



If we can package that much power in a shirt-pocket, imagine what our Series 9800 Model 10 and 20 can do:

Model 10. The one for doing repetitive problems (statistics, quality assurance, or surveying, to name a few). It comes with an LED Display, 50 registers *and* 500 program steps of memory. Coming in at under $3,000, the Model 10 can both perform a complete regression analysis, and solve 10 simultaneous equations. You can add

092/5



special functions, memory and printer with or without alphanumerics.

Model 20. The one for a lot of on-the-spot programming of complex problems. You get the best of both worlds: Very fast operation internally, with direct communication between you and the calculator. You key in your problem just as you'd write it—in Algebra and English. It gives you instructions and labeled solutions that you readily understand through its unique alphanumeric display and printer. Add to this Model 20's extensive error detecting and correcting features and its whopping memory—and you'll quickly find that it'll take you from concept to solution faster than any other system around.

What's more, with the Series 9800, you're not limited to the data formats of the Calculator. For input, you have your choice of Marked Card Reader, Paper Tape Reader, or Digitizer; for storage, the Tape Cassette; and for output, a Typewriter, or our X-Y Plotter that both draws and writes.

Support Is Another Thing. We're in a unique position to help you. It's the aggregate of our experience in virtually every discipline of science and engineering that does it for us. Not just with products but with people. People like your HP Field Engineer. Chances are, he'll bring the solution to your problems with him. If not, he'll put you in touch with someone who will. The point is, he can talk your language. So you do get the most from your investment. Save time in the beginning. And money in the end.

Service Is A Third. With over 170 field service centers in 65 countries, service is available regardless of where you are. For most, it takes only a phone call.

Product Line Is A Fourth. You probably already know us as one of the world's leading designers and manufacturers of precision electronic measurement equipment. To that end we build over 2,000 products for scientists, engineers, doctors, and businessmen.

Today we're a leader in computing equipment as well. Our line runs from the Model 35 Calculator, right on up to the System 3000, a multi-lingual, multi-programming computer. Between those, and all that goes between, we can help you find the most cost-effective solution to your problems.

For more information or a demonstration of the HP Series 9800, write: Hewlett-Packard, P.O. Box 301, Loveland, Colorado 80537.

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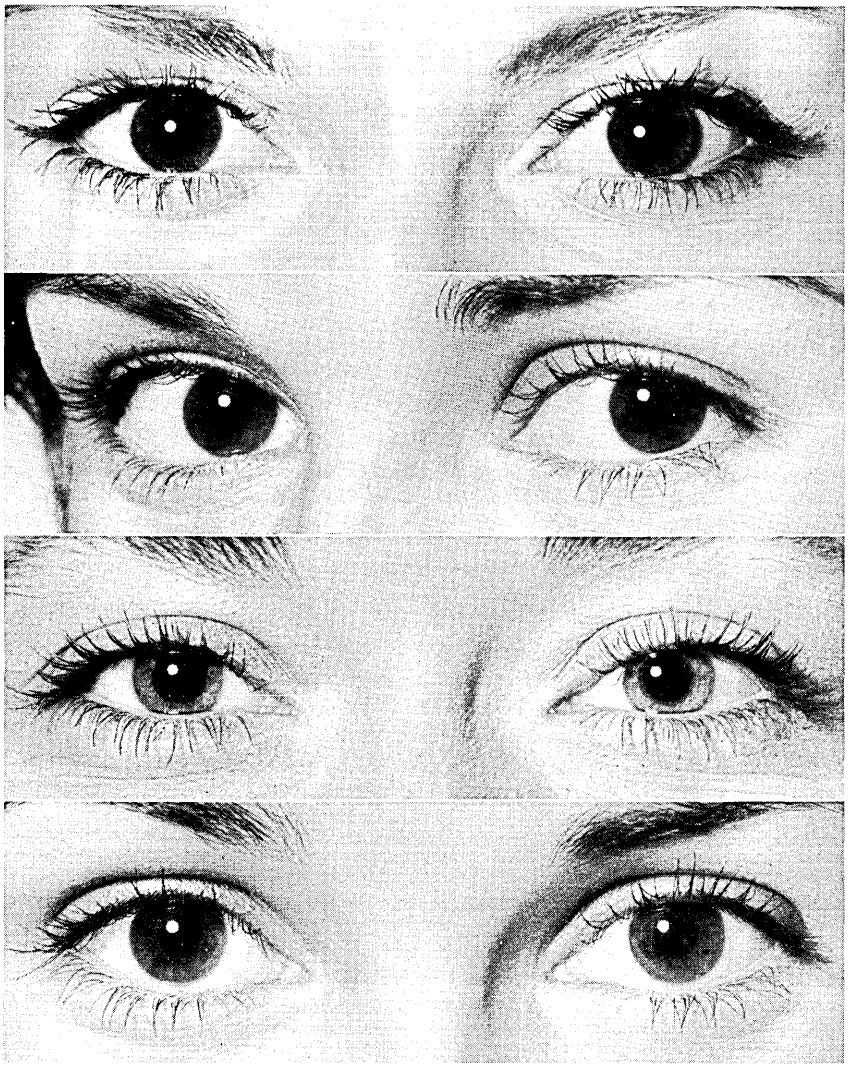
CALCULATOR PRODUCTS

HP sales, service and support in 172 cities in 65 countries.
For more information, circle reader service no. 111.
For a demonstration, circle reader service no. 112.
For information on the HP-35, circle reader service no.113.



NCR Paper-

the eyes tell the story about our new Deep Blue image.

Our new Deep Blue image makes eyes light up.

Deep Blue, against an even whiter sheet, gives our carbonless copies much more contrast. Not only do *you* see it better, your copying machine sees it better.

This new system makes those fuzzy, smeary carbon copies a sorrier sight than ever.

Deep Blue is another breakthrough from the people who invented carbonless paper. When you put NCR's business systems know-how together with Appleton's paper making and coating skill, a lot of good things happen.

Our new Deep Blue image gets the eye of approval!

This is the year **NCR Paper means business.**

NCR *Paper*® Appleton Papers Inc., P.O. Box 348, Appleton, Wisconsin 54911, Subsidiary of NCR.

APPLETON

SCANDATA **introduces the first big idea in data entry for the Seventies:**

the 2250 Data Entry System

The first data entry system to perform a universal range of data input requirements

Integrating, for the first time, scanning and keyboarding, to provide direct page and document reading, handprint reading, multifont typewriter reading, rejected character entry, and production keyboarding and key verifying in a single system

Delivering lowest cost, accurate, timely, complete data entry

More than OCR. Data Entry.

CIRCLE 49 ON READER CARD

Scan-Data Corporation
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You can install this Four-Phase CRT intelligent terminal system complete with 98K byte CPU, 50 million byte disc file, magnetic tape drive, high speed line printer, bi-sync communications, and 32 interactive CRT's . . . plus DOS, COBOL, Data Entry Software, and plug-compatible Simulators for IBM's non-programmable 3270 and 2260 Display Systems for less than the monthly rental of an IBM 3270 Display System alone.

IBM 2260 Replacement

One System IV/70 can replace up to four IBM 2260/2848 Display Systems with *typical monthly savings from 40% to 60% on a 1-year lease.*

☐ Field proven simulation of all standard and optional 2260/2848 features with both local and remote 360's and 370's

☐ 4800 baud remote speed, 39,000 bytes per second local

☐ Media Conversion Feature for card-to-tape, card-to-print, and tape-to-print

☐ Adding Machine Mode enables terminals to double as desk calculators

☐ Independent Supervisory Mode for inter-terminal communications and training

☐ Small CPU requires only 800 watts and operates in normal office environment

☐ Easily upgradable to other intelligent terminal applications such as . . .

IBM 3270 Replacement

System IV/70 can simulate both local and remote IBM 3270 Display Systems with *typical monthly savings from 20% to 40% on a 1-year lease.*

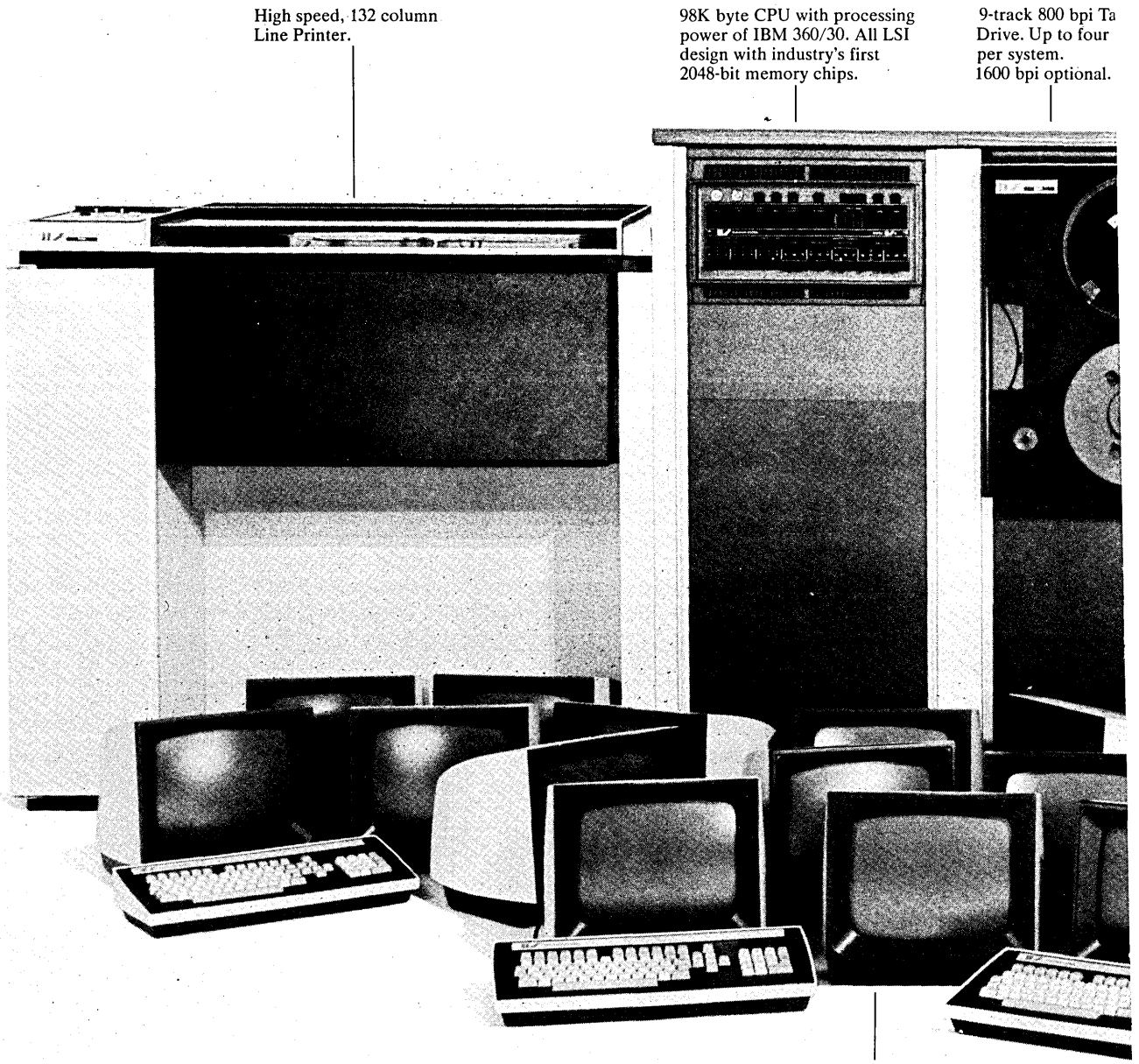
☐ Simulates all functions of 3270 Models with easy conversion from IBM 2260/2848 simulation

☐ Supports IBM features of BSC remote communications, Dual Intensity, Audible Alarm, and Selector Light Pen

☐ Improves communications efficiency through format control by data field, character addressing, data compression, and exception transmission

☐ Accommodates extensions for local format storage and retrieval, single-key message generation, real-time data editing, and local disc fallback during central system down time

The New



Data Entry and RJE

For shared processor data entry with magnetic tape output, System IV/70 can be operated with all editing and validation features for *less than $100 per terminal per month on a 1-year lease.*

☐ Provides all functions of IBM keypunch and key verifier plus real-time character-by-character editing and validation features that significantly reduce 360/370 preprocessing

☐ Combines multiterminal data entry system with functions of IBM 2780 Remote Batch Terminal

☐ Displays full length records of up to 750 characters in fill-in-the-blanks formats that resemble source documents

☐ Supports conditional field checking, data reformatting, and hard copy output of screen images, data files, and operator statistics

☐ Outputs data to magnetic tape, bi-sync communications with 2780 protocol, or local IBM Channel

☐ Receives and stores 360/370 reports in unattended mode for CRT access and hard copy output

COBOL Front-End Processing

For branch office distributed computing applications, System IV/70 can be configured with COBOL and a 72K byte CPU, 50 million byte disc drive, printer, bi-sync communications, and six 1920-character CRT's with dual intensity and audible alarm for *less than $2000 per month on a 1-year lease.*

☐ Enables custom COBOL programs to be written easily for both batch and interactive applications

☐ Implements a comprehensive subset of ANSI COBOL with Video Extensions for use with Four-Phase CRT's

☐ Supports ISAM file organization for efficient data base management

☐ Processes data entry files for stand-alone report generation and other user applications

☐ Provides rapid solutions to remote computing problems without impacting data processing systems currently in use.

We have installed over 200 intelligent terminal systems throughout the nation in leading business, financial, and government organizations.

We support these systems with complete customer service. Comprehensive systems engineering, education, maintenance, and software are included in the monthly rental price.

Open a window on your world. Call our nearest Branch Office for a personal demonstration today.

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Or send for our new brochure:

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National Marketing Headquarters
10420 North Tantau Avenue
Cupertino, California 95014

I am interested in System IV/70 for:

☐ IBM 2260 Replacement
☐ IBM 3270 Replacement
☐ Data Entry and RJE
☐ COBOL Front-End Processing
☐ All of the above

No. and type of terminals now in use

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Title _____

Company _____

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City _____ State _____ Zip _____

System IV/70

50 million byte Disc Drive. Up to four per system for total on-line file capacity of 200 million bytes.

85 key Data Entry or Typewriter Style Keyboard with numeric entry island and 12 function keys.

Selector Light Pen with Desk Stand.

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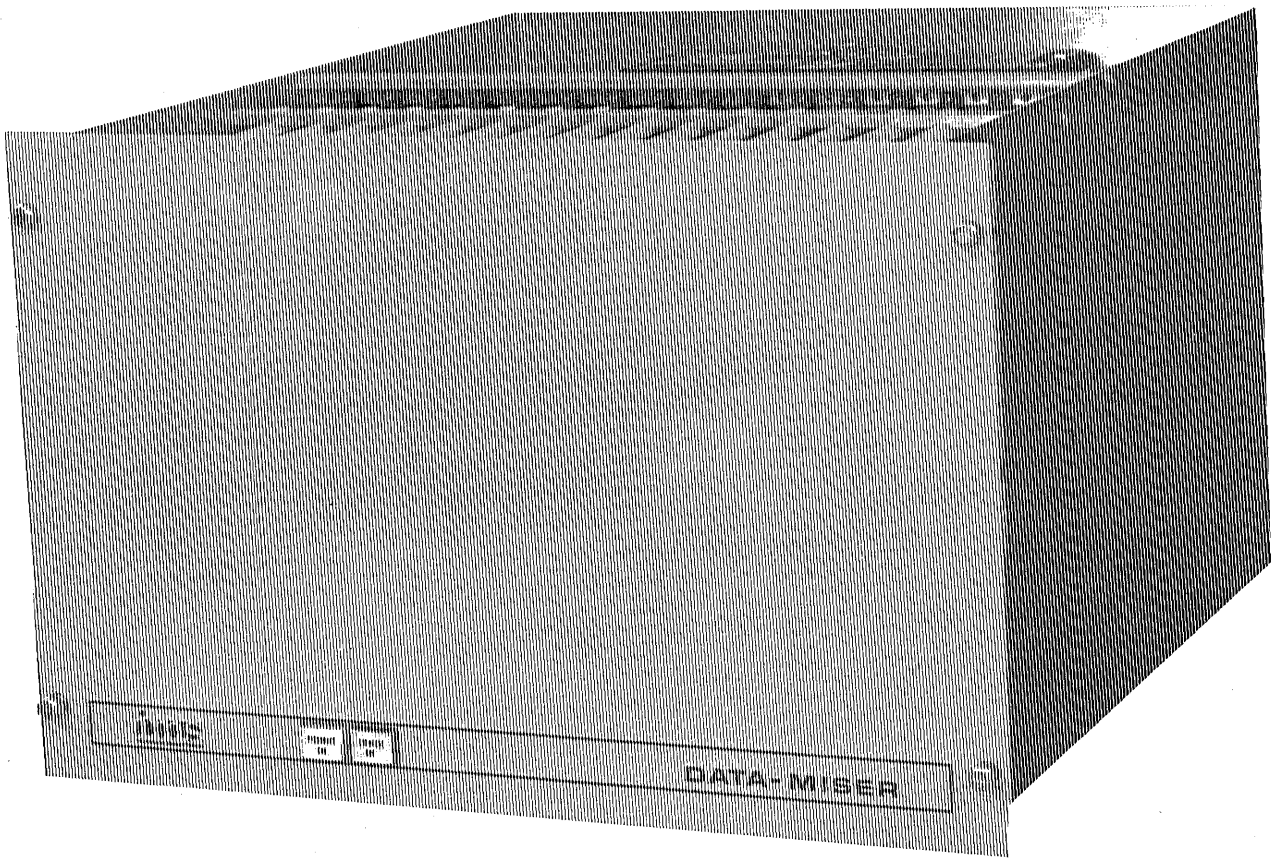
CIRCLE 16 ON READER CARD

NOW...DATA MISER™! THE TOTAL UPGRADE FOR PDP-11 USERS AT A TOTAL COST OF..... $4,950!

OPENING A NEW ERA IN MINICOMPUTER SYSTEMS APPLICATIONS . . . ☐ DATA MISER™ . . . the field-proven completely plug and DOS compatible moving-head disk memory system that provides 1.25 million words of storage and includes the controller, power supplies, and cabling required to "plug into" the PDP-11 Unibus. Flexibility is the keyword! The DATA MISER™ is field-expandable . . . using the initial controller . . . up to 10 million words by simply adding additional 5¼" high disk drives at only $1,950 each. **AND . . .** ☐ ***The system is DEC DOS compatible or available with an IMS DOS Monitor.*** ☐ ***75 ms average access time.*** ☐ ***10 μs/word Data Transfer Rate.*** ☐ ***Disk is sealed in dust-proof enclosure.*** ☐ ***Available with Removable Cartridge Drives for infinite off-line storage (optional).*** ☐ ***Only 12¼" high — fits standard 19" rack; weighs less than 50 pounds.*** ☐ *Delivery is 60 days ARO.* ☐ *Write or call today for your free copy of the DATA MISER™ mini-manual.*



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CONTINENTAL U.S.A.

International Memory Systems
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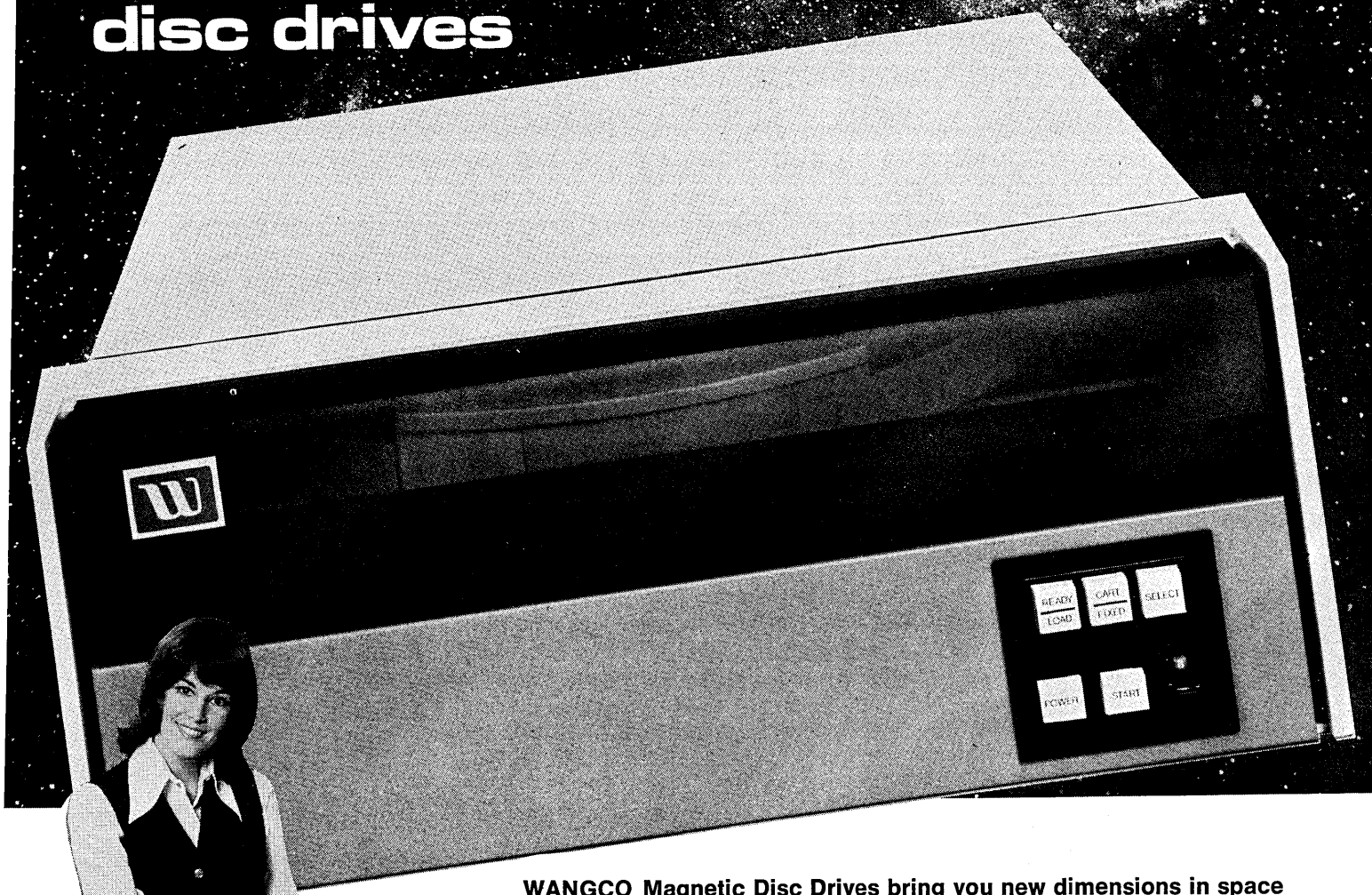
CIRCLE 20 ON READER CARD

MAKE YOUR SYSTEMS FLY

with WANGCO's low cost disc drives



WANGCO Magnetic Disc Drives bring you new dimensions in space and time. The front-loading Series-F, using the IBM 2315-type disc cartridge, stores *twice* the data in the same 7-inch rack height as the Diablo Model 31. The new voice-coil actuator provides faster access and long-term reliability without adjustments.

Capacities to 100 megabits, with one fixed and one removable disc, full interface flexibility, built-in power supply, daisy-chain capability, and plug-in functional modules to *keep* your system flying.

Give your system new dimensions of lower cost and higher performance.

Write for our new data package

NOW . . . THE WORLD'S SMALLEST TOP-LOADER

If you want a top-loading disc drive, the WANGCO Series-T, *only 7¾ inches* high, using IBM 5440-type cartridge, gives you the same flyable features as the Series-F. *Both* give you more stored data per inch of rack height, low cost, and the data reliabiilty your system needs.

WANGCO

SETTING THE PACE IN PERIPHERALS

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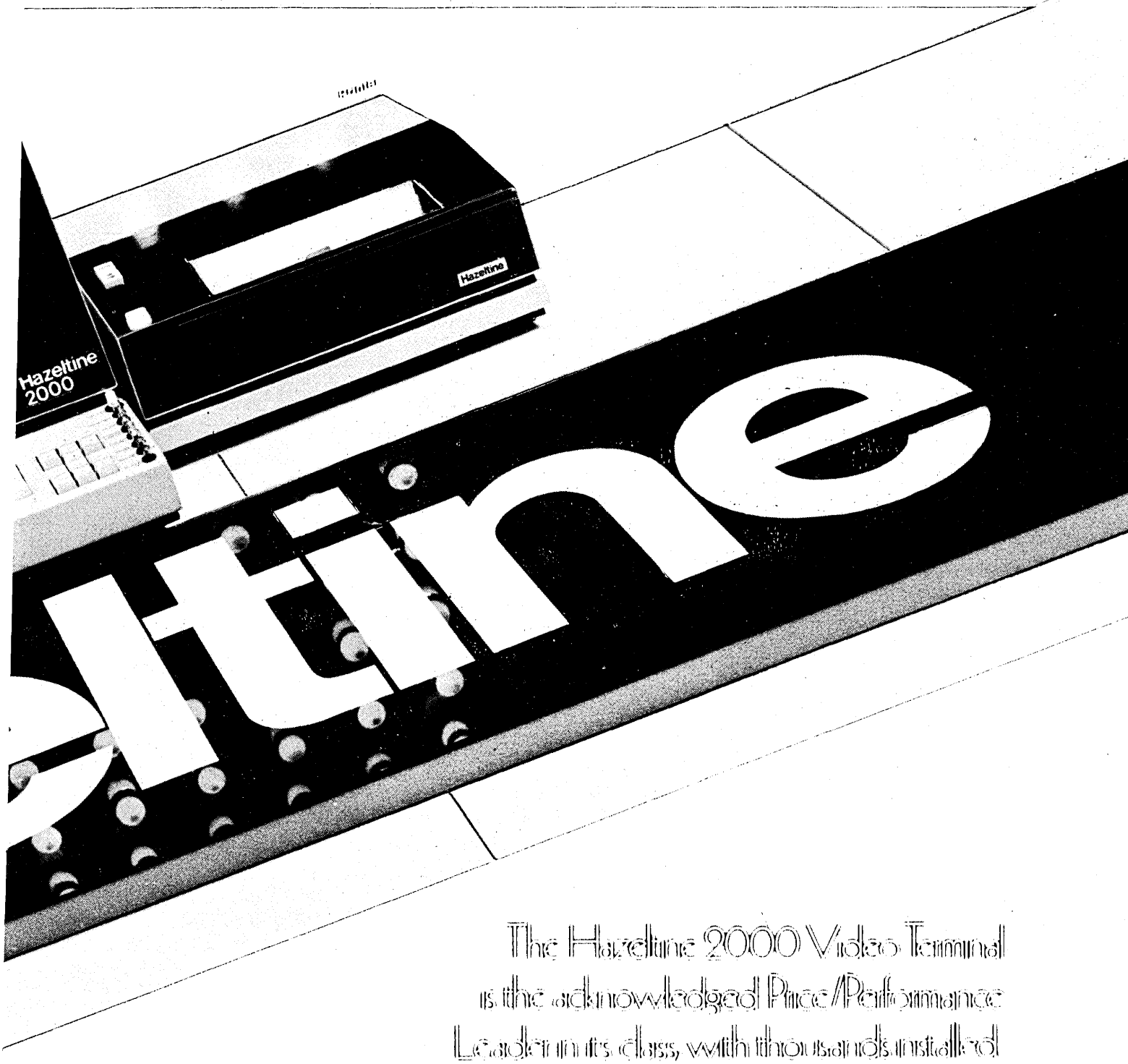


The Hazeltine 2000 Video Terminal
is the acknowledged Price/Performance
Leader in its class, with thousands installed

See for yourself—ask for a demonstration

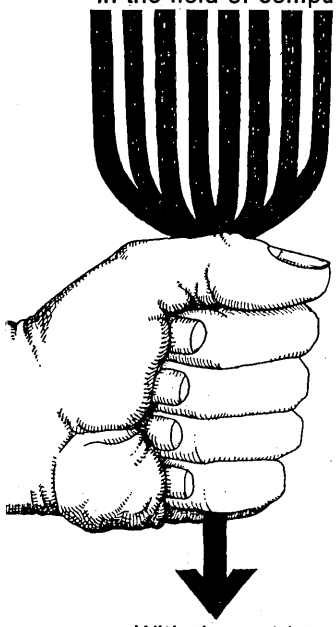
CIRCLE 26 ON READER CARD

If you use leased lines, we'll help you use the least lines.

What we'll do is design, furnish, and install for you a Time or a Frequency Division Multiplex System. At multiple locations. Anywhere in the world. The whole works.

All of which, by reducing the number of lines you lease, drastically reduces your costs.

The Singer Tele-Signal Operation, a leader in the field of computer-based communications systems, has done this kind of work for years for military, civilian, and international customers.

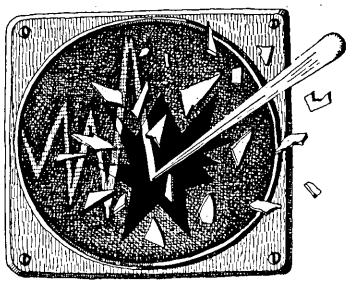


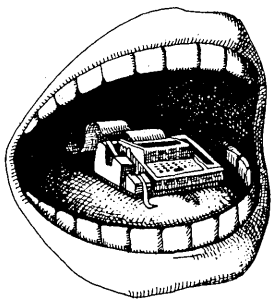
For Time Division multiplexing, we provide plug-in integrated circuit-card assemblies. They're engineered to give you the maximum in bandwidth utilization.

For Frequency Division multiplexing, we offer plug-in assemblies to accomodate a variety of rates to serve almost any teleprinter and/or data modem terminal hub equipment.

Our multiplexing systems reduce your need for leased lines and will concentrate a maximum number of channels into one.

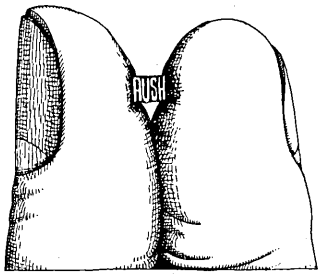
With the multiplexing, you'll need a Data Network Management Center. We'll supply it. A complete monitoring and control facility. One that insures the integrity of the system by rapidly isolating network faults, and thereby increasing traffic throughput.





Some companies require simultaneous speech and data communications (Speech Plus). We'll supply it. Up to eight data channels operating with speech. Or we can quickly tailor a system to suit your requirements.

We also improve the quality of a voice channel over a radio path using our linked compressor and expander (LINCOMPEX). And we have the answer to most of your telephone signaling problems with our universal inband signaling units.



Not the least important part of the system are the modems; these allow your digital devices to talk to each other over telephone lines (leased or DDD). We'll supply them. Many with features not found in their Bell counterparts.

We'll also supply voice privacy equipment, test equipment, and everything else you require to complete your communications system. And we'll provide service and personnel training throughout the world.

We've done all this for such prestigious telecommunications users as RCA Global, American Airlines, Western Union Data Services, FAA, NASA, and the U.S. military services.

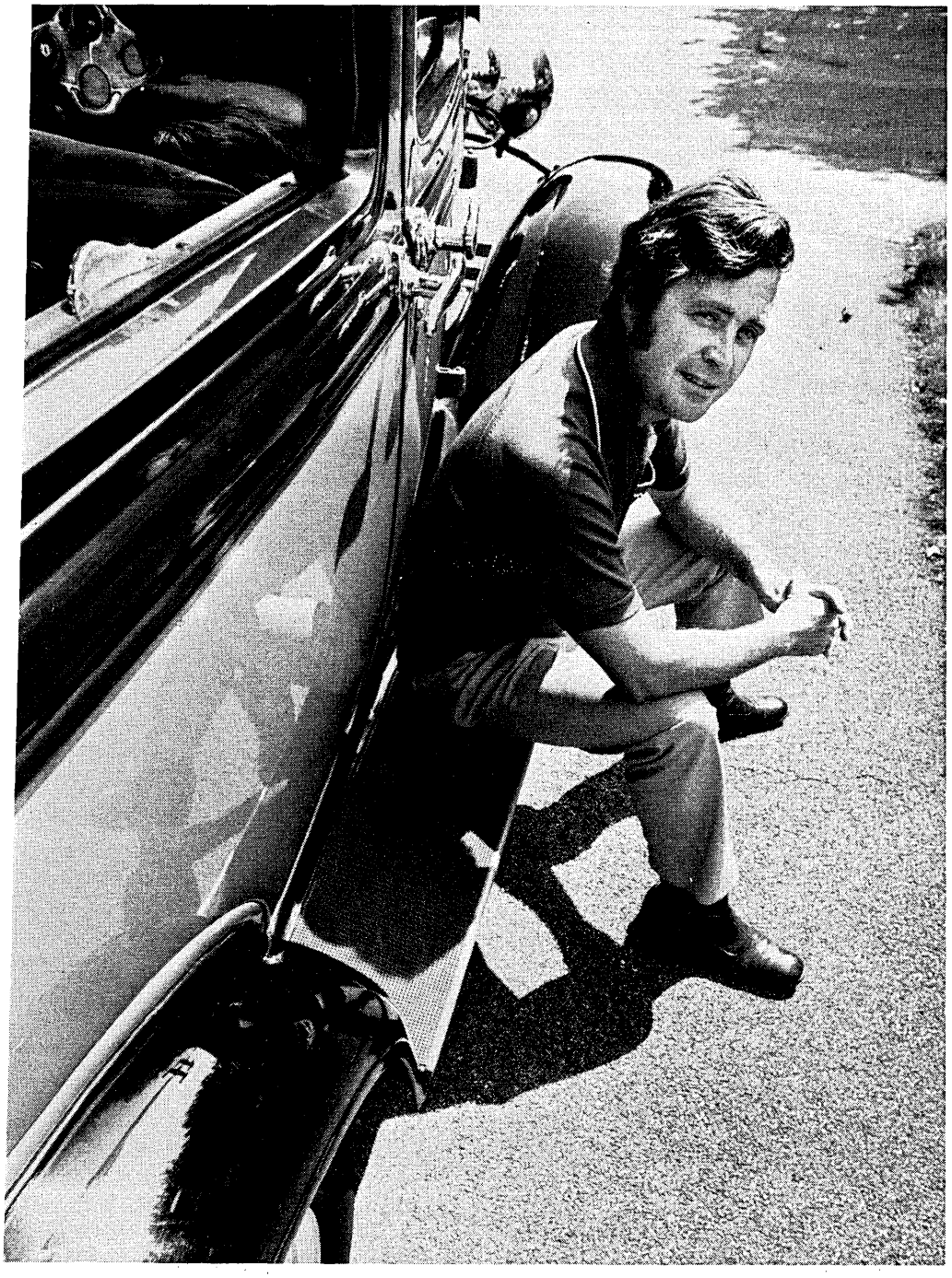
So if you're in the market for highly-reliable, complex communications systems and components, check out the Singer line for fast, easy answers.

For information, write: The Singer Company, Kearfott Division, Tele-Signal Operation, 250 Crossways Park Drive, Woodbury, N.Y. 11797 Or phone (516) 921-9400.

SINGER

AEROSPACE & MARINE SYSTEMS

At last, a really new computer.



I may be different, but when another new computer comes along, I cringe. Do they really think I'll buy it because it has a Supersonic Omnibus, 66 Multifarious Registers, and the new universal language, FOLDEROL?

Imagine my surprise and delight to discover a company that designs computers for the way people really use them. Instead of chasing nanoseconds they put all of the systems software together first, and then built a fast, low-cost box where it could do its exercises. Finally, somebody has developed a system that asks not what the software can do for the hardware but vice versa. The result is a computer with more software available now than most computers ever hope to have: DOS, RTOS, FORTRAN IV, MACRO assembler, IOCS, the works.

With that kind of software available, I wonder what's small about the PRIME 200?

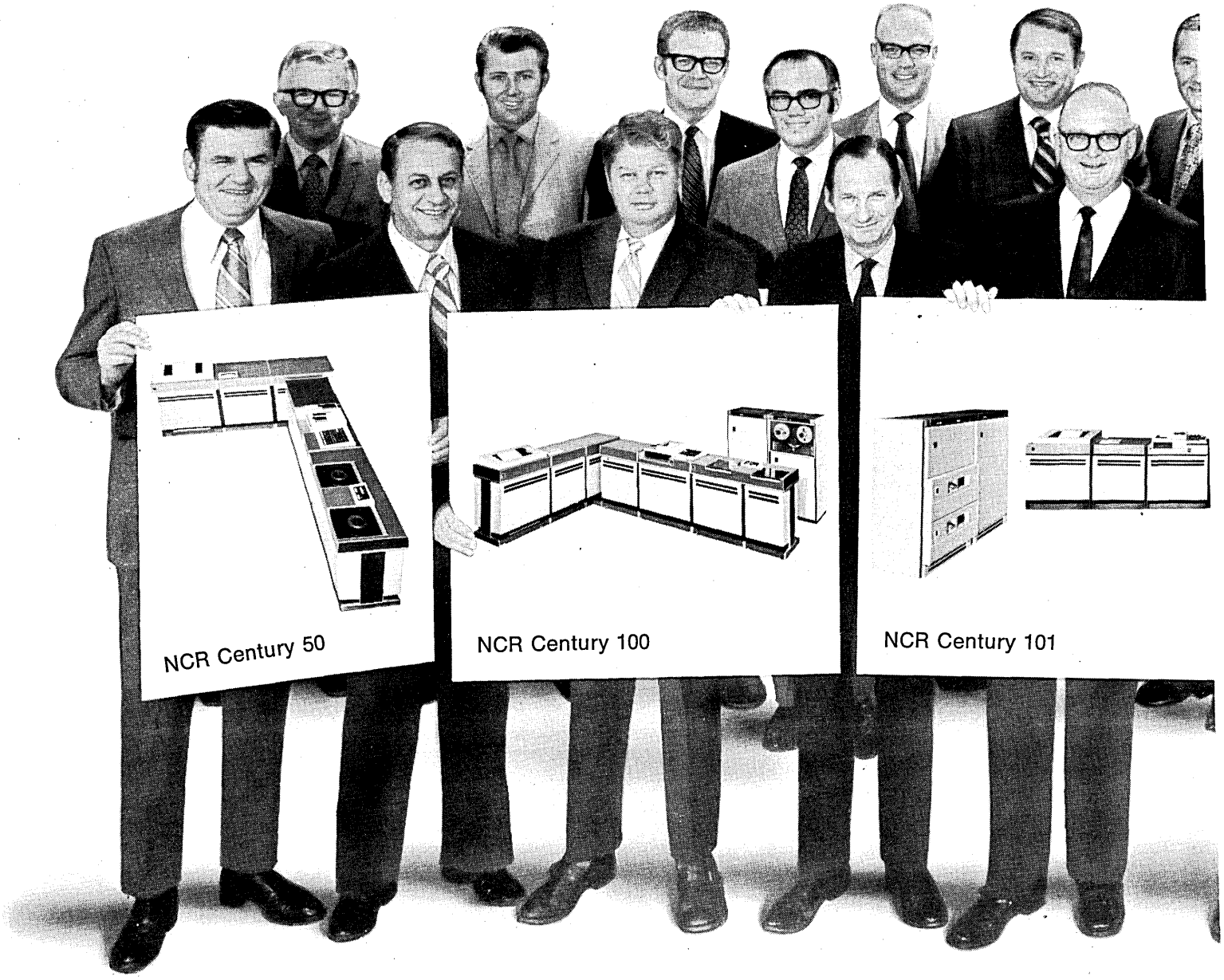
The PRIME 200 16-bit computer raises a lot of interesting questions for which we have prepared detailed answers. Let us send them to you. Prime Computer, Inc., 17 Strathmore Road, Natick, Mass. 01760. (617) 655-6999.

Prime 200
small computer

Prime sales offices: Boston (617) 237-4565, New York (212) 896-6262, Washington D.C. (703) 533-9343, Philadelphia (215) 688-0396, Jacksonville (904) 396-5253, Chicago (312) 887-1845, Dayton (513) 435-1343, Detroit (313) 356-4840, Tulsa (918) 663-0518, Palo Alto (415) 968-6003, Los Angeles (213) 881-8433.

Authorized representatives: Phoenix (602) 957-9110, Albuquerque (505) 255-2330, Denver (303) 771-0140, Seattle (206) 454-9332.

The NCR Century



The NCR Century 50. A powerhouse for small businesses. Designed for businesses that couldn't afford a computer system before. A small business computer. Yet the only thing small about it is the price. Price it and see. (Now with communications capabilities —so larger businesses can use it at remote sites.)

The NCR Century 100. Our most popular. Popular because it's a medium-size computer and most businesses are medium-size. Popular because it's been proven again and again in all kinds of applications in all kinds of businesses. Including businesses like yours.

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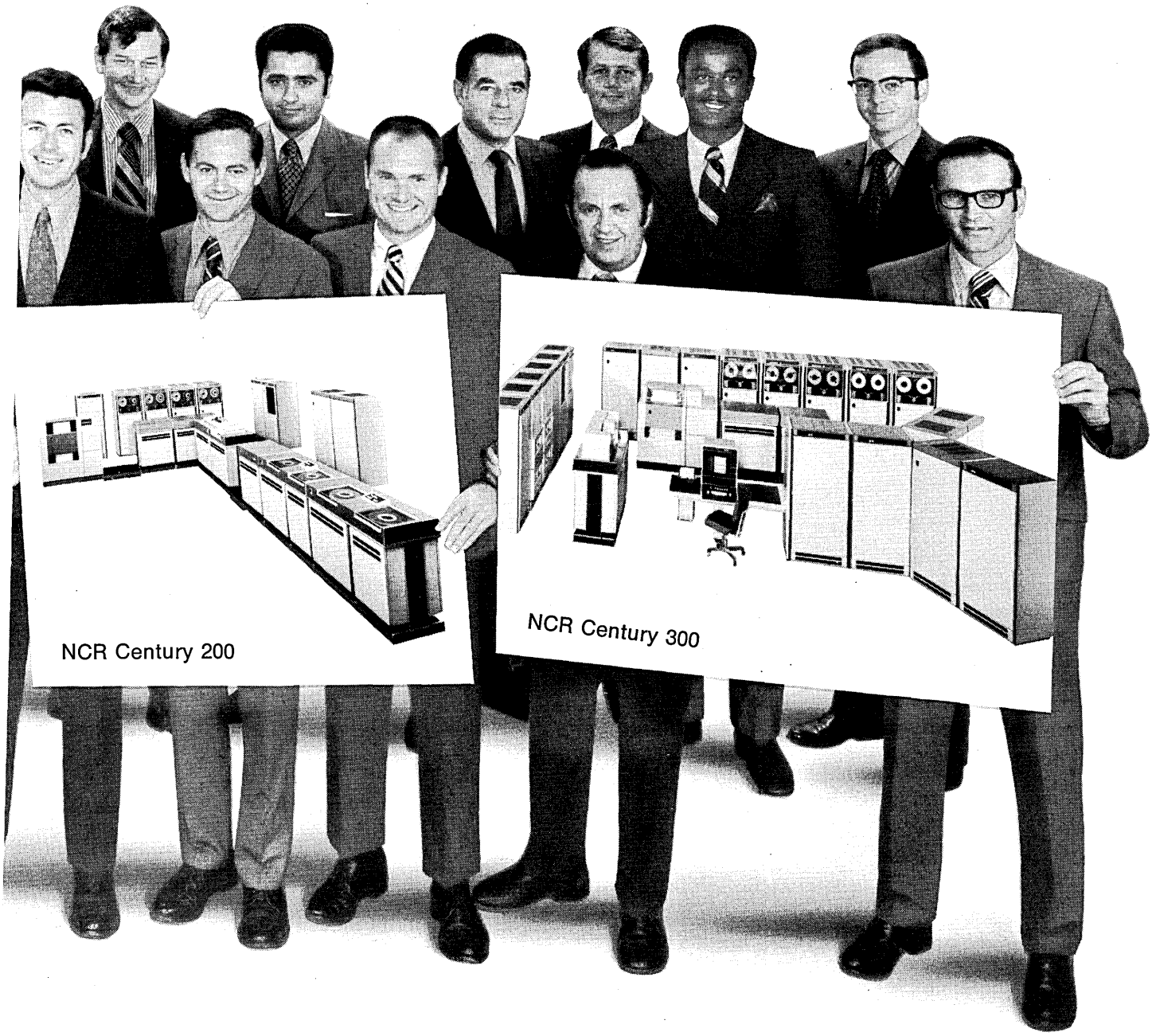
The NCR Century 200. A workhorse for businesses on the grow. Main memory up to a half million bytes. A 1500/3000 lpm printer. With a vast number of programs, applications and communications possibilities. A big business computer system with a not-so-big price tag. Designed to help you grow bigger . . . profitably.

family and friends.



The NCR Century 300. Our biggest and most advanced. Designed for on-line and multiprogramming. There aren't too many information processing jobs around too big for it to handle. And, like every other NCR Century computer system, it's compatible with its smaller brothers. So, wherever you start, you'll have a hard time outgrowing us.

And behind every NCR Century computer are thousands of NCR support people like the 23 you see here. Experts in retailing, manufacturing, banking, you name it. Experts in systems design, programming, applications, software. Experts with NCR's 86 years of business experience behind them. Experts who know your business as well as they know NCR's business—computers.

When you're ready to talk computers and terminals, talk to the people at the computer company that talks your business language: NCR.

NCR
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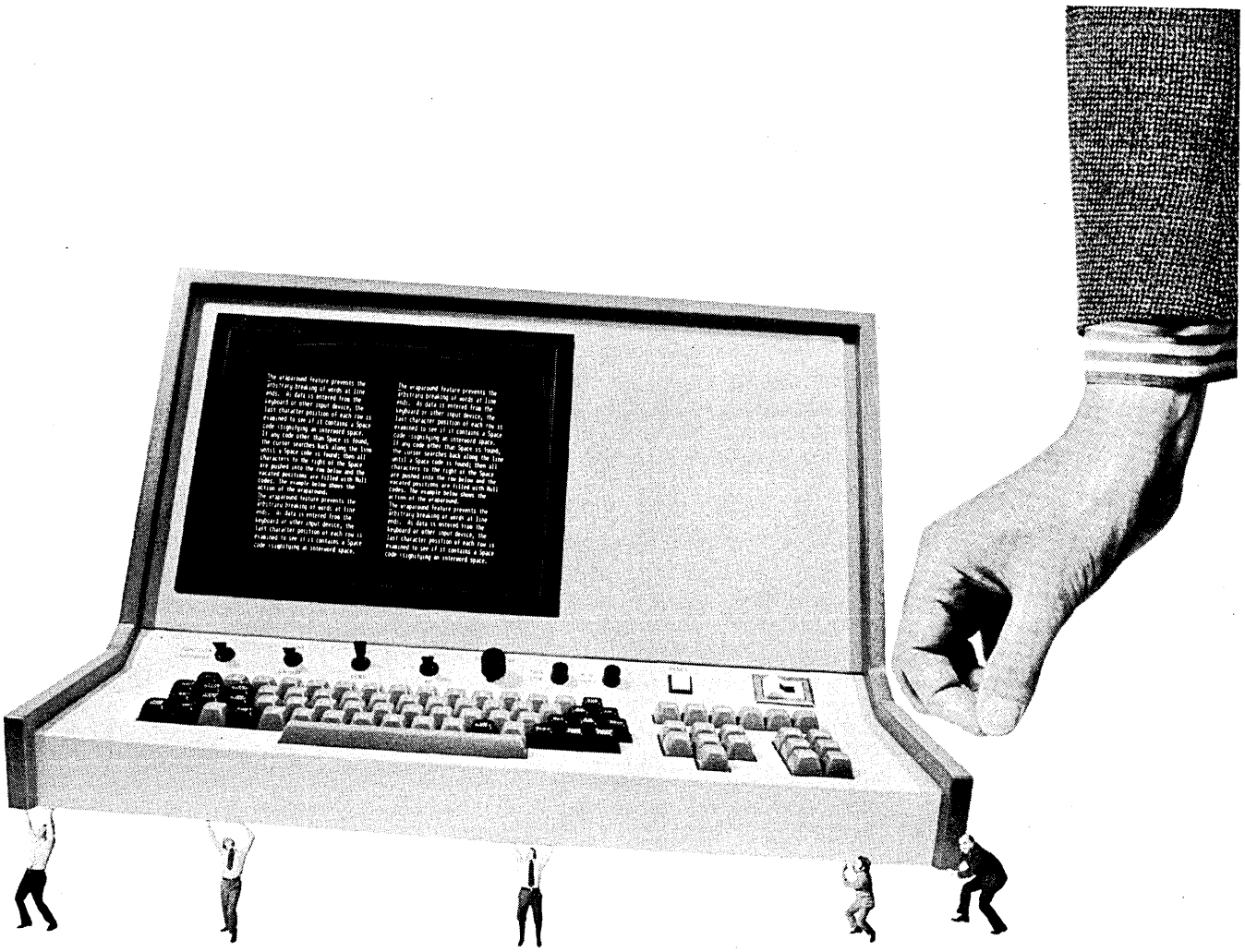
CIRCLE 37 ON READER CARD



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They not only enter, process, remember, display and transmit data as rapidly as possible, they also edit at electronic speeds.

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Our automatic calling and answering unit costs 20% less than the Bell system unit.

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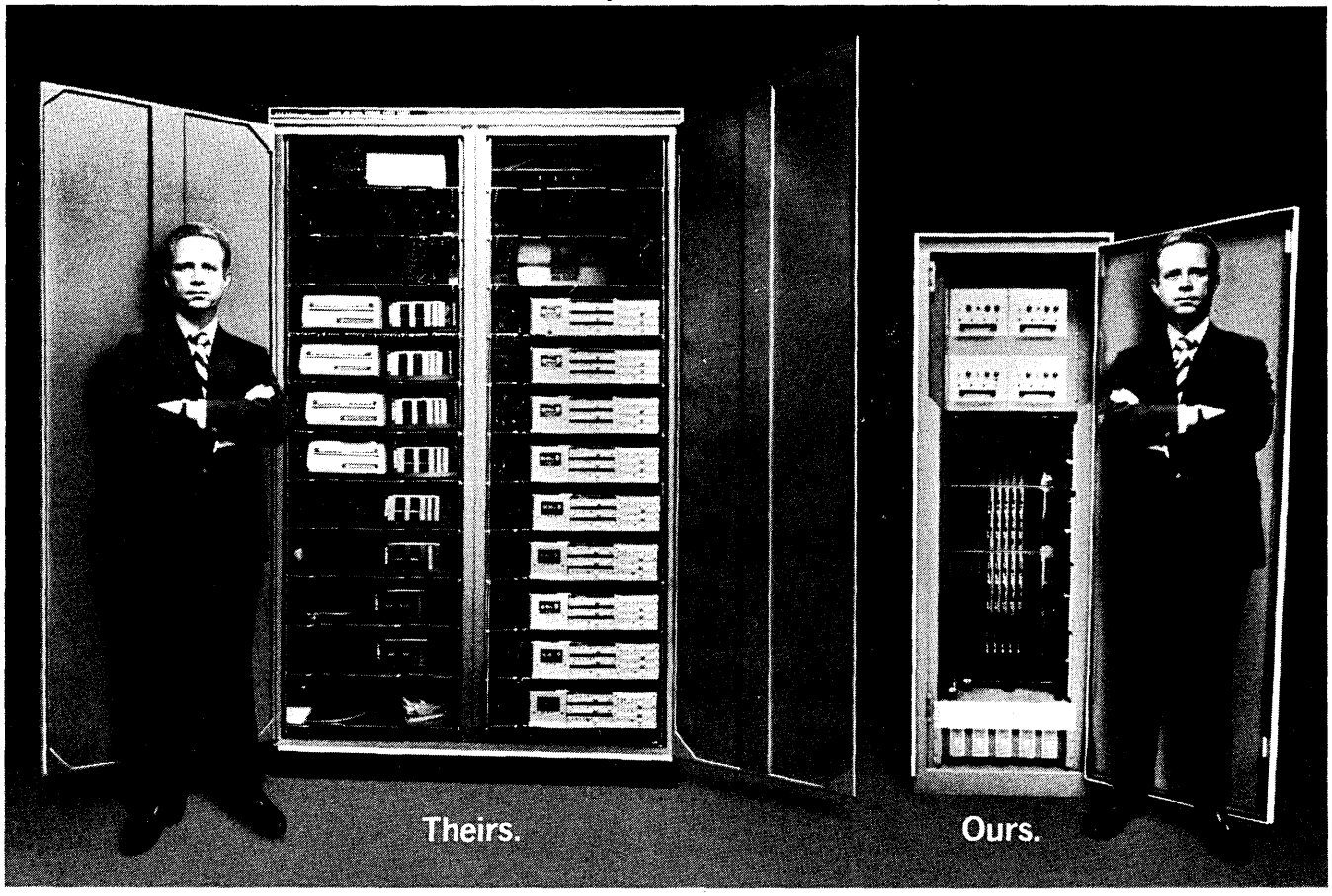

Our ACAU automates communication between computers or data terminals. It eliminates the need for an operator by putting calling and answering under computer control.

Ma Bell has a unit that does the same job. But ours costs less and saves space.

Here are some of the job details:

The ACAU allows automatic polling and selecting of remote terminals by the computer through the switched network. Dialing by computer makes it possible to call terminals when long-distance rates are low and computer time is available.

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Installation and maintenance are easy. Various options are available. The nitty-gritty are described in a brochure available from John Walters at Teleprocessing Industries, Inc., 82 McKee Drive, Mahwah, N.J. 07430. Phone 201-529-4600. Telex 138953. A Western Union subsidiary.

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Western Union's Teleprocessing Industries, Inc.

We teach computers how to communicate.

Most of the equipment for manufacturing automation is available, awaiting the development of suitable software and systems work

Programmable Automation: The Bright Future of Computers

Probably the fastest growing application of information sciences during the next decade will be computer-based automation of the manufacturing process. All aspects of manufacture—design, prototyping, production engineering, part forming, assembly, inspection, material transfer and storage—will increasingly become directly controlled by computers. Furthermore, computer control will bring a new flexibility to automation; the machines that perform manufacturing operations will be *programmable*, allowing one machine to perform a variety of manufacturing steps. This capability, combined with complete computer-based scheduling and allocation of resources, will result in a major increase in manufacturing productivity, especially in the important area of batch production and job shop operations. In addition, most of the dull and demeaning jobs within a manufacturing facility will be replaced by more interesting and challenging tasks such as programming and system maintenance.

The purpose of this article is to describe the coming role of computers in manufacturing, the benefits to be expected from their use, and the development program needed to achieve those benefits.

First, it is important to distinguish among the various activities that are called "manufacturing."

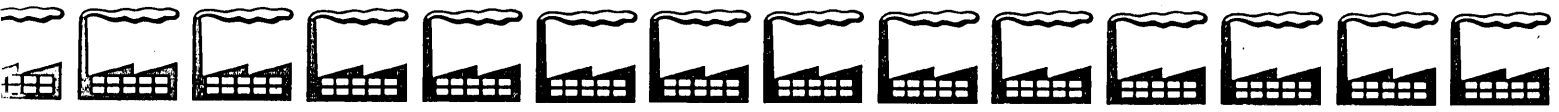
Three types of manufacturing

Products (and their subcomponents) are manufactured by three different methods: process industries; mass production; and batch production.

Process industries create products by control of a continuous process; oil refineries and modern glass and steel production are conspicuous examples. Computer-based automation of process control in these facilities is highly advanced. Due to the continuous nature of the process, its manipulation requires only control of rather simple mechanical devices, such as valves, within a highly rigid system, based on sensor feedback requiring modest bandwidth and computation. Computers are clearly suited to the control of routine production, with humans performing supervision (requiring more complex pattern recognition) and maintenance (requiring more complex manipulation of objects). I will not consider manufacture by process industries further in this article.

Mass production of discrete objects on an assembly line is a second type of manufacturing process. The classic example is automobile production, with production rates exceeding 100 units/hour. Much higher rates are achieved for simpler objects, of course. There is a linear flow of in-process materials and subassemblies between work stations at which manufacturing steps are performed, usually by "hard" automation specially designed for the task. If all the products being mass-produced by an assembly line were identical, the impact of computers on the control of the production process would be minimal, for several reasons: little flexibility is required in the production machinery, therefore the control of that machinery is not complex; special-purpose "hard-wired" machines and control logic can outperform more general-purpose equipment, since they can take advantage of opportunities for parallelism and simultaneity (e.g., concurrent boring of eight cylinders in a V-8 engine block), and the cost of special-purpose equipment can be completely amortized over a long production run. But automobiles, for example, are not produced identically; they are custom-made to a considerable extent, so flexibility is needed—*ergo* programmable Unimate industrial robots performing spot-welding in the General Motors Vega production plant—and computer control of in-process inventories becomes necessary. However, the bulk of U.S. discrete product manufacturing is not produced by mass production, but rather by batch production techniques.

Batch production uses manufacturing facilities in a flexible manner. The facilities are configured to produce a particular product; that product is manufactured in a lot size varying from two or three to thousands; then the facilities are reconfigured to produce a different product. The reconfiguration may be modest, such as mounting a new tape and work-holding fixture on a numerically controlled machine tool, or it may be more extensive, requiring mechanical adjustments involving wrenches or cams, or a differ-



in Manufacturing

by Robert H. Anderson

ent set of procedures used by people in the operation of general-purpose tools. Batch production procedures are often associated with "job shops," which may vary in size from a two-man machine shop to companies like the Rohr Corp. in Chula Vista, California, which produces 8,000 to 15,000 different products and has an inventory of some 30,000 different items at any one time.

According to a respected Commerce Dept. economist, batch production techniques account for about 75% of U.S. production, by value (excluding process industries). In considering that estimate, it is important to realize that although the final assembly steps in the manufacture of a product might be performed using "flow-through" mass-production techniques, many of its parts and subassemblies are frequently most economically created by batch production.

In assessing the impact computers will have on manufacturing, two dominating facts emerge from the above discussion: (1) most U.S. manufacturing is performed by batch production techniques; (2) batch production requires sophisticated scheduling and control of productions facilities; and, above all, it requires flexibility in the use of those facilities.

How will computers most affect the manufacturing process? By bringing to the important area of batch production and job shop operations precisely those features most needed: flexibility in scheduling and control of resources, including control of the actual production processes themselves. Before considering the individual processes used in manufacturing and what computer control has done and will do to them, a more basic question should be addressed: why introduce more computerization and automation into manufacturing?

Why computerize manufacturing?

There are several compelling reasons why the manufacturing process will continue to become automated, and why computers will become more and more directly involved in controlling all aspects of manufacture. Computerized automation will continue until people only *supervise* the process, provide middle- and high-level *management* decisions, and provide such *services* as acting as an interface to other people in sales or in creative design to meet aesthetic judgments and requirements. Some of the most important reasons for increased computerization of manufacturing are the following:

Reduced prices. Computerized automation can dramatically reduce manufacturing costs, especially in a job shop environment. One indication is afforded by numerically controlled (NC) machine tools, and more recently by direct numerical control (DNC), linking the tool directly to a central computer, and computer numerical control (CNC), using a local minicomputer as controller; manufacturing cost reductions of 75% over manually operated machine tools are routinely reported, with manufacturing times simultaneously reduced by 75%. The repeatability and uniformity of NC processing also reduces wastage and rejects. Huge job shop operations like the Rohr Corp. have installed computer-based inventory and warehousing systems to reduce costs. These examples are only an indication of the potential, because many manufacturing processes—notably assembly—are not yet under computer control.

The importance of reducing manufacturing costs, of course, goes beyond aiding the individual consumer. As the entire world increasingly becomes one marketplace and such nations as Japan compete directly with the U.S. in high technology products, our prices must remain competitive. Japan *is*, in fact, heavily committed to computer-based industrial automation; a $100 million government-sponsored R&D effort is currently under way there in applied pattern recognition and robotics with the explicitly stated goal of industrial automation. The fruits of that program are already being seen. Japanese research results on robots with tactile sensors, reported at the recent Second International Symposium on Industrial Robots, surpass any U.S. efforts on tactile sensing. Our direct competitors will be reducing manufacturing costs through computer-based automation; with our labor costs much greater than theirs, flexible automation of high-technology manufacturing is probably the most important response the U.S. can

make to remain in the international trading community.

Increased product quality and uniformity. Most rejects and errors during a manufacturing process can be traced to human variability or error. By contrast, the use of numerically controlled machine tools for metal cutting provides an example of the reliability and effectiveness of machines in manufacturing. The manufacture of such products as precision waveguide slotted antennae or diffraction gratings *requires* the uniformity and reliability of automation. Increased use of sensors for closed-loop feedback will make machines more responsive to their environment and will lessen the occurrence of "dumb" errors which are sometimes associated with automation. But as humans intervene less and less in the actual routine manufacturing process, there will also be fewer "random" error conditions (caused by humans) with which machines must cope. Increased product quality will also result from the ability to schedule more thorough, uniform inspection steps during manufacture.

Customization of products. One of the main themes of this article is that computers will bring a *flexibility* to automated manufacturing while maintaining a high productivity rate. The first manufacturer that can offer truly customized products (such as clothing to fit your precise measurements, perhaps with your own design modifications incorporated) *at mass production prices* will unleash a consumer demand that will cause the computer-based automation of entire industries.

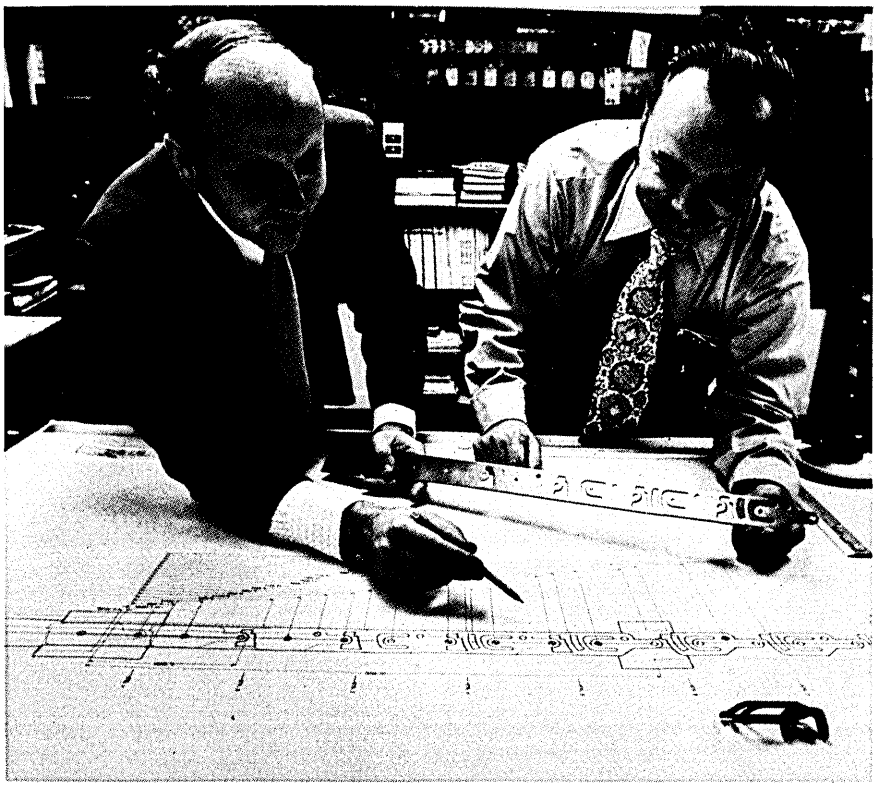
Increased job satisfaction. The demeaning nature of many factory jobs is rapidly becoming a major labor issue. The current generation of workers is more educated and has more options available; they will not act like machines 40 hours/week. Fortunately, computer-based automation requires human labor, but in more satisfying jobs. The predominant factory jobs in the future will be programming, system maintenance, supervision and management.

Programmable automation

The question is: On what time scale will computer-based automation of manufacturing proceed, and what form will it take? I am currently involved in an investigation for the Advanced Research Projects Agency (ARPA) of DOD which is formulating an answer to that question and to related questions of direct interest to DOD: (1) What will be the impact of computer-based automation on DOD procurement? (2) If there are significant benefits, such as reduced prices and shorter lead times, what technological developments are required to achieve computer-based automation so that those benefits can be realized?

There are, of course, no general answers; they depend on many characteristics of the product and on the manufacturing method. Our study has concentrated on the important job shop/batch production environment, and has formulated a concept of *programmable automation* for that environment. There are three key attributes distinguishing programmable automation of manufacturing; all components of the manufacturing process—parts forming and machining, assembly, inspection, resource transfer and storage, and scheduling—are:

1. *Highly automated* with human supervision, but requiring little human intervention in the routine manufacturing process (and therefore not limited by human reaction times or by human variability).
2. *Flexible:* all manufacturing components are programmable.
3. *Highly integrated* with computer-



Mobility Systems' guided order-pick vehicles installed at Ford Motor Co.'s North American parts redistribution center automatically carry order pickers to the correct location. Vehicles can be directed by manual keyboard data entry, on-board punched card readers, or on-line computer.

aided design and engineering facilities, accounting systems, and management information and manufacturing control systems, so that information acquisition from each of these areas contributes to the entire system.

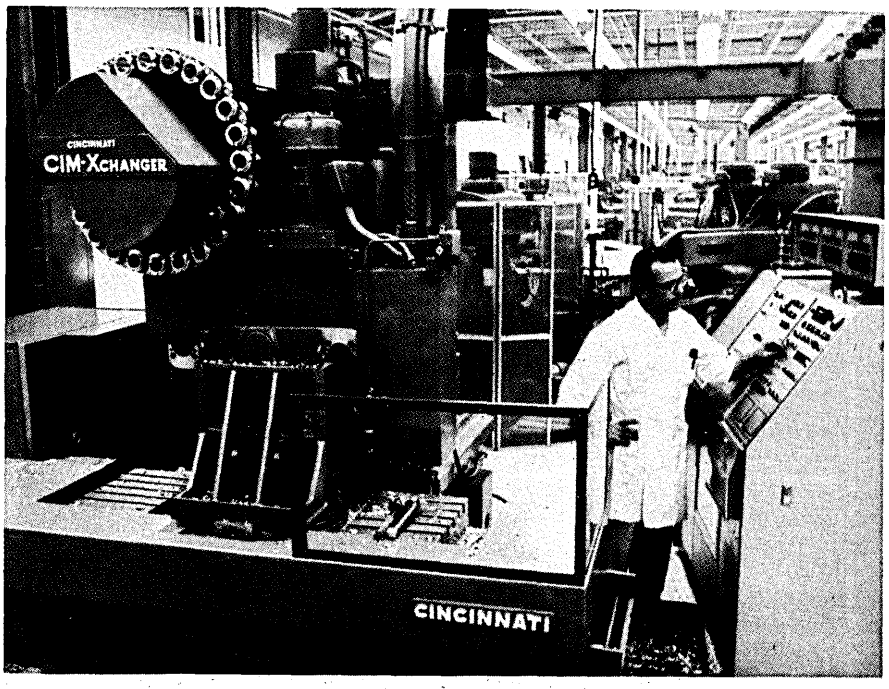
Is complete programmable automation feasible today in a manufacturing facility? Probably not. But it is potentially closer than might be thought. To see how such a facility would operate and what developments are required for its realization, consider the following description of a "hardware realization" of the concept. (There are certainly other possible hardware realizations. The point is not how the concept is implemented, but rather that the entire manufacturing process be studied as a unified system.)

A programmable automated manufacturing facility is deceptively easy to imagine. The "plant floor" might consist of a number of work stations, distributed in a convenient manner (perhaps grouped according to function—part forming and machining assembly, inspection, storage—for ease of maintenance, cleanliness requirements, etc.). Each work station performs a manufacturing operation under direct computer control, and is serviced by a computer-controlled "random-access" conveying mechanism. Such a conveying mechanism would be capable of transporting in-process materials between any two work stations in the facility, most probably on standard-sized pallets, under program control; this conveying mechanism would have the important property that it maintains control of the orientation of any palletized materials being transported. Actual implementation of the conveyor system might be in the form of a two-dimensional overhead grid of rails with turning points at some or all intersections and rail-mounted "part movers" capable of traversing the network, or it might use a number of floor-mounted carts capable of following buried cables. The interface between the conveying system (which would have limited degrees of freedom and coarse positional accuracy) and a work station (perhaps requiring rather precise orientation and positioning of tools and in-process materials) might well be handled by an industrial robot with some limited sensory feedback capabilities. One robot would normally provide the I/O interface for a group of several work stations, since the processing time at a work station tends to be long relative to the I/O time.

From the foregoing cursory description of aspects of a computer-controlled automated manufacturing facility, some important attributes of that facility may be derived. First of all, it is flexible in several respects. Since the order in which manufacturing operations are performed is governed only by control of the conveying mechanism, rather than by physical placement of work stations in a "flow-through" line linked by rigid conveyors, that order can easily be changed, e.g., to add additional inspection steps, or to incorporate a new manufacturing technique. In fact, such flexibility allows the manufacturing process to be quite adaptable to changes in materials and production technology; work stations incorporating a new technology can be installed in any spare location and "debugged," then introduced into the manufacturing process by modifying the conveyor scheduling algorithm to route in-process materials through that station.

Another form of flexibility involves efficient allocation of resources. If work stations performing assembly and inspection operations are programmable in the same manner that NC machine tools are, and if they are under direct computer control, then the most efficient use of the manufacturing facilities would probably encourage the manufacture of several different products concurrently using common

Diecomp, Inc., a small engineering company in South Plainfield, N. J., has developed a proprietary process called PDDC® (Progressive Die Design by Computer) which offers the promise of producing tool and die designs on a computer using the specifications of the part to be manufactured as the basic input. Starting with the manufacturer's drawing of the part to be mass produced. Diecomp's technicians digitize the part drawing and enter it into their Xerox Sigma 6 computer, along with such additional parameters as material specifications and the desired die construction type. All other necessary information—including a knowledge of geometry and characteristics of materials, the ability to recognize problems that have standard solutions, and data on the customer's own equipment—have been stored in the computer's memory. The system then produces, on a computer-driven plotter, the various assembly and detail drawings required to build the special die for the required part. The system also derives significant data directly from the design process, including scheduling and inventory control information, costing elements and press-tonnage requirements. Another important by-product of the design system, said by the company to be available within a few months, will be the automatic generation of NC tapes to control the actual machining of the tool or die components. The photo shows Diecomp project manager David Wladaver (left) and Oswin Shifman, manager of engineering and design services, check one of the many computer-generated detail drawings needed to make the die used to fabricate the parts shown on the drafting table.



At TRW Systems in the Los Angeles area, a PDP-8 using the UNIAPT NC Parts Programming package from United Computing Corp. produces paper tape for the Acramatic IV controller that directs the operation of a Cincinnati Milacron CIM-Xchanger milling machine.

manufacturing resources. By analogy, time-sharing a computing facility between several programs permits better use of resources—for example, while awaiting completion of an I/O operation—than does the sequential execution of those programs (dependent, of course, on the required time to switch between programs; "switching" an assembly machine between different products may involve significant delays in exchange of work-holding fixtures, etc. and those delays must be taken into account). Job shops today use their facilities in a "time-shared" manner, but the lack of a complete, centralized cognizance of the status of all resources does not permit precision in scheduling the use of those resources. An often-quoted statistic in many current manufacturing operations is that an in-process part or subassembly sits idle, queued for the next operation, 90% of the time. The problem is one of management, and computers are well-suited to performing the rather low-level management decisions involved in routine allocation of resources, subject to human supervisory control and establishment of priorities.

The flexibility of a programmable automated manufacturing facility is naturally limited by the manufacturing processes implemented within it. (But it is not necessarily limited to one "plant"; nothing prohibits portions of the conveying network from involving transport between physically separate facilities, with a computer network maintaining control between the separate facilities.) It is also limited by size considerations. The most obvious implementation of a programmable automated facility would rely on several distinct standard-sized pallets for material transport, inventory, machine loading, etc. The pallet sizes become limiting factors. One facility will not produce both wristwatches and air compressors, but the concept of programmable automation can be applied to manufacturing facilities of considerably different scale.

Developments required

Programmable automation is a prediction of how a manufacturing facility will operate at some time in the future. The concept provides a useful framework within which to evaluate steps currently being taken toward computer-based automation. Three examples of such steps are: numerical control of machine tools; industrial robots; and automated warehousing systems. Are current developments in these areas consistent with the overall concept of programmable automation described above?

Numerically controlled machine tools. There are three major areas of activity here. One involves DNC and CNC—how to distribute the computing power between a centralized computer and an on-site minicomputer. The argument does not functionally change the characteristics of computer control of machine tools. More important is that machine tools be capable of communicating with a centralized computer-based control system; both DNC and CNC permit this.

A second area of activity is the trend toward a cluster of different machine tools (e.g., boring, milling, grinding) interconnected by a conveying system, with automatic loading and unloading of in-process materials from the individual machine tools. These systems permit a sequence of several different machining operations to be performed on a palletized part, under computer control, and without human intervention. Notable examples are Cincinnati Milacron's prototype Variable-Mission system and System 24 of Molins Machine Co., Inc.. These systems incorporate the programmable automation concept to a considerable extent for the metal-removal component of the manufacturing process.

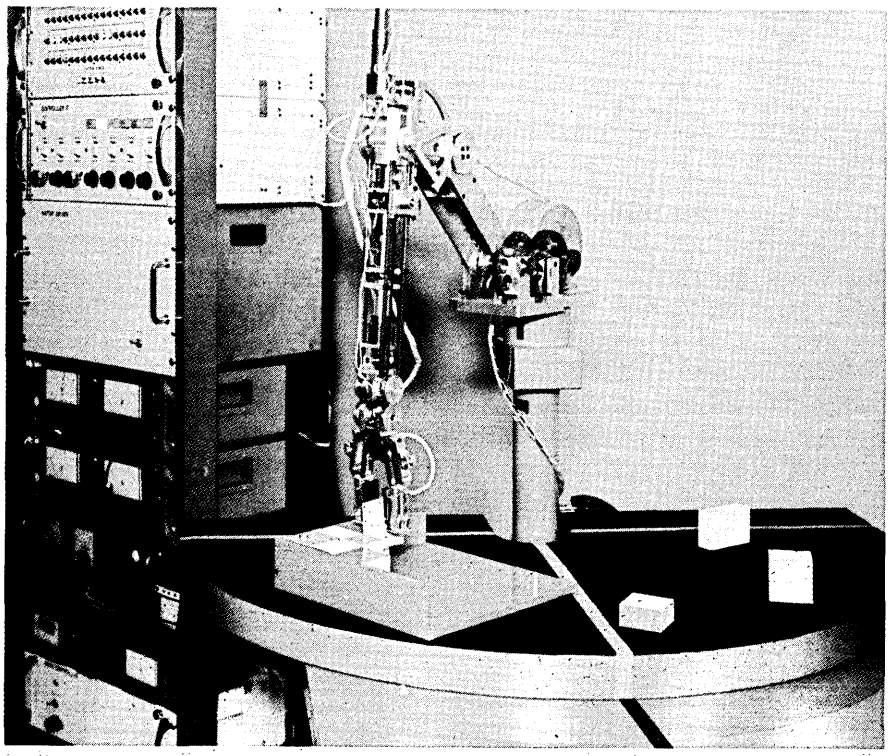
The third area of activity involves adaptive feedback and in-process inspection—the use of sensors to monitor and control the machining process as it is being performed. Some increases in productivity will result from such adaptive control, but perhaps of greater importance to a highly automated facility is the ability of these sensors to detect such exceptional conditions as tool breakage.

In summary, the current state of the art in the metal removal aspect of manufacturing is entirely consistent with programmable automation and, in fact, provides an example of such a system in microcosm.

Industrial robots. The current generation of industrial robots, exemplified by the Unimate (Unimation, Inc., Danbury, Conn.) and Versatran (AMF Versatran, New Rochelle, N.Y.), are programmable "put and take" transfer mechanisms. They have no built-in feedback from tactile or visual sensors, and rely on absolute positional accuracy (about .050" in a working area having a diameter of about 20 feet).

In a paper presented at the recent Second International Symposium on Industrial Robots, Mr. J. F. Engelberger, president of Unimation, Inc.,

At the Central Research Laboratory of Hitachi, Ltd., Kokubunji, Tokyo, Japan, a computer-controlled robot with tactile sensors has been developed. HI-T-HAND can feel for scattered objects, recognize their form and position, change their position to facilitate subsequent operations, select the best method for shifting and positioning in a pallet, and push an object against the wall of a pallet or other objects for tight packaging.



said that second-generation Unimates will have a compatible computer interface, program memories of any desired size with random program selection, and the ability to synchronize with a moving target. He also predicts that a third-generation industrial robot, a "thinking robot with coordinated hand and eye," won't be needed at all in the industrial environment. Basically, I agree with this prognosis, although there is really a spectrum of visual processing and coordination to be considered. Robots will retain their niche as a flexible interface between work stations and the conveying mechanism; this does not require complex visual processing or "intelligence." However, some degree of sensing and feedback—especially tactile sensing—is clearly desirable to reduce the precision with which known parts must be presented to these robots. In current applications, the cost of special tooling to retain precise part orientation for a robot application is often greater than the cost of the robot itself; limited sensory feedback would dramatically reduce the requirement for such special tooling.

Automated warehousing systems. This technology is advanced to the point of being ready for integration into a programmable manufacturing facility. Most such warehousing systems rely on standardized pallets, and are capable of being interfaced to a computer-based inventory control system.

Given the above inroads of computers into manufacturing, it may seem that computer integrated manufacturing systems are well advanced. Actually, there are major blockages to be overcome, especially in the following areas: (1) Product design for automated assembly. Current design philosophies are too heavily biased toward the unique assembly capabilities of two-handed humans with their sophisticated visual, tactile, and force sensing systems. (2) Programming of such processes as assembly and inspection. (3) A work station specializing in visual processing, to perform subtle inspections, to provide initial orientation of parts, etc. (4) Programmable assembly and inspection machines. (5) An integrated software system capable of data collection, resource allocation, scheduling, control of production processes, and interface to accounting and management systems.

The last two development areas in the preceding list are of special importance.

The assembly process typically accounts for 50% of production cost. Especially in job shop operations, assembly is very labor-intensive. Consequently, it is subject to human variability and is not amenable to computerized coordination with other manufacturing operations. Therefore, programmable automated assembly machines are a vital component of an integrated manufacturing system. There are many trade-offs to be investigated in automated assembly: (1) A group of inexpensive, rather specialized assembly devices vs. a sophisticated, more flexible machine. (2) Rigidity and mass for absolute positional accuracy (in the manner of current machine tools) vs. flexible manipulators using sensory feedback for incremental accuracy (in the manner of human assembly workers). (3) The use of a general-purpose "wrist" capable of accepting special-purpose grippers and tools vs. a general-purpose "hand" which obviates the need for a collection of specialized grippers. (4) The use of two or three "hands" working in concert vs. one hand supplemented by work-holding fixtures and pallets. Most likely there is no single set of right answers. Initially, more data is needed on the nature of the assembly task so that the spectrum of possibilities is more clearly understood. However, our initial studies indicate that sophisticated visual systems and "artificial intelligence" are not needed for most assembly operations; the emphasis in development should be on simple vision devices and on low-bandwidth tactile and force sensing feedback.

The development of complete software systems for manufacturing facilities is, of course, crucial to the concept of programmable automation. Probably the largest development effort in discrete production control systems is being made by IBM. According to a recent Quantum Science Corp. market study entitled *Factory Automation*, IBM has captured 60% of the market for factory data collection systems. An eight-volume IBM planning document contains detailed specifica-

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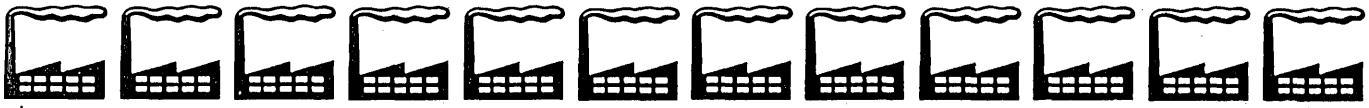

Batch Production	Manufacturing facilities are used to produce a batch of identical or very similar products, then reconfigured for production of a batch run of a different product; the batch (or lot) size may vary from one item to thousands of items.
CNC (Computer Numerical Control)	Control of an NC machine by a local digital computer; in most cases the local computer will have a communication link to a larger, more centralized computing facility.
DNC (Direct Numerical Control)	Control of an NC machine by a remote digital computer.
"Hard" Automation	Special-purpose manufacturing equipment designed for the manufacture of a particular product; equipment requires substantial modification for re-use for another purpose.
Industrial Robot	A programmable material transfer device for use in factory environments.
Job Shop	A manufacturing facility which contracts to produce a specified quantity of a product; most often a number of different products are produced concurrently using some manufacturing resources in common.
Mass Production	Characterized by a high rate of production of identical or very similar products; transfer of in-process materials between work stations is usually automated.
NC (Numerical Control)	The actions of a machine are governed by specifications read from a tape, stored in a local memory device, or received over a communication link.
Process Industry	Creation of a bulk product by control of a continuous process.
Programmable Automation	All components of the manufacturing process are highly automated, programmable, and integrated with other relevant information systems.
Tactile Sensing	The use of sensors to provide feedback similar to the sense of touch in humans.
Work Station	A location at which a step in the manufacture of a product is performed.

tions for a Communications Oriented Production Information and Control System (COPICS) governing almost all aspects of the manufacturing process (see Fig. 1); perhaps the single most important development in programmable automation would be the implementation and distribution of that system. The resulting *de facto* standardization of interfaces would bring to the area of manufacturing automation the same type of umbrella that has been in operation in the areas of computer peripherals and memory systems.

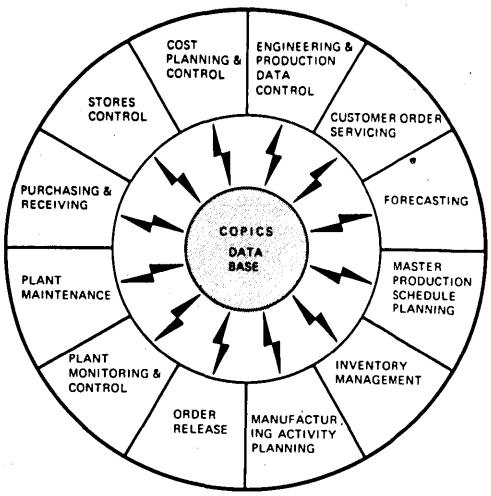

Fig. 1. Application areas covered by IBM's proposed COPICS system.

Without such standardization, developments and products tend to become fragmented. (The only other alternative would seem to be an active role by such institutions as the National Bureau of Standards or the American National Standards Institute in setting interface standards for the modules of an automated production facility.)

The software system governing an automated factory will be large and complex; however, the system appears (from the COPICS specifications) to be highly modular, which will aid in its development. Such a system seems within the state of the art in large software development efforts. It is important to realize, however, that the computer-software system must be used, and defined, directly by high-level manufacturing professionals, who may never have used computers before. Computer scientists will not be running the factory.

How do we get there from here?

Naturally there will not be a sudden quantum jump in the computer-based automation of present manufacturing facilities. Neither will large numbers of shiny new factories be built soon incorporating all of these concepts. The capital investment in current production facilities requires an evolutionary approach to their modernization.

It is quite possible for programmable automation to evolve in existing production systems. Initially, the individual work stations may rely heavily on human intervention, with the worker gradually assuming more of a supervisory role as the capabilities of the machine improve. Also, the conveying system may gradually expand from an initial automated warehouse to provide material routing among increasing numbers of work stations. However, for there to be an orderly evolution toward programmable automation, it is vital that an entire manufacturing facility be studied as a system; within that system, functional blocks must be identified and the interfaces between these blocks clearly delineated. Two obvious sources of interface specifications are the characteristics of the conveying mechanism—which interfaces with nearly all other mechanical functions—and of the information flow to and from the computer-based control system. During this evolution, it is important to work toward achieving the goal of total automation of the routine manufacturing operations. The maximum impact of computers in manufacturing will come from complete, real-time computer cognizance and control of all processes and resources, allowing the precise scheduling and allocation of those resources.

A prototype discrete manufacturing facility incorporating most of the concepts discussed in this article could most probably be built before 1980—the difficulty of the task depending, of course, on the flexibility and programmability of the production processes and on the magnitude of the R&D effort undertaken. But the spread of computer-based automation into a significant segment of industry will take decades. (Numerically controlled machine tools were commercially available in 1955; at present—17 years later—less than 1% of the metal cutting machine tools in use are numerically controlled.)

It is becoming clear that a focused five- to seven-year development program aimed at total, integrated, computer-based automation of discrete product manufacture can produce systems which will dramatically increase U.S. manufacturing productivity and increase the quality of both jobs and products. The emphasis in this program should be on developing flexible automation for assembly operations and on direct computer scheduling and control of all in-process materials and manufacturing processes.

The infusion of information sciences into the manufacture of discrete products requires a coordinated effort among government, universities, research institutes, and industry, with a recognized national priority. Computers will have a dominant role in future manufacturing technology. The benefits obtainable from their use are needed now.

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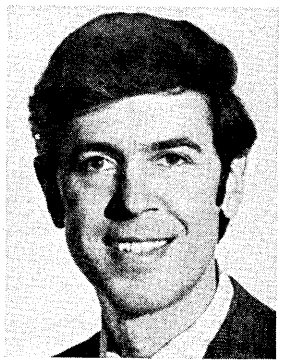

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CIRCLE 17 ON READER CARD

In a recent interview, the president of IBM World Trade responded to questions on company policies, practices, and attitudes towards the European market

IBM Abroad

by Angeline Pantages, International Editor

Jacques Maisonrouge, president of IBM World Trade Corp., was given stronger control over that $3 billion subsidiary just in time. Just in time to hear the Justice Department ask that IBM be broken up and announce extension of its antitrust suit to include World Trade.

With the recent appointment of Gilbert Jones, chairman of World Trade, to the all-powerful IBM Corporate Office, the reins as chief executive officer have been passed to the 48-year-old Maisonrouge. The French executive has also been made a senior vice president of parent IBM. It seems he can no longer be thought of as IBM's "token European"—as many considered him when he became president under a Watson—Arthur K. Watson—in 1967.

Maisonrouge, with Jones, shares in the credit for the World Trade (WTC) performance that gave IBM more than half its profits in 1970 and 1971—more than $500 million in each year. Naturally, he also has a big share in the current fight to stave off not only the U.S. government, but also the governments of European countries and Japan who would like to increase their computer market share—inevitably at IBM's expense.

In an interview with the World Trade president in New York, he talked about antitrust, WTC's reorganization, and the new markets and technologies. He spoke at length—though walking the IBM line—with atypical candor for an IBM executive—and, if a female reporter can be indulged, with the extra-charming manner typical of French men.

The U.S. antitrust laws have full control over what an American company does abroad when it affects other American companies—even if the company, like IBM, manufactures many products outside the U.S. for sale abroad. "There is an extraterritoriality of application of the U.S. laws when a U.S. company deals with another U.S. company," Maisonrouge explained. But even though the U.S. has no control over what IBM does, say, to foreign competition, "we would just not treat foreign competition any differently. It doesn't make any sense, long-term, from a business standpoint.

"I must say that we just have a set of policies and principles which are based on good business judgment and ethics, and they match the constraints of the antitrust laws, the objective of which, in fact, is to make companies have good business ethics. So it is a very nice match. Whether U.S. laws apply or not overseas, we apply the same judgment and ethics . . . We will fire a salesman who disparages competition in Japan as we fire him here . . . This company has always played an honest game. For instance, we have never tried to use any tax loophole. You know, the headquarters of IBM Europe are in Paris," he said, meaning you don't go to France to evade taxes.

"That is what makes us foreigners like this company, even though it is sometimes hard for a foreigner to be in love with an American company," he smiled. "Our great success is that we are almost all foreigners. We have 115,000 non-Americans out of 115,300."

We pointed to seemingly anticompetitive moves IBM had made abroad: refusal to maintain 360/30s with independents' memory extensions, peripheral price cuts, and—on the new 370s—the bundling of memories with the central processor, and the integrated control units.

Maisonrouge explained that the policy on the memory extensions was "for very good practical business reasons. It is a problem to have good service in remote locations." His example was that when a leasing company brings a 360/65 into a country whose largest machine is a 40, "we do not have customer engineers who can service anything above a 40. It's not that we try to be tougher, it's just that we can't do it, and they understand it. That's why they don't sue us."

"Our great success is that we are almost all foreigners. We have 115,000 non-Americans out of 115,300."

As to whether the effect of IBM policies will be to obliterate the American and foreign independents in Europe: "I think that there will always be a place for peripheral manufacturers. If they don't make memories they will make cpu's, plug-compatible cpu's," he laughed. "It's a vast market and what is worrying them is that they are not completely free to decide on their strategy because they have to watch the IBM rules. You cannot ask a company which is technology oriented to wait for the others to be ready to do something. People very often don't realize how the cost of computing went down in the last ten years . . . if we find

technology solutions to reduce the costs of memory, I think it is our responsibility to do it."

We commented that European users told us they find no technical advantages to the integrated store control (for peripherals) on the new 370s, just a price advantage. "Well, I think that if there were no independents of any kind, we would have done the same thing—for technical reasons. There will be one day when the whole memory, the cpu, and channel control of the computer will be in a box, like a shoe box. At that time we cannot be asked to put one-third of the shoebox in one room, one-third in another. Moreover, the methods of production will be so automated that you will have to have a single unit. But we will still need for years magnetic tapes and disc files, et cetera. It's fair game for everybody."

The European Economic Community (EEC) itself has been making antitrust noises. One of its more recent decisions kept Continental Can from merging with a Dutch competitor. While it involved a merger, the decision more broadly defined the "dominant concern" concept: "enterprises are in a dominant position when their scope for independent behavior is such that they can make their decisions without paying substantial attention to competitors, buyers, or suppliers."

Asked if this decision was worrying IBM, Maisonrouge first countered that IBM has never grown by merger. "It's an investment which was made 50 years ago and it has been successful . . . by the sweat and blood of Frenchmen and Germans, and Belgians and Britishers."

"If you multiply the density of circuits by 10 or 100 you change the whole manufacturing game."

Doesn't IBM fit that definition of dominant concern? "If you look at IBM, you will find that there has always been very strong competition. In the time of the punch card, we had more competition in Europe, proportionately, than we had in the U.S. Since the computer became a major tool of management, the European governments have pushed very hard their national industries. And I think they have a body of practices which is far tougher, vis-à-vis a company like IBM, than I think you can imagine here. They promote their companies very strongly. Sometimes we think it a bit unfair."

Is the government control of computer buying abroad that great in dollar volume? "In the present stages it is much bigger proportionately than in the U.S. In the U.K. and France, there is much more government business than private industry. The public utilities, the telephone company are nationalized. The steel industry in the U.K. is national; BEA and BOAC are not exactly independent. In France, all the coal mines are in the hands of the government, the five largest banks and the five largest insurance companies are government controlled. Forty-two percent of the data processing business in France is government controlled. So when the government is dedicated to pushing their national company, they have a very healthy market." He noted that Germany is more decentralized than other countries, but France, the U.K., Belgium, Holland and Italy in particular exert a lot of government influence on industry.

Has the EEC's head of industry and technology, Altiero Spinelli, indicated ways they would like IBM to change in Europe? "Not precisely. He has made comments in a speech about an American manufacturer. We suppose it is IBM. He is a very dedicated gentleman who wants to push European industry in all the high technology areas," and like all the governments wants national companies.

"I think we have convinced him that in Europe we are reasonably European and that we have contributed a great deal to the well-being of Europe.

"It's an amazing situation when you hear people criticizing IBM, but at the same time recognizing that in terms of ethics, in terms of service to customers, in terms of employee relationships which we consider with great care—we are an example. The only criticism they have is 'well, you're too big and too good.' And then I tell them back in 1952 the gross income of the IBM Corp. was $300 million and that's not a giant. So we have become a big company without an acquisition. And I say it hurts us who have been there since that time to think that all our work which has made that company big, now is criticized. IBM France, when I joined it in 1948, had 1,100 people in total. Now they have 18,500."

Jacques Maisonrouge, president of IBM World Trade Corp.

This argument about IBM has raged for years, and the next natural question was: regardless of how IBM achieved its position, can the world afford diminishing competition and allow one company to have power over this resource?

"My point is that we have had increasing competition," countered Maisonrouge. "It would make an IBM salesman cry if you told him we have no competition," he said, pointing to "all the work we do to recognize, to study what we can do better, and the number of accounts that we lose to competition." He completely dismissed Dr. H.R.J. Grosch's thesis that all IBM's computer competition will be dead in 10 years unless it bands into a worldwide consortium.

"I don't know if there will be 20 companies 10 years from now, but there will be a number." If one looks at Japan and Europe, "they are growing much faster than we are. Moreover, they are beginning to talk together." Maisonrouge thinks that agreements like that of CII, Siemens, and Philips will succeed because "there is such a determination by the European governments and the EEC to have a European-based and European-owned industry."

IBM World Trade's recent reorganization, splitting the operation into Europe and Far East/Americas, led many to believe that its headquarters would be moved to Paris. Certainly more power was shifting to Paris and some thought it was the result of the EEC pressure on multinational companies to locate more decision-making control in its member countries.

In fact, World Trade headquarters is moving in 1974—from Manhattan to a new facility in Mt. Pleasant, N.Y. About 1,300 staff are involved, plus a "few hundred" being shifted to the staff of the Far East/Americas operation, which will be in Mt. Pleasant.

IBM Europe has definitely been given more decision-making powers, however. Previously, this 600-man operation in Paris did not really have strong control in formulating operating plans for Europe—in finalizing contracts, in responding to requests for special systems (such as the banking terminal developed in the U.K.), and in coordinating industry marketing and support.

Starting this fall, 50 WTC executives and managers were making the transfer to Paris to provide the expertise to take control of those functions. In-

cluded are Americans Frank Cummiskey, formerly vice president of marketing of WTC and now president of IBM Europe, and financial man, J. J. Farese, now assistant general manager for finance and planning. Under Farese are many transferred powers: plans and controls, controller, treasurer, legal, and real estate.

Cummiskey's vice president and deputy is Swiss Kaspar Cassani, formerly general manager of the North-West Europe area. M. P. Vahl was promoted from head of dp operations in Germany to vice president of dp operations for Europe. This upgraded post was previously handled by two staff directors, with staff control from the U.S. It includes responsibility for customer and system engineers, industry marketing, program products, and other marketing functions.

"What we have done," said Maisonrouge, "is not a major change. It is just a recognition that Europe represents about 70% of our total business overseas, and that Paris must have the muscle to handle the problems of the 70%. In spite of the so-called easy communications between Europe and the U.S., it still takes more time to communicate between New York and Stuttgart than between Paris and Stuttgart."

Maisonrouge's comments belied the inevitable headaches of a multinational computer firm in trying to meet the "slightly conflicting objectives" of decentralization to "meet the demands of the marketplace" and of a worldwide product line. "If you want to deal with Shell or Volkswagen, you must be able to give them the technical or contractual answer on the spot and not have to rush to the headquarters here to discuss terms and conditions."

For example, on an RPQ (a special system request) IBM Europe "will have the muscle, with financial people to make the analyses, approve it, and price it, and with legal people to work on terms and conditions." Too, IBM has for some time had industry marketing centers abroad, such as a retail center in Paris, a manufacturing center in Munich, and an insurance center in London. But until last year, the coordinating organization was in New York—defining industry strategies and interfacing with the U.S. company on applications development. "We have practically nobody now in industry marketing in World Trade in the U.S." That responsibility resides in Paris.

As to EEC pressure, the WTC president noted that "it is important that the Europeans and the EEC understand that our operations in Europe are as European as possible, while maintaining the necessary controls that an investor must have over his investment anywhere in the world . . .

"Sometimes I am surprised by comments made by some politicians here or in Europe that this company should be in Europe. We still have a large percentage of our stockholders in the U.S. I've not heard that any European company with a large U.S. subsidiary has decided to move its headquarters here.

"As a one-product-line company, our interface with the System Development Division must be strong, and that means that World Trade must have a substantial group of people here to interface with the engineers. Whatever happens in the next 10 to 20 years, we will always have people here for that interface."

". . . we think that the Eastern countries are an important market because they have great needs, but they all have problems of currencies and how to purchase Western products."

IBM's technological advances in circuitry and memory technology also have affected the World Trade organization. Generally, Maisonrouge noted that "in looking at our future workloads in the components area, we have concluded that we will need less manufacturing space and less people than normal growth without technological improvement would have required. If you multiply the density of circuits by 10 or 100 you change the whole manufacturing game. And I would say perhaps we made some planning mistakes, that it went faster than we thought. Our plans made in 1969 were substantially different from our current projections of manpower and manufacturing space." While not commenting on whether this means cutbacks, he noted that it explains a "very painful decision —to stop the construction of a plant in Hanover, the first time that happened in IBM history." (IBM had purchased the race track grounds in this German city to construct a components plant which would have employed about 1,000 people. With its circuitry breakthroughs, it had to cancel the plan—a much-publicized event in Europe—and equitably settled the issue by paying the Hanover government, in effect, to take back the land.)

Has the international customer rushed to make the crossover to virtual storage systems? "It is a bit early to predict," answered Maisonrouge. "In the U.S., when a new product is announced, customers are very willing to order it right away. The Europeans are much more conservative . . . they want to see it before they order it." But he thinks they will come around, because of the "main thrust of virtual storage to make the work of the customer easier."

Some overseas users were annoyed by the immensity of the virtual storage operating systems, and what that will mean in memory consumption when IBM finally announces cheap *real* memory. "We hate these big programs, but we have just not found a way to solve that. We will be delighted to have easier smaller programs, if only because we spend a helluva lot of money on those programs." He invited any "bright ideas" to solve the problem.

World Trade seems to be pushing into the telecommunications market overseas, judging by its successful introduction of the 2750 and 3750 private automatic branch exchange systems. "The whole marketing thrust of the 3750 is to use it as a support for data processing installations. Our emphasis in our program for line switching is the use of this equipment intimately associated with computers. Our intention is not to go into the central exchange, which are pure voice-switching devices. Our general thinking is that we must be in all kinds of office automation—typewriters, power typing (word processing), teleprocessing, data processing, and data manipulation which involves switching of lines."

IBM has been in East Europe selling its products for years, but Russia is a new market for the company. How big is it, and are the Russians really planning to buy 1,000 360s from IBM, as reported in Paris newspapers?

The article, said Maisonrouge, reported a conversation between the people of CII and Russian officials, and "anything which happens in conversation between some officials and a competitor which is reported through somebody who was not there . . . Well, I would like to find the guy who wants 1,000 computers myself."

About the market, "we think that the Eastern countries are an important market because they have great needs, but they all have problems of currencies and how to purchase Western products." Too, trade negotiations with these countries are "always long, so it's not going to be a big boom suddenly." He noted any figures on potential are sheer guesses. "I'm sure that they (the Russians) have a potential for 25,000 computers right now, if they want to use them. It's like people asking 'why don't you sell computers to China?' They don't need labor-saving devices."

At the time of the interview, the elections were coming up, and surely Maisonrouge had some feelings about what the candidates might mean to a

multinational company?

As a foreigner, it is not politic to comment on candidates, he mused, but "I hope that there will not be a return to protectionism and isolationism whatever administration is in place. My hope is that whoever is in power will realize that some bills which have been proposed will be detrimental to the economic health of the U.S. and the rest of the world."

Particularly the Hartke-Burke bill is a worry to multinationals, attempting to curtail American investment abroad and stem the "export" of jobs. The reaction in Europe is "generally negative, although you will always find those who are against U.S. investments and when they find partners in this feeling here, they are delighted."

Like most top IBM executives, Jacques Maisonrouge spent all his professional life at IBM, starting in 1948. An electronics engineering graduate of Ecole Centrale de Paris, he won a scholarship to study at a university or study a subject at a private company. "I chose electronics, computers, and calculators although I had no vision about what computers would become. At that time we didn't even know the word computer."

After working on the SSEC computer at 590 Madison in New York, he was sent back to start the first applied science group in France. After that he transferred to sales in IBM France, and in 1957 moved to IBM Europe as manager of planning and research, then regional manager, and finally assistant general manager. Between 1962 and 1967, he moved between New York and Europe, becoming a World Trade vice president in 1962, president of IBM Europe in 1964, and finally WTC president in 1967.

The French executive has been plagued by rumors that he and his family are unhappy in the States and that he would like to go home to enter politics. About the first, "that's an absolute lie," he said fervently. "I prefer by far to work here than in Europe. I find that working relations are easier, that human relations are better. Moreover, I love New York."

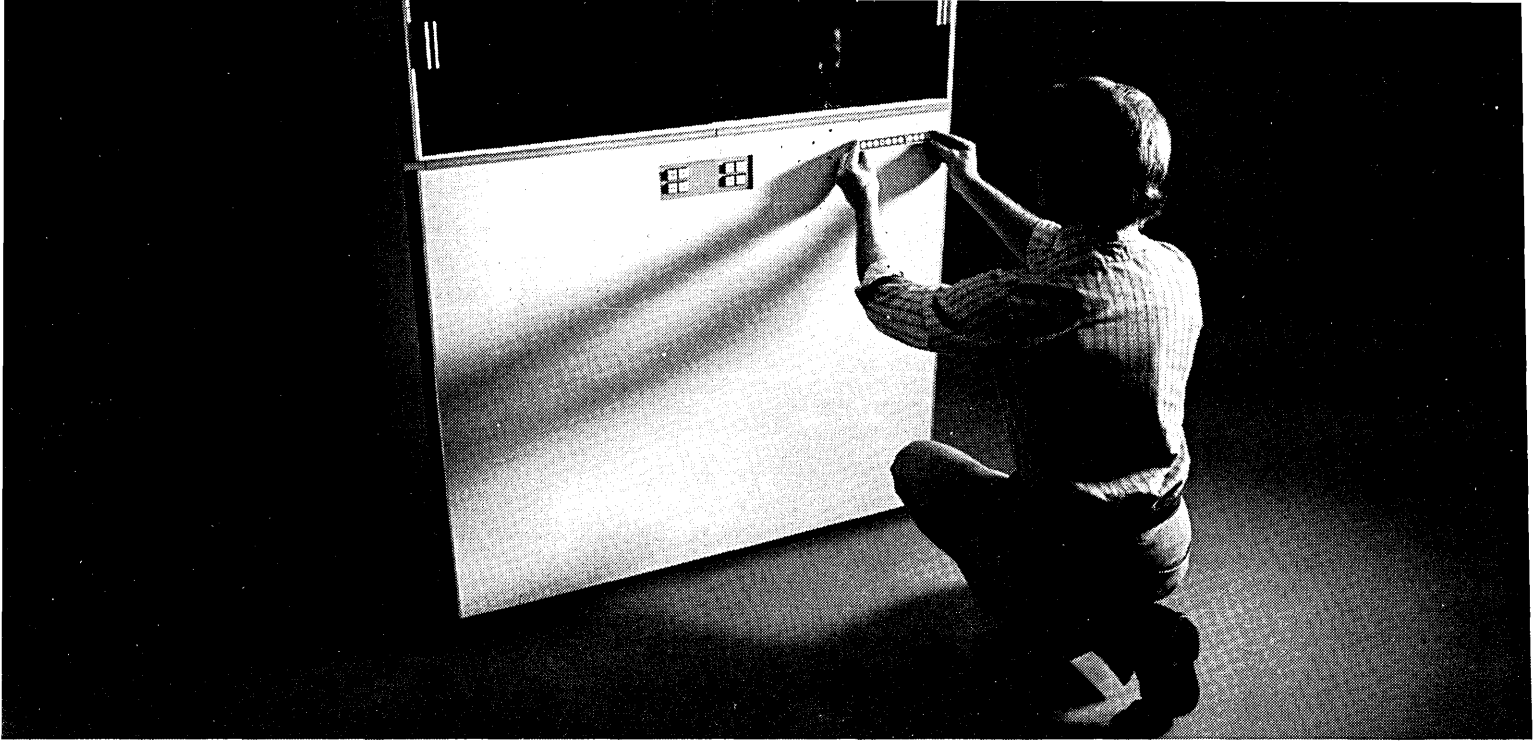
To emphasize this, Maisonrouge pointed with great pride to the astonishing accomplishments of his children in the U.S. The oldest of five was an M.D. at 22½, and is now a resident doctor in a Montreal hospital. "My second one is in her third year of a PhD program in biology at Columbia. She's old; she's going to be 22. And the third one is at the Courant Institute at NYU, preparing a PhD in mathematics. She's going to be 21, and graduated summa cum laude from Barnard at 19. So why would we not like it here?"

He added that "I don't say that I will stay here for the rest of my life. The main reason would be a family reason because our parents are getting old, and we are one of these Latin families who are very close."

As to politics (Maisonrouge and J. J. Servan-Schreiber have long been opponents over the multinational issue): "The French have all the politicians that they need, very bright people, very good people. You have to be very strong to be a politician. You must have a very thick skin to accept those things, and I'm very upset by criticism, unfair criticism, so I couldn't sleep at night."

He also noted that most who know him assume that he will eventually go back to France, and "in typical French fashion, they think it's impossible when one has occupied the post I have in the U.S. that he would accept a lower post. But in our American thinking, it is not impossible at all."

While those comments seem to leave the door open to Maisonrouge returning to IBM in Paris (if he goes back before he's 60) some say that his recent promotions leave the door open for a move to Armonk. Perhaps in the slot of IBM president. □



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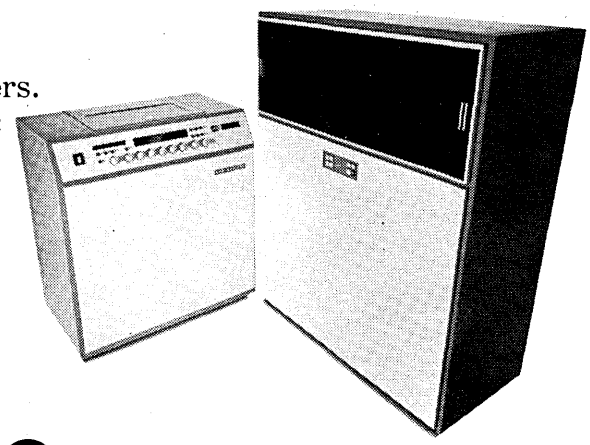

CALCOMP

In many cases, it is actually more economical to purchase a computer after leasing it long enough to take advantage of the purchase option credits

The Best Time to Purchase Your Computer

by Randall J. Hekman

Once a firm makes the decision to procure a computer, it must choose which vendor's product offers the necessary capability for the least cost. Analyses of costs are typically made by comparing the lease and purchase alternatives. Because payments will be made over a period of time, consideration for the cost of money is taken through the "present value" or "discounting" technique well known by comptrollers and financial managers. Most firms have, as a matter of policy, a required earnings rate which expresses the minimum return on the dollar required for all capital investments. This rate may vary from about 10% to 25% depending on the firm. Mathematical tables (called discount tables) exist which permit a manager to determine how much money he needs today to meet an obligation in the future, assuming the funds he holds will earn interest at the required earnings rate. For example, to meet an obligation of $1000 to be paid in three years, a manager with a required earnings rate of 10% will need to have only $751 now. In three years the $751 will have grown to $1000.

With a moment's thought it can be seen that discounting cash flows will tend to encourage managers to lease rather than buy their computers; it is preferable to spread payments into the future rather than make a large lump-sum payment now. This is not to say, however, that it is never economical to purchase. What it does mean is that the break-even point (the point in time where the cost of lease equals the cost of purchase) moves further into the future than otherwise. Fig. 1 shows how the straight-line (nondiscounted) break-even point is affected by a required earnings rate of 10%.

Equipment from most vendors can be procured by outright purchase or by lease with an option to purchase. Under the lease with option arrangement, vendors allow a fraction of the lease payments to accrue as purchase option credits, reducing the purchase option price of the machine as time goes on.

The contracts now in existence between the federal government and various computer manufacturers have exceedingly diverse methods of accruing purchase option credits. Some manufacturers allow a constant percentage of lease monies paid to accumulate as credits; others have rates which vary from year to year. Some vendors take a percentage of the gross lease (lease plus maintenance); others only consider net lease (excluding maintenance).

If straight line break-even point is:	Then the discounted break-even point is:
1 year	1.05 years
2 years	2.22 years
3 years	3.53 years
4 years	5.04 years
5 years	6.79 years
6 years	8.90 years
7 years	11.54 years
8 years	15.08 years
9 years	20.46 years
10 years	32.08 years

Fig. 1. Effects of discounting cash flows on break-even point, with required earnings rate of 10% per year

In addition, each vendor has his own way of eventually halting the accumulation of purchase option credits (lest the buyer should eventually acquire title to the machine by leasing it). Some vendors specify that the accumulation of purchase option credits will end when the credits total a certain fraction (such as 70%) of the initial list price of the machine. Other vendors stop the accumulation of credits after a certain period of time (such as two years) elapses.

Regardless of the method used, equipment from most vendors can be leased for a period of time and then purchased for a total of not many more actual dollars (not discounted) than it costs to purchase the equipment initially.

Earlier we mentioned that discounting money tends to favor leasing over purchasing as the most economic method of procuring a computer, all other things being equal. When the discounting technique is applied to the cash flows involved in leasing a machine for a period of time and then purchasing it, a somewhat surprising thing occurs. Given the right combination of purchase option credit factors and required earnings rate, it becomes less expensive to lease for a period of time and then purchase than to purchase the equipment initially. Fig. 2 shows this effect for a type of equipment offered to the government. Column A lists the time at which the machine is converted from lease to purchase, assuming an installation at time = 0 months. Column B lists the total amount of lease money that will be paid up to purchase. Column C lists the purchase option price as calculated by this vendor's particular purchase option credit factors. The cost of maintenance is omitted since it is the same regardless of the manner of acquisition. Column D is the sum of Columns B and C, listing the total money that must be paid for a given conversion time. As one might expect, the least amount of money (not discounted) is spent by initially purchasing the machine. When these cash flows are discounted at a 10% rate, however (as shown in Column E), the cost drops from $1,034,000 for a purchase at time=0, to $973,488 for a purchase at time = 18 months. Also note that the cost of purchasing the machine initially is not substantially different from purchasing after 36 months of lease.

The knowledge of this fact helps an organization in two ways:

Best Time to Purchase

1. It lets the organization spend less money in acquiring computer capacity (assuming the present value technique has practical significance).

2. More importantly, it gives the organization an economic rationale for not investing large sums of money in a computer before it is known if the system will perform satisfactorily.

How does a manager determine the optimum time to purchase his machine? The author has written a relatively simple FORTRAN computer program which calculates the discounted cost of purchasing the machine as a function of time. The basic formula (its derivation is explained at the bottom of this page) for the discounted cost of leasing to time = t and then purchasing is:

$$\text{Cost}(t) = \left(\frac{1-(1+r)^{-t}}{\ln(1+r)} \times 12 \times (L-PM)\right) + \left((1+r)^{-t} \times P(t)\right)$$

Where:

Cost (t) = the discounted cost of: (1) leasing from time=0 to time=t years, plus (2) purchasing at time=t years. (This cost excludes all allowance for maintenance; see derivation for details.)

t = time in years when purchase conversion is made, assuming installation at time=0 (t need not be an integer.)

r = the decimal equivalent of the firm's required earnings rate (e.g., .15 for 15%).

ln = the natural logarithm (FORTRAN function ALOG).

L = monthly lease cost (*including* maintenance).

PM = monthly maintenance cost to be paid *after* purchase.

P(t) = purchase option cost at time=t years (based on the computer manufacturer's formulas).

This formula was used to analyze IBM's commercial contract for the 370/145 cpu. The 370/145 has a list purchase price of $583,440 and a lease price (including maintenance) of $12,155 per month. The maintenance charge after purchase is $1,250 per month. As the 145 is leased, 55% of the money paid accrues as purchase option credits for a maximum of 12 months.

This means that after 12 months of leasing, the purchase option price has been reduced to $583,440 − .55 × $12,155 × 12 = $503,217. Because of the contract, the price stays at this level indefinitely. Fig. 3 shows how the optimum time to purchase the cpu (the point in time where conversion from lease to purchase produces the lowest cost stream) varies as a function of the

A Firm's Required Earnings Rate (percent)	B Optimum Time to Convert from Lease to Purchase (months from installation)	C Discounted Cost from Installation to Time Title Is Transferred (dollars)
0%	0	$583,440
5%	0	$583,440
10%	8	$581,858
15%	12	$559,707
20%	12	$538,971
25%	12	$519,861
30%	Never	$498,772

Note: Installation at Time = 0 months. Column C assumes purchase conversion is made at the optimum time. Excluded from these costs is an allowance for maintenance equal to $1,250 per month from installation to the time the computer is removed.

Fig. 3. Discounted cost of acquiring an IBM 370/145 cpu

A Month in which Conversion is Made from Lease to Purchase	B Accumulated Cost of Leasing Computer	C Purchase Option Price	D Total Lease Plus Purchase Cost (not discounted)	E Total Lease Plus Purchase Cost (discounted)
0	$0	$1,034,000	$1,034,000	$1,034,000
6	$ 132,000	$ 915,000	$1,047,000	$1,001,512
12	$ 264,000	$ 796,000	$1,060,000	$ 975,808
18	$ 396,000	$ 697,000	$1,093,000	$ 973,488
24	$ 528,000	$ 598,000	$1,126,000	$ 975,270
30	$ 660,000	$ 532,000	$1,192,000	$1,006,780
36	$ 792,000	$ 466,000	$1,258,000	$1,039,243
42	$ 924,000	$ 400,000	$1,324,000	$1,072,504
48	$1,056,000	$ 334,000	$1,390,000	$1,106,417

Installation of Computer at Time = 0 Required Earnings Rate = 10%
Note: Purchase Option Credit Factors = 90% for year 1, 75% for year 2, and 50% thereafter until the accumulated credits equal 70% of the list price. The list price is $1,034,000; rent is $22,000 per month; maintenance is excluded since it is the same whether the machine is owned or leased.

Fig. 2. Acquisition cost as a function of the time conversion is made from lease to purchase

*The basic formula is derived as follows: The present value of $1 spent at time=t years with a required earnings rate of r is $(1 + r)^{-t}$. When this factor is multiplied by the purchase cost at time t (P(t)), the resulting product is the present value of that payment. This explains the right term of the equation.

The present value of paying lease over time is the incremental summation of all lease payments multiplied by the discount factor at each time t:

$$\text{Discounted cost of leasing} = \int_o^t L \times 12 \times (1+r)^{-t}dt$$

Since L and 12 are constants we get:

$$\text{Discounted cost of leasing} = 12L\int_o^t (1+r)^{-t}dt$$

$$= 12L\left(-\frac{(1+r)^{-t}}{\ln(1+r)} + C\right)$$

Since the function must equal 0 at t=0,

$$C = \frac{1}{\ln(1+r)}$$

So that:

$$\text{Discounted cost of leasing} = 12L \times \frac{1-(1+r)^{-t}}{\ln(1+r)}$$

To calculate the full cost of acquisition one would have to add to the sum of the purchase and lease costs calculated above the cost of maintenance after purchase. Because this cost is a function of the removal date of the computer and is, consequently, more difficult to work with, the author subtracts an allowance for maintenance from the calculation of the lease costs *before* purchase and ignores the cost of maintenance *after* purchase. Therefore, all the costs calculated by using the formula in the text can be set equal to the total acquisition cost by adding the following factor (which is a *constant* for any given release date).

$$12PM \times \frac{1-(1+r)^{-t_r}}{\ln(1+r)}$$

Where t_r = removal date of computer, in years from installation.

PM = monthly maintenance cost to be paid *after* purchase.

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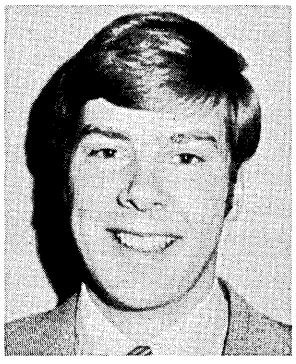
firm's required earnings rate.

Notice how the discounted acquisition costs (Column C) decrease as the required earnings rates (Column A) increase. Notice also how stopping the accrual of rental credits at 12 months affects the optimum time to purchase (Column B). The values themselves cannot exceed 12 months until the required earnings rate gets so large that the firm feels it is less expensive to lease the machine for a month and then pay the $503,217 purchase cost than to buy it now for the same price.

Assuming a typical required earnings rate of 15%, a firm can save $23,733 or 4.07% by purchasing the computer at the end of 12 months rather than immediately. If IBM had a more "liberal" contract allowing rental credits to accrue beyond the 12th month, the optimum time to purchase (still assuming a 15% required earning rate) would be 33 months after installation at a discounted cost of $545,826. This would result in a savings of $37,614 or 6.45%, and greatly increase the financial flexibility of the user.

Other vendors' contracts will produce similar results when analyzed. Some will encourage a conversion from lease to purchase as much as three or four years from installation. Others, like IBM, will suggest a purchase closer in time to installation. Only a few contracts will show no economic advantage to delaying the purchase. Overall, however, the use of this methodology should allow firms to realize measurable reductions in their data processing costs with a minimum of effort. □



Mr. Hekman is now an assistant prosecuting attorney of Kent County, Mich. He was previously in the information systems division, Office of the Chief of Naval Operations, Washington, D.C., and this article is based on his work there. He has a BS in industrial management from MIT's Sloan School of Management and recently received a JD in law from George Washington Univ.

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Starting with Hollerith's battery-driven apparatus and its 26-compartment box with pop-up lids, sorting has been a constant factor in the development of data processing

The History of Sorting

by Donald E. Knuth

Dr. Knuth's immense project of recording most of what is known about computer programming techniques exclusive of numerical analysis was begun in 1962. This is an excerpt from The Art of Computer Programming: Volume III: Sorting and Searching. It is scheduled for publication this month by Addison-Wesley Publishing Co., Reading, Mass. This third volume in the series will have 738 pages and be priced at $17.50.

A search for the origin of today's sorting techniques takes us back to the nineteenth century, when the first machines for sorting were invented. As we know, the U.S. traditionally conducts a census of all its citizens, every ten years, and by 1880 the problem of processing the voluminous census data was becoming very acute; in fact, the total number of single (as opposed to married) people was never tabulated that year, although the necessary information had been gathered. Herman Hollerith, a 20-year-old employee of the Census Bureau, devised an ingenious electric tabulating machine to meet the need for better statistics-gathering, and about 100 of his machines were successfully used to tabulate the 1890 census rolls.

Hollerith's original battery-driven apparatus included a "sorting box" which contained 26 compartments. The operator would insert a 6⅝" x 3¼" punched card into the "press" and lower the handle; this caused spring-actuated pins in the upper plate to make contact with pools of mercury in the lower plate, wherever a hole was punched in the card. The corresponding completed circuits would cause associated dials on the panel to advance by one unit; and furthermore, one of the 26 lids of the sorting box would pop open. At this point the operator would reopen the press, put the card into the open compartment, and close the lid. One man reportedly ran 19,071 cards through this machine in a single 6½-hour working day, an average of about 49 cards per minute! (A typical operator would work at about one-third this speed.)

Population continued its inexorable growth pattern, and the original tabulator-sorters were not fast enough to handle the 1900 census; so Hollerith devised another machine to stave off another data processing crisis. His new device (patented in 1901 and 1904) had an automatic card feed, and in fact it looked essentially like modern card sorters. The story of Hollerith's early machines has been told in interesting detail by Leon E. Truesdell, *The Development of Punch Card Tabulation* (Washington: U.S. Bureau of the Census, 1965). Hollerith and another former Census Bureau employee, James Powers, went on to found rival companies which eventually became part of IBM and Remington Rand Corporations, respectively.

Hollerith's sorting machine is, of course, the basis for radix sorting methods now used in digital computers. His patent mentions that two-column numerical items are to be sorted "separately for each column," but he didn't say whether or not the units or the tens columns should be considered first. The nonobvious trick of using the units column first was presumably discovered by some anonymous machine operator and passed on to others; it appears in the earliest extant IBM sorter manual (1936). The first known mention of this right-to-left technique is an incidental remark which appears in an article by L. J. Comrie, *Trans. of the Office Machinery Users' Assoc.* (London, 1930), pp. 25-37. Incidentally, Comrie was the first person to make the important observation that tabulating machines could be fruitfully employed in scientific calculations, even though they were originally designed for statistical and accounting applications. His article is especially interesting because it gives a detailed description of the tabulating equipment available in England in 1930. Sorting machines at that time processed 360 to 400 cards per minute, and could be rented for £9 per month.

The idea of merging goes back to another card-walloping machine, the *collator,* which was a much later invention (1938). With its two feeding stations, it could merge two sorted decks of cards into one, in only one pass; the technique for doing this was clearly explained in the first IBM collator manual (April, 1939).

Then computers arrived on the scene, and sorting was intimately involved in this development; in fact, there is evidence that a sorting routine was the first program ever written for a stored program computer. The designers of EDVAC were especially interested in sorting, because it epitomized the potential non-numerical applications

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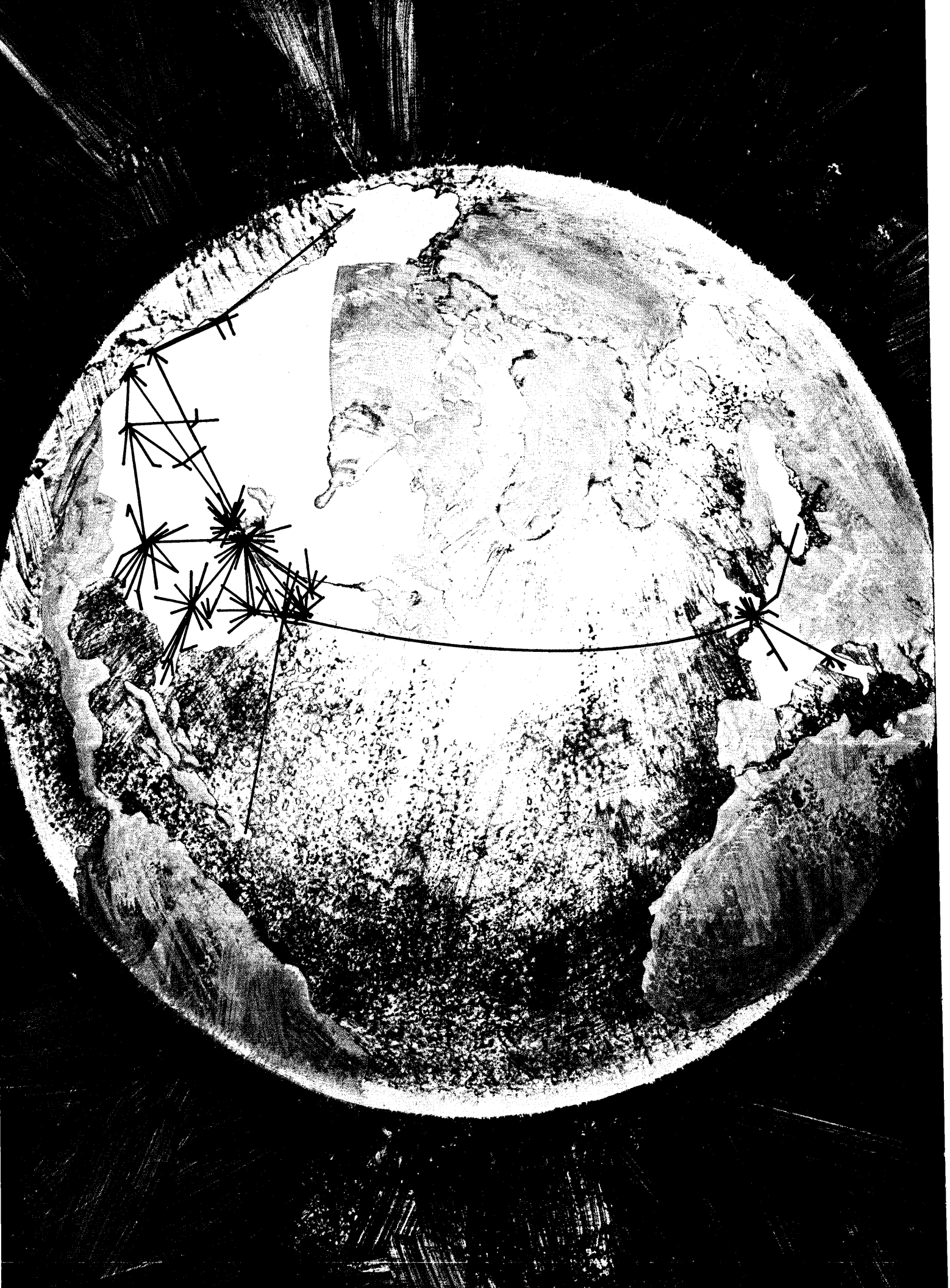

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of computers; they realized that a satisfactory order code should not only be capable of expressing programs for the solution of difference equations, it must also have enough flexibility to handle the combinatorial "decision-making" aspects of algorithms. John von Neumann therefore prepared programs for internal merge sorting in 1945, in order to test the adequacy of some instruction codes he was proposing for the EDVAC computer; the existence of efficient special-purpose sorting machines provided a natural standard by which the merits of his proposed computer organization could be evaluated.

The limited internal memory size planned for early computers made it natural to think of external sorting as well as internal sorting, and a "Progress Report on the EDVAC" prepared by J. P. Eckert and J. W. Mauchly of the Moore School of Electrical Engineering (Sept. 30, 1945) pointed out that a computer augmented with magnetic wire or tape devices could simulate the operations of card equipment, achieving a faster sorting speed. This progress report described balanced two-way radix sorting, and balanced two-way merging (called "collating"), using four magnetic wire or tape units, reading or writing "at least 5000 pulses per second."

John Mauchly lectured on "Sorting and Collating" at the special session on computing presented at the Moore School in 1946, and the notes of his lecture constitute the first published discussion of computer sorting. Mauchly began his presentation with an interesting remark: "To ask that a single machine combine the abilities to compute and to sort might seem like asking that a single device be able to perform both as a can opener and a fountain pen." Then he observed that machines capable of carrying out sophisticated mathematical procedures must also have the ability to sort and classify data, and he showed that sorting may even be useful in connection with numerical calculations. He described straight insertion and binary insertion, observing that the former method uses about $N^2/4$ comparisons on the average, while the latter never needs more than about $N \log_2 N$. Yet binary insertion requires a rather complex data structure, and he went on to show that two-way merging achieves the same low number of comparisons using only sequential accessing of lists. The last half of his lecture notes were devoted to a discussion of partial-pass radix sorting methods which simulate digital card sorting on four tapes, using less than four passes per digit.

Shortly afterwards, Eckert and Mauchly started a company which produced some of the earliest electronic computers, the BINAC (for military applications) and the UNIVAC (for commercial applications). Again the U.S. Census Bureau played a part in this development, receiving the first UNIVAC. At this time it was not at all clear that computers would be economically profitable; computing machines could sort faster than card equipment, but they cost more. Therefore, the UNIVAC programmers, led by Frances E. Holberton, put considerable effort into the design of high-speed external sorting routines, and their preliminary programs also influenced the hardware design. According to their estimates, 100 million 10-word records could be sorted on UNIVAC in 9,000 hours (i.e., 375 days).

UNIVAC I, officially dedicated in July, 1951, had an internal memory of 1,000 12-character (72-bit) words. It was designed to read and write 60-word blocks on tapes, at a rate of 500 words per second; reading could be either forward or backward, and simultaneous reading/writing/computing was possible. In 1948, Mrs. Holberton devised an interesting way to do two-way merging with perfect overlap of reading, writing, and computing, using six input buffers: Let there be one "current buffer" and two "auxiliary buffers" for each input file; it is possible to merge in such a way that, whenever it is time to output one block, the two current input buffers contain a total of exactly one block's worth of unprocessed records. Therefore, exactly one input buffer becomes empty while each output block is being formed, and we can arrange to have three of the four auxiliary buffers full at all times while we are reading into the other.

The culmination of this work was a sort generator program, which was the first major "software" routine ever developed for automatic programming. The user would specify the record size, the positions of up to five keys in partial fields of each record, and the "sentinel" keys which mark file's end, and the sort generator would produce a copyrighted sorting program for one-reel files. The first pass of this program was an internal sort of 60-word blocks, using comparison counting; then came a number of balanced two-way merge passes, reading backwards and avoiding tape interlock as described above.

By 1952, many approaches to internal sorting were well known in the programming folklore, but comparatively little theory had been developed. Daniel Goldenberg coded five different methods for the Whirlwind computer, and made best-case and worst-case analyses of each program. When sorting 100 15-bit words on an 8-bit key, he found that the fastest method was to use a 256-word table, storing each record into a unique position corresponding to its key, then compressing the table. But this technique had an obvious disadvantage, since it would eliminate a record whenever a subsequent one had the same key. The other four methods he analyzed were ranked as follows: straight two-way merging beat radix-2 sorting beat straight selection beat bubble sort.

These results were extended by Harold H. Seward in his 1954 Master's thesis. Seward introduced the ideas of distribution counting and replacement selection; and he analyzed external sorting as well as internal sorting, on various types of bulk memories as well as tapes.

An even more noteworthy thesis—a PhD thesis in fact—was written by Howard B. Demuth in 1956. This work helped to lay the foundations of computational complexity theory. It considered three abstract models of the sorting problem, using cyclic, linear, and random-access memories; and optimal or near-optimal methods were developed for each model. Although no practical consequences flowed immediately from Demuth's thesis, it established important ideas about how to link theory with practice.

Thus the history of sorting has been closely associated with many "firsts" in computing: the first data-processing machines, the first stored programs, the first software, the first buffering methods, the first work on algorithmic analysis and computational complexity.

None of the computer-related documents mentioned so far actually appeared in the "open literature"; in fact, most of the early history of computing appears in comparatively inaccessible reports, because comparatively few people were involved with computers at the time. Literature about sorting finally broke into print in 1955-1956, in the form of three major survey articles.

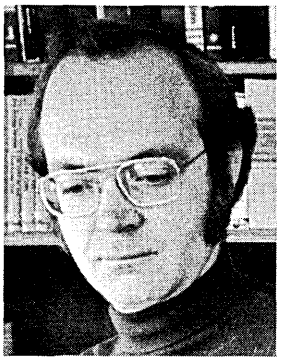
The first paper was prepared by J. C. Hosken, *Proc. Eastern Joint Computer Conference* 8 (1955), 39-55. He began with an astute observation: "To lower costs per unit of output, people usually increase the size of their operations. But under these conditions, the unit cost of sorting, instead of falling, rises." Hosken surveyed all the available special-purpose equipment then being marketed, as well as the methods of sorting on computers. His bibliography of 54 items is mostly based on manufacturers' brochures.

The comprehensive paper "Sorting on Electronic Computer Systems" by

History of Sorting

E. H. Friend, *Journal of the ACM* 3 (1956), 134-168, was a major milestone in the development of sorting. Although numerous techniques have been developed since 1956, this paper is still remarkably up-to-date in many respects. Friend gave careful descriptions of quite a few internal and external sorting algorithms, and he paid special attention to buffering techniques and the characteristics of magnetic tape units. He introduced some new methods (e.g., tree selection, amphisbaenic sorting, and forecasting), and developed some of the mathematical properties of the older methods.

The third survey of sorting to appear about this time was prepared by D. W. Davies in England; and during the following years several other notable surveys were published. A symposium on sorting was sponsored by ACM in November, 1962; most of the papers presented at that symposium were published in the May, 1963, issue of *ACM Communications,* and they constitute a good representation of the state of the art at that time. New sorting methods were being discovered throughout this period: address calculation (1956), merge insertion (1959), radix exchange (1959), cascade merge (1959), Shell's diminishing increment sort (1959), polyphase merge (1960), tree insertion (1960), oscillating sort (1962), Hoare's quicksort (1962), Williams's heapsort (1964), Batcher's merge exchange (1964). Further details and references to the literature may be found in the author's book *Sorting and Searching* (The Art of Computer Programming, Volume 3). □



Dr. Knuth is professor of computer science at Stanford Univ. and is spending the current year at the Univ. of Oslo, Norway, as a Guggenheim Fellow. Among other activities in the last few years, he has spent a year as a staff mathematician at the Institute for Defense Analyses and been a visiting lecturer at Princeton Univ.

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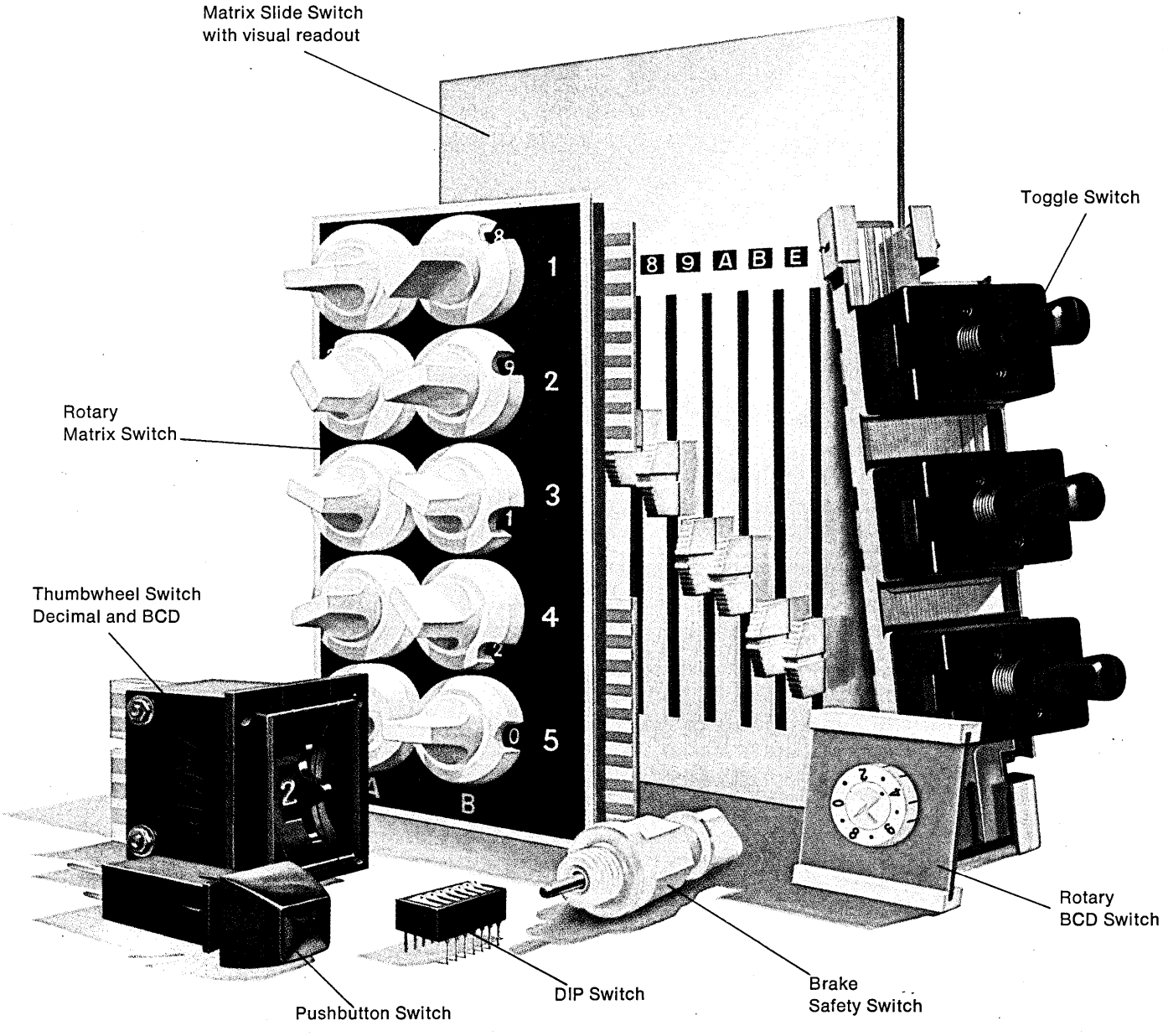


After defining your requirements and selecting the necessary components, it's time for the complex business of vendor selection, contracts, and installation

Data Communications: Putting It All Together

by Richard L. Deal and P. C. Wood

The first two articles in this series explained how to define your requirement for a data communications system and how to select the related components. Each of these chores is complex, time-consuming, and potentially hazardous considering the dollars that can be wasted if mistakes are made. If you don't have a staff communications man, hiring a consultant is an effective way of minimizing the risk—provided you find the right one.

As a bare minimum, he should have a degree in engineering, mathematics, or a physical science. Preferably, he will also have done graduate work in systems analysis, mathematics and/or engineering. He should provide references showing he has worked on a variety of data communications applications, and has dealt with all the major phases of system implementation, beginning with preliminary studies, and continuing through detailed design, preparation of specs, evaluation of bids, contracting, installation, test and evaluation.

Recent experience is particularly important because of the rapid, if not frantic, pace of change in data communications technology. The last thing you want is a data communications network that can't be adapted to new equipment and concepts likely to become available in the foreseeable future; even worse, of course, is a system based on years-old technology.

In checking a consultant's references, find out from his other clients whether they presented him with problems similar to the ones involved in implementing your system. You should also find out whether he delivered to these clients what he originally promised.

If you're considering a consulting firm, rather than an individual, try to find out the specific person or persons you would be dealing with. Do they have the necessary training and experience? Who have these individuals worked for in the past, and what do their clients think of the work that was done?

Perhaps the most important single attribute of a data communications consultant is objectivity. He must be able to serve your organization without consideration for any potential future business he may get from you. Therefore, we would suggest not relying on consultants supplied by vendors, including mainframe manufacturers, common carriers, and software houses which offer communications packages. The consulting services provided by these organizations *should* be used as a secondary resource, however—since this support is usually free, and sometimes a vendor's analysis will spot problems, or suggest solutions, that may not occur to a competent consultant. But make sure that the final evaluation of such recommendations is made by an individual who is beholden only to you.

One way of assembling a list of candidate consultants is to check the *Datamation 1972 EDP Industry Directory*. You should also talk to data communications users in other companies, preferably people you know, who have applications similar to the one you're planning.

Consultants are usually paid on the basis of the time and materials they expend on your behalf; a flat hourly, daily, or weekly rate is common. Travel and other incidentals are billed separately. In Washington, a rate of $250-350 per man-day is typical; rates in Boston, New York City, and Los Angeles may be higher.

A good way of monitoring a consultant's performance is to obtain progress reports periodically, verbal as well as written. The individual who receives these reports must be familiar enough with the job to spot shortcomings in the consultant's performance, and he should be aggressive enough to ask questions whenever the reports become too technical. Consultants have been known to become overly technical on purpose—to hide mistakes.

Vendor choice

Once you have your own technical man, the next major step is to select the vendor or vendors who can provide you with a workable data communications system. The technical analysis described in earlier articles of this series presumably has enabled you to decide what is needed in the way of components. By checking the literature and talking to your consultant, you should be able to locate possible suppliers, but first you should consider how many vendors you want to do business with.

A vendor of turnkey systems usually supplies all the hardware and software components comprising a system, and is also responsible for combining them into a workable installation. Post-installation tune-up and maintenance are

performed by his staff. The main advantage of a turnkey contract, as far as the user is concerned, is that he deals with a single source. This is particularly valuable when maintenance problems arise; a turnkey vendor can't blame someone else, unless the system he's supplying is integrated with a computer supplied by another company.

The obvious way to solve the latter problem is to have your existing mainframe supplier provide the communications equipment. But often this strategy is too costly, or limits the capability of your communications system. An alternative is to obtain the communications system from a supplier who has successfully integrated the same or similar equipment with computers of the same make and model as the one you're using. You're on safe ground so long as this record of success with prior installations can be verified, and so long as the two suppliers have agreed upon means of determining their individual maintenance responsibilities. Be sure you know the details of this arrangement.

Multiple vendors

Another way of assembling a communications system is to obtain the individual components from different suppliers. Often, the result is a more cost-effective system. But, since each vendor maintains only his own equipment, the danger of fingerpointing when troubles develop is greatly increased.

In dealing with vendors of communications channels, you generally have less leverage, and less choice, than in dealing with suppliers of other components. Competition is growing among carriers, as a result of the establishment of such companies as MCI and Datran, but for the foreseeable future most data communications users will have to obtain their lines from Western Union or one of the telephone companies. The service offered by this latter group is identical in most respects. However, you do have some options:

Lines going into, or passing through, heavily loaded metropolitan centers, usually are worse than those that do not. It's a good idea to ask your common carrier to route you around these areas, and the switching centers that serve them. One thing you can do to help accomplish this is to locate your data center outside a metropolitan area.

The better your error detection/correction codes and line control software, the better your lines will perform. Error detection / correction codes validate data, while line control software monitors the quality of the related lines, and provides objective evidence of trouble which can be presented to the carrier. This software can also be designed to shut down a troublesome line at a certain error level for a specified time interval so that system compute power is not used up coping with the problem. Manual backup procedures should be available when lines are down.

There are many error detection and correction codes, together with many ways of implementing them. Some check for any odd number of erroneous bits per character and per character group; VRC (Vertical Redundancy Check) and LRC (Longitudinal Redundancy Check) are examples. Both add an extra (redundant) bit to characters and to specified bits in groups of characters.

By devoting more software/hardware to this function, other codes can be implemented. The IBM Binary Synchronous Protocol, for example, includes a Cyclic Redundancy Check (CRC) which computes a check character and appends it to each block of characters in the message. The receiver will acknowledge (AK) or not acknowledge (NAK) each block depending on the recomputation and comparison of the CRC on the received data to that transmitted with the message block. If a NAK is sent, the transmitter resends the erroneous block. Mathematical analysis is used to determine optimum block lengths for given error characteristics on a line. An excellent discussion of this subject can be found in the *IBM Systems Journal,* Vol. 6, No. 4 (1967). The article, by J. L. Eisenbies, is titled "Conventions for Digital Data Communications Link Design."

Other possible ways of making your communications channels more cost-effective may be found in the tariffs. For example, interstate channels generally cost significantly less than similar intrastate facilities. You may be able to exploit this difference by connecting points within the same state through a concentrator or multiplexor in an adjoining state. Detecting such opportunities in the tariff language isn't easy, though, because it takes experience to understand their murky syntax and peculiar logic, so it's a good idea to farm the job out to your consultant.

Checking with users

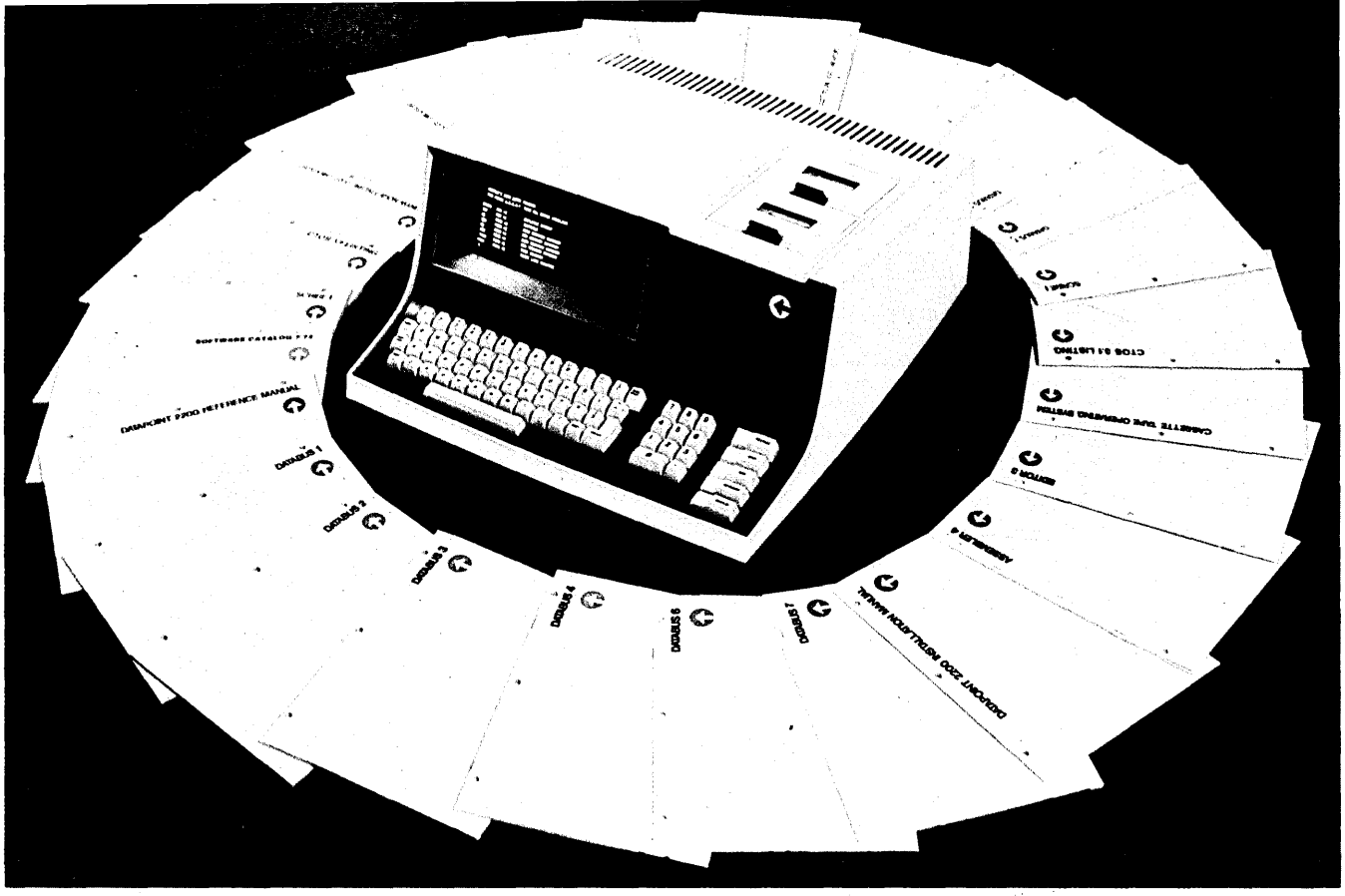
Regardless of how many vendors you ultimately decide to do business with, it's critically important to contact their previous customers, particularly those whose systems are similar to your own in terms of hardware, software, and applications. You should try to view at least a few of these installations personally, preferably at a time of heavy activity. And you should find out about problems encountered in contracting for these systems, installing, testing, operating, and maintaining them. Try to check the system log and any related documentation at each site. It's particularly important to ask about any troubles a user encountered immediately before and after his system went operational, for this is a period when good vendor support is crucial.

You should also evaluate each candidate vendor's engineering, installation and maintenance capability directly. If the vendor contracts maintenance of his equipment to another company, ask what its experience is, where the nearest office is, and who its other clients are; they should be contacted for an evaluation of the service provided.

The language in the vendor's maintenance contract is another key item. It should specify the maximum time that will elapse between a call for service and the appearance of a service engineer. Also, the contract should state that any component or subsystem which fails will be replaced immediately if it cannot be repaired within a specified time. Related considerations are the size of the vendor's spare parts inventory and its proximity to your site.

In many installations, some maintenance is performed by the user's own staff. If you plan to use this scheme, be sure each prospective vendor provides your people with adequate training and/or documentation. His preventive maintenance routines shouldn't demand more technical competence, or time, than your staff can supply. This is a particularly important consideration in operating data communications systems, since suppliers of terminals, modems, and communication channels, unlike computer manufacturers, typically provide only minimal preventive maintenance service. In this environment, it is essential that you have a responsible, technically oriented individual in charge of all maintenance functions. He should be thoroughly trained in the use, internal operation, and maintenance of each device in your system.

Although the amount of in-house maintenance you perform will be conditioned largely by the technical ability and available time of your staff, the "maintainability" of the hardware you select is also a significant factor. Often, one manufacturer of, say, modems, will offer more, or better, fault diagnosis features than another, so a careful comparison of competing units is advisable. You should make sure, for example, that each test lamp or button has a clear meaning, that malfunctioning lamps can be detected easily, that



Other mini computer manufacturers talk about their software: Datapoint delivers

The Datapoint 2200, a unique combination of powerful computer, display, and dual cassette drives, has established an enviable record as an all-purpose computer and communications system. Its success, however, is not based on hardware capabilities alone.

Many computer professionals have been pleasantly surprised to discover that the Datapoint software catalog makes available more comprehensive offerings of program-generation software than most other mini computer makers. And all the programs are created and run on the Datapoint itself — no other computer is required.

Here's a selection of available Datapoint software:

OPERATING SYSTEMS

- DOS — A powerful Disc Operating System based on the 2.4 megabyte cartridge disc.
- MTOS — An operating system based on the Industry-compatible magnetic tape.
- CTOS — For stand-alone operation, a powerful cassette-tape operating system.

DATABUS, A HI-LEVEL LANGUAGE — Databus, the Cobol-like Datapoint Business Language, was written especially for the Datapoint. The language contains comprehensive character and arithmetic capabilities. While programs may be written quickly in English-language statements, its real power lies in its ease of I/O operation Tapes, disc, and printers are handled in Databus as well as communications peripherals.

SCRIBE, A TEXT PROCESSING LANGUAGE — The combination of a Datapoint 2200 plus an upper and lower case printer can form the heart of a text-processing system. The SCRIBE program, actually a high-level language, allows text to be entered via the 2200's keyboard, visually edited and stored on a cassette tape. Upon command, this stored text may then be printed on a Selectric typewriter or on any Datapoint printer. Users having heavy text handling chores such as reports or manuals will find the SCRIBE system extremely cost/effective.

ASSEMBLY LANGUAGE PROGRAM GENERATION — Machine Language Programs are quickly constructed by use of the Editor, Assembler, and a selection of Debuggers.

TERMINAL EMULATORS — Datapoints can simulate many well-known terminals and offer a multi-purpose alternative to a user. A variety of Terminal Emulator programs are available with many of the packages offering more flexibility than the original, yet maintaining the required discipline. Recent terminal packages include an IBM 2780, CDC 200 User Terminal, UNIVAC DCT-2000 and UNITERM, a flexible teletype-format emulator.

UTILITIES — Many sub-routines and other useful software items are available for the applications programmer. I/O drivers, communications, fixed and floating point arithmetic and a variety of other routines are available as well as a complete set of diagnostics.

This proven-in-use software capability is a big reason for the success of the Datapoint 2200 as a versatile computer or data terminal system in more than 1000 installations. Prices for the Datapoint 2200 begin at $6040 with a variety of lease and purchase plans, with worldwide maintenance available.

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CIRCLE 8 ON READER CARD

the use of the test controls is clearly documented. You should be able to test each system component separately, as well as together with the rest of the system. Programmable elements, such as terminals and front end processors, should have a complete set of system diagnostics.

It is essential that you obtain adequate documentation from each vendor covering those maintenance chores you intend to perform with your own people. Make sure the operation of the device is clearly described, that key points are illustrated, that testing and repair procedures are explained on a step-by-step basis, and that the vendor has provided both a listing and a textual description of his diagnostic software. The text should explain when and how to run each test and how to interpret it.

Prices and terms

The final factor to consider in evaluating candidate vendors is their pricing terms. The key question here (aside from price per se) is whether leasing or purchasing will offer the greatest benefit. Your own financial situation, or policy on tax credits, cash flow, etc., may eliminate one of these options, but assuming you have a choice, here are some factors to consider:

If your system is likely to grow or change considerably—in terms of transmission load, number of terminals and/or new applications—within the first few years after it's on the air, then leasing is probably your best option. Another alternative would be to purchase, initially, components that meet your anticipated needs. The direct dollar cost of purchasing data communications hardware is generally a good deal less than the cost of leasing the same items. But there are disadvantages. Probably the biggest one is the fact that you must forecast your future data communications requirements, and doing that with sufficient precision is difficult in a growing organization. Also, purchasing requires a substantial capital outlay—leasing, by comparison, frees virtually all of this money for other uses — and makes it more expensive to add improved equipment that becomes available later on.

One way of minimizing these latter disadvantages is to find out from prospective suppliers whether they will soon be announcing components that are more suitable for your application. If a new product is on the way, this would be an argument for leasing the current version.

Granted your system may not *require* the latest technology—at least not now. But it's probably a mistake to assume this will continue to be the case. Data communications equipment is undergoing continuous, rapid, and varied changes. This is particularly true of terminals; both the kinds of devices available, and their reliability, are increasing significantly. Almost certainly, over the next few years, suppliers will come up with a more cost effective product for just about every application. We expect that, for most users, the march of technology will have less impact on cpus, peripherals, and modems.

Even if your data communications load, per se, isn't likely to change significantly for some time, changes in your dp system—acquisition of a different computer to handle a bigger central site workload, for example—may produce incompatibilities which will force replacement of data communications hardware/software. Here again, if the risk exists, leasing is the best way to minimize it.

Another important advantage of leasing over purchasing is that it usually elicits greater cooperation from the supplier, since he has a continuing reason to keep you happy.

After deciding whether you want to lease or purchase, and completing all the other evaluations discussed earlier, you should have a list of vendors who at least seem capable of providing acceptable components, support, and financial terms. The next step is to find the one vendor offering the best mix of capabilities. To do this, you need a bid specification. It should state what you want as completely and unambiguously as possible.

On larger, complex systems, each vendor's equipment and software should be tested before signing a contract, through the use of such tools as benchmark runs and simulated operation under peak traffic conditions. Smaller systems which rely largely on hardware and software that have been available for some time and are in wide use don't have to be tested. You can accept each vendor's claims regarding performance provided you check with other users as discussed earlier in this article.

Be sure you also check the financial stability of each vendor who answers your request for bids. The best way is to ask for his most recent P&L statement. Stock prospectuses and annual reports should also be analyzed.

Negotiation

The next step is to negotiate a contract. Here again, you must draft a document that describes what is to be provided, completely and unambiguously. The contract should also protect you in case the vendor runs into trouble— i.e., doesn't deliver on time

"I'd like 200 shares of Ideal Toy Company at market, 300 shares of Mattel at market, 400 shares of Parker Brothers . . ."

and/or delivers hardware/software that is inadequate. Remember that in a dispute this contract will be the chief, and probably the only, repository of facts that can't be questioned by either side, so it's important to cover all possible contingencies.

Your company lawyer and / or contracts manager should draft the actual document, because its enforceability requires proper use of legal terminology and familiarity with contract law. If these individuals have prior experience in writing systems contracts, well and good; if not, we strongly recommend that they obtain expert assistance (your data communications consultant, assuming he has helped write such contracts himself, may fill this requirement). It takes very specialized experience to know how much can justifiably be demanded of a data communications equipment vendor in the way of service and support, how far these demands can safely be reduced in subsequent negotiations, and what contract language should be used to make the agreed-upon terms and conditions perfectly clear to both sides.

You and/or your consultant will have to decide what the contract ought to say about the system's operational performance. By now, presumably, you know what you want. But in discussing this area with your legal contracting experts, make sure you don't end up with a document that's overly restrictive. The best way to avoid that trap is to specify requirements in terms of performance—e.g., require a system that delivers a given throughput, in bits/sec., or messages/hour; that provides a specified mean time to failure (MTF) and mean time to repair (MTTR) for individual components. Avoid tying the vendor's hands by forcing him to deliver these capabilities in particular ways. Don't insist on dynamic or static buffering, for example; let him decide, at least initially, whether to provide a hard-wired or a programmable communications processor.

After system installation and acceptance, you should allow at least a couple of months for your own people to familiarize themselves with the new equipment; then, evaluate its performance. To manage this "break-in period," as well as the routine operation that follows, there should be one manager in charge. From day to day this individual should be able to state whether the system is performing satisfactorily. He needs a thorough knowledge of the hardware and software, as well as an ability to communicate well with people. He should maintain complete logs of system hardware and software performance, and collect daily line and system error/usage statistics. Most important, he should review this data frequently, so that troubles are spotted at an early stage, and he should have the personal attributes needed to get corrective action started promptly.

Persistence will be particularly necessary if your system encounters trouble with lines supplied by the phone company. We have found, however, that if you keep banging on the phone company's door, eventually they hear you. Sometimes the attitude of a local operating company changes magically after a user complains to corporate headquarters.

Once the phone company recognizes that you have a problem, it may set up a free conference call enabling your staff, their engineers, and factory representatives of each vendor to discuss the trouble. As different test procedures are tried, all the participants have a chance to discuss the results.

These conference calls are an effective way of coping with the fingerpointing problem we mentioned earlier, which is particularly likely to crop up during the first few months a system is on the air. The authors recently had an experience with one teleprocessing system that illustrates what can happen.

Fault-finding

The system involved a major manufacturer's computer, another vendor's multiplexor, AT&T long lines, and the cpu manufacturer's terminals. The problem arose when the user encountered operational difficulties and suspected that the telecommunications unit attached to his cpu was at fault. The bug appeared only occasionally, but disastrously. The problem was bounced around in this way:

The cpu manufacturer blamed the user's software.

The user programmers said the fault was caused by the cpu or TCU.

The cpu manufacturer blamed AT&T.

AT&T said: "It's not us. All we do is test lines."

The cpu manufacturer said it was the multiplexor.

The user decided the problem was on the local lines.

The cpu manufacturer said the user's software must be at fault because his diagnostics showed no problem with hardware or control programs.

The user then insisted that the TCU was the source of trouble.

It took 72 hours of almost constant nagging, but ultimately the cpu maker acknowledged that his equipment really was the villain. The decisive point was probably reached when the user presented daily error listings; they showed what the data stream looked like at each terminal site, on the transmission line, at the input and output sides of the TCU, and other key points. Analysis of this data showed clearly that the user's software wasn't responsible, and indicated that the terminals and TCU were the likeliest culprits. While it wasn't certain, at this point, that the cpu maker was to blame, the evidence was substantial enough to persuade him to look inside his part of the system, and ultimately this move led to a correction of the trouble.

The moral of the tale is that, while fingerpointing represents a very real problem in every multivendor system, you can overcome it if you're prepared, ahead of time. This user *was* prepared. He had good programmer and system personnel, he had detailed, comprehensive system operation statistics, collected daily, which nobody could argue with, and he had persistence. All of these qualities are essential if you want to operate a data communications system successfully. □

Mr. Deal is director of data systems, a group within Telcom, Inc., that specializes in planning, engineering, and management of data processing and data communications systems. He has a BSEE from the Citadel and has done graduate work in operations research, systems analysis and business administration.

Mr. Wood is a program manager at Telcom, Inc. He has been a telecommunications consultant to several nationally recognized firms and to government agencies. He has a BSEE from Lowell Technological Institute and an MSEE from Pennsylvania State Univ.

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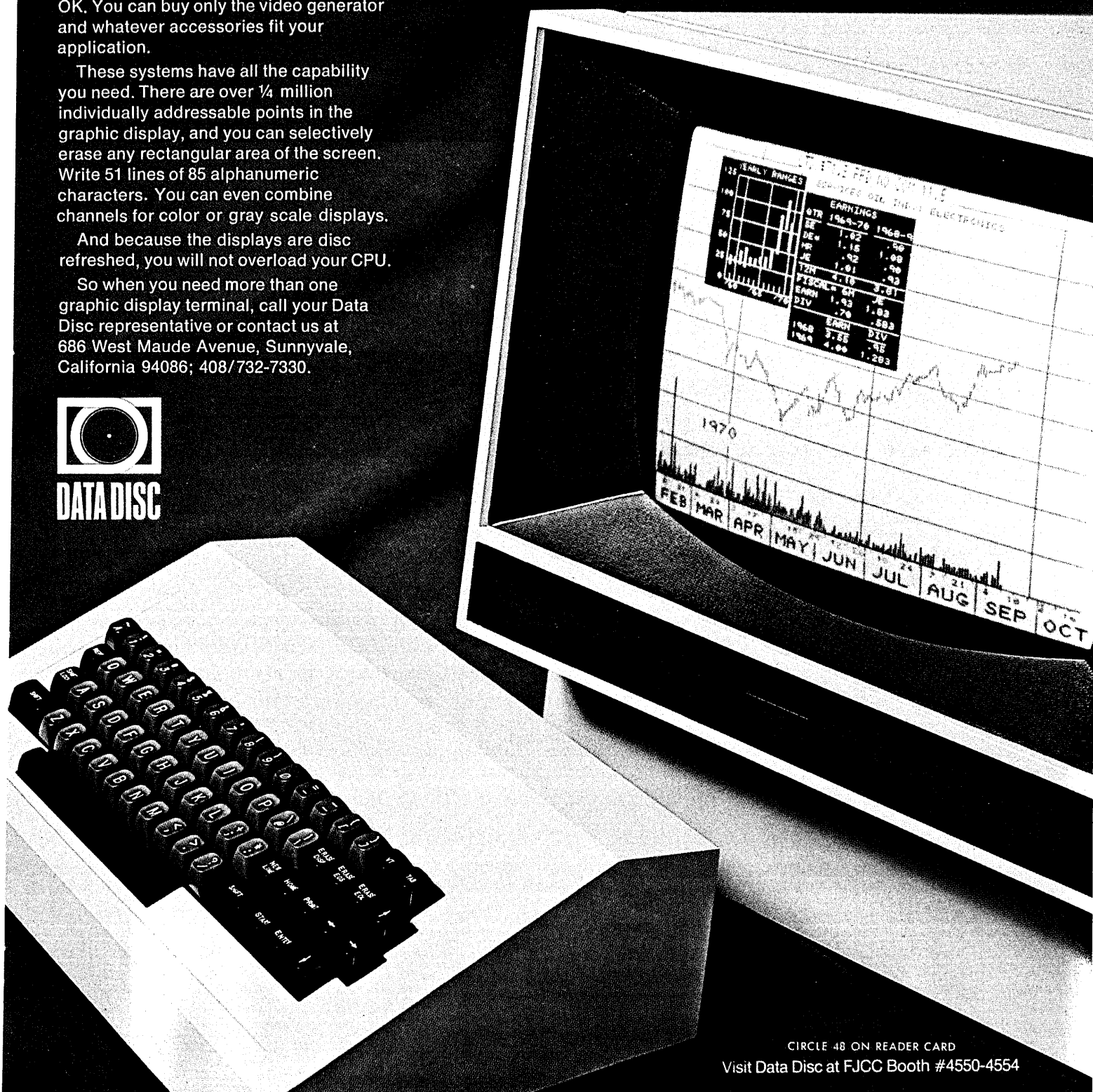

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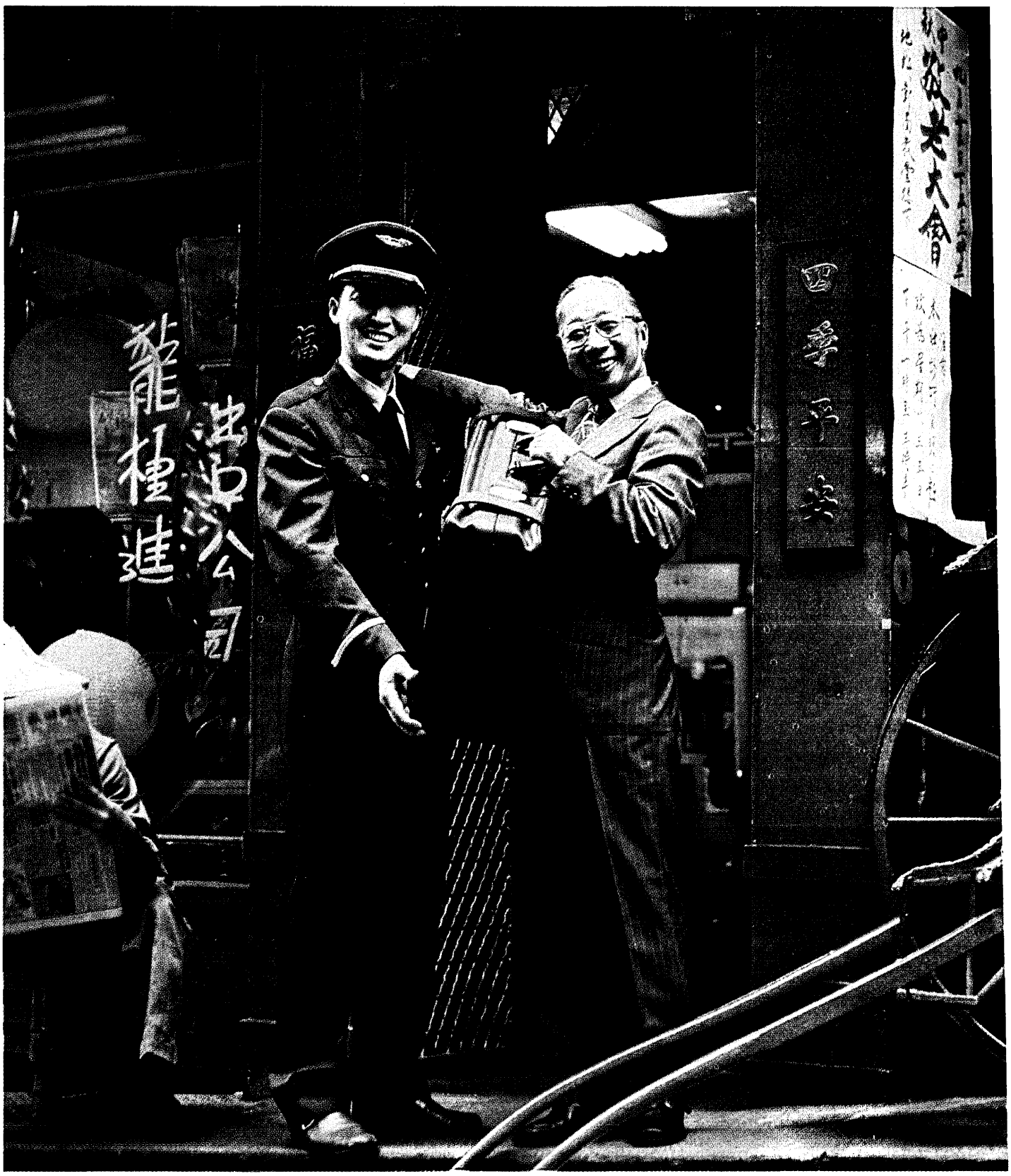

ıg Kong, a Univac computer story.

On a recent business trip, a Mr. Soong and his suitcase accidentally took different planes out of Bangkok. One went East, the other went West.

When Mr. Soong landed in Hong Kong, China Air Lines discovered that his bag hadn't been transferred to the flight. So they did the natural thing.

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It could have been a lost pet or a prized set of Walter Hagens. The Eastern system has been notably successful in reuniting objects of all kinds with owners in all places.

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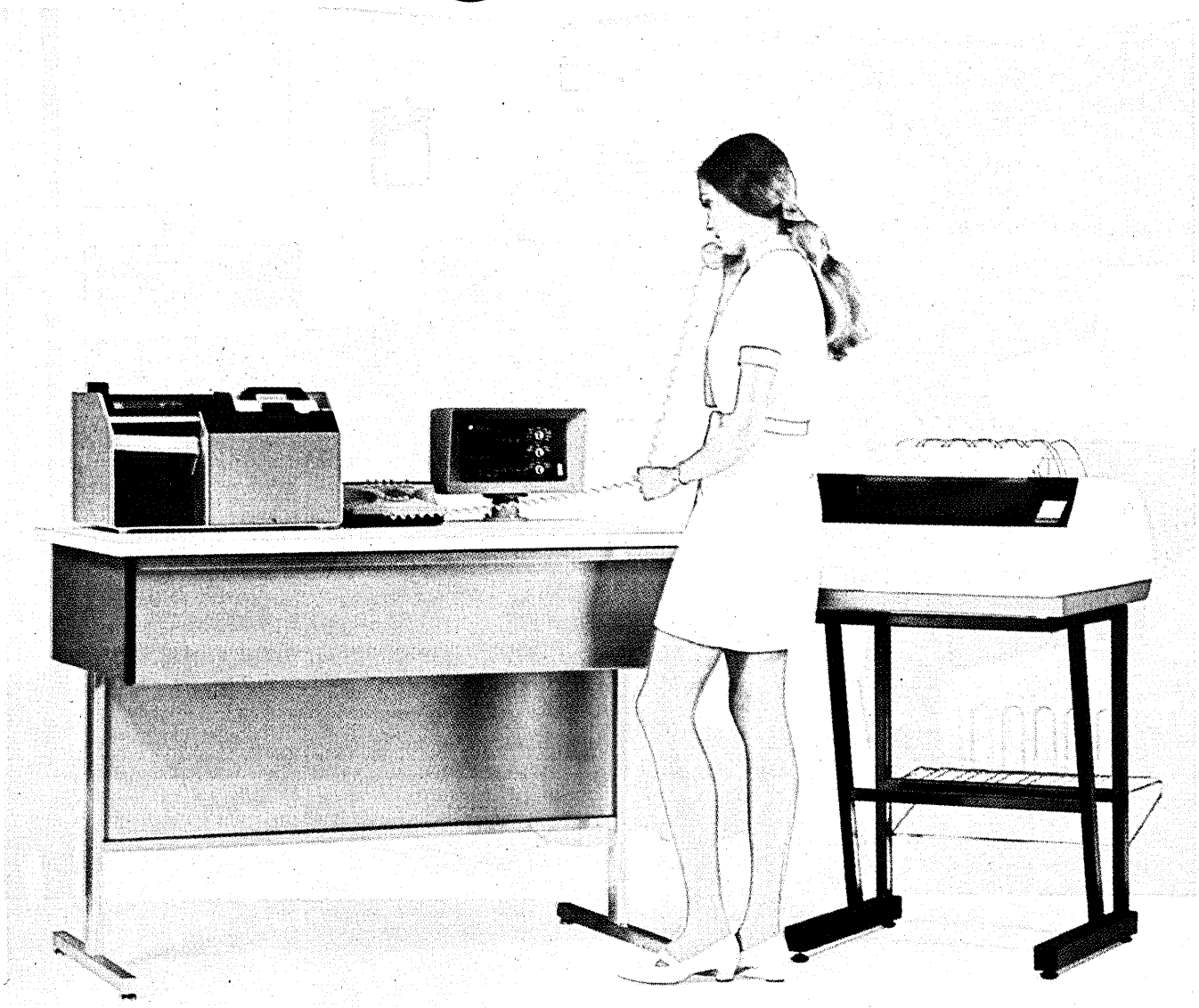

The retailers who have them praise point-of-sale units, but software and communications competence are lagging

NRMA 14th Annual Information Systems Conference

by Phil Hirsch, Washington Editor

How one retailer saved $123K/year by installing an electronic point-of-sale (POS) system was described in detail recently at the lush, plush Doral Country Club in Miami, during the 14th annual Information Systems Conference of the National Retail Merchants Association (NRMA). The retailer, Sam Solomon Co., a South Carolina catalog merchandiser, is spending more, actually, for equipment rental ($102.4K vs. $36.9K) but has reduced the related labor costs from $198K to $42K per year, and cut collateral expenses by $32K. The genie responsible for this economic miracle is a system comprising Pitney Bowes-Alpex terminals and a System/3 central computer.

Dreams of reaping similar savings impelled more than 600 department store executives and suppliers to attend the four-day NRMA meeting; several Japanese were among the attendees. Asked about their plans to market POS equipment in the U.S., the Japanese had little to say. A number of IBMers attended also; they were more talkative but no more informative.

According to coffee break rumor merchants, IBM is testing two electronic POS systems at customer locations in California. One site, reportedly, is a McDonald's drive-in, the other a Sears store in the San Francisco area. According to these same sources, IBM will shortly introduce a family of POS terminals. Other rumors: the first Japanese electronic cash register to be offered in the U.S. was introduced recently by Tokyo Electric Co. (TEC); Burroughs is having trouble eliminating the bugs in a new credit authorization terminal; TRW has developed software that early next year will enable its credit authorization terminals to handle sales and inventory data, and NCR is about to introduce a new freestanding register, called the 230, made in Japan, which will be priced at $3295. The new unit, designed primarily for food supermarketeers, is hard-wired and reportedly has no automatic data input capability, which could mean that NCR believes the grocers aren't ready for POS yet.

A long way to go

The size of the electronic POS market and the effect of computerization on department store merchandising procedures received extended attention at the NRMA meeting. According to Bill Power, director of retail service for Touche Ross & Co., "Maybe there are 20,000 or so POS terminals installed in all of retailing (including grocery supermarkets), out of a potential of a couple of million." Another speaker, Herbert Schwartz, president of an El Paso, Texas, department store called The Popular, reported that about 416 point-of-sale devices—mechanical, electromechanical, and electronic—are now being used in department stores and other nonfood establishments. Of these, 6% are electronic, and 6¼ % are electromechanical.

Power indicated that buyers are now coming out of the "tire-kicking stage" and predicted there would be mass

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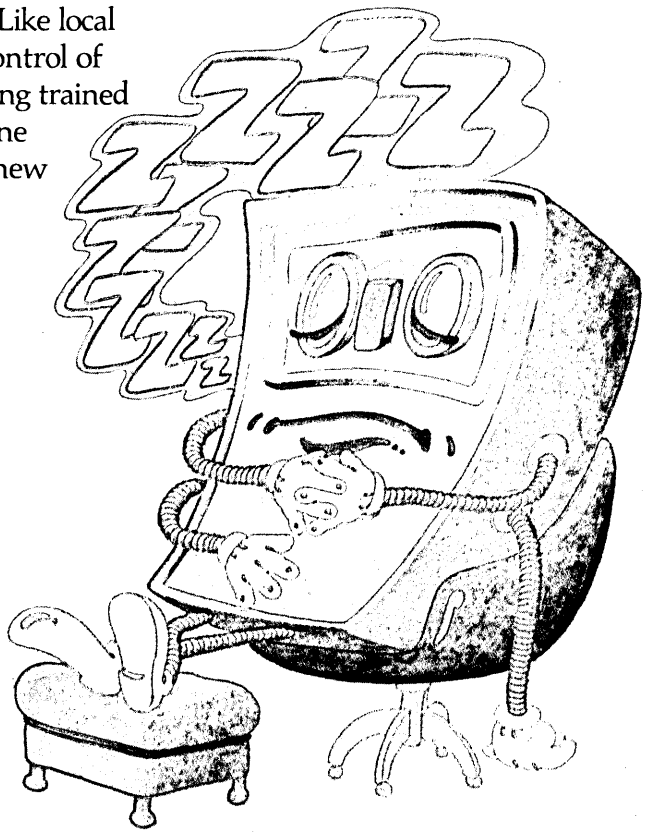

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If all your communications terminals do is communicate, you could be shortchanged.

acquisition of electronic POS equipment over "the next several years." Almost none of the larger companies plans to order any more mechanical registers in significant numbers, he added.

Power called the electronic POS terminal "the thin edge of the wedge"; in its wake will come "other kinds of terminals, system development, broader use of data communications, automatic price ticket reading (with its attendant necessity to change marking systems), and management acceptance of the 'new technology'" (which has been around since about 1962, he reported at another point in his talk). But a mountain of application software remains to be written. "Hopefully, after we work out all the kinks in the keyboard, the wand, the merchandise tag, the communications, etc., we will be able to deal with, say, the inventory management problem."

Expanded use of computerized cash registers will encourage a trend toward centralization already evident in the retail field, Power added. "Many companies have, or are in the process of implementing, regional data centers that serve two or more divisions (stores)." He predicted these systems would expand geographically as well as in terms of applications and sophistication. "Eventually, we will see true remote batch processing systems, of the kind that have been commonplace in manufacturing companies for some time." The ultimate result will be "functional and organizational centralization," concentration of files, and a need for software that can support accounts payable, accounts receivable, payroll, personnel, general ledger, and related bookkeeping operations of a multistore merchandising company on a centralized basis.

Software still behind

A somewhat different view of the future was presented by the keynote speaker, Herbert Schwartz, the El Paso department store president. He thought POS was a great boon to the retailing fraternity but cautioned that systems won't be bought in quantity until additional sofware is available. Specifically, programs are needed "that will allow a department store to take information from the merchandise identifier (e.g., stock label or ticket) and convert it to the store's own departmental and classification needs." Also, "universal" software packages, permitting automatic re-order of staple and fashion merchandise, are needed. Another presently unmet requirement, he added, is a system that will "accurately keep track of the movement of merchandise . . . among the various locations in a multistore organization." It would be "the height of inefficiency" for small and medium-sized retail stores to develop this software on their own, he added; a better solution would be for NRMA to form a committee and develop standardized packages.

The association is already attempting to reduce the confusion and hazard involved in selecting POS hardware; a committee headed by Robert Capone, of J. C. Penney, has been working for some time on a set of standards intended to define an acceptable POS system. Capone said at the Miami meeting that the standards should be available by next fall. The committee is being assisted by an equipment manufacturer's liaison committee made up of about a dozen suppliers, including IBM and Fujitsu.

There was a good deal of discussion about data communications at the meeting; perhaps the most interesting commentary came from Harvey Poppel, of Booz, Allen, & Hamilton. He contended that, despite "staggering" expenditures for communications equipment and related systems ($100-200 billion will be spent in this decade, said Poppel), "communications suppliers and common carriers collectively know amazingly little about the end-user market." Also, "most large and small business organizations are inadequately prepared to make telecommunications purchasing decisions."

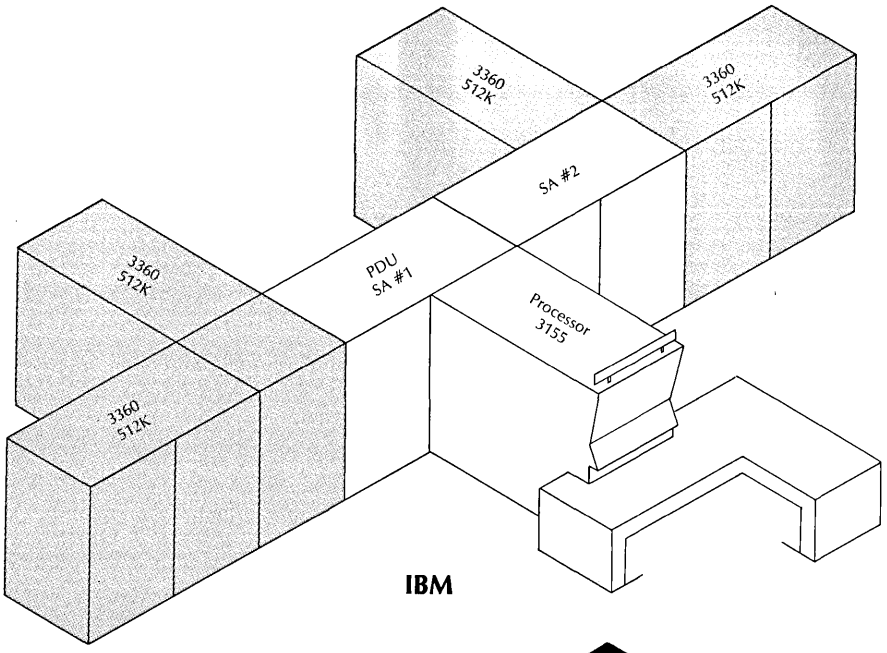
Typically, said Poppel, these decisions are made by one of the following:

A communications manager/supervisor ". . . trained in only one area of communications . . . usually recruited from a common carrier (and) with little or no experience in the user's business."

A data processing manager "who, even more than the typical communications manager, lacks adequate technical training in communications, but partially offsets this disadvantage by having a much better understanding of the total business from his edp systems work."

An office or purchasing manager at the local level who ". . . usually has many other responsibilities and generally lacks any training or in-depth experience in communications."

A common carrier representative. " . . . With FCC actions sanctioning . . . competition, and the technological development of new communications media such as facsimile and data, there are now a growing number of suppliers . . . Yet some fairly large organizations and most medium and smaller businesses illogically continue to cling to their local telephone/telegraph companies for all buying judgments." □



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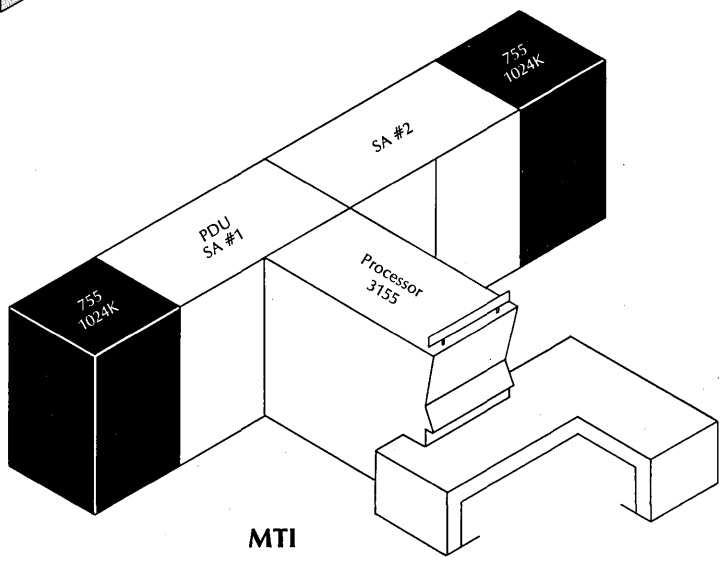

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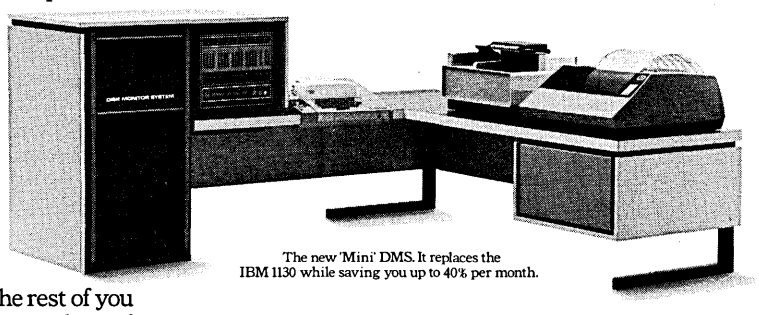

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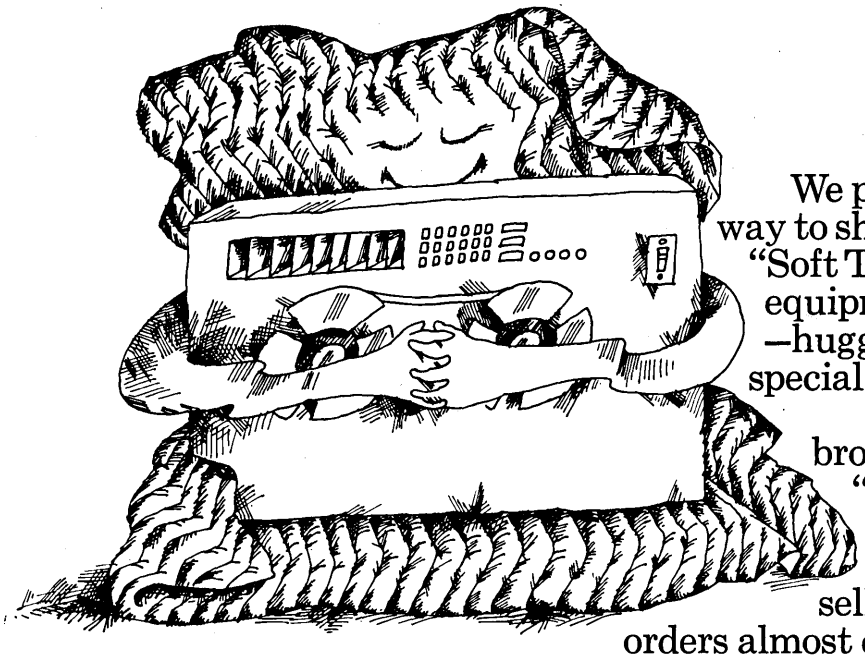

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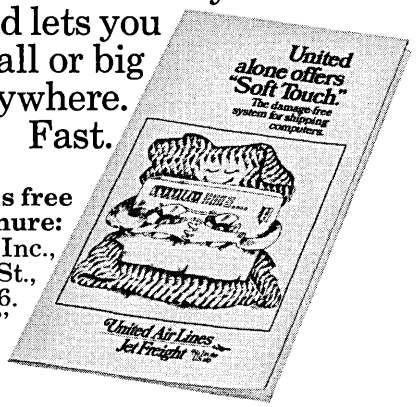

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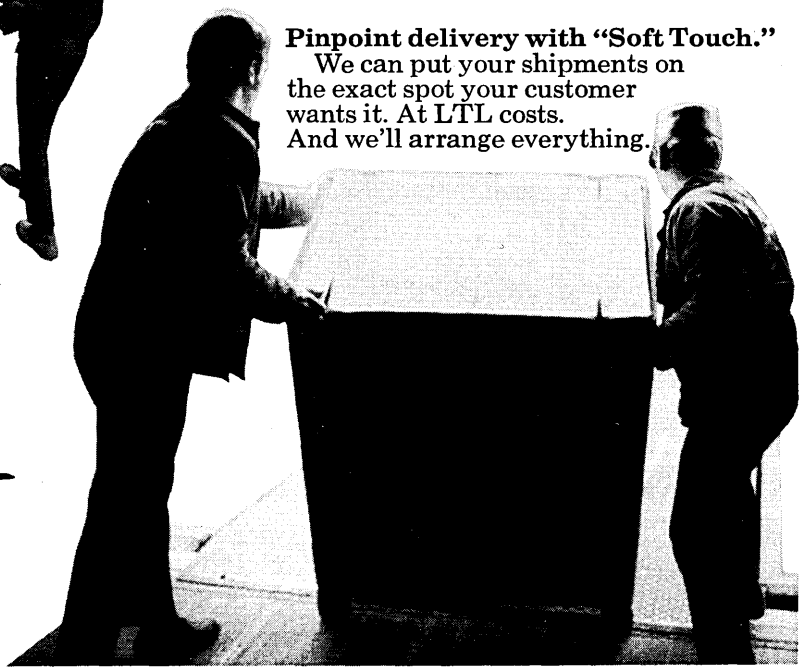

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News in Perspective

AT&T's long-heralded digital data system will connect five cities by the beginning of 1974 (page 93). But in its application to the FCC to build the system, Ma Bell is vague on what it'll charge customers of the so-called "data under voice" service...

Software industry pioneer Fletcher Jones of Computer Sciences Corp. died last month piloting his own plane. On page 93, associates recall how the 41-year-old executive directed the small firm in 13 years from a two-man organization to one of 6,000...

Will the Justice Dept.'s antitrust suit against IBM go to trial? Federal Judge Edelstein has indicated it will (page 96)...

There is more pressure on federal agencies to standardize the way they manage their computer-based financial management systems (page 97). This will make GAO audits of their performance more feasible...

The Supreme Court hands down its ruling on the celebrated Benson-Tabbot software patents case (page 97)...

Are the Russians about to produce their own third-generation computers and abandon plans to buy them abroad? One Soviet dp expert, in a recent interview, answered with a firm "yes" (page 101).

Privacy

Computer Systems and the Issue of Privacy: How Far Away Is 1984?

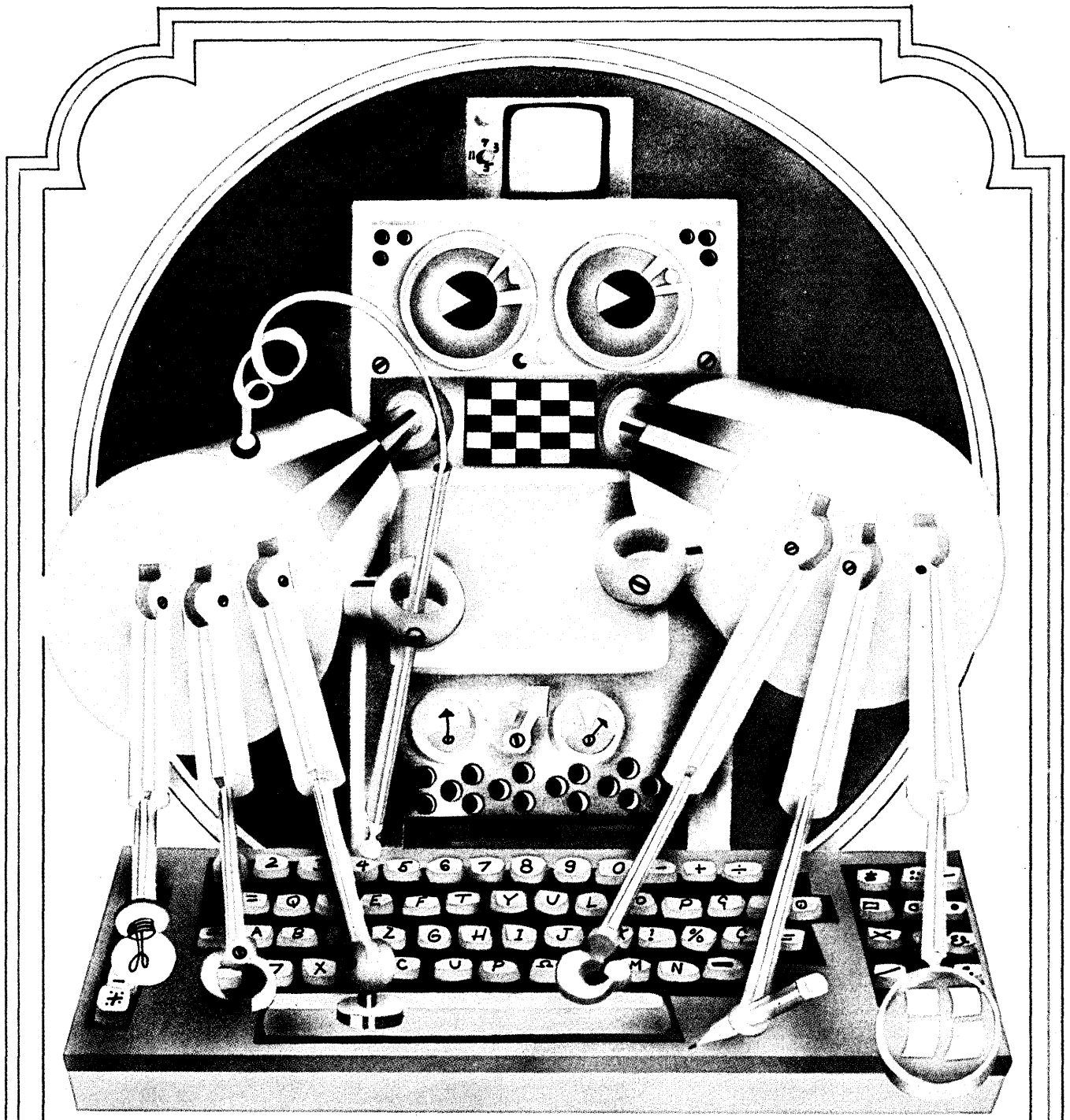
Dr. Ed David, the President's science advisor, last month assured Congressman Bill Moorhead of Pennsylvania that a report entitled "Communications for Social Needs" has been "rejected." The report proposed federal support for several new applications of communications and computer technology, including a system that would enable the feds to turn on every radio and tv set in the country, ostensibly to warn people of impending disaster. Moorhead called it "a Nixon Administration plan for a potential government-operated propaganda and spy system."

Soon afterward, Dr. David's press spokesman, John Lannon, admitted to this reporter that, although the report has been "completely rejected," the projects described in the report may still be under consideration. Further evidence of this came from Jack Robertson, of "Electronic News," who recently interviewed William Magruder, special assistant to the President, and reported, in the Nov. 6 issue, that Magruder expects the Administration to provide some money next year for experiments in CATV-wired cities and electronic mail handling. Both of these projects are described at considerable length in the allegedly rejected report.

Essentially, the electronic mail handling proposal involves optical scanning of letters and transmission of their contents by satellite from origin to destination post office. The "wired city" would utilize two-way CATV. Systems employing the same basic technology have already been tested successfully by the police to monitor remote locations through video cameras and specialized sensors. Although the "rejected" report doesn't talk about this application directly, it does explain that the wired city would be the precursor of a "wired nation" —formally known as a "National Public Service Telecommunications System," to be supported by satellite and terrestial communications channels. Several centralized data banks, consolidating files accessible to law enforcement, health, education, and other agencies—public and private—would be linked to this national system, which would output a number of services ranging from weather reports to canned "educational" programs prepared by the government for use on radio and tv.

The report on "Communications for Social Needs" insists that individual privacy wouldn't be threatened by these proposals. In discussing the electronic mail handling system, it says, "all handling of letters will be mechanized so that the original letter cannot be read while being converted for transmission." Also, "all materials will be outputted in sealed letter form. Thus, the letter will never exist in a form which can be read during the time it is in the sanctity of the mail." It takes only rudimentary technical knowledge, however, to realize that such a system could easily be programmed to detect, and print out, letters bearing particular names or addresses.

Meanwhile, a three-year privacy study, directed by Dr. Alan F. Westin, has been completed; it is billed as "the first nationwide, factual study of what the use of computers is actually doing to record-keeping processes in the United States, and what the growth of large-scale data banks . . . means for the citizen's constitutional rights to privacy and due process." The gist of the report is that "central data bank developments are far from being as advanced as many public commentaries have assumed," and so popular fears about loss of privacy haven't been realized, yet. The report stresses that, because of the increased efficiency of record-keeping, and the growing intensity of public concern, the middle '70s is when lawmakers and the public "must . . . evolve a new structure



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of law and policy to apply principles of privacy and due process to large-scale record keeping."

Nothing to save

But another study, scheduled to be published this month in book form, suggests there will be nothing left to save if we wait until the mid-'70s. This study was done by The Lawyers' Committee for Human Rights, a foundation-supported research group.

The committee charges that the Justice Dept., through its control of the National Criminal History System (NCHS), has acquired "greatly increased capability to monitor the activities of all citizens . . . and (arbitrarily) prevent or punish those activities . . ." System control was transferred from the states to the FBI despite objections from the Law Enforcement Assistance Administration (LEAA)—which supplied most of the money for NCHS—and despite an explicit warning from the President's Crime Commission that a centralized criminal records system would be subject to "executive manipulation," the committee said.

By 1975, NCHS will provide centralized, on-line access to criminal history files in all 50 states, the report added. "No federal, and few state laws" regulate this system; constitutional protections for individuals who have NCHS dossiers "are limited and narrowly defined," so both state and federal dossier banks continue to evolve primarily "by the force of their own momentum."

In many states, adds the lawyers' committee, criminal history files are being integrated with other kinds of sensitive information, so that comprehensive individual profiles can be extracted. The federal government is encouraging this development by funding projects like the Integrated Municipal Information System (IMIS), a HUD program aimed at producing a common, computerized information file that can be accessed by all the departments of a city government. Two IMIS systems are now operational—in Long Beach, Calif., and Wichita Falls, Texas. Three other cities are developing related applications. The feds will spend $5.1 million on the project in FY'73, compared with $3.5 million last year.

If a universal individual identifier (UID) is adopted by the United States, it will almost certainly become easier to integrate personal files now maintained independently by private and government organizations. Another even more chilling prospect is that bank loan officers, school registrars, personnel managers, and other grantors of social benefits will be able to make much greater use of aggregated statistics to weed out alleged "poor risks" ahead of time.

This process consists essentially of analyzing the existing poor risks—borrowers, for example, who don't pay on time—to find common demographic characteristics, such as age, income, place of residence, schooling, and/or family status. Future applicants who have the same characteristics are then rejected, or at least considered less qualified to receive the job, the school admission, or the loan.

Used now in reverse

Direct mailers use this technique in reverse to find the areas where their sales prospects are greatest; they rely on Census data, often combining it with proprietary statistics. Many lenders use point systems, based on an applicant's age, income, and other demographic characteristics, to determine his ability to pay. The use of this technique is so widespread among insurance companies that Maryland has decided to establish a state-operated automobile insurance program. An estimated 75% of the drivers who will be covered haven't been able to get policies from private firms—not because of poor accident records, but because of employment or credit records that reflect on their "stability."

No one really knows how extensively such systems are being used today. But it is probable that many organizations don't use the technique because it's too difficult to get the needed data. A universal ID will reduce this problem by making it possible to describe any desired group of individuals and then automatically access the independently maintained data bases that may have records on them.

The social security number is a likely UID; it's already being used for purposes never contemplated by the original Social Security Act—to identify students, welfare recipients, and owners of bank accounts, among others. Many companies are now using an employee's social security number to identify his payroll record. And, according to Charles Rowan, executive director of the National Association of State Information Systems (NASIS), some states are encouraging the use of social security numbers by their constituent agencies in the expectation that it will become an official UID. The American National Standards Institute (ANSI) recently drafted a "standard individual identifier (SII)," based on the social security code, and was ready to submit it to a final ballot of the membership until Senator Sam Ervin complained; final action has been delayed, but only until "public policy is resolved."

It may be too late

Rowan, the NASIS official, was one of the participants in a lengthy conference on automated personal data systems convened recently by HEW Secretary Elliot Richardson. Another participant—Prof. Arthur Miller of Harvard—said it may be too late to stop the trend toward use of the social security number as a universal identifier.

One purpose of the HEW conference was to analyze procedures that might be imposed on use of this code to protect individual privacy. Late last month, conference participants were at work on recommendations. They will probably complete a preliminary report by the end of next month, which then goes to Richardson for his review. He will pass it around among his department heads for their appraisal, after which the conferees will be asked to prepare a final set of recommendations.

Assuming these recommendations call for changes in present procedure, further time will be needed to implement them. In any case, only HEW's operations will be affected. Further review, discussion, and analysis will be necessary before other federal, state, and/or local government agencies adopt

recommendations. This will be "a slow process," said David B. H. Martin, executive director of the conference and a special assistant to Richardson. He didn't see any humor in that remark. **—Phil Hirsch**

Communications

AT&T Seeking DUV Approval

American Telephone and Telegraph has unveiled technical details of its long-heralded digital data system (DDS), but it is vague on what prospective users would pay for the service.

If the company is given FCC approval, it will build a 1.544-Mbps microwave channel connecting five major cities—Boston, New York, Philadelphia, Washington, and Chicago. In each city users will be connected by cable to the long-haul portion of the system; these cables will transmit data in digital form. Analog circuits will provide local-loop connections in adjacent areas. The projected incremental cost of the DDS is $1.3 million. Four classes of service are to be provided—2.4-, 4.8-, 9.6-, and 56-Kbps. DDS facilities also will be capable of supplying channels for Bell's present 50-Kbps services, such as Dataphone 50, for "high-speed data channels such as 1.344-Mbps or 1.544-Mbps, and for other uses which may be developed in the future," the company said. It promised "no more than one error second in 200 seconds of data transmission at 56-Kbps," and said remote testing capability to be incorporated into DDS would reduce the duration of a service outage to "no more than two hours."

The company plans to have the five-city net built by Jan. 1, '74, and to begin offering service between Boston and New York that same month.

The "extras"

DDS rates will be based on a service connection charge and an interexchange channel charge, plus additional amounts depending on individual customers' needs. He'll pay extra for multistation connections and for junctions between DDS and analog channels. He'll also pay extra for the interface between his terminal and the DDS local loop, if he gets this component from the phone company. However, AT&T indicated it would tolerate independently made, customer-provided interfaces, which the company refers to as "data service units." Essentially, the DSU converts a binary-level digital data stream into multilevel format; the former is required by the terminal, the latter by the local loop.

AT&T's request to the FCC for a construction permit was accompanied by a schedule of "illustrative" rates, but phone company officials stressed the adjective and said the final rates, to be disclosed when a tariff is filed sometime next year, are likely to be far different.

MCI, other specialized carriers, and Western Union probably will oppose the new filing, which could delay the projected startup date well beyond January '74.

Twenty-four cities would be interconnected by the end of 1974, and 96 by the end of 1976, AT&T said in its construction permit application. Point-point service only will be provided the first year ('74), after which multipoint connections will be available. DDS channels will utilize a full-duplex, synchronous "data under voice" (DUV) transmission technique that permits AT&T to piggyback them onto existing microwave facilities. The new channels will occupy a portion of the radio spectrum below 564 kHz; i.e. under the frequency band used for existing voice and data services.

An MCI official indicated his company's major concern, regarding DDS, is with the costing method. "If AT&T is going to use existing facilities, then the rates for DDS have to include a pro-rata share of existing costs, not just the incremental expense of providing the new service," he said. The phone company, based on its past pronouncements, seems certain to propose rates based solely on incremental costs.

People

Fletcher Jones Founder of CSC

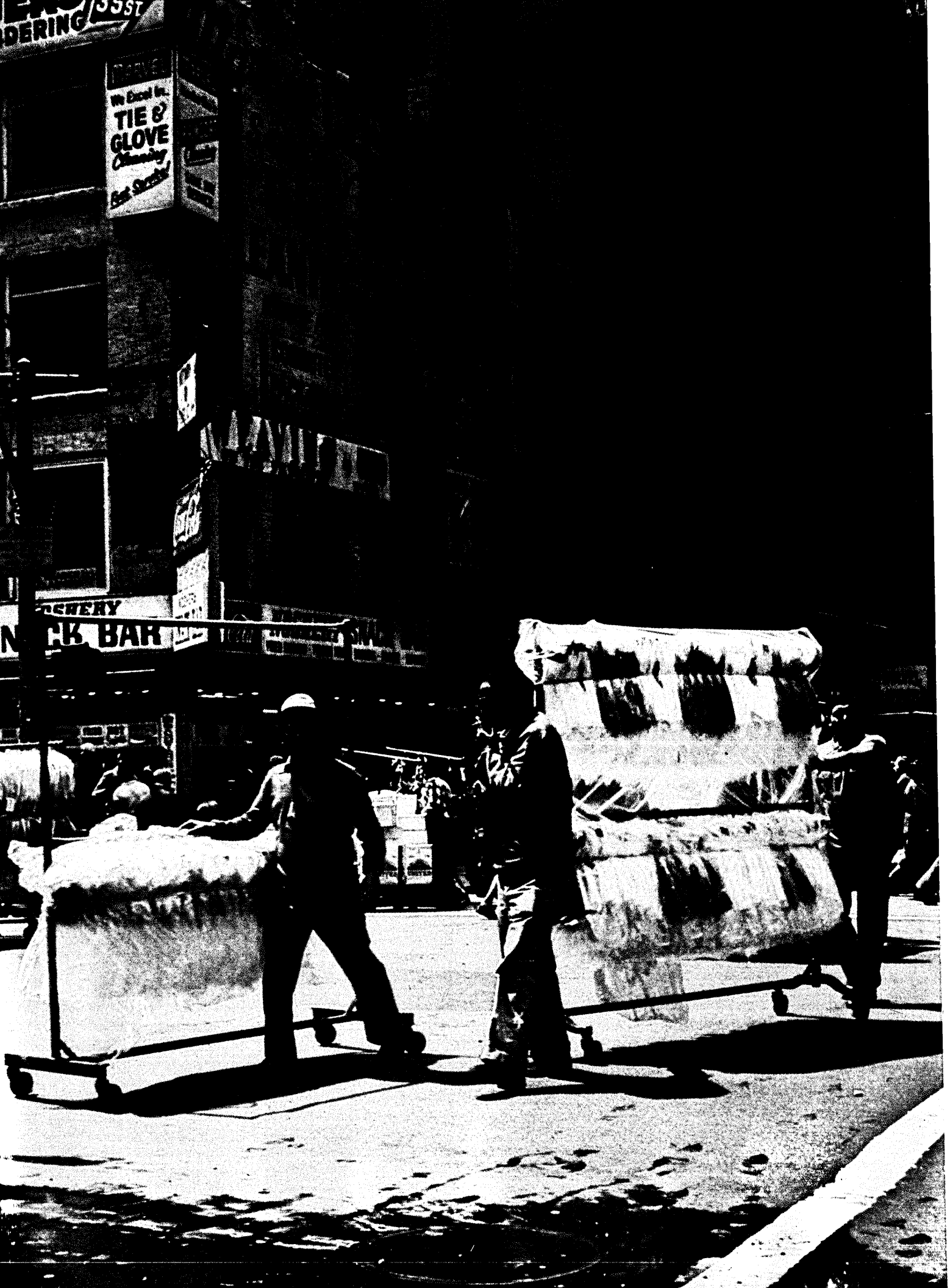
A close associate of Fletcher Jones described him as an executive who could "psyche himself into believing his solution to a problem was the right one. The rest of us looked for the best solution, and then listened to others. Jones found the unusual approach to a solution and then convinced everyone else it was the right one."

The technique worked. When he died in a private plane crash on election day last month, Jones, who was 41, had in 13 years built Computer Sciences Corp. from a two-man contract programming firm with an initial investment of $100 to an organization of 6,000 people and sales of $128 million. At his death the market value of the stock he held in the company—about 24% of the shares outstanding—was $15 million.

He was a millionaire who was living the good life. He had become an avid art collector and a well-known horsebreeder. Divorced, he lived with his two sons at Westerly Stud Farms, a sprawling ranch in California's Santa Ynez Valley, some 90 miles north of CSC headquarters in Los Angeles. He was returning to the ranch from a trip to Los Angeles, alone in his single-engine Beechcraft, when the plane crashed into a mountainside 8 miles from the Santa Ynez airport.

The tall, lean native of Fort Worth, Texas, began his career as a mathematical analyst and computer programmer at Chance Vought Aircraft Co. in 1950, after graduating from Duke Univ. He joined North American Aviation three years later and soon became director of the company's computer center in Columbus, Ohio. An associate there recalls: "We all sensed Fletcher was planning something big. And sure enough he was—building the contacts at Columbus and as the charter secretary of SHARE that would help him start CSC."

Jones formed the company with Roy Nutt, a programmer at Chance Vought, in April 1959, offering contract programming to mainframers and in later years extending the operation to programming space shots, selling proprietary packages, forming a time-sharing network, and computerizing New York's highly publicized off-track betting system.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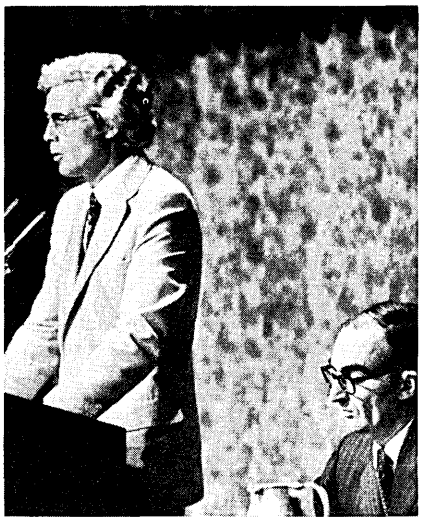
22132

In less than 10 years, CSC was grossing more than $53 million a year.

Jones was characterized in a recent newspaper story as "a loner who seemed unencumbered by the weighty responsibilities" he held as chairman and, until the end of 1969, as president of CSC. Nutt, agreeing with the description, said he had "an immense ability to look at



FLETCHER JONES presiding at 1971 annual meeting, with CSC cofounder Roy Nutt.

things in a detached manner and to articulate the real situation."

A former close associate, Jack Strong, remembers Jones as a master at the bargaining table who once shocked his associates by turning down a $200K offer from a client to accelerate an urgent programming project in which CSC was three months behind. "At that time, we were a small company," Strong recalls, "and $200,000 meant a lot to our survival. CSC completed the program—three months late—but received the $200,000 anyway."

A key to Jones' seeming detachment, according to Strong, was his penchant for delegating authority, "almost to a fault." In the mid-sixties he relinquished control of the company's day-to-day operations, and in recent years commuted from his ranch only three or four days a week.

William R. Hoover, 42, president since 1969, continues in that post and succeeds Jones as chairman and chief executive officer. Nutt was elected chairman of the directors' executive committee.

Antitrust

The Justice Suit: A New Urgency

After languishing in judicial limbo for nearly four years, the pretrial proceedings of the Justice Dept.'s antitrust case against IBM have taken on a new urgency, and at this writing there were indications that the case will go to trial.

Although nothing definite has been set, the drift of the proceedings indicates that the case will go to trial rather than be settled by consent decree. In one session last month, for instance, U.S. district court judge David N. Edelstein said: "The real outcome of this case will not and cannot be known until this case has been tried and reviewed on its merits and a final adjudication of judgment handed down . . . this case will be tried in open court completely exposed to public view. It will be tried fairly and will be decided by the laws of the land."

Many outside observers of the case have felt that IBM wanted to see the case settled without going to trial.

Judge Edelstein's remarks were made when he reprimanded IBM board chairman T. Vincent Learson for discussing the case with the press. Specifically, Mr. Learson had told a "Wall Street Journal" reporter that the break-up of IBM "will never happen" and that the Justice Dept.'s recent call for the break-up was mainly a change in wording from the original Justice complaint filed against IBM nearly four years ago.

"Ironic" situation

Judge Edelstein referred to the situation involving Mr. Learson as "ironic"—an allusion to the fact that it was IBM itself that had pressed the court for the restrictive order that forbids Justice Dept. and IBM employees from discussing the case with the press.

The judge issued a sharp statement on the issue. He said:

"Is it not clear that a positive, adamant declaration by an important officer of IBM concerning the outcome of this case in the process of pretrial procedure may give the impression that such declaration is based on inside information or that a private deal may have been agreed upon?

"Is not disclosure of this type a dangerous one?

"Doesn't a statement such as made by Mr. Learson possibly create the sinister inference that he or others are privy to information or knowledge which formed the basis for his prediction and conviction that IBM will never be broken up?"

It was at this point that the judge made it clear that the case would be decided at a trial in open court.

Mr. Learson was represented by IBM's general counsel Nicholas deB. Katzenbach, who said that Mr. Learson had acted "consistent" with advice that he had given top IBM officials. Mr. Katzenbach had observed that IBM has obligations to communicate with its employees and its stockholders. He also said that he believed that the restrictive press order applied more to attorneys than to company officers.

IBM has been attempting to obtain a separate trial to determine its share of the computer market, but Justice has been resisting the move, maintaining that the entire case should be tried at one time. IBM has taken its own census of the computer market and has been attempting to broaden the definition of that market in a way that will make it appear that IBM's market share is smaller than the Justice Dept. claims it is.

Apollo and other shots

In another development, the principals in the case were attempting to obtain approval to witness the final Apollo moon shot in Houston and Cape Kennedy in December. IBM has proposed that the principals in the case visit NASA computer installations to learn more about electronic data processing.

Meanwhile, trial of control Data's suit against IBM has been set for November 1973 in St. Paul. The case, which also involved an IBM counterclaim against CDC, is expected to take at least several months.

A third antitrust suit against IBM —filed by Telex Corp. of Tulsa—is undergoing pretrial proceedings in St. Paul, and Telex is said to be hoping for the trial to get under way early next spring.

In a fourth suit against IBM, attorneys for Greyhound Computer have formally asked the Ninth Court of Appeals in San Francisco to reverse a U.S. district court judge's decision that dismissed Greyhound's suit against IBM. The case, which had been initially heard in Phoenix, will be submitted to a three-judge federal panel after both sides file additional papers in the case. **—W. David Gardner**

Federal Government

Agency Seeking Standard Controls

The General Accounting Office (GAO) is planning to impose much tighter controls on federal agencies that use computer-based financial management systems. Efforts are now under way to develop standard procedures which the agencies would, in effect, be required to use in managing their systems. GAO hopes to begin applying the standards in about a year.

The new program is the outgrowth of a lengthy study done by a special panel of the Computer Science and Engineering Board, a constituent of the National Academy of Science. The study, which hasn't been officially released, defined the system management areas where standardized procedures need to be developed.

If all the recommended procedures are developed and adopted, GSA auditors will be able to evaluate an agency's entire system management activity, including such tender matters as whether the agency is conforming to government-wide software standards, how effectively it's using machine time and programs available elsewhere in the federal establishment, and what changes might be needed in the number and makeup of the dp staff.

If the evaluation is unfavorable, the auditor will have a good chance of persuading the agency to accept his recommended changes. For GAO is required by law to report substandard systems to Congress, which controls agency appropriations.

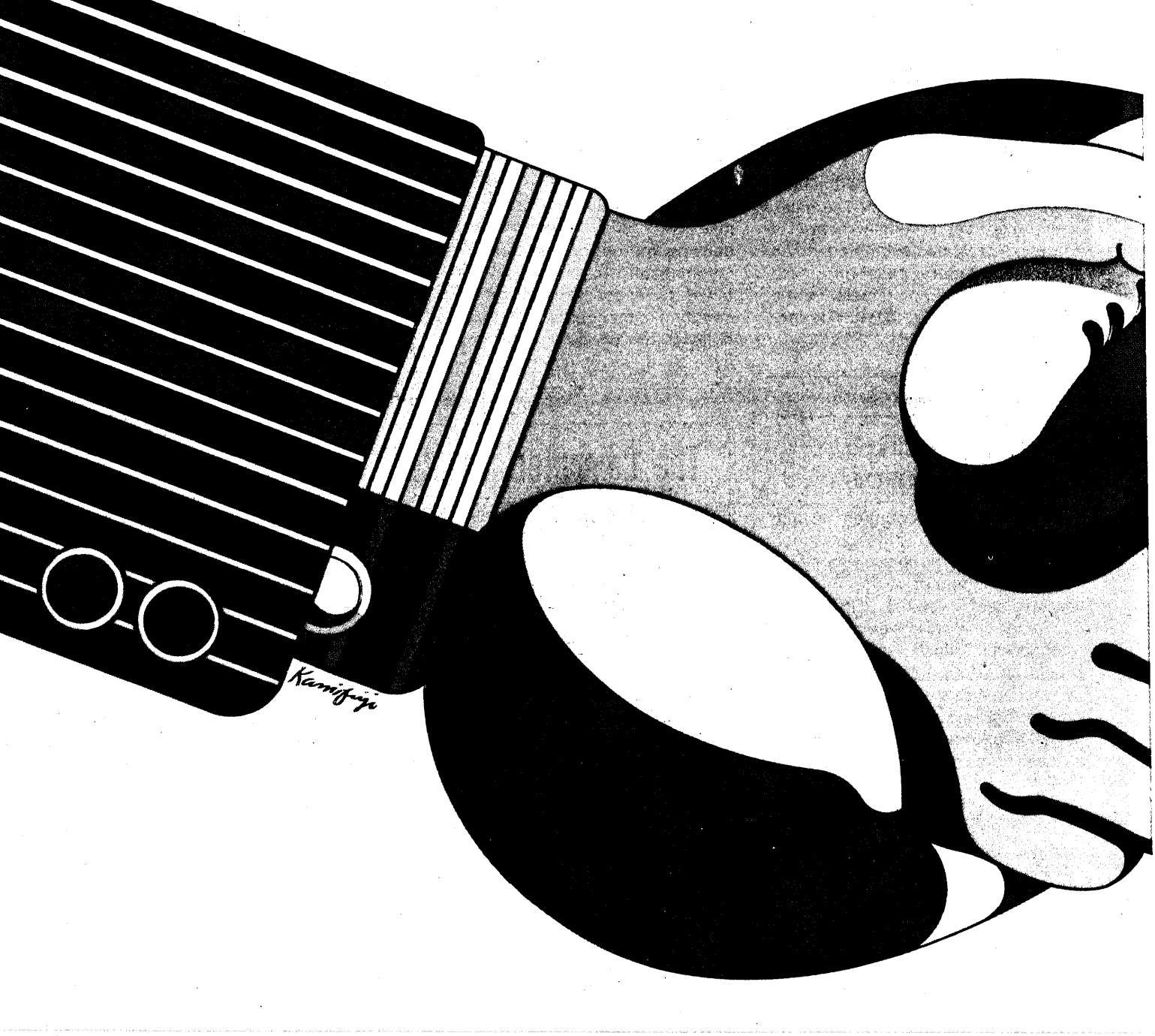
The office has been making a much more limited analysis of financial management systems used by Executive Branch agencies for several years. About half of these agencies now conform to GAO guidelines.

Recurrent efforts have been made to enact legislation which would give GAO even greater clout, by denying appropriations more-or-less automatically to an agency which failed to adopt recommended accounting procedures. One source believes the upcoming program for evaluating each agency's system management activity will increase Congressional support for such legislation significantly.

Software

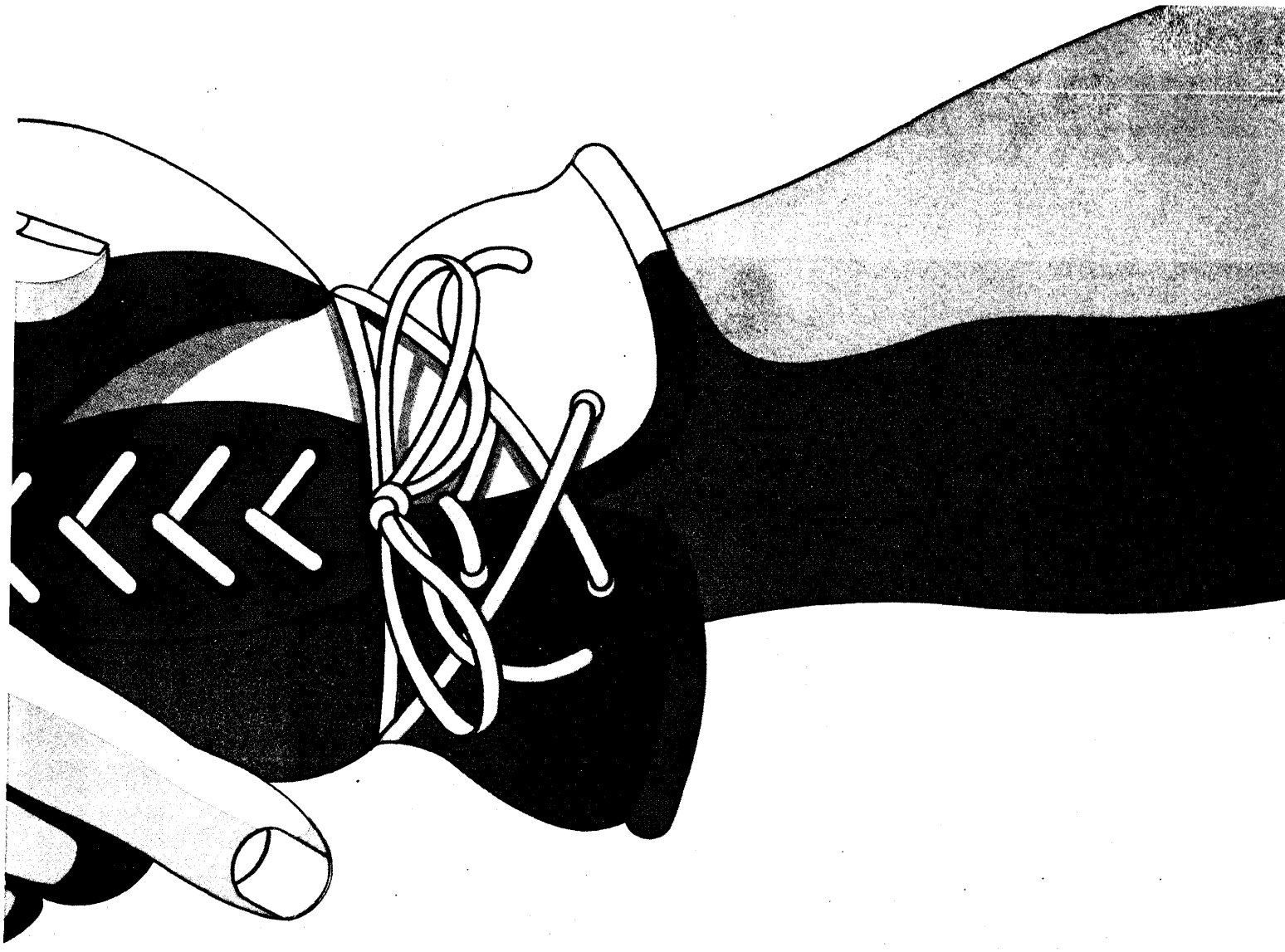
Final Round for Software Patents?

The U.S. Supreme Court decided unanimously last month that a process for converting signals repre-



Why are so many of our competitors also our customers?

CIRCLE 78 ON READER CARD



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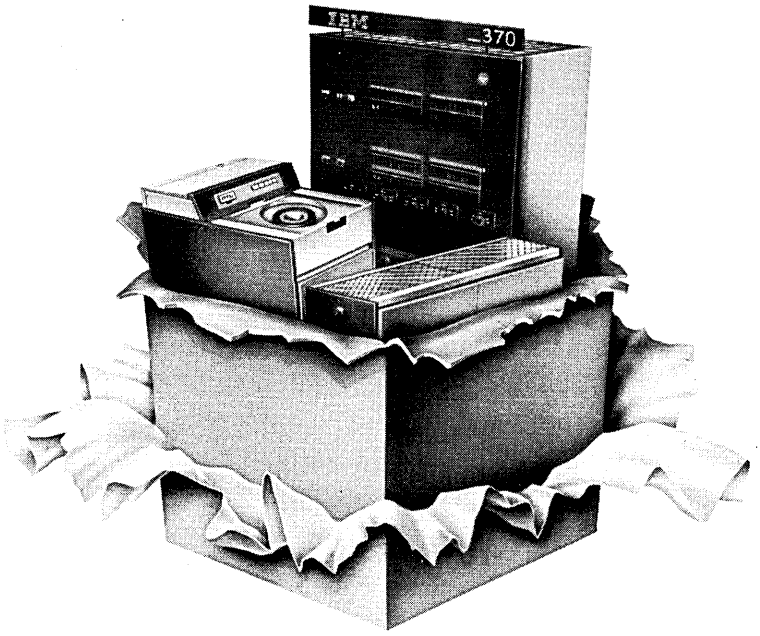

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CIRCLE 55 ON READER CARD

senting BCD numbers into binary number signals is not patentable—essentially because the claim is too "abstract and sweeping."

The inventors, Gary Benson and Arthur Tabbot, of Bell Telephone Laboratories, earlier had been turned down by the Patent Office; subsequently the U.S. Court of Customs and Patent Appeals (CCPA) decided their claim was patentable. The high court's decision, written by Justice William O. Douglas, came in response to an appeal filed by the Patent Office.

"It is conceded (by attorneys for Benson and Tabbot) that one may not patent an idea," wrote Justice Douglas, "but that, in practical effect, would be the result if the formula for converting binary code to pure binary were patented in this case."

Douglas added that Supreme Court precedents require a patentable process to be "either tied to a particular machine or apparatus" or to be based on an operation which changes "articles or materials to a 'different state or thing.' " However, he added: "We do not hold that no process patent could ever qualify if it did not meet the requirements of our prior precedents . . . If programs are to be patentable, considerable problems are raised which only committees of Congress can manage . . ."

Software Tax Could Mean Emigration

The computer population of Nevada could explode if California's software tax muddle is resolved in a way that makes it too expensive to maintain computer installations in that state.

When a bill originally intended to place a two-year moratorium on the imposition of property taxes on software in California was defined by the State Board of Equalization in a way that permits imposition of fresh taxes (see Nov., p. 8) the matter of how to do it was left up to the assessors. The assessors have decided that market value is too hard to determine in the case of software, and cost should be the base. The tax rate will be 4% of this cost every year.

Some assessors haven't done anything yet because they still don't know what it's all about, said Tom O'Rourke, president of Tymshare, Inc., Cupertino, Calif., and chairman of the coordinating committee of the new Computer Software & Services Group of WEMA (formerly the Western Electronic Manufacturers Assn.). "But others are riding their white chargers down the streets looking for software to tax."

WEMA's CSSG has taken on the software property tax matter as their major concern and has appointed a special committee to work on goals and a strategy "as soon as possible." CSSG will fight on the legislative level. "Others will fight in the courts," said O'Rourke, "and that's okay, but courts tend to look favorably on anything which produces tax revenue, and I feel our greatest hope lies in making the legislators understand our position." He suggested that CSSG make a survey of the number of computers in the state by legislative districts. This would exclude computers owned by manufacturers who can pass the tax on to users and those owned by government contractors who can write the tax into their contracts. "Then we go to individual legislators and show them the figures, pointing out that the software tax could drive these computers and associated people and jobs to Nevada with the net result a loss in revenue to the state of California."

"We don't care where our computers are," said O'Rourke, whose time-sharing firm has software resident in California belonging to users all over the world. "And the assessors don't care where they send the bills if the software is in California. I'd just as soon put the computers in Nevada and operate over a telephone line."

International

Russia: Its Own Third Generation?

A Russian data processing expert says the USSR is on the verge of producing its own third-generation computers and may not be much interested in importing them, even if the U.S. lifts its trade restrictions. Although Soviet computing systems are behind the U.S. in many respects, notably in operating systems and peripherals, they may fit Russian applications better than American machines would.

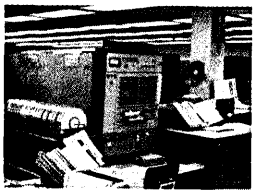
This comment, contrary to popular speculation, was made by Oleg Semenkov, who was interviewed during a tour of the U.S. as part of a scientific exchange program. Semenkov is the director of the 500-man Institute of Engineering Cybernetics of the Academy of Sciences of the BSSR (the Russian republic still often referred to as White Russia).

"Russia has several thousand computers," he told us, "most of which are used in scientific and manufacturing applications. And the great majority of the computers installed are Minsk machines, either the Minsk 22 or the 32." The 22 is a second-generation machine, with 8K to 16K 37-bit words. The multiprogramming 32 is sort of between the second and third generations, according to Semenkov. It is built with discrete components and has from 16K to 64K of 37-bit words. Peripherals for both include magnetic and paper tape, printers, plotters (drum and flat-bed), and displays — even with light pens. The model 32 has a card reader, too, but not a punch. Discs are not available but are expected to come with third-generation equipment due this year or next.

Time-sharing is not presently supported. The machines are generally run in batch mode, but on-line debugging is prevalent. When time-sharing does come of age with the next machines, the Russians expect to see some trade-offs between sophisticated time-sharing systems and "personal" minicomputers, which are already entrenched as solvers of math and simpler engineering problems.

Programming languages used are primarily Fortran and Algol 60, Oleg

Extend a little, replace a lot,



Model 65 – extended from 256K to 512K.
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360 users get any size they want with Fabri-Tek 360 core.

Model 40 – extended from 32K to 384K.
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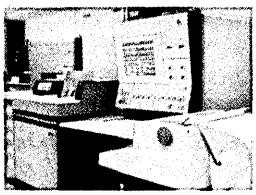
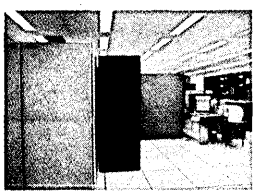
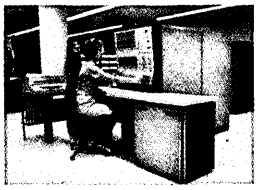
Vermillion, South Dakota



Model 22 – extended from 24K to 64K.
United Farm Agency
Kansas City, Missouri

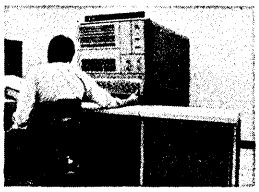


Model 50 – extended from 512K to 768K.
University of Wisconsin
Madison, Wisconsin



Model 30 – extended from 32K to 64K.
Chi., Mil., St. Paul & Pac. R.R.
Chicago, Illinois
Leased from Dearborn Leasing

Model 22 – extended from 32K to 64K.
Computer Graphic Systems
Toronto, Ontario, Canada
Leased from Greyhound Leasing



Model 30 – extended from 32K to 64K.
Medtronic, Inc.
Minneapolis, Minnesota

Model 30 – extended from 64K to 128K.
American Broadcasting Company
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Model 30 – extended from 8K to 64K.
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Model 30 – extended from 64K to 128K.
XCS Management
Vancouver, British Columbia
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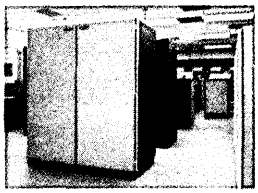
Model 40 – extended from 64K to 128K.
Further expansion to 192K planned
Graco, Minneapolis, Minnesota



Model 50 – extended from 256K to 512K.
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San Francisco, California

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says, and both the Minsk machines have these compilers. Although the 22 and 32 have the same word length and are strongly related, they are not compatible at the assembly language or object level. They can run the same source-language programs.

English standard

The notable absence of card punches on both machines leads to keeping object programs on magnetic tape if they are produced at all. "Most of the time programs are recompiled," he said, admitting that this leads to some inefficiency. Apparently most input to the machines is through paper tape, but a strange anomaly occurs no matter whether tape or cards are used. The Russians use Roman notation to input their programs and data, but get line printer output in the Russian (Cyrillic) alphabet. We have heard this same kind of comment about others, including mainland China. So a de facto English standard exists worldwide in programming languages. This standard may imploy some consistency in computer architecture, too.

Although admitting that the Minsk machines are "yesterday's computers," Semenkov doesn't feel that they would be replaced by IBM 360s or 370s. "After all, the 360s and 370s are not built for manufacturing applications. Further, they are not compatible with the existing base of Minsk computers nor with our existing software." He added that the BESM 4, BESM 6, and URAL 14 large-scale scientific computers are not in any danger either.

Data processing in the USSR is nearly evenly split between scientific and commercial work, but this is probably misleading considering that the Minsks are counted as commercial machines even though they are used so heavily in manufacturing. Oleg considers that engineering applications, including production management and manufacturing controls, are now the most exciting, and they are his institute's primary concerns.

The institute's staff includes about 100 programmers and 200 manufacturing engineers. The remainder of the 500 are computer support people and mathematicians. Hardware includes one Minsk 22, one 32, and a couple of minicomputers.

Solving problems

His institute is not a production organization. It yields neither products nor designs for products. Its purpose is to devise ways to solve engineering problems and to teach those methods to the real working engineers. The institute will have trained 200 people when its first year of operation is completed.

Complex problems, such as the design of computer-based manufacturing control systems, are attacked in three ways: "through the design of a process simulation by engineers; through the employment of computers to analyze that design using hardware, software, and especially graphics; and through optimization by mathematicians."

Do computer technicians enjoy special status in the Soviet Union? "As far as people are concerned, great attention is paid to new branches of sciences, starting in the 10th grade. But computer people have the same status as other technicians. This is especially true around a city like Minsk, where 50% to 60% of all the computers are made (and dp technicians are so common)."

One current project at the institute is a design method called Pre-Production Stage System. PPSS' most important goal is management information. "A manufacturing process is ready when: (1) you know what must be manufactured (you have the engineering drawings); (2) you know how it is to be manufactured (you know the tool assignments and material specifications); and (3) there is a managment system to use in its manufacture (schedules, supply and maintenance plans). That's what PPSS is for."

While the institute uses engineering applications programs that produce information for numerically controlled or computer-controlled machines, they do not use the U.S.-developed APT tooling program because it requires something like 200K bytes of core and they don't

have that much.

The same split

Asked whether Soviet "computers" used in manufacturing were really numerical controllers, Semenkov said the split between numerical controllers and direct digital control systems was "about like it is in the U.S. There is a trend to NC on production lines, but there are really two topics to consider in the design of a manufacturing system: labor (which is cheap by U.S. standards), and product quality. Some products are impossible without automation. Quality usually forces automation."

But he was not blind to "people" problems created by this automation. "Computer development will help product quality, making products not possible otherwise. But the impact on society is greater than the visible result in manufacturing; it requires the redesign of the educational system and the solving of psychological and social problems."

"There are many problems concerning the development and use of computers," he said later at an IEEE panel, "and there are different solutions for different countries." A big part of the Russia's problems in developing its industry will be just in catching up and learning to build processors and peripherals fast enough. Contrary to Semenkov's feelings about the unattractiveness of U.S. machines for Soviet applications, Russia may be forced to import hardware and forced to go through the kind of conversions U.S. users did when the 360s were first introduced. They will have an opportunity to leap-frog almost a full generation, and it's hard to think they would pass that up.

— R. A. McLaughlin

Depressing News for Harassed ICL

The great management realignment at the U.K.'s International Computers Ltd. was not able to prevent a painful November. As the company's stock remained persistently depressed at around $2, the first report came that ICL is expected to lose a prestigious installation at the London Stock Exchange to IBM. The current system includes teleprinter terminals in about a hundred offices of exchange numbers, allowing them to check their commitments quickly and to open new bargains. With a demand for a bigger system to serve the London Exchange with exchanges in the provinces, one proposal for a new installation has a System/370 at the top of the list.

This news comes in the wake of a decision by the Royal Air Force to remove a $250,000 management information project from ICL's software subsidiary Dataskil. The Air Force job was for control of its global stores and supply operation that is centered in Hendon, a few miles north of London. The system will now be based on a modification of a development by Computer Sciences International for the new Customs and Excise cargo handling scheme at London Airport. The Hendon system basically needs real-time control software for a transmission network containing 600 display terminals.

New Joint Ventures in EEC

The official expansion of the Common Market January 1 includes a plan for devising a common policy for industry, technology, and scientific development as soon as possible. Agreement on a common computer industry policy will, unfortunately, be missing. An EEC official said the problem lay in trying to phase a gradual merger of national programs. At the moment, he said, the product ranges in the mainframe field were too diverse to achieve even the beginning of any harmony.

But perhaps the politicians should observe the cooperation among software houses. Two new Anglo-French tie-ups have been made following other earlier successful ventures.

One is a product and know-how link-up between the Hoskyns Group and Sligos, the French systems company that is the result of a recent four-organization merger. The association is described by Hoskyns as a first step in forming a multinational "club" of leading consultant-systems companies. There is no financial exchange between the two firms, but there are three aspects to collaboration: Each company markets the other's products; they can both exchange know-how and professional staff for specific assignments; and they can cooperate on major assignments in Europe and in servicing multinational clients in the U.S. Both companies want to develop facilities management services, which are beginning to blossom in Europe.

The other new venture is between SPL International, U.K., and a consultancy called Steria, which has an associate, Steriabel, in Belgium. These two emphasize collaboration on skills in operating systems design, data communications, air traffic control, process control, and computer aided design.

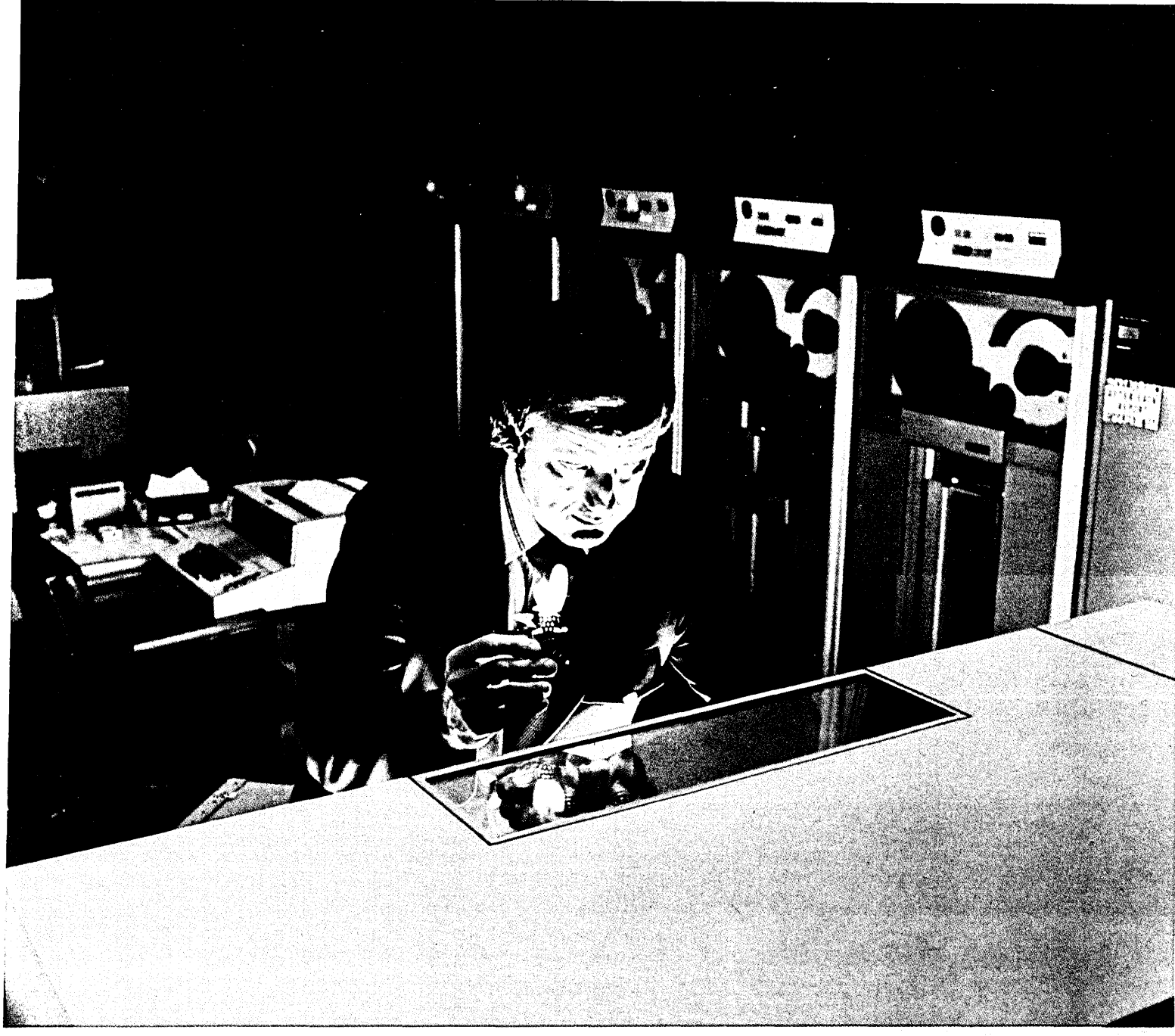
U.S. Firms Subject to EEC Sanctions

One outcome of the reelection of President Nixon is that the Common Market countries are prepared to hold their fire on trade actions that could adversely impact exporters, including U.S. dp firms. Soon after the election it was reported that Nixon was planning to visit Europe, partly for a summit of the EEC countries. The Economic Commission can and does impose sanctions on manufacturers that manipulate prices and that deliberately withhold resources from another in a way construed as obstructive and unfair trading to another community member. American manufacturers operating in different countries in Europe need to scrutinize practices such as possible price differentials.

Urban Systems

City Planning: A Game Way to Go

The average citizen would have a lot more to say about the community in which he lives if a computer game demonstrated last month realizes the potential its designers



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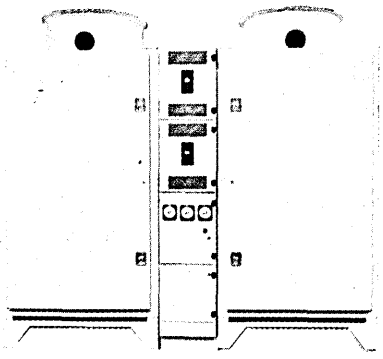

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see for it.

The game, Trade-off, was played via nine APL terminals at a conference on Shelters for Mankind at California State University, Los Angeles. It was the first test of what is planned as a community participation tool.

Among other things, the game demonstrated how easily computer questionnaire data can be manipulated using APL, said Warren Juran, APL marketing manager for Proprietary Computer Systems, Van Nuys, Calif. Juran was one of the game's three architects. The other two were Ruth Baker, president of Experiments in Art and Technology in California, and Frank Reynolds, a systems analyst with Empire Computer Services.

The game was divided into two parts, a computer-aided questionnaire and a group interaction section. During the questionnaire portion, each player designed an ideal city, using a terminal to record his preferences. At the end of this portion each player received a profile of the city he'd designed, and his preferences were captured in data files for subsequent analysis.

The second part of the game was played using groups of three players. In each group, players used a democratic voting process to reach agreement on the design of their ideal city. Each group had a limited amount of money and land. The impact of their selections on these limited resources was displayed on the terminals as part of the voting process.

Central theme of the game was to design communities of 100,000 people, with the players assuming the roles of the economic and social decision makers who determine the quality of life in the communities.

Stay under budget

In the group part, one of the first jobs is selecting a name for the city to be designed. The computer, a 370/145 at Proprietary Computer Systems, asks each player to identify himself by typing in his name. It then retrieves the records created by each player in the questionnaire portion, which include community names selected during that portion. The three names are displayed and players vote, ranking the names in the order of preference. The computer assigns points to each name based on the number of first, second, and third place choices. Names and points are then displayed and each player is asked if he approves the group choice. One who doesn't can vote his preferences again. Voting continues until either a consensus is reached or players exceed a time limit built into the game. The computer then records the city name chosen and proceeds to the first of seven selection categories, publicly supported services. Each player is informed that he has $25 million and 12 square miles of land and will have to tax the residents of his city if the resources required by his selections exceed these limits.

Each player sees a summary of choices made by others in his group during the questionnaire portion. Choices are ranked in order of the number of points received, using the same weighted preference ranking method used in selecting the city name. In addition to the community services selected by the players, the cost and land requirements associated with each choice are displayed, along with the total money and land use and the amount that would remain in the budget if the selection were accepted.

The computer leads the selection process through six more categories: economic environment, home environment, leisure, transportation, type of government, and sources of revenue for financing the selections. Voting always continues until a consensus is reached or a time limit exceeded. When all selections have been made, the computer prints each player a souvenir profile of the city designed by the group.

The interactive nature of the group part of the game requires use of a shared data base by the three players. Sychronization of this operation was made possible by the shared file enhancement provided by the APL system used, Juran said.

Planning a city by computer was fun for these participants in a conference on "Shelters for Mankind" who planned their cities using a computer game called Trade-off.

Most were novices

Three of the nine terminals were used for gathering questionnaire data, and the remaining six for the interactive session. The questionnaire terminals provided a sample of 180 individual "ideal cities" along with some personal data on the players who designed them. Median age of the players was 25 years; 32% were married; 62% were men. Most of the players were unfamiliar with computer terminals; 81% had never played a computer game before.

At the end of the conference, a group of APL programs was written to summarize the questionnaire results and correlate them with the

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age, sex, and marital status of the players. The analysis, said the game's designers, showed a surprising amount of agreement between these groups on the features selected for their "ideal cities." Education, housing, and environmental protection were popular selections for priority services. Most of the players wanted at least a touch of the country in their ideal cities. A pure city environment scored low in the voting. The traditional form of family was more popular than communes, singles, and nomadic life styles. The most popular form of transportation was walking, with the city laid out to place most things within walking distance of everybody. Traditional forms of city government (mayor, city council) were less popular than community forums, local neighborhood groups, and cooperatives. There was little agreement on the best type of taxes, indicating it's difficult to find methods of raising money attractive to any large segment of population.

The game was a success as an attention getter. The terminals were mobbed throughout most of the conference. Its designers feel this suggests that the techniques used were a practical and stimulating aid to surveying opinions and to letting people participate in and gain insight into the community planning process.

The game currently is being expanded to allow collection of free-form comments and "write-in" selections. Facilities also are being added to permit comparison of "ideal cities" designed individually during part one of the game with the cities designed under the budgetary and group opinion pressures associated with part two.

—Edith Myers

Compatibility

NASA Lands on Tape Problems

The problem of data interchangeability among different manufacturers' computers doesn't get much mention anymore. That doesn't mean it has disappeared, however. Efforts to "tune" these systems' tape drives to create and read tapes on any drive have met with varying degrees of success.

Consider the problem at NASA's huge computer complex in Greenbelt, Md., where more than 900 devices classified as computers have created a tape library approaching one million files. Here a tape might be created on a Univac 1108, passed to a job running on a CDC 3200, and possibly be mounted for processing on such second-generation equipment as an IBM 7010. And approximately 2,000 miles of tape a week is exchanged with outlying sites for processing on still other types of computers.

William Poland, a NASA engineer at Greenbelt, has been given the assignment of analyzing the problem and proposing possible solutions. "Right now it looks to me like 800-bpi NRZI is too critical a recording method to use successfully on a variety of computers. Every time we have tried to upgrade our 556-bpi library, we have been unable to run successfully. Look at all the variables associated with the problem. The tape drive designs differ from vendor to vendor. Some are designed so that the tape contacts the read head at a very high angle of attack, which seems to hold the tape to the head better at high speed than drives with lower angles of attack. Some vendors record at 50% of nominal amplitude, others range to as low as 20%. Add to these the varying preventive maintenance cycles by the different vendors, and you wind up with a chronic problem."

The manufacturers have tried to help NASA. Maintenance schedules have been reviewed, and in some cases the service frequency increased. And the manufacturers had no objections to NASA engineers modifying the drives. NASA engineers etched the capstans on some drives because they suspected that part of the problem was due to the smooth backing on the tape slipping on the rubber capstans.

Poland has sought other sources of temporary relief, too. "The National Bureau of Standards has special tapes called SRM-3200s, SRM standing for Standard Reference Manual. These tapes are specially selected based on a number of criteria, including thickness of recording oxide, uniform oxide coating, uniform width throughout, etc. We have two of these tapes for our engineers to use in setting up the various tape drives. You should see the way the tape comes—in a walnut box with brass fittings on it!" Well it should for $670 each.

On new procurements, Poland said: "I'm thinking that before we acquire computers in the future, we're going to make sure that there is a high degree of data interchangeability between them. They, the vendors, are going to have to prove it to us."

—Michael W. Cashman

Elections

Vote Count Computer an Unsung Hero

An IBM 370/155 counted some 3 million ballots in Los Angeles County last month with speed and precision, but still there were cries of computer foul-up from newsmen who would have liked to have had significant results in their hands half an hour after the polls closed.

There were minor delays, but these weren't the fault of the 155; nor was the fact that when the final tally was made at 5:55 a.m. the morning after election, 22 precincts were among the missing.

L. A. County had 24 360/20s on temporary lease to transfer the punched ballot votes to tape. Fourteen of these were located in the county Hall of Records in downtown Los Angeles and the remaining 10 in the county data processing center in Downey, some 10 miles away. This center is the permanent home of the 155, which regularly serves the county's engineering data center.

Ballots were packaged in the precincts and delivered first to approximately 70 distribution centers, and from there sheriff's personnel took them to one of the two Mod 20 centers. One of the 20s at Downey wasn't functioning properly election afternoon, and it was decided not

to use it. A second went down during the evening, but these were the only computer problems and didn't significantly delay reporting of returns.

The 22 missing precincts were traced and counted. In some cases the losses resulted from mishandling of header cards, used to identify each precinct, by Mod 20 operators. In other cases it was a simple misplacement of boxes of ballots so that operators thought some had been transferred to tape when they actually had not been.

A significant delay in absentee vote counting was caused by an injunction obtained by county supervisorial candidate (successful) Baxter Ward which prevented the Registrar-Recorder's office from opening the absentee ballots before 8 p.m. the day before the election. In the past these have been opened beginning at 5 a.m. that day so that card-to-tape processing could begin on those votes at 8 a.m. and be completed by the next morning. This time only half the AVs were on tape by election morning, and the rest had to be done that afternoon, adding to the burdens of Registrar-Recorder and data processing personnel, who also had logic and accuracy test runs to handle on all of the 20s and the 155.

There probably were some delivery delays and some in the card-to-tape procedures; but as fast as the 155 received the tapes, it gobbled them up—at three times the speed of the 360/50 used to process the primary election tapes. Observers who watched the count of the 22 missing precincts three days after election came to appreciate the speed of the 155, which did in 3 minutes what it took a 360/50 15 minutes to do for the late count.

Direct to disc

Even greater speed and lower costs may be in the offing for future L.A. County elections. The county has been experimenting with a system that would eliminate the card-to-tape procedure. It uses four IBM 3505 card readers which read ballots directly to disc. It would also alleviate the damaged ballot problem. Some 35,000 ballots were sufficiently damaged to be rejected by the system in the November election and had to be reproduced for a later count. John Coughlin, L.A. County deputy director of data processing, said the 3505s can handle seriously damaged cards. He estimated use of the system could save the county $300,000 per election.

The county has offered to handle next April's mayorality election for the city of Los Angeles, and if this happens the new system will get its first practical test then. Maybe it'll be an election free of mentions of computer goofs and even free of pictures such as appeared in the "Los Angeles Times" two days after the election. It showed an empty room at the Downey center which, on election night, had housed inspection teams checking in boxes of ballots. "By mid-afternoon Wednesday," said the caption, "the computers were gone."

Benchmarks

Small Systems for Univac: Sperry Rand's Univac Div. appeared to be shoring its stance in the small computer systems market with the announcement that it will acquire EMR-Computer, Minneapolis. EMR, a division of Weston Instruments, Inc., which is a subsidiary of Schlumberger Ltd., produces small- and medium-scale systems for specialized applications, such as data communications, telemetry data reduction, laboratory automation, industrial control, and geophysical processing. Terms of the proposed acquisition were not disclosed.

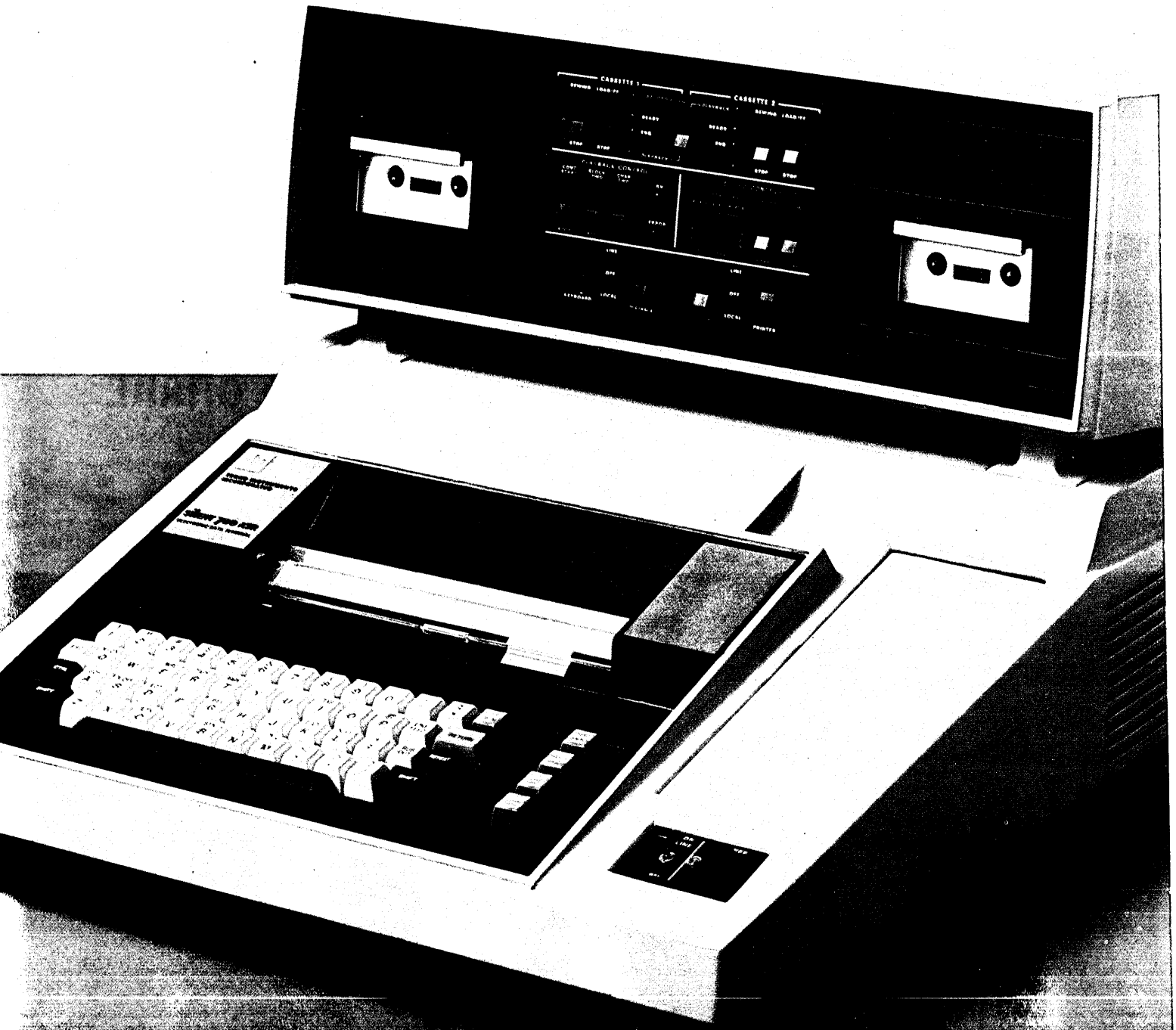
AM Boosting Spending: Addressograph Multigraph Corp. will double capital expenditures in the current fiscal year and will increase research, development, and engineering expenditures by more than 30%. Charles L. Davis, president, outlined these plans at the AM annual meeting last month and said AM's goal is to become "the most broadly based graphics company in the world and a leader in data transaction systems." He said the company will market "upwards of 20 new products during the year" toward this end.

Charges and Countercharges: Digital Equipment Corp., in a Boston federal court, charged Lockheed Electronics Co.'s Data Products Div. with patent infringement in the use of PDP-11 memory addressing techniques in Lockheed's SUE minicomputers. Lockheed countered in a Los Angeles federal court with a suit seeking an injunction to stop the DEC suit. Lockheed contends the DEC action "was filed without good cause" and that DEC's patent on memory addressing techniques is "invalid." The two suits are expected to be consolidated in one court.

Anniversary of the Transistor: On Dec. 23, Bell Laboratories will observe the 25th anniversary of the transistor. It was on Dec. 23, 1947, that John Bardeen, who had worked on theory, and Walter Brattain, who had worked on surface properties, demonstrated a device that amplified a speech signal 40 times. It was called a point-contact transistor because it consisted of two pointed gold contacts, less than two thousandths of an inch apart, on one side of a piece of germanium wafer. In 1956, Bardeen, Brattain, and Dr. William Shockley received the Nobel prize for discovering the transistor effect. □

silent 700
electronic data terminals

Texas Instruments announces...



the twin-cassette "Silent 700" ASR terminal for $2,750

(KSR terminal for $1500)

Here is a powerful improvement over conventional paper-tape ASR (automatic send-receive) teletypewriters . . . at half the cost of other equipment with comparable performance.

In *Silent 700** ASR terminals, TI has combined sophisticated magnetic tape cassette data storage with the field-proven features of *Silent 700* keyboard data terminals.

Speed. Quietness. Reliability

Data transmission rates up to 120 characters-per-second can significantly reduce line charges. And quiet, 30 characters-per-second electronic printing makes the *Silent 700* acceptable to any office environment. Field operating experience has proven that *Silent 700* terminals typically require only one or two remedial service calls per year.

Communications Economy

Off-line data preparation and transmission from cassette storage reduces errors, line costs and operator time. Simultaneous transmit/receive and simultaneous on-line/off-line operation permit maximum system utilization.

Powerful Data Editing

Data is recorded in ANSI standard block format. Block or character data editing capability is combined with high-speed tape duplicating and an optional automatic record locator for fast search of cassette files.

Reliable Data Storage

Philips-type digital-grade cassettes store 800 bits-per-inch for up to 310,000 characters storage per two-track cassette. Bit-error rates are typically no more than one in 10^7.

Modular Expandability

Simplified design permits easy addition of other optional features including automatic remote control of record-playback functions, answerback memory, and built-in modems. The compact $1500 KSR (keyboard send-receive) model is easily converted to the standard $2750 ASR model by addition of the cassette module.

OEM and quantity discounts are available. Contact the nearest TI office listed below for more information on how *Silent 700* terminals can cost-effectively improve your data communications system performance. Or contact Texas Instruments Incorporated, Digital Systems Division, P.O. Box 1444, Houston, Texas 77001, phone (713) 494-5115, ext. 2126.

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CIRCLE 39 ON READER CARD

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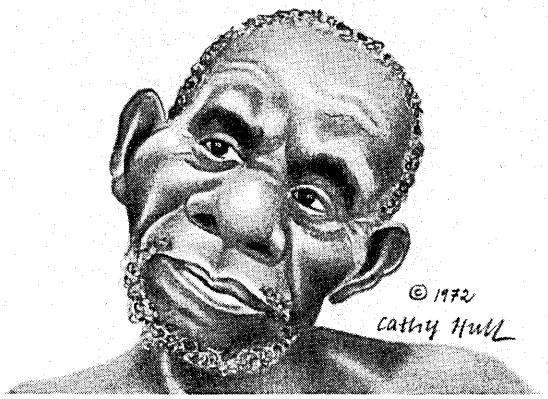

The Problem of the Perplexed Pygmy.

A dauntless bush pilot bailed out of his burning plane into a remote jungle, where he was captured by a tribe of savage pygmies and condemned to death. Only one question stood between him and that "Great Squadron in the Sky": the manner in which he was to die.

Tribal custom dictated that this decision was to be left to the witch doctor who, by asking each victim to make an affirmative statement, effectively forced each to seal his own fate.

If the voodoo man considered the statement to be true, a tribesman would shoot a poisoned dart into the victim with a blow gun. If the witch doctor judged the statement false, the victim would be burned at the stake. Either way, the future looked bleak for the flier. His death was an apparent certainty to all assembled, except to the shrewd flier. He pronounced a short statement which so perplexed the high priest that he called off the execution.

What did the flier say?

Commercial.

Whatever the flier said, it gave the witch doctor something to worry about. We'd like to suggest something to you that you *won't* have to worry about: Capitol/Audev 6400 computer tape.

New Capitol/Audev 6400 has at least twice the storage capacity of the tape you're using now, 6400 fci instead of 3200 fci. Yet it performs at any existing system density — 556 bpi, 800 bpi, or 3200 fci, on any transport.

And it performs quietly, with virtually no head wear or oxide shed.

Capitol/Audev 6400 also performs reliably. Every reel is 100% certified, with the guarantee of no first pass permanent errors at the specified system density.

Get full details about problem-free Capitol/Audev 6400 — and the answer to the Perplexed Pygmy's problem — by writing today to Dept. 10, Audio Devices, Inc., 100 Research Drive, Glenbrook, Conn. 06906.

Be our customer.

And let us solve your computer tape problems.

Capitol/Audev

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Dorothy Tucker is Chairman of the New York City Chapter of ACM. She's also Internal Training Consultant for the Computer Systems Department at Bankers Trust, a position with considerable management responsibility. She's involved in a highly sophisticated in-house training function, keeping managers and systems analysts in one of the largest banks in the country up-to-date on the latest trends and techniques in data processing education.

"I wouldn't be in this job if it weren't for ACM" says Dorothy. "I had been involved in DP education and marketing for a number of years. My ACM Committee work and chapter meetings resulted in a lot of additional contacts. One of them led to this job.

"Since joining the bank, I've found my activity in ACM helps me do my job better. It's not just keeping up with the state-of-the-art. It's reinforcing the professionalism of our field. And using my leadership experience in motivating volunteers at ACM to do a better job in DP training work at Banker's Trust. I really think ACM has helped me find—and grow in—a new, satisfying career.

Dorothy Tucker has more than enough ability to do her job well. Being active in ACM gives her something extra.

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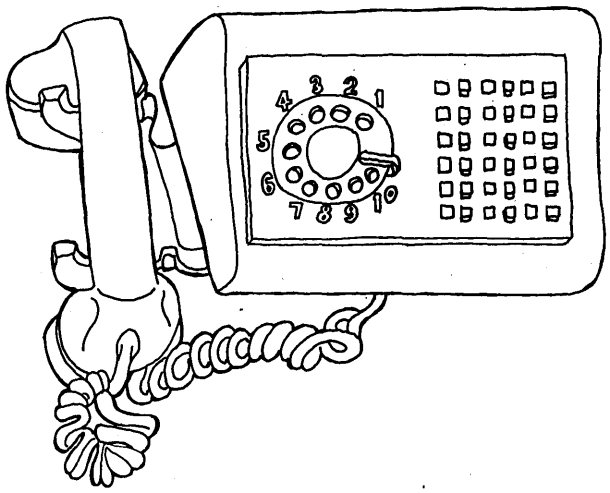

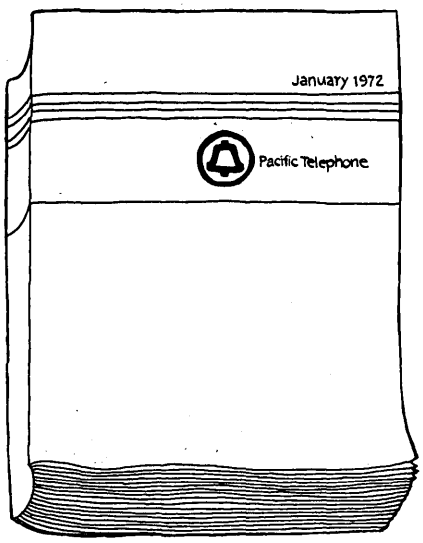

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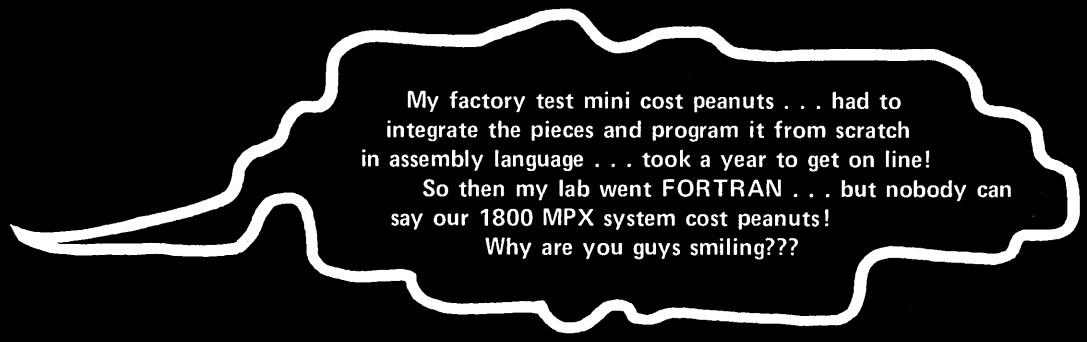

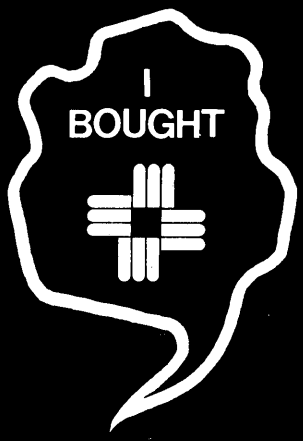

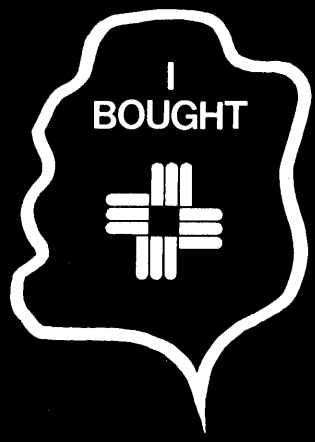

The MODCOMP II, newest MODCOMP family member, is a 16-bit, 800 nanosecond computer with FORTRAN IV that operates under the MAX III foreground/background executive. A system configuration with 16K words of memory is listed at $9500.

The MODCOMP facts are available on request . . . for further enlightenment

modular computer systems

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CIRCLE 31 ON READER CARD

Hardware

Hardware Notes . . .

A system that stores both digital and graphic information on the same high-density hologram has been developed by engineers at Hitachi's central research laboratory. The major problem they had to overcome was the unacceptable level of image resolution deterioration as photographs and diagrams were reduced in size by the same method applied to textual information. Their solution is a system in which the graphic information is read as analog, then broken down into parts too small for the eye to detect, subjected to the laser beams, passed through random phase shifters, and concentrated with a lens. The result is a memory system that can store all the information in a 500-page, 8¼ x 11¾-inch book on a hologram no larger than a postage stamp. It's a laboratory device for now, but the Tokyo-based firm says we won't have to wait too many more years for commercial products.

The first 256K 360/30 has gone into operation at Greyhound Computer Corp.'s San Francisco data center. The memory, manufactured and installed by Computer Hardware Consultants and Services Corp., Newton, Pa., is four times the original maximum memory allotment of 64K and gives the 30 an impressive performance boost. Greyhound pitted it against a string of cpu-bound compile jobs that take its 256K 360/40 14½ minutes to do. The 30, at 18 minutes, was 24% slower, but these jobs could never have been run on the 64K 30. Benchmarks run on I/O-bound jobs showed the 30 and the 40 to be roughly equal, but the model 30 uses Software Design Inc.'s GRASP spooling package, and the 40 doesn't.

Expanded memory capacity is also being offered for selected IBM 370 models. Starting in April, Itel Corp., San Francisco, will offer up to 4 megabytes of semiconductor memory for any model 155 or 165.

Trade-in allowances seem to be the latest in industry pricing schemes. Honeywell offers it on its newest 2000 series machines (Nov., p. 180), and now mini manufacturer Interdata, Oceanport, N.J., offers 25% off the price of its New Series model 70 processor to owners of the older series 3 and 4.

Batch Terminal

The 4775 intelligent batch terminal is a take-off on the vendor's faster and more neatly packaged 4780 terminals. Its advantage is a price cut of more than 25%.

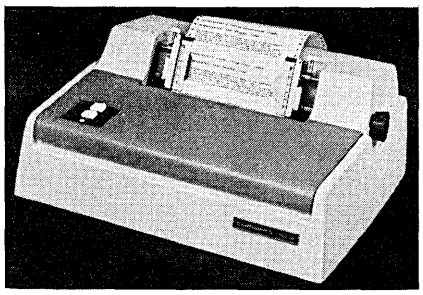
Built around a Lockheed SUE mini, the 4775 is configured with a 400-cpm card reader and a 135-lpm and dot-matrix printer in its base form, the Model 1. The Model 2 gets a 300-lpm printer good for six copies at a time (instead of three). The prices for these machines are $25,400 ($775/month including maintenance) and $29,250 ($875/month), respectively. Available options include a 600-cpm card reader, a 60-200 cpm card punch, mag tape, crt, and teleprinter.

Both models emulate a 360/30 Work Station under HASP, an IBM 2780, CDC 200 User Terminal, Univac DCT 2000 or 1004. Software is included for this emulation and for off-line EAM processing. Deliveries are scheduled for the second quarter of 1973. SCS REMCOM, Garland, Texas. For information:

CIRCLE 134 ON READER CARD

Matrix Printer

This buffered line printer, the Model 306, opens a new range of performance for users with minibudgets. Available as an on-line peripheral with a standard 75,000 cps parallel interface or as a remote terminal with a transmission speed up to 9600 baud, the matrix device spins out 80-character lines at a rate of 100 cps for a price



more like that of a 30 cps unit. That rate translates to 60 to 150 lpm on up to five-copy pin-fed forms.

The moving print head puts down a whole character at a time using 8-bit ASCII characters from a 64-character set. Characters are constructed from a 5 x 7 matrix (7 x 9 characters are available optionally). Anticipating a popularity like its predecessors, the 306 is offered not only with more characters per set (to 128) but also with character sets for 17 different languages. Elongated bold-face characters can be made in any of the sets.

Best of all, the printer is priced at $1995 in single units in its on-line form, and can be interfaced to most popular computers, the vendor claims. CENTRONICS DATA COMPUTER CORP., Hudson, N.H. For information:

CIRCLE 131 ON READER CARD

Printer/Plotter

The Alphagraphic 1100 may be the only electrolytic printer/plotter on the market. It differs from look-alike electrostatic devices in that it uses treated paper, and does not require inks or toners.

The device functions as a line printer (180 lpm on 128-character lines) or as a plotter (10 inches per second paper speed with 75 dot/inch resolution). Interfaces are available for DEC, H-P, and Data General minis, among others. Printing is done with 64 ASCII characters in 5 x 7 matrix form.

Prices are $6,050 each for single units with double buffering, or as low as $4,800 in large quantities. Availability is 30 days ARO. LITTON DATALOG DIV., Melville, N.Y. For information:

CIRCLE 135 ON READER CARD

Ocr Document Reader

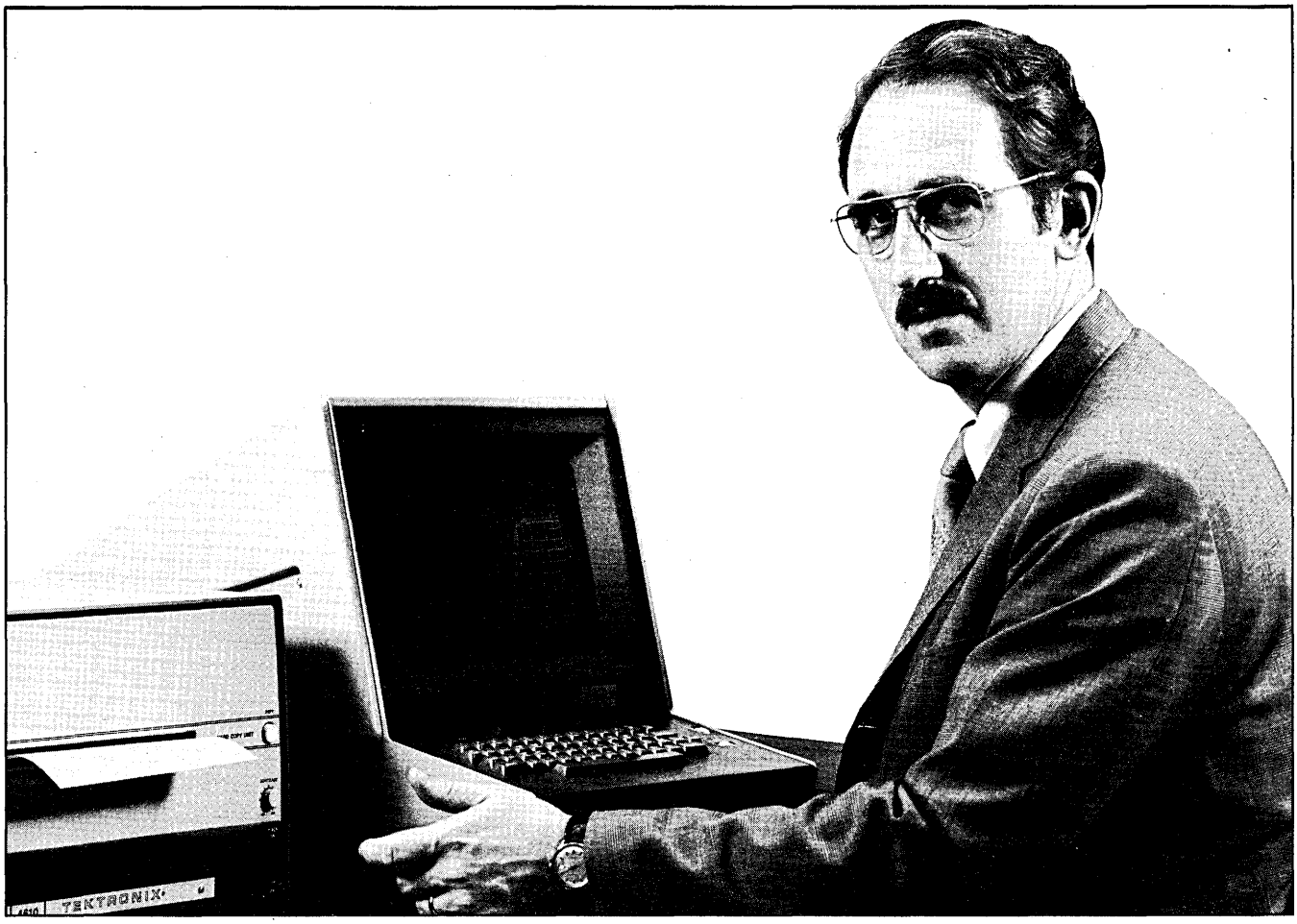
The model 7100 is just about as easy to operate as a copying machine. After powering it up, a cursor is adjusted to the line that is to be read, a reset button depressed, and the document is fed into the machine. One or two lines per document can be read, and documents can vary in size from 2 x 3 inches up to 6 x 9 inches. After sending the information to a buffered card punch, a cassette, or magnetic tape unit, or even over a modem to a computer, the documents are placed in accept/reject stackers. The character set recognized is OCR-A size 1; all the numerals; C, N, S, T, X, Z; hook; fork; chair; and vertical bar. The reject rate is said to be less than one in 10,000, and the substitution rate less than one in 50,000. In quantities of 100, the 7100 sells for $4450 each. Leases for the unit can be arranged. COMPUTER ENTRY SYSTEMS CORP., Silver Spring, Md. For information:

CIRCLE 136 ON READER CARD

Office Computer

Burroughs may find salesmen from two of its divisions pitching the same commercial application customers now that the accounting machine line has been expanded to include the L8000. Larger and faster than any of its other office machine series, the 8000 could challenge even the B1700 in some ap-

LOW COST GRAPHICS



FOR THE INNOVATOR WHO WANTS TO EXTEND THE POSSIBILITIES.

Maybe you're one. Impatient to work on the future. You think conceptually, so you want to see ideas when you need them.

The alphabet alone doesn't supply your answers. With our graphic terminal, you have the ability to change and test alternatives. In a flash. You can instantly interpret relative positions of any process. You can project your ideas and relate them to history. You can game more of your theories in an hour than you could in a day on a plotter/printer. It's like having a magic tablet. Control is at your fingertips.

We have the software, too. You can hook-up to over 25 different computers. Just add our subroutines to your program and run. You can even do complex line drawing with automatic scaling, clipping and windowing.

The 4010 has alphanumerics with graphic capability. Want full upper and lower case along with graphics? You'll get it in our new 4012. And if you're into APL, we have the first graphic terminal on the market. The 4013. You can start with a 4010 for as low as $3,950.

All of the 4010 series lets you use our terminal peripherals; paper or mag tape readers and recorders. Even control remote display devices. When you need a record of an idea, push a button. Our 4610 Hard Copy Unit will reproduce it on the screen in 18 seconds.

We service what we sell, too. And guarantee it.

Now, wouldn't it be nice to have more time to innovate? Find out how. Write: Tektronix, Inc., Information Display Products Division, P.O. Box 500, Beaverton, Ore. 97005. Or call (503) 292-2611. or Tektronix Datatek N.V. P.O. Box 7718 Schiphol Airport The Netherlands

TEKTRONIX®

CIRCLE 65 ON READER CARD

plications.

The L8000 is rated at up to 32 times as fast internally as earlier "L" series machines. It can perform a two-byte add in 3 usec, including a fetch from its 1.5-usec semiconductor memory.

A COBOL machine, the L8000 has from 4K to 48K bytes of user semiconductor storage in addition to space reserved for the control programs. Dynamic memory overlays allow larger programs to be run. Downward compatibility with other Burroughs' accounting machines—and a kind of upward compatibility through its COBOL subset—gives the L8000 something the vendor calls "instant maturity."

Prices start at $12,990 for the cpu, a keyboard, and printer. Options include mag tape cassettes (necessary for sorting), magnetic record ledger handling, and complete applications programming systems. (Since the company is unbundled, the latter could run as much as $3700 for a ready-to-roll wholesale system with general ledger, sales accounting, financial reporting, etc.) BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 137 ON READER CARD

Tty-compatible Crt

A year ago this firm offered what it says now was an "immature" implementation of a good idea. It consisted of a 64-character ASCII keyboard with an optional built-in acoustic coupler and a set of wires that clipped on to a user-supplied tv set for $960. But the tv could display only eight lines of 32 characters and wasn't quite what the market wanted.

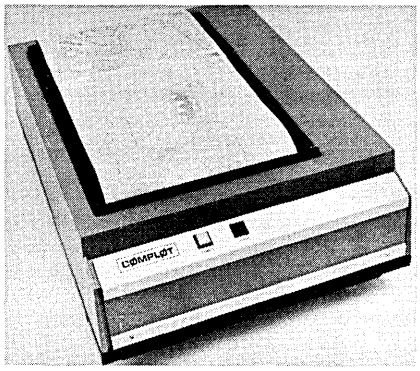
This rebuilt version, designed to be transparent to the model 33 tty, is called the DIGI-LOG 33. Its ASCII keyboard and acoustic coupler remain relatively unchanged, but the monitor supplied with them can display 16 80-character lines, with 40-character line length and hard copy printer also available. The standard data rates are 110 and 300 baud when using the coupler, or the unit can be hardwired for 9600-baud communication. The choice of interfaces includes current loop, EIA RS232, and basic TTL. The 33 only weighs 10 pounds, making it a lot more portable than the product it competes against, and it's priced at $1395, including the acoustic coupler. Delivery will be shortly after Christmas for the first units. DIGI-LOG SYSTEMS, INC., Willow Grove, Pa. For information:

CIRCLE 138 ON READER CARD

Printer/Plotters

White roll paper feeds through the Complot CPE-57 printer/plotter at a rate of about 120 inches/second whether the unit is printing alphanumerics or graphics or both. The speed of the electrostatic device leads to 1,228 square inches of 0.01-inch resolution plotting or 733 lines of alpha per minute on 11-inch forms.

Aimed squarely at the market held by Gould and Varian, the CPE-57 can



be attached to small, fast machines like the Digital Equipment Corp. PDP-11 or large, fast machines like 360s. It is priced as low as $6500 plus interface for a printer-only model, $7000 for a plotter-only model, and $8000 for a split personality unit. The interfaces can up the price by $1500 to $4000.

Supporting software is in FORTRAN; the character set is ASCII; and six sizes of print characters are standard. Script or other lettering styles can be added as factory-installed options. HOUSTON INSTRUMENT, Bellaire, Texas. For information:

CIRCLE 139 ON READER CARD

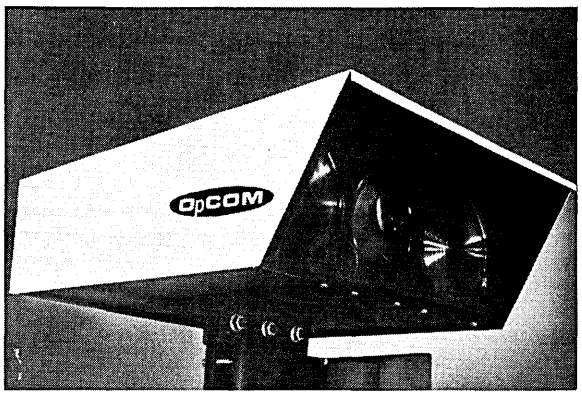
Multi-font OCR

IBM considers its 3886 optical character reader a "small" system at only $91,000 or so; and by IBM measures that may be true. Still that doesn't seem like an exorbitant price for a unit that will read OCR A, OCR B, Gothic numerals, or handprinted numerals (in either the European or English style) mixed on the same document. The 3886 does this at speeds from 5,800 per hour for 3 x 3-inch documents with 8 characters of data each to 330 per hour for 8½ x 11-inch documents with one line of 78 characters. Paper sizes to 9 x 12 inches (32 lines of 82 characters) are accommodated.

Actually, two models are available—Model 1 for on-line operation to a 370 running under a VS operating system and a slightly slower model 2 for off-line operation (to a 3410 tape drive). Model 1 has a 24K built-in buffer, expandable to 96K; Model 2 has 32K, expandable to 104K.

Two printing options are available—one to add a serial number of 10 digits

product spotlight



Laser Communications

User interest in optical data transmission remains high primarily due to its promise of solving communications problems without the "aid" of the phone company, its relatively low cost, and, to some extent, its Buck Rogerish aura. Optical units introduced to date, however, have relied on infrared light, and the maximum range we've heard claimed was about one mile—in clear weather.

The Laser Data Link (LDL) has been successfully used by its developers at ranges up to 25 miles in clear weather, but the firm doesn't want to guarantee operation at that distance. It does say, however, that 8 miles through smog has been achieved, and that's without repeater stations. A pulsed gallium arsenide laser is used to transmit up to 24 voice-channel T1 lines or a number of 40.8-kilobit links with its 1.54-megabit data rate.

Third-party maintenance can be arranged, but with its totally solid-state construction, it's claimed the LDL is very reliable. Currently available are RS 232C, MIL Std 188C, AT&T 303, and WE D1 channel bank interfaces. In the works are signal repeaters for extending the range. A typical configuration, consisting of two transmitter/receiver units, 100-kilobit clock, and an RS 232C interface is priced at $9600, with deliveries in small quantity off the shelf. OPTICAL COMMUNICATIONS, INC., Orlando, Fla. For information:

CIRCLE 130 ON READER CARD

Today mini users need faster and larger memories. For the first time, DIVA now offers the 2311, 2314, and 3330 type discs for minis.

Your mini can be from the DEC, Data General, TI, or Interdata families, including the DCC-116 and the GE PAC 3010/2. The disc drives can range through the entire size spectrum. They can be mini – the Floppy Disc, small – 2310/5440, intermediate – 2311, large – 2314 (including dual spindles and double densities), or they can be the largest – the 3330. DIVA's controllers can integrate any combination for you.

Does your application need disc compatibility between a mini system and a 360? How much would it be worth to be able to pre-process data on your mini's disc packs and then transfer the packs to a 360 without worrying about disc format changes or DOS compatibility?

If you only need a controller, DIVA will provide it. If you need the mini and the controller, DIVA will provide them. If you need the complete system of mini, discs, and controller, DIVA will provide it. Standard items include complete I/O driver software, diagnostic software, and hardware as necessary.

Call or write Dave Britton at DIVA to find out just how far DIVA can stretch your mini's memory and meet all of your requirements for fast, large, and low cost disc controllers – or complete systems.

Five times the capacity of the 2310! Twice the speed! The same price! This is the DD-14, DIVA's newest total disc system.

The DD-14 has a capacity of 29 million bytes, a transfer rate of 312,000 bytes per second, and an average access time of 35 milliseconds. It offers mini users – with mini budgets – the opportunity to break away from the 2310 and upgrade their disc systems by an order of magnitude. The price is $12,800.

This concept is frankly revolutionary. There is nothing available today in its price/performance class for the mini user who must increase memory size without increasing total system cost. The DD-14 has the same total disc compatibility with all minis that exists within the disc systems of the 360.

Worldwide field support is provided to all DD-14 users through qualified service centers.

DIVA

DIVA INC.
58 Maple Ave., Red Bank, N. J. 07701
(201) 842-6500

Industry's Source for Disc Systems

to each document read, the other to add a user-defined error code in the margin next to lines containing a format error or unreadable character. The options are $7400 and $5100, respectively (plus $1400 for an adapter for either or both). Base price for the 3886 is $91,000; in addition, Model 2 needs a tape drive ($7700 and up). Shipments are scheduled for the third quarter of 1973. IBM CORP., White Plains, N.Y. For information:
CIRCLE 142 ON READER CARD

Small-scale Systems

A Data General Nova 1220 minicomputer, a Centronics 165 cps serial printer, and a Computer Operations LINC tape peripheral are included in this business system for $895/month on a three-year lease, including maintenance. The software development can be performed by the vendor under a separate contract and typically requires $5-7K "front money." The application programs written for the first customer included programs for order entry, order preparation, and customer invoicing. Availability of the system depends on the amount of software required, but will typically be 90 days. The 25-employee software and systems engineering firm will initially concentrate on eastern seaboard companies interested in customized computer applications. INTERNATIONAL COMPUTING CO., Bethesda, Md. For information:
CIRCLE 147 ON READER CARD

Mini Voice Response

The S-11 SPEECH SYNTHESIZER is a voice-response system complete with interface that plugs into the UNIBUS channel of the Digital Equipment PDP-11. The SYNTHESIZER assembles words using a set of 54 phonemes under the guidance of a software package that allows the user to construct the desired phrase. The total vocabulary is limited only by the amount of memory on the mini. Memory can hold up to four different inflections of the phrase so that users won't dread listening to it.

The S-11 can talk through speakers or headsets, or there are options for coupling it to the telephone network. Additionally, a Touch-Tone input decode option makes two-way communication possible, in effect making any telephone a terminal of the mini and its voice-response system.

Interfaces for some other common minicomputers and a 360/370 channel interface are also available. The price of the S-11 is $5K including a modem. Demonstration units are ready; production units are available approximately 90 days aro. INTERFACE SYSTEMS, INC., Ann Arbor, Mich. For information:
CIRCLE 143 ON READER CARD

Office Computer

The P 603 is one of those products that's hard to classify generically: It can be used in all the typical accounting applications, but also remembers alpha information and performs word processing; and it can communicate with other computers via off-line paper tape or through an on-line communications link, qualifying it as an intelligent terminal.

The hardware consists of a number

Drum Printers

These two vendors are offering 600-lpm drum printers to end users, both based on the popular Data Printer Corp. V132 (132-column) model that has been offered to oem's long enough for 1,000 to have been installed.

Digital Associates' model designation for the printer system is 600 DP, supplied with complete interfacing and cabling hardware. It's available for the following computers: Digital Equipment PDP-8, 11, and 12; Data General Nova line; the Hewlett-Packard 2100 series; Varian's 620 models; all Interdata Corp. cpu's; and some rarer machines. Including most interfaces, the complete system sells for $12,550, or rents for $420/month on a three-year lease.

Installation and complete maintenance is offered nationwide and in Canada, with a typical maintenance charge of $100/month for parts and labor during any eight hours of prime shift time (8 a.m. to 6 p.m.). Units are immediately available. DIGITAL ASSOCIATES CORP., Darien, Conn. For information:
CIRCLE 141 ON READER CARD

Peripheral Data Machines also offers the 132-column, 600-lpm Data Printer Corp. printer, but can also supply an 80-column variant. The 132-column model accepts paper widths ranging from 3½ to 19½ inches and prints its 64-character ASCII repertoire on up to seven copies. The printer and interface are packaged together in a sound-deadening cabinet.

Interfaces are available for the following computers: Digital PDP-8 and 11; Hewlett-Packard's 2100 series; the IBM 1130; the Honeywell 316 and 516; the Data General Nova series; and the Varian 520/i and 620/i. Complete documentation covering the operation and maintenance of the print system is provided with the printer, and periodic or as-required maintenance can be provided nationwide (but to some extent depending on the specific area) on a separate contract.

The price of the 132-column model is $11,520, and the 80-column unit is $1K less. Third-party leases can be arranged. PERIPHERAL DATA MACHINES, INC., Hicksville, N.Y. For information:
CIRCLE 157 ON READER CARD

of core-like storage registers for serial instruction execution from magnetic cards or tape. The 603 can be programmed in a logical language by anyone with an eighth-grade education, says its maker, and constructed programs can be dumped onto magnetic cards for external storage. The card is then reinserted into the machine to restore the application program.

Also available (optionally) are read-only memories that contain fixed-instruction sequences called by a user program or through the typewriter keyboard for calculating trigonometric, exponential, and logarithmic functions; for generating special constants; and for doing floating-point operations. Optional peripherals include magnetic tape cartridges (an auxiliary memory that can hold up to 28,672 data characters or instructions), ASCII paper-tape reader and punch, and an XY plotter. The basic 603, capable of executing 384 program steps, is priced at $6260. OLIVETTI CORP. OF AMERICA, New York, N.Y. For information:
CIRCLE 140 ON READER CARD

Business Systems

The Digital Equipment DATASYSTEMS series is a set of hardware and software offerings based on DEC's PDP-8 and PDP-11 minicomputers. The packages will be offered both to oem's and to

what DEC terms "highly self-sufficient" customers, such as large corporations that have programming staffs capable of doing the application software required. System software and utilities are supplied by DEC.

The 300 series has three models—the 320, 330, and 340—all based on 8K PDP-8 12-bit computers. The 320, priced at $28,834, includes the mini, four DECtape drives, an alphanumeric keyboard display, printer, and the Commercial Operating System (COS) monitor. The 330 model adds 3.2 megawords of disc storage, raising the price to $32,385. The model 340 adds another 3.2-million-word disc drive (two additional units can be attached) and loses the DECtapes. This model sells for $32,485. Included in COS is DIBOL (DEC-supported COBOL), a sort/merge utility, foreground/background capability, and a data entry package that runs in the foreground partition and supports eight interactive display terminals.

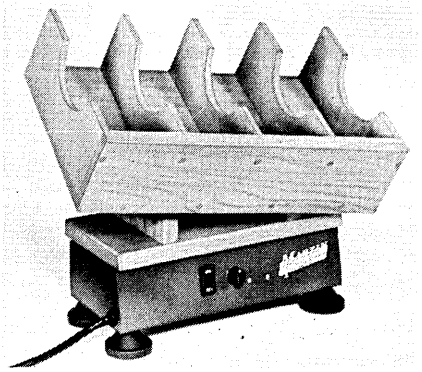
For now there's only one member of the 500 level systems, the model 520. It's a 32K PDP-11 16-bit mini, two 2.4-megaword cartridge discs, a 300-cpm reader, crt display, and 132-column printer, priced at $52,220. COS at this level controls RPG II and FORTRAN IV language processors, in addition to the standard MACRO assembly language. Sort/merge is also included in the software.

It's a big step up to the DATASYSTEM 700, available in a myriad of configurations ranging in price from $60-150K. The 700 can be either a PDP-11/40 for supporting up to 16 simultaneous users of DEC's RSTS monitor (resource time-sharing system), or a PDP-11/45 with up to 124K words of real memory, 160 million words of disc storage. Statements written in the BASIC-Plus language are checked line by line for validity by RSTS. Delivery time runs from four to five months on the systems, which will initially be marketed in Boston, New York, Chicago, Los Angeles, and San Francisco. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 145 ON READER CARD

Card, Paper Joggers

Describing a card or paper jogger as "solid state" might seem pretentious, but in the case of these nameless models, the claim seems to be justified. Most joggers use electric motors and belts and are irritatingly loud. By contrast, these units use electromagnetics to joggle at 60Hz. Operation is quieter, and the unit probably won't tend to move around on the table surface. The paper model accommodates documents up to 11 x 17 inches, and the card model is divided into four bins,



each of which holds 3 inches of cards. The price is $129.95. MARTIN YALE BUSINESS MACHINES, Chicago, Ill. For information:

CIRCLE 144 ON READER CARD

75-ips mtu: $3K

The TDX series of tape drives is offered to oem's and most minicomputer users. The drive is an American design built under contract in Japan and shipped back here. The speeds available are 23, 37.5, 45, and 75 ips, with choices of 7-track (ASCII) or 9-track (EBCDIC) read/write heads and electronics, and all popular densities. Oem's can buy 9-

track, 800-bpi, 75-ips versions for $3K each in orders of 100 units. An IBM 1130 unit, complete with controller, drive, cables, and cabinet is priced at $11K to users. A similar system for the Data General Nova is priced at $8500. Maintenance is performed nationwide by Honeywell. INFOTEC, Plainview, N.Y. For information:
CIRCLE 149 ON READER CARD

8-bit Minis

Touching all the bases at one time, this firm has announced four minicomputers that span a price range of $3200 to $8500 and cover applications running from oem controllers to communications to education.

The 1600/60 is a communications dual processor. It includes a model 1600/30 8-bit arithmetic processor which can perform a 32-bit add in 6 usec; has 1,536 words of 200-nsec read-only control store; and can have up to 32 buffered channels, up to four multiplexor subchannels, and an unreasonable number of daisy-chained programmable channels (over 300 are theoretically possible).

The 1600/60's minicomputer front end performs communications functions and error checking, providing data transfers at up to 50KB. It and its 1600/30 arithmetic counterpart have separate busses to a common core which is rated at 1 usec and comes in chunks from 8K to 64K.

A smaller configuration including the 1600/30 is the 1600/40 educational system, which can handle up to 32 terminals running BASIC programs. The unusual part of this offering is that the compiler and operating system-like software is all in factory-loaded firmware.

The 30 is available alone, too, at a price of $6500 including enclosure. The firmware and alterations that make it into the 40 bring the price to $7150. The 1600/60 communications dual processor runs $8550. Maintenance is provided at rates from $100/month, depending on configuration and distance from a major airport. Software is composed primarily of editors, debugging programs, I/O drivers, and utilities (including disc utilities the vendor thinks approach a disc operating system).

Finally, the 400/10, a bottom-of-the-line 8-bit machine constructed around a "Microbus" that looks something like a Digital Equipment Corp. "Unibus" to us, is a faster and cheaper upgrade of an older model. It features from 1K to 64K of core, a programmed (buffered) I/O channel, a direct memory access channel, 114 commands, a real-time clock, power fail restart, and a slug of other features at an oem price of $3190 for a 4K version. MICRODATA CORP., Irvine, Calif. For information:
CIRCLE 146 ON READER CARD

Oem Tape Units

The AT 1052 is a single-capstan tape drive that operates at 75 ips. It's a little different from other such drives we've seen in that it performs its rewind function without drawing the tape out of the vacuum columns, which the manufacturer says reduces the chances of tape damage. The 1052 automatically threads the tape with or without the IBM tape cartridge. Oem's can order an assortment of recording densities, tracks, and heads for both read/write, and read-after-write modes. In quantities of 50, NRZI models of the 1052 sell for approximately $8K each, with units available 4-5 months aro. POTTER INSTRUMENT CO., INC., Melville, N.Y. For information:
CIRCLE 150 ON READER CARD

Card Punch

The speed of the P100 depends on the number of characters being punched; it varies from the 100-cpm rated speed to three times that if 10 or fewer of the 80 columns are being punched. The unit has a single input and single output hopper. It will be available in January for $9990. DOCUMATION INC., Melbourne, Fla. For information:
CIRCLE 132 ON READER CARD □

Software & Services

Software Notes . . .

Great Britain, like the U.S., is very concerned with the performance of its air traffic control system. The Ministry of Defence has appointed Computer Analysts and Programmers Ltd. to investigate techniques for achieving maximum flexibility in real-time computing systems—particularly air traffic control. Considering the aspects of ATC that CAP will study, it appears the U.K. may choose to scrap what it has now and start anew. Under study are the problems of accommodating different types of I/O devices during the lifetime of a system; how to design a system allowing for partial or complete restructuring of the data base so future advanced features can be implemented; and how to design a system so that functional changes don't endanger its performance.

Still in the U.K., the Royal Radar Establishment in Malvern, Worcestershire, is offering its Algol 68-R compiler through ICL to all 1900 computer series users running the George 3 operating system. Only a nominal charge for distribution costs is asked, and among the improvements claimed over standard Algol 68 are the ability for users to define and operate on any data structure desired and to handle references to objects.

Users finally are starting to realize that there are ways to improve computer installation performance without touching the hardware or software, according to Software Sciences Corp. in New York City. The firm claims nearly 70 installations of Scope (System 360/370 Computer Operator, Programmer Evaluation) since last year's announcement. Scope consists of 21 different multiple-choice tests for system and application programmers and for computer operators. The programmer tests cover such subjects as the Cobol, Fortran, PL/1, and assembler languages; operating system facilities; debugging techniques; and telecommunication systems. Operator tests are available for the OS and DOS monitors and the Hasp spooler. Software Sciences has just announced that Scope is available for perpetual usage, a change from the previous policy of delivering the tests for a one-time examination. A nine-module set for OS or DOS sells for $11K on a nondisclosure agreement.

PL/1, BAL Measurement

The STROBE software monitor has previously been able to measure the performance of COBOL production programs in terms of percentage of cpu time spent in each routine and in terms of I/O overlap. Measurements were related to symbolic names rather than to addresses. Now it is also offered in versions which can do this for PL/1 and assembly language programs.

STROBE operates under OS MVT or MFT and requires 4K of extra space for the routine that collects the data. (A second program for reporting on that data takes 90K.) Nine reports show cpu usage by symbolic source tags, statement numbers, and storage addresses, among other information. Overlap is emphasized, as are the 10 most active procedures, the most active disc cylinders, and least active core.

Overhead for data collection is said to be about 5% for programs over a couple of minutes. The monitor is priced at $9400 for one language and $1000 for each additional language processed. (But a version intended for one language can do the work on programs in another language, too, except for relating to symbolic names and statement numbers.) PROGRAMART CORP., Cambridge, Mass. For information:

CIRCLE 221 ON READER CARD

Report Generator

Although report generators were invented to make the constructing of reports easier, the job is often still too complicated, especially for inexperienced programmers. With EASYOUT, the programmer need not concern himself with horizontal spacing; instead he gives field lengths, titles, and even can specify how far apart two fields should be. In addition, the input is free format and in nearly plain English.

For instance, he may write FROM = 11 THRU 16, EDIT = $, TITLE = 'NET AMOUNT', ADD TO = TOTAL, IMPLY. The program will then take character positions 11 through 16 from each input record, add a dollar sign and two decimal positions, print a heading, and build a running total. Other commands and operations are equally easy looking.

Written in assembly language to replace "tough-to-use" RPG, the program operates in 24K under OS and typically compiles in a tenth of a second on a model 65. It is available in object form for $750. M.H. MCKINNEY, College Station, Texas. For information:

CIRCLE 222 ON READER CARD

Cobol Optimization

A typical savings in total execution time of 27.6% has been experienced on COBOL programs run through this optimization service, according to its vendor. Since anyone would like to save that much time, the critical evaluation factors become cost and reliability. The vendor guarantees that no problems will be caused by his system and will accept liability for (proved) damages if anything ever does occur.

Pricing of the service is handled in three ways: You tell them what your computer time is worth per hour and guarantee them 50% of the first year's savings on the improved programs, or you pay 50¢ per card on a flat-rate volume, or you pay 25¢/card if you have a good number of programs (like 200) that you would like to turn over at the same time. (Or the program can be purchased for $30,000 if you really have problems.)

Turnaround time is said to be a couple of days, and programs for most machines are accepted, including Burroughs, GE, and IBM. The vendor cautions that smaller savings—8-10%—are realized on character machines, however. (But the cost is still based on net savings.)

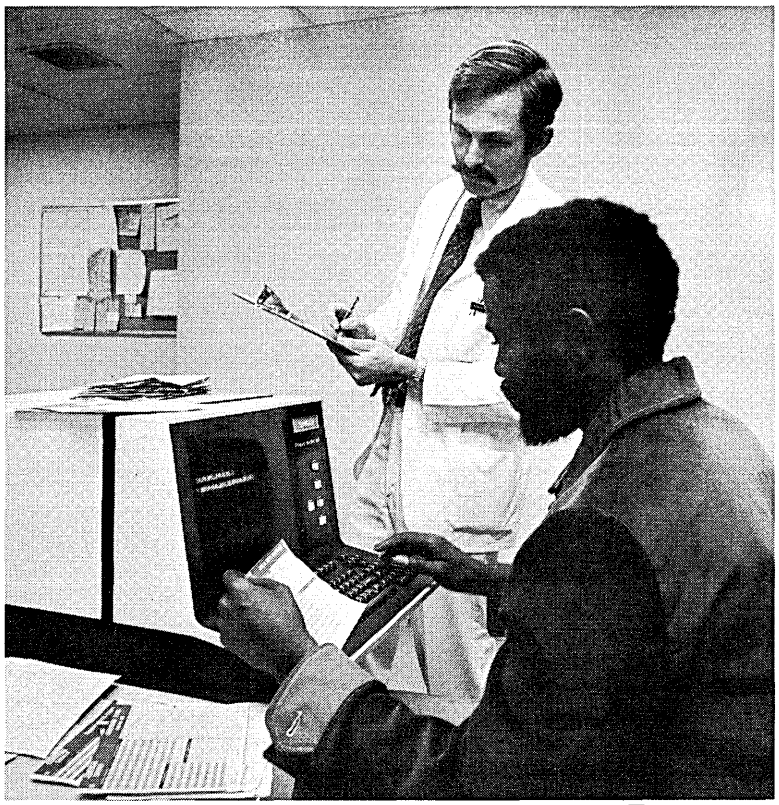
To do the job, a source deck and any associated library routines are required. The parameter-driven optimization routines will alter file structures if allowed, or note where additional savings could be realized from altering file formats. And since the optimizer program works on source code, it complements any optimization done at the object code level by mainframe manufacturer's utilities. The service is free if it doesn't do anything for you, which seems like an offer hard to refuse. UNIVERSAL DATA SERVICES, INC., Washington, D.C. For information:

CIRCLE 223 ON READER CARD

Library Cataloging

This vendor claims that magnetic tape, disc, and data cell files are defended from operator error and even from operator stupidity by the Quartermaster library cataloging program, which is also said to make applications programming somewhat easier and reduce the number of tapes and disc packs in use. Programmers benefit by being able to address data sets by name instead of address or physical device.

The program maintains a volume catalog on disc for disc and drum files with volume table of contents information, and for labeled tape files. This catalog is checked for information like expiration of retention period and



How Denver General Hospital took the emergency out of its replenishing procedures.

Denver General is a 350-bed hospital in Colorado's capital city.

Like most hospitals, it struggled with a 150-day inventory load that still couldn't eliminate expensive rush ordering.

Its accounting system couldn't account for more than 75% of all items moving out of inventory. Which meant that somewhere along the line, 25% of proper patient charges weren't being made.

This year, Denver General installed SYSTEM TEN* computer by Singer.

Now, Denver General bills from its accounting process 100% of all inventory used.

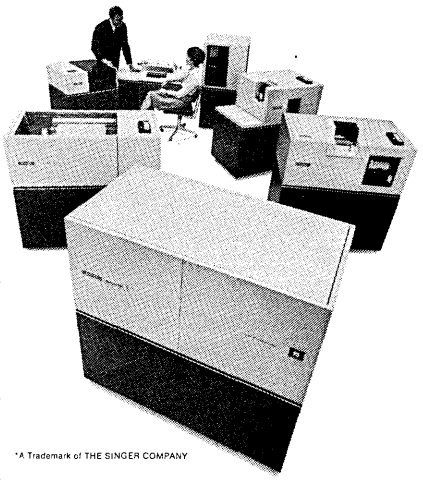
The hospital is now working with a 30-day inventory, with virtually no rush-ordering.

Every ward and every service orders supplies through SYSTEM TEN. Files are constantly updated. The system prints out on a regular basis: balance on hand, current usage, year-to-date usage, year-to-date receipts, and current receipts. A stock status report is printed monthly, but could be done daily if needed.

Once a week, purchase orders are generated from the system, with the ability to override orders in order to increase them, decrease them, or not order at all.

Soon, another SYSTEM TEN will take over the hospital's total accounting system, following patients from admission to discharge, tracking charges, preparing bills — even preparing the General Ledger. Together, the two systems will give Denver General an automated cost accounting system.

We can supply you with all the facts on SYSTEM TEN installations for many industries. Specific case histories that include hardware, software, configuration, sample forms, costs. Just contact your nearest Singer Business Machines representative. Or write: Singer Business Machines, San Leandro, California 94577.



*A Trademark of THE SINGER COMPANY

System Ten by SINGER

whether a certain program may access that file. A daily transaction run is used to put new tape numbers into the system, to extend SAVE periods, or to release data sets ahead of time. During that run, Quartermaster scratches tapes and makes file space available.

Written in PL/1 for use on 360s and 370s, the program is installed by the vendor as part of the $7500 package price, even at sites that don't have the PL/1 compiler. Also included are manuals for operators, librarians, and systems programmers, which attempt to put all the answers to JCL questions in one place—contrary to IBM's way, the vendor claims. Quartermaster is said to be transparent to OS, and it adds a task to each job and executes in space allocated to that job step rather than independently in another part of memory. PHOENIX-HECHT INC., Chicago, Ill. For information:

CIRCLE 224 ON READER CARD

ISAM Replacement

OS/AMIGOS, a replacement for IBM's ISAM, has been around for a few years, but using it required converting those applications programs that were originally constructed to use ISAM. This option reportedly makes existing programs interface with AMIGOS-formatted files by simply translating ISAM requests into equivalent AMIGOS code.

AMIGOS is claimed to offer improved speed (reductions in program elapsed times of 20-80% depending on disc usage), smaller core requirements (a basic reduction of 6K, plus another 600 bytes per file minimum), and reduced disc requirements (typical savings of 15-20% on fixed-length records).

The program still requires that the user's files be converted (through a free utility) and that minor changes be made in the JCL. The vendor states that "if they can find the JCL, they can make these simple changes."

AMIGOS runs $8K on a one-year contract or $17K for three years. The ISAM transparency option adds a one-time charge of $500 to those prices. COMRESS, Rockville, Md. For information:

CIRCLE 225 ON READER CARD

Easy-to-use CPM

LESS/TIME is a critical path method program oriented to the manager willing to forego handling a large amount of highly detailed project description data in favor of handling less data more quickly.

It's offered in 8K and 16K 16-bit versions set up for the IBM 1130, but it's written in FORTRAN IV and can be transported to other systems. LESS/TIME features multiple starting and ending events, random event numbering, organization codes, holiday and work-week length cognizance, etc. Reports include a list of the input cards, an event status listing, a project activity report that can be restricted to a span of dates or to certain organization codes, a bar chart showing the schedule data in graphic form, and a milestones chart.

The 8K version sells for $1K, and the 16K edition is $1250. LESS/TIME will be supplied in object deck form on a customer-supplied disc cartridge. Installation and training are offered separately. RAY SAUER, Los Angeles, Calif. For information:

CIRCLE 226 ON READER CARD

Improved DOS Spooling

Version One of the DOS ASAP spooling system sold against IBM's free POWER program on its ability to operate in significantly less core (6K vs. 18K for a minimal case; 10K vs. 26K or more for two partitions, the vendor claims): because it did not require its own partition; and because it could begin outputting immediately rather than having to wait till the end of a job.

Version Two offers all those features plus printer/punch backspacing for

paper or card jams; multiple-copy output requests from control cards; partition balancing (making BG and F2 partitions equivalent priority); automatic peripheral assignment changes for changing between partitions; a job accounting interface; and support for new peripherals, including the 3330 disc. Like version 1.0, ASAP 2.0 can run in small nonmultiprogramming installations.

It is available free to Version One users and for $3500 to new customers. An output-only version runs $2900. UNIVERSAL SOFTWARE INC., Danbury, Conn. For information:
CIRCLE 227 ON READER CARD

PDP-11 Operating System

If the TAG-11 operating system for Digital Equipment Corp. PDP-11s really does run from two to five times as fast as DEC's own DOS-11, then there may be some truth to the rumor that DEC is rewriting its DOS—possibly to avoid embarrassment.

Part of the improvement in TAG-11 is said to be from better arrangement of disc sectors and part from swapping larger blocks between disc and memory. Also, TAG-11 takes only 8K of core compared to 12K for DOS-11 and requires less resident memory.

Available with a single-user BASIC compiler, a link editor, loader, extended editor and octal debugging aids for $1200, TAG-11 comes for less than $900 when bundled with this vendor's discs or DECtape-like mag tape peripheral. DATA SYSTEMS DESIGN, Berkeley, Calif. For information:
CIRCLE 228 ON READER CARD

Cobol Generator

Three kinds of skeletal programs are created by AXIOM TWO—for file updating, file copying, and report generation. Running from parameterized input forms, AXIOM TWO can produce operational COBOL programs that need only to be fleshed out with JCL and with additional computational clauses if desired.

Now requiring 64K on a 360/30 or larger machine, the vendor is trying to cram the source generator into 32K. The program, said to be easy to install and use, is distributed in object form on tape for $4000. DIMENSIONAL/EXPORT SOFTWARE CORP., Los Angeles, Calif. For information:
CIRCLE 229 ON READER CARD

Time-shared MIS

Straight BASIC was thought too difficult for nonprogrammer use as a file-building and report-generation language, so the subset used for FLEXIMIS disregards some rules and makes talking to a computer more comfortable. FLEXIMIS has three modes of operation: conversational (where the program asks for a selection criteria and the user responds with something like "all workers with hours over 48"), prompting (where the system prints all the options and the user chooses), and control file mode (where the selection criteria and reporting formats have been previously stored).

The program is an upgrade of one that did not offer some of the trickier options like OR and BUT Boolean statements, subtotaling, and "set" items (a kind of indexing by internal parameters). Functions performed include plotting, checking, listing, sorting/merging, updating, modifying, and subtotaling, among others.

A big plus is the fact that the service is on a national network so that large corporations can maintain central data bases to be accessed by FLEXIMIS. The service is offered in 250 cities in the States and in eight overseas countries as part of GE's Mark III. The pricing for it is based on a $7/hour minimum terminal connect charge, plus 7¢/computer resource unit, plus 50¢/1,920 characters of storage. GENERAL ELECTRIC INFORMATION SERVICES, Washington, D.C. For information:
CIRCLE 230 ON READER CARD □

software spotlight

Readable Dump

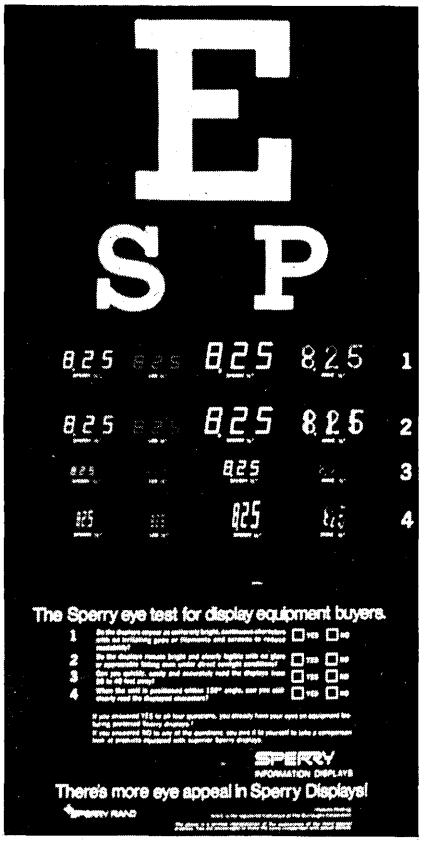
ABEND dumps are difficult to work with unless you particularly enjoy converting hex to decimal and hunting for option bits. So it might be worth $195 to an installation to get this dump package, which adds readable data to the dump without displacing any that the regular program prints. The additional material appears just before the hex listing, in English, and gives about 17 data items, including block size, logical record length, volume serial number, sense bytes, I/O completion codes, the region size and how much of it was actually used, dispatch priority, and what OS release the job was run under.

The package, called simply G92638 because the vendor did not want to go through a copyright name search, is added to the SVC LIB, so it takes no extra core. It works under OS MVT. Users are given both source and object code, and are offered a 21-day free trial. Maintenance will be handled through the mail. M. A. PILKERTON CO., Anaheim, Calif. For information:
CIRCLE 220 ON READER CARD □

Literature

Eye Appeal

An eye chart which doubles as a display equipment buyer's guide compares the appearance of the vendor's displays, LED's, and Nixie tubes and



outlines factors which should be considered in the selection of equipment using displays. SPERRY INFORMATION DISPLAYS, Scottsdale, Ariz. For copy:
CIRCLE 200 ON READER CARD

Source Data Collection

Bulletin in 12 sections describes a source data collection system, covering construction, assembly details, life expectancy, pricing, major features, and electrical and mechanical or operating specifications. MOHAWK DATA SCIENCES CORP., Herkimer, N.Y. For copy:
CIRCLE 201 ON READER CARD

Sorter-Scanner Study

Case study outlines a southeastern phone company's use of an IBM 360/20 and a Scanak Model 216-40 sorter-scanner to handle service billing without keypunching. The study includes illustrations of all documentation involved. CUMMINS-CHICAGO CORP., Chicago, Ill. For copy:
CIRCLE 202 ON READER CARD

Transmission Corridors

Technical bulletin called "CORRIDOR: Computerized Environmental Impact Analysis" reviews a computerized method of mapping transmission corridors for cross-country rights-of-way. The publication covers electric power-line application but notes that the same technique is applicable to highways, pipelines, telephone wires, or other routings over public and privately owned land. A series of computer graphics is used to illustrate the impact of such environmental factors as future land use, economic value analyses, population density, and other land use restraints. COMPUTER SCIENCES CORP., Los Angeles, Calif. For copy:
CIRCLE 203 ON READER CARD

High-speed Printer

A four-page brochure covering vendor's TermiNet 1200 high-speed data communication printer also lists optional equipment available to supplement the printer in communication systems operation. GENERAL ELECTRIC COMMUNICATION SYSTEMS DIV., Lynchburg, Va. For copy:
CIRCLE 204 ON READER CARD

Credit Authorization

Six-page brochure describes a point-of-sale credit authorization system that operates independently of a store's central edp system. It is made up of terminals, crt displays for referral situations, a controller, disc memory, and a modular software package. DATATROL INC., Hudson, Mass. For copy:
CIRCLE 205 ON READER CARD

Planning Software Projects

Bulletin describes a planning technique which it says helps reduce computer programming costs with "thorough plans and accurate estimates leading to effective project controls which ensure that software is done right the first time on time." SHERRITT ASSOCIATES, Pasadena, Calif. For copy:
CIRCLE 206 ON READER CARD

Disc Controller

Data sheet describes a self-contained disc controller which interfaces any 16-bit processor and up to eight IBM 2311 and 2314 compatible drives. It also interfaces IBM-compatible single or double spindle, standard or double density units including Century Data models 212 through 215. TELEFILE COMPUTER PRODUCTS INC., Irvine, Calif. For copy:
CIRCLE 207 ON READER CARD

Report Generation

"A Quick Look at QUICK QUERY" describes a new version of a report generation system for the Honeywell 6000, Honeywell 400, and IBM 360 and 370 series computers. The 70-page document contains a sequence of report requests with corresponding query forms and generated reports. CONSOLIDATED ANALYSIS CENTERS INC., Los Angeles, Calif. For copy:
CIRCLE 208 ON READER CARD

On-Line Accounting

Brochure describes a general accounting service called RC/Basic which handles billing, accounts receivable, sales analysis, and inventory control via terminals in a customer's office. ISC/PRYOR COMPUTER, Chicago, Ill. For copy:
CIRCLE 209 ON READER CARD

Card Reader System

Four-page bulletin describes a card reader system which permits reading data from punched cards into vendor's Micro 800 and Micro 1600 computers. The system consists of a card reader, an interface controller, and necessary interconnecting cables and mounting hardware. MICRODATA CORP., Santa Ana, Calif. For copy:
CIRCLE 210 ON READER CARD

Synchronous Modem

Six-page brochure describes a synchronous modem capable of automatic answer operation at 2400 bps over dial-up telephone lines. Included are descriptions of important features, theory of operation, and complete technical specifications. INTERTEL, INC., Burlington, Mass. For copy:
CIRCLE 211 ON READER CARD

Computer Eye

Case history series includes a description of how a low-light-level television camera is being used at Stanford University as an "eye" for a computer involved in artificial intelligence studies. The computer, equipped with a metal hand, already has mastered Instant Insanity, the children's game which requires stacking multicolored blocks in such a way that no adjacent sides have the same color. SIERRA SCIENTIFIC CORP., Mountain View, Calif. For copy:
CIRCLE 212 ON READER CARD

Digital Data Links

Brochure describes a new series of digital data links which provide a means of transmitting synchronous digital data over a short haul line-of-sight path, at rates up to 1.544 megabits per second. The systems require no FCC licensing and are for use in areas of local data and voice distribution. OPTICAL COMMUNICATIONS, INC., Orlando, Fla. For copy:
CIRCLE 213 ON READER CARD □

EVERYBODY CAN USE IT AT ONCE.

Computer aided design. Graphic production work. Graphic data reduction. With Calma's Graphic Data Station you can do them all. On one system. At one time.

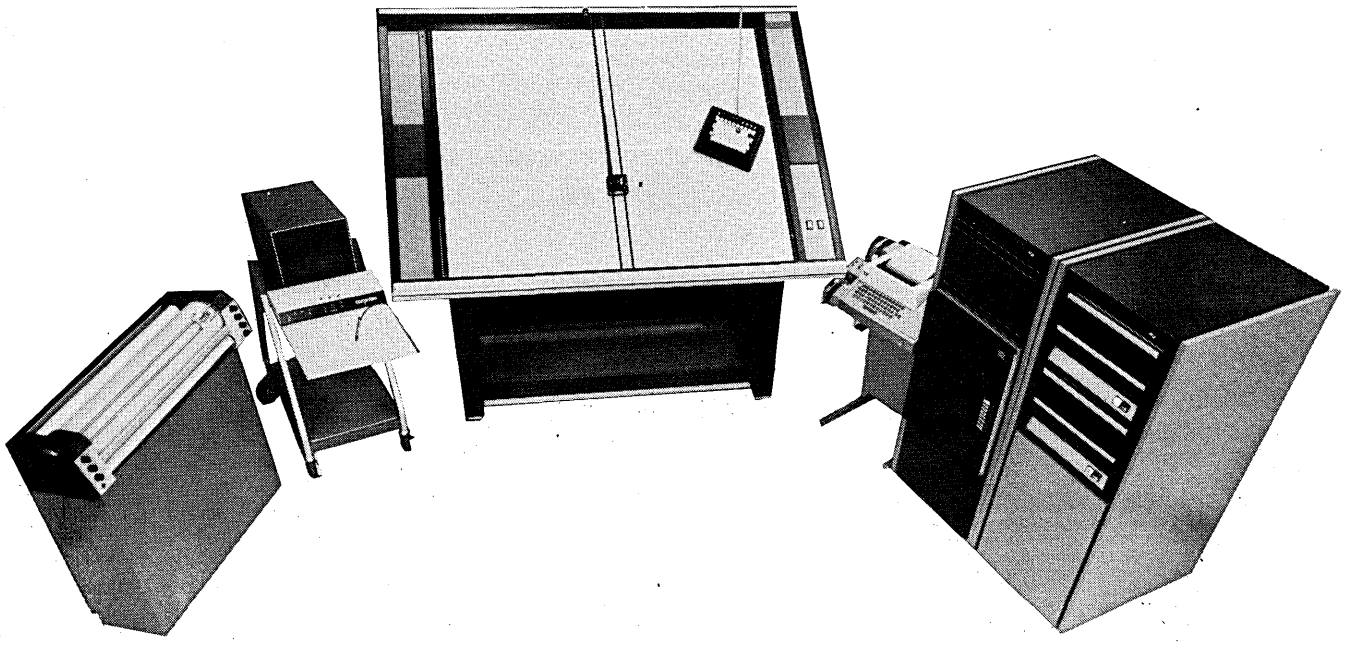
The system's disk operating system is so powerful that six work stations (digitizers *or* graphic tablets) can operate simultaneously – with CRT displays and alphanumeric keyboards at each station if desired. At the same time, three plotters, cutters or pattern generators can be run on-line in the background while control tapes are generated for off-line use. And with all these devices working, there is no appreciable degradation of system performance.

This true multi-processing of graphic data is possible because the GDS is built around its own 12K word computer and 2.5 megabyte disk memory (expandable to 10 megabytes).

The system is completely modular. Start with one work station and expand later without obsoleting a single component. Calma's huge and constantly expanding software library is fully supported.

Learn why the Calma Graphic Data Station is outselling all other interactive design and production systems worldwide today. Send for our new brochure. Calma Company, Corporate Marketing Headquarters, 1930 Isaac Newton Square East, Reston, Virginia 22090. Phone (703) 471-1450.

CALMA COMPANY



People

"We want to keep it simple, do the common uncommonly well," says JAMES H. VAN WAGENEN, president, Globe Decision Services, Inc., of his company's initial offerings in the information services market. Globe is newly spun off as a separate profit center from Swift & Co., the multibillion dollar conglomerate best known for its operations in the food field. Van Wagenen was Swift's director of information services for two years prior to the spin-off. He believes this effort to take his company's computer resources to the open marketplace will succeed because "we know what the marketplace is like and because we first assured ourselves we could meet all internal needs and still have something to offer to the outside."

J. H. Van Wagenen

He feels similar attempts made "while the bloom was on the rose" failed because they were made hastily, without recognition of the realities of the marketplace or internal requirements and, in some cases, because of too vertical an orientation. Globe, says Van Wagenen, will not zero in on a single market, "although we have in-house capabilities in things like insurance, oil, and, of course, food." Globe will start by offering software packages, systems analysis, systems design, programming, operations research, computer services, and facilities planning. Although it offers on-line services internally, it won't sell these outside for now and probably won't at all, "unless we develop a special type of program which we feel could be beneficial offered on-line."

Facilities management is definitely on Globe's list. Before joining Swift, Van Wagenen was head of systems development for the Fibers operation of Celanese Corp. and earlier held marketing positions with IBM and MAI Equipment Corp. Of his "keep it simple" philosophy, Van Wagenen notes "that's something I have to sell my staff; they tend to lean toward the complex." He said one of the reasons behind the spin-off was "the surfacing of a variety of specialized talents." Globe currently has 130 employees, and Van Wagenen expects this to grow to 300 in a year. Currently 3% of its activity is outside work, and this is expected to reach 5% in a year and "to grow significantly after that." The firm has five U.S. computing centers and a nationwide switched communications network.

Anyone who dreams of getting out of the crazy computer business for the solitude of the country should talk to VINCENT A. VAN PRAAG: you never leave it behind. For 20 years, the 57-year-old computer industry veteran has been starting computer companies—or, later as a consultant, rescuing them. He's now the managing partner in a group of former Scientific Data Systems people who in recent years have acquired 28 citrus ranches in southern California's lush Coachella Valley near the Salton Sea. They run them by computer.

Vincent A. van Praag

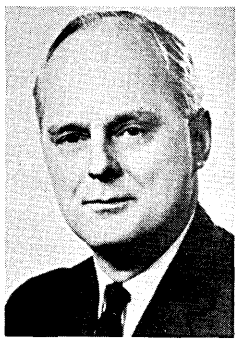
Using a Novar terminal in a Palm Desert office and a 360/50 time-shared in Los Angeles, van Praag last year computerized all day-to-day accounting. Soon he'll complete development of a minicomputer-based system in the desert that, in addition to accounting, will be used

for production, soil and market analysis, and for making acquisition decisions. With the system—two 12K PDP-8/Ls, using assembly language—his partnership will be able to analyze 58 different factors that go into making the decision to buy a ranch. Data for each of the 28 ranches are contained in 350K cassettes.

The group acquired its first ranch four years ago as a tax shelter. They now have 2,000 acres, most bought in "very poor shape," requiring three years to be taken into the black. "It's not unlike the early days in the computer business when you didn't have enough money to operate nor the information on which to make decisions." Innovation had to be substituted: the group built the first known mechanical tree pruner—5" diameter saws mounted on a trailer; it pays the worker 20% above the average and gives many of them motorcycles to patrol the ranches.

Van Praag left the Air Force in 1952 to join the Bendix Computer division which he left in '57 to cofound Packard-Bell's computer operation with Max Palevsky and Robert Beck. When Beck and Palevsky left to form the phenomenally successful SDS, van Praag became a consultant and cofounder of a number of small companies, "how many, I don't know, and I won't say how many made money." But back at the ranches things are looking good. They're targeting a return of $1K per acre vs. the average there of $800 for well-run citrus ranches.

A huge paper company is keeping a watchful eye on paper's replacement—microfilm. Last fall, Scott Paper Co., with annual sales of close to $1 billion, formed a business information systems division in Holyoke, Mass., to exploit the activities of its Scott Graphics division as a supplier of diazo microfilm and the hardware to reproduce it. Chosen to run the division as its vp and general manager was CHARLES P. YERKES, a well-known micrographics specialist who formerly was president of Yerkes-Wolf, a consultant firm. Dr. David R. Wolf, the firm's vp, also joined the Scott division as director of market and product development.



Charles P. Yerkes

Yerkes said he's observed a growing trend towards a "merging" of dp and micrographic technologies, particularly in the management of large data bases. "Lots of data never again needs to be manipulated," Yerkes says, "so it doesn't belong in a data base, even though it has to be referred to often." Instead, it's microfilmed, reproduced, and distributed to those who need it. And they use the central computer only to locate it.

This is showing up primarily in insurance companies to keep track of policy holders. Only such "key" information on an application form as name, birthdate, and social security number, is stored in the computer, together with indexing information to retrieve the information that doesn't change very much and which is microfilmed.

Scott said it formed the division to develop and sell "sophisticated micrographic information systems," but Yerkes said in an interview late last fall that how the company would do it still was in the planning stage. Yerkes, a mechanical engineer who has done graduate work in business administration and physics, is a director of the National Microfilm Assn. He has held marketing posts within the microfilm business, including the post of sales manager of NCR's microform products operation. □

Books

The CAI Author/Instructor
by J. C. Meredith

Educational Technology Publications, Englewood Cliffs, N.J., 1971
127 pp., $5.95.

This slim volume (26 of its 127 numbered pages are blank filler sheets, known as "chapter opening pages") contains several important hints and warnings to the instructor who may one day find himself in the role of CAI author. The advice in this book is based upon the author's experience in preparing CAI material for a graduate course in librarianship in the Institute for Library Research at the Univ. of California (the particular campus is not named).

There are two especially good pieces of advice offered in this book. One deals with the illusory "simplicity" of some CAI languages:

". . . even though there exist 'high-level user-oriented' CAI languages with which a novice can learn to work very readily, such initial facility is quite superficial. Nothing in CAI is as easy as it looks. The amount of mechanistic scheming and arranging needed to exploit a good CAI language, the placement of symbols and delimiters, the detection and analysis of errors—all take a good deal of time and attention. There are hidden constraints in every language, and the creators of computer languages are not very good at explaining them to amateurs."

Another good point concerns the instructor's participation in the choice of a CAI system:

"The author/instructor needs a running headstart to develop the requirements for the particular system he would like to have at his disposal. The best configuration for one kind and level of instruction may not do at all for another kind and level, but if the teacher is not in a position to assert a preference well ahead of time, the engineering, programming and cost considerations will eclipse all else."

However, once the book gets beyond these preliminaries and focuses upon the actual preparation of CAI course materials, difficulties arise. At the end of his introduction, the author states:

"This guide deals only with computer-assisted instruction of the kind often referred to as 'conversational' or more accurately 'directed dialogue.' "

It turns out that the kind of dialogue dealt with is that in which the instructor asks a question and uses the student's wrong or partially wrong answers to guide him to the correct answer. This is a technique which a good teacher uses in class discussions, and the suggestion that this be done on a computer represents a form of teacher simulation. The examples in this book show programs which ask questions, analyze the responses, and deal appropriately with the exposed state of the student's knowledge.

The relative merits of teacher simulation as a CAI strategy cannot be discussed in any depth in this review. But what must be discussed are those parts of the book which could only confuse and mislead the reader who has little or no acquaintance with the state of the art in CAI.

The first item which must be straightened out is the context within which Meredith places teacher simulation. He does not discuss the range of alternative CAI approaches, saying only:

"Directed dialogue CAI differs rather sharply from computational CAI, which deals mainly with mathematical and engineering concepts, usually in a drill-and-practice or problem-solving vein."

The reader would clearly be justified in inferring from the above passage that there are roughly two forms of CAI, directed dialogue and computational, and that problem solving and drill and practice are both examples of computational CAI, yet neither inference would be correct.

Taking the last point first, problem solving *is* an example of computational CAI, but drill and practice is *not*.

Computational CAI is in wide use at the college level, and is gaining in popularity in secondary schools. The purpose of computational CAI is to allow the student to deal with material which could not otherwise be included in the course. The student writes and enters the source program himself. Computational CAI is in use in fields of study where lengthy calculations are required: engineering, mathematics, accounting and management science, the social and health sciences, etc.

In contrast, drill-and-practice CAI is found almost exclusively in elementary education (the only exception being adult remedial programs). Its purpose is to provide the teacher with a daily summary of student performance on standard test items. The student works only with problems which have been stored by somebody else (or generated by the program in reaponse to his performance). Drill-and-practice programs are in use today in elementary arithmetic, spelling, and reading.

More importantly, there are more than two forms of CAI. Meredith simply does not mention interactive (tutorial), prescriptive (computer-managed), simulation (other than teacher simulation), or lesson storage and retrieval modes of CAI. But each one of these modes has advantages for partic-

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Charlie Asmus, Sales Director, The Grand Tour
DATAMATION 35 Mason St., Greenwich, Conn. 06830 (203) 661-5400

ular instructional situations, and the audience to whom this book is addressed should have a clear picture of the full range of different ways in which computers are used to aid the instructional process.

A second point which calls for clarification concerns an issue upon which almost all writers who discuss the preparation of self-instructional materials agree. Meredith is in good company when he urges that the CAI author should include in his course planning a definition of the objectives of the course, and a specification of important characteristics of the intended student population. The problem raised by Meredith's treatment of this issue is that, having told the reader to state objectives and student characteristics, he simply drops the matter, and does not tell his readers what to *do* with such statements. The CAI author really needs to know the terms in which course objectives should be defined, and student characteristics specified. Furthermore, the CAI author needs to know precisely how such items are related to his final product. In what ways would his completed course be different if the objectives, the student characteristics, or both had been different? Perhaps these items are not crucial for a program which attempts to simulate the teacher end of a teacher-student dialogue, but then why mention it at all? The reader is left in the confusing position of having been told to do something, but not being told how, or why.

A third and final point concerns the reasons for revising CAI materials. In his introduction, Meredith discusses the difficulties inherent in revising instructional sequences, but warns that:

"Still, the author/instructor must be prepared to make changes in response to group opinion, with the best show of cheerfulness he can muster."

Later, in Chapter 4, we read:

"One excellent hedge against the painful necessity of performing deep surgery on an existing program in order to win its acceptance is to engage one's associates in some of the early planning. One should seek the most candid criticism ahead of time, rather than waiting until all the work is done and the program is ready to go online."

One could easily get the impression from the above passages that the only reason for revising CAI programs is to win the acceptance of one's academic colleagues. I suggest that this emphasis upon "group opinion," especially in the absence of any alternative discussion of the process of course revision, ignores the fundamental purpose of the CAI effort, namely, the instruction of the student. If a CAI course is designed to teach something, then the primary motivation for revising the material should be any evidence from testing with students that the course does not teach. By failing to point this out, and by concentrating instead upon the politics of winning peer approval, Meredith does a disservice to the student and to the CAI author. In Chapter 11, Meredith does state:

"They [the students] are, in the last analysis, the ones who know best if the system works for them."

That's true, but the implications of the statement are never developed, or even hinted at. Those who design self-instructional materials have developed procedures for systematically testing sequences using actual members of the intended student population. What the reader needs to be told here is what kinds of student performance data to gather, and how to relate such data to course revision. And here, again, the treatment in this book is less than adequate.

In summary, this book deals with using a computer to simulate directed dialogue, but lacks the scope the reader needs to put this particular kind of CAI in its proper perspective in relation to the other kinds of CAI. It also leaves the reader confused about the function of such important items as course objectives, student characteristics, and the process of revising CAI materials.

—James L. Rogers

Book Briefs

The World of EDP Standards

by Marjorie F. Hill
Control Data Corp., Systems Standards Dept., HQM268, P.O. Box 1249, Minneapolis, Minn. 55440, 1972
182 pp. $3 (paperback)

This booklet, intended as an introduction to the standards environment, is a handy reference for those now participating in standards committees or who wish to gain an understanding of the standardization process, of the standards organizations involved in the process, and the part each plays in the formulation of edp standards for the world. Although developed for internal distribution within Control Data, the document contains no mention of CDC involvement and is therefore being offered to an outside audience. Quantity discounts are available. □

letters

(Continued from page 25)

theory and idealism, though they also are important.

WILLIAM R. SIMPLER, JR.
Little Rock, Arkansas

By the way

I have been deluged by RAMIS users who have called to point out two errors in the October article, "A Review of File Management Systems," (p. 52) in which information about RAMIS was provided. At the present time, there are over 400 RAMIS applications in operation in over 75 organizations and not 23 as mentioned in the article. Also, the monthly rental price is $840, not $500.

GERALD D. COHEN
Mathematica Inc.
Princeton, New Jersey

Overwhelming superiority

In response to the letters of Messrs. Carroll and Bromberg in the October issue, (p. 25), we, as programmers who have used both COBOL and ADPAC since 1969, would like to make several additional points.

It is our experience that the superiority of ADPAC over COBOL is overwhelming. Formulation of logic, coding, debugging, and maintenance are easier and faster, making the programmer more efficient, just as the single-pass compiler and optimized macros make the machine more efficient when ADPAC is used. Mr. Carroll's estimate of 75% greater efficiency may well be conservative when all factors are considered. ADPAC is even superior in one of COBOL's supposed strengths, "self-documenting" coding. While COBOL field names and paragraph headers can be made to resemble English, this does not necessarily do anything to document the logic of the program. ADPAC's fixed-format structure makes program logic immediately intelligible to one ADPAC programmer looking at another's ADPAC program, and the 20-position comment section on each source card more than compensates for the restricted field name length.

Admittedly, COBOL does have the great advantage of already being a "standard" language. However, this results in a vicious circle; COBOL became a standard because it was widely used; now it is widely used because it is a standard. Unless installations begin to use other languages more extensively, no other language can ever become a standard, and commercial programming will never advance beyond COBOL.

Managers are afraid of ADPAC because it is not manufacturer independent and because there are not enough ADPAC programmers around. The first fear is certainly valid—for now—but if the demand arises, we are sure that ADPAC compilers can be written for non-IBM machines. The second fear is unwarranted. Even supposing that the entire ADPAC-trained staff of an installation were simultaneously wiped out, the ADPAC code can be translated into very good ANS COBOL by the POLYPAC feature. Furthermore, ADPAC is so easy to learn that a programmer experienced in some other language could handle existing programs within a few weeks, aided to a great extent by the ADPAC Language Manual, which is exponentially better than any other we have seen.

The choice is between an inefficient standard language and a super-efficient but, as yet, nonstandard language. We urge all installations to look into and try ADPAC, and we are sure that its merits will lead to the popular use necessary for it to become an accepted standard.

WILLIAM K. COUR
DONALD R. JURAN
MARILYN C. DODD
U.S. Dept. of HEW
Washington, D.C.

What's good for them

Regarding the October Forum (p. 187), I think Mr. Goetz assumes rath-

er more than he proves. Two questions come to mind:

1. Are the bad things he says about programming really the effect of the alleged monopoly on software development, or just growing pains in a discipline which is even yet not defined to the point where it can be taught in colleges at a consistent level?

2. Would "good" software really sell? It seems to me that if, as I suspect, his firm (ADR) produces good software, and good software sells, he should have no complaint. Frankly, I doubt that users really know what is "good" from them yet.

In short, Mr. Goetz, I heartily agree that programming needs some better tools; but I think they will be developed in spite of most people's desires, not because of them; and this takes R&D funding dedicated to the long run instead of to immediate market needs.

EDWIN W. BRINK
Menlo Park, California.

Cobol comfort

I was disappointed with Howard Bromberg's letter in the October issue (p. 25). His first argument for using COBOL, rather than modern alternatives such as ADPAC or PL/I, is that: "The concept of tradition is more important than economy. COBOL has been with us for over 10 years and continues to evolve. We are used to it."

It is tragic that many programmers refuse to change languages simply because they are comfortable with a familiar one. I believe that attitudes like this one are responsible for the lag in widespread acceptance of super-languages like PL/I and APL.

DANIEL D. BERNICE
Rockville, Maryland

Purchase price

Dick Brandon's article (Sept., p. 76) on "Computer Acquisition Method Analysis" covers the ground rapidly and succinctly but in doing so leaves a few loose ends.

The following are some of the questions left unanswered:

1. Is 10 years the right period to choose for comparative purposes? The answer is of course yes if you are going to keep the machine for 9 years, but probably not if you believe you will (or actually do) keep it for, say, 6 years. If you intend keeping the machine for x years, then to allow for delayed tax effects, you must evaluate over x + 1 years. That is, to compare 5- vs. 6-year lease alternatives for a machine you expect to keep for 6 years, you should evaluate over a 7-year base period.

2. What is the effect of changing the base period of evaluation? The effect of shortening the base period of evaluation is to decrease the relative attractiveness of the purchase alternative.

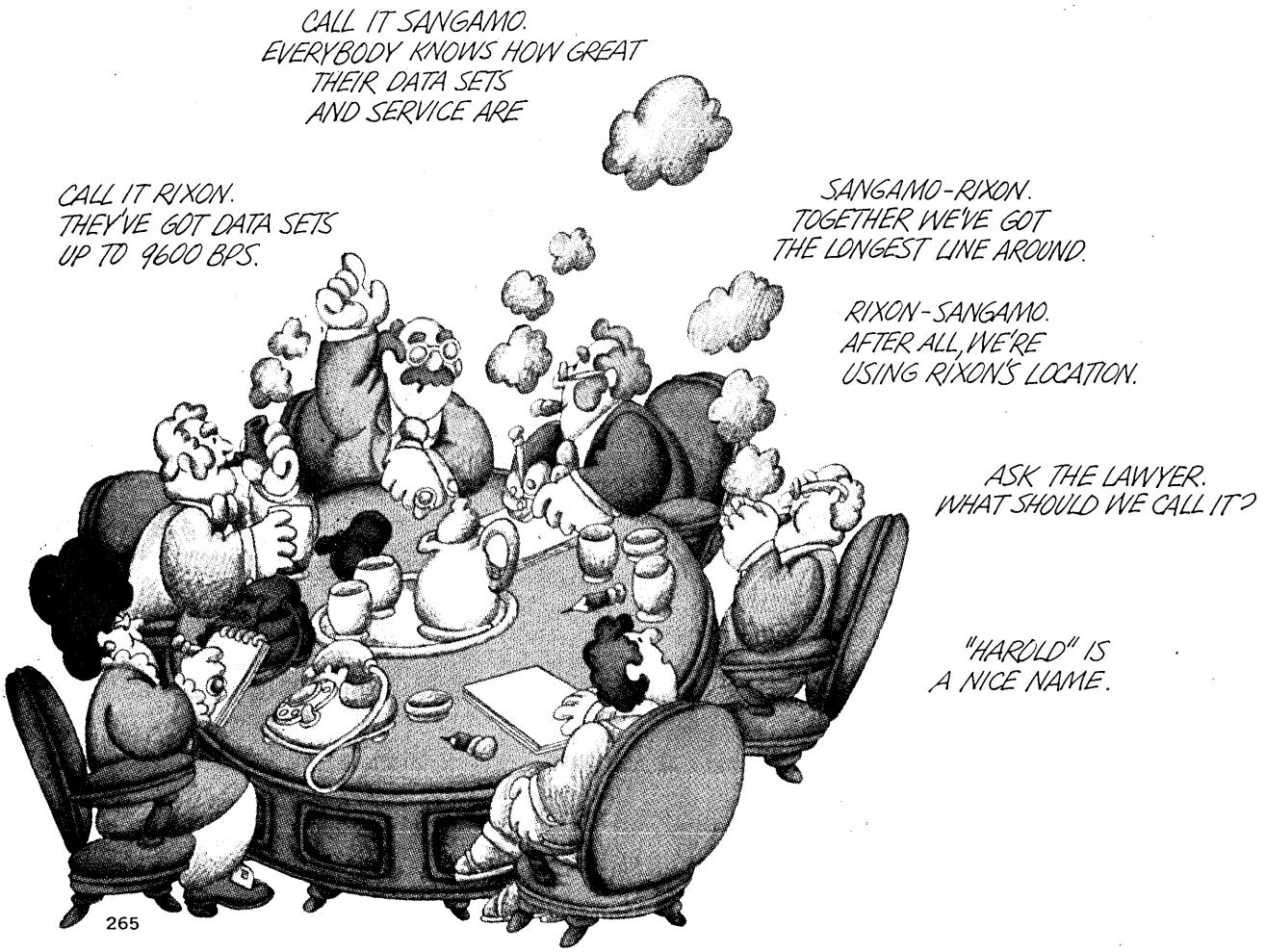
3. What is the effect of changing the discount rate? If you increase the rate of discounting above Brandon's 8% figure, you are in effect saying that cash in hand is becoming increasingly valuable to you. Thus, the purchase alternative again becomes progressively less attractive as you increase the discount rate, because by increasing the discount rate you are making the sums prove that it is less desirable to spend that nice, warm balance in the bank.

4. Which is the best acquisition method? Purchase may be but is not necessarily the answer. The answer is that method which best fits the company's financial position over the evaluation period.

5. How am I affected tax-wise? It is oversimplistic (in the U.K. anyway) to say that tax benefits allow halving of the costs of leasing and renting. This is only true (in the U.K.) for established companies with accumulated profits to offset against costs. For new companies with no profits, these tax benefits do not exist.

These points show that simple though the arithmetic provided by Dick Brandon is, there are still difficulties to be resolved in making the right decision.

J. N. CHAPPLE
London, England □



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(Continued from page 8)

be development of a standardized merchandise I.D. NRMA is working on this. NBS will help with development of evaluation criteria and will assist in judging candidate codes submitted by system manufacturers.

The two groups will attempt to promote use of reorder systems in which information is recorded on mag tape or similar media at the point of sale or nearby, and then transmitted to suppliers for processing. The program will be aimed at helping retailers reduce inventories, shorten reorder delivery cycles, eliminate paper work, and increase employee productivity.

The plan is aimed at extending the program beyond department stores to such retailers as discounters, druggists, and eventually supermarkets. An NBS spokesman said development of standardized reorder software that is machine independent is "a possibility."

SDC CORP. DROPS HARDWARE PROJECT

Citing "lack of a ready market," System Development Corp., the big software company, has withdrawn its first hardware offering--the System/One intelligent terminal. Announced at the 1971 FJCC with promises of applications packages and custom software, the product now will be reoriented toward the text composition market under a new name, Text II. A source close to the project, who has since left the company, says the concept of the project was sound. "It's just a typical case of a primarily government-supported company trying to make it in the commercial world and not knowing what doors to knock on and what support software was required."

Meantime, the Santa Monica, Calif., company has quietly been reincorporated in Delaware under a new name, SDC Corp.

DATA GENERAL TALKS JAPANESE DISC LICENSE

Data General Corp. has been talking with Nippon Minicomputer Corp. about the latter firm manufacturing DG's Novadisc in Japan. Nippon already is in high gear cranking out Data General's Nova minicomputer line. In the last year or so, the Japanese firm has shipped more than 200 Novas--most of them 1200s, but some 800s too. It probably will begin manufacturing the Supernova soon. Nippon, which claims some 30 to 40% of the Japanese mini market, has been licensed by Data General to sell its mini line for more than a year.

RUMORS AND RAW RANDOM DATA

IBM may be readying a very small business computer system, even smaller than a System/3. It would be marketed through the office products division,..We hear that the IBM 5920, a portable order entry terminal being marketed in Europe, may soon be tested in the U.S. by the Kroger food chain...And IBM is reported to have withdrawn tentative offers to upgrade existing 195s to Virtual Storage 198s. The $2 million price tag may have turned off prospective customers... Burroughs is trimming its plans for large-scale disc and tape drive manufacturing in California, placing a 300,000-sq.-ft. plant in Mission Viejo on the selling block and auctioning off machinery from that plant and one in Westlake Village. Burroughs buys many of its disc drives from Century Data...Fred Bickford, an engineer and government employee who lives in Alexandria, Va., wonders what he's going to do with two software packages he acquired as collateral on a $50,000 loan he guaranteed to a software company which defaulted last July...Informatics next month will announce Production IV, a six-module manufacturing management system, written in Cobol, and in use in some large Scandinavian manufacturing plants. It's claimed to be the first integrated system of its kind to be offered in the U.S.

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This forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

The Forum

What's New With DO?

The ANSI FORTRAN standards subcommittee (X3J3) is in the late stages of producing a new standard FORTRAN specification. Due to the widespread use of FORTRAN, and the ease with which people writing RFQs can and will specify "the compiler will process the ANSI Standard FORTRAN language" we can expect that the impact of the new standard will be widely felt independent of its merits. The statement which is expected to be most significantly modified by the new standard is the DO statement. It is hoped that this exposition of the revised DO statement will provoke comment, pro and con, so that we can determine the desirability of the tack being taken before the statement is cast in the formalese of a new specification.

Our first objective in revising the DO statement specification was to remove nebulous restrictions on how the statement can be used and devious descriptions of how the statement operates. Our second objective was to enhance the statement's capability, making it more useful to the programmer yet not a nightmare to the compiler, especially for optimization. Hopefully, compilers using the new form of the DO statement can be produced for machines with less than a quarter million bytes and still produce good object code.

```
DO 4 I=8, 2, 3
```

What should happen at execution time when this statement is executed? The responses to this question are so diverse that you find it can be used as a personal philosophy test for FORTRAN programmers.

Nihilistic: "The statement should clearly have been caught by the compiler and flagged as fatal to execution!" For these people I request that they replace 8, 2 and 3 with variables which happen to have these values and answer the question again.

Pragmatic: "It should clearly (pick one of the following, depending on which compiler is being used locally)

A. Execute the range once.

B. Skip the range.

C. Issue an error message."

Pedantic: "The standard clearly states that it should be executed . . . uh . . . let me read that section again."

Machiavellian: "The standard is weasel-worded so that you can either execute it zero times or once."

We are currently opting for pragmatic (B), i.e., the execution of the statement will result in skipping all statements through statement 4. We selected this option primarily because we feel that people encountering the language for the first time will be least surprised with the result, i.e., the DO isn't done.

The next change adopted was to eliminate the concept of "second level definition." Unless you have suffered through reading section 10 of the current standard, you probably don't know the definition of "second level definition." The net effect of this change is that when the range of the DO has been executed as many times as required, the value of the control variable is known to the programmer. You probably

didn't know you didn't know—well, now you know. As to what that value will be, you still don't know because it hasn't been decided.

If the range of a DO statement contains another DO statement and its range, this structure is referred to as a nested set of DO loops. The current standard only permits you to branch out of *and return* to the range of the innermost DO of a nest. Why you cannot leave the range of any DO in a nest and return to any DO's range which has not yet been executed as many times as requested is unknown and difficult to diagnose at compile time. In the FORTRAN users and compiler writers interest, we have decided to eliminate this restriction.

```
DO 7 M=10, 1,-1
```

Why not? Have you ever tried to count down in a DO loop? Without introducing curious intermediate variables or using nonstandard subscripts it is impossible to count down in a DO loop. We don't plan to retain this impediment any longer. To supersede the current definition in terms of the control variable being less than the terminal parameter, the concept of a trip count has been introduced. The trip count is calculated for DO 2 N=J, K, L as $[(K-J)/L]+1$, where $[X]$ is the greatest integer not greater than X. If this quantity is negative, the range of the DO is skipped as stated earlier. The DO loop will be satisfied when it has been executed this many times. For compiler writers it is important to note that this quantity need not always be calculated but only that it suffices to determine how many times the range will be executed before the loop is satisfied.

Given the trip count concept, we could see no reason for the prohibition that N, J, K and L of the example in the preceding paragraph could not be redefined during the execution of the range of the DO. Only the redefinition of L would result in any effect in the way the DO loop was performed. After examining the ramifications we decided that if we fixed the incrementation quantity at the time the DO statement was executed, this would produce the most flexible and consistent DO statement. The variable L is freed for other use and any desired gyrations of the control variable can be performed directly on N.

Via these definitions, the process of controlling the execution of the DO loop has been made independent of the operations performed upon its parameters (J, K, and L) after it has been executed. Since only the values of the variables, and not the variables themselves, are used in determining the loop controls, we saw no reason that these could not be integer expressions. We now intend to permit integer expressions in these positions.

The next obvious extension at this point is to permit the control variable and parametric expressions to be of any type, maybe even type LOGICAL might be useful! Even further, assuming mixed mode arithmetic, N, J, K and L might all be of different types. It is intended to accomplish this for the benefit of all Simpson's rule, etc., users. There is, however, a fly in the ointment. As described above, when we

the forum

execute the DO statement, the trip count and incrementation value are preserved. The latter is added to the control value prior to executing the range of the loop again. If this procedure is followed on a machine with, say, six-digit accuracy we can see truncation error creeping into our computation of the control variable. As to how much error creeps into how bad a case, I suggest you try it out on your local six-digit machine (who has one of those?). Clearly, for DO 2 X=100000., 200000.,.1 you are not going to see a lot of change in X. To avoid this, the value of the control variable could be recalculated each time through the loop via X=100000.+A*.1, where A is the number of times statement 2 has been executed. This would require that the initial value of the control variable and another iteration count be retained in memory for each loop in addition to that which is already kept. Also, the ability to carry a modification of the control variable from one execution of the range to the next would be lost. Personally, I feel that the overhead introduced by such a procedure is too large and the loss of accuracy too small to justify the adoption of such a procedure. This topic is currently under discussion by X3J3.

The above remarks are not finally approved features of the FORTRAN committee, but serve to indicate the way things are going at this time in the area of the DO statement. Your reactions and comments on this and other areas of FORTRAN are solicited. They should be sent to: ANSC X3J3, American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018.

—Fred Thorlin
Mr. Thorlin is a member of X3J3 and prepared this statement at the request of chairman Frank Engel.

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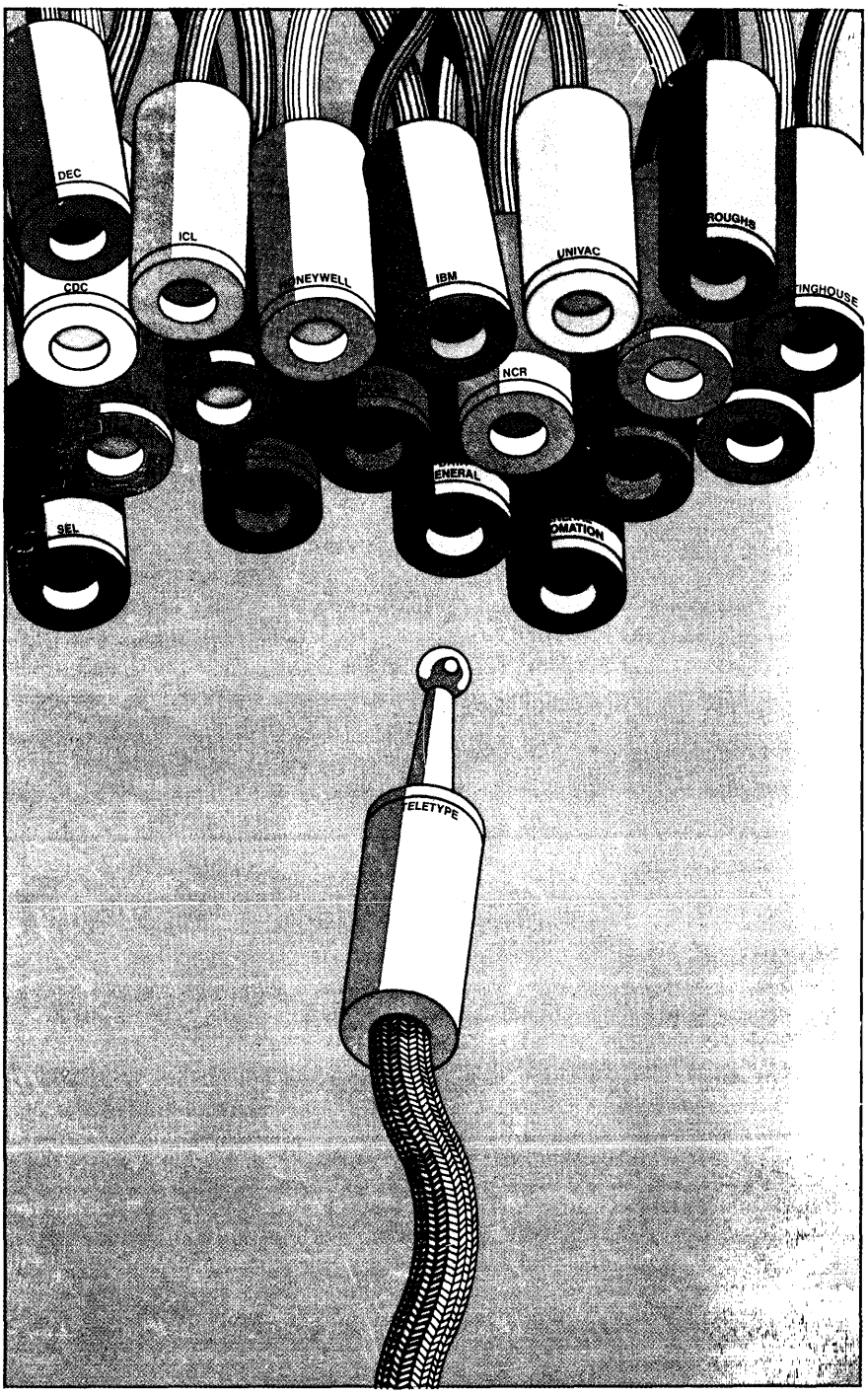

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