

DATA MATION 70[®]

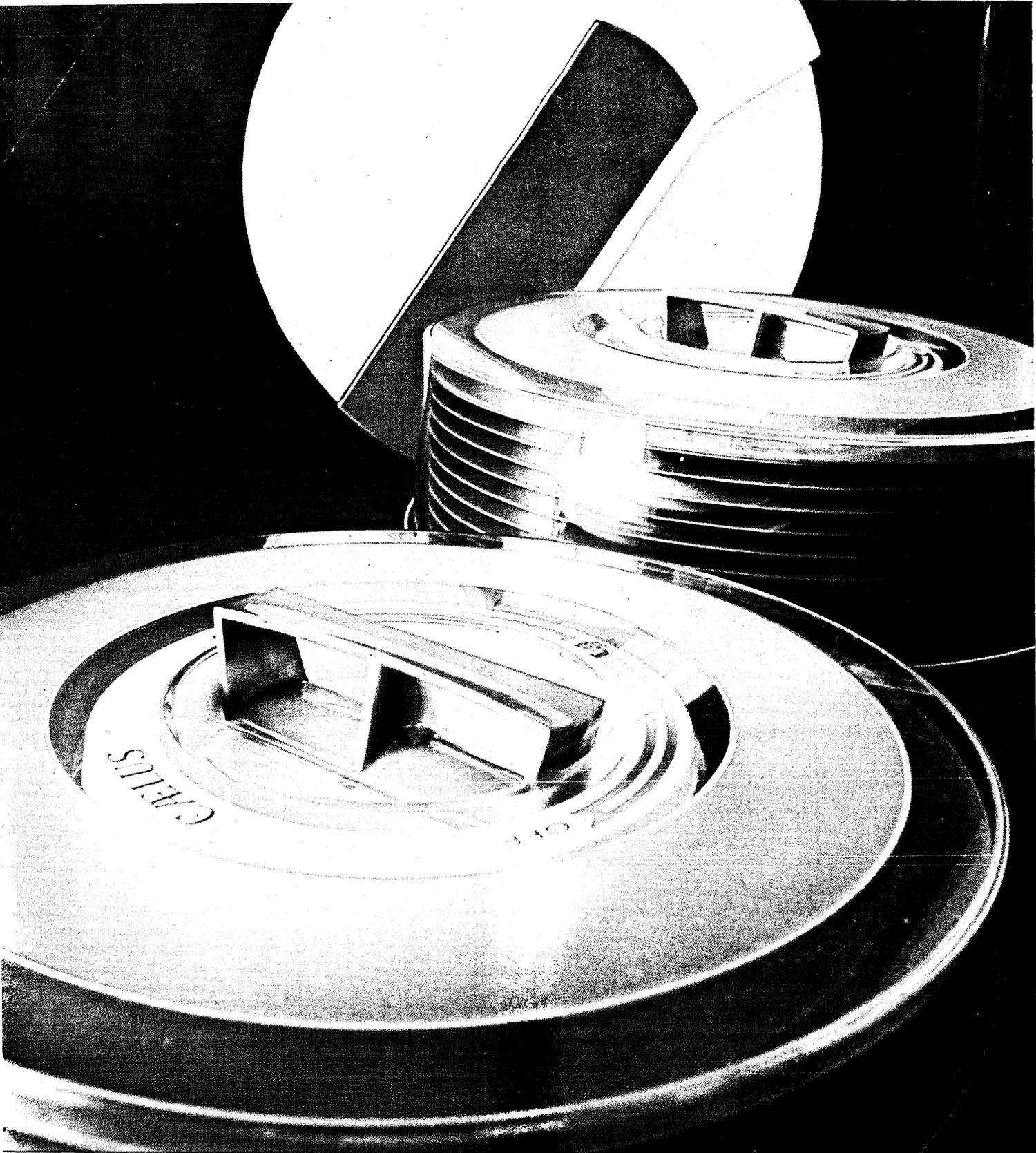
November 15



70
FJCC

HOUSTON
NOV 17-19

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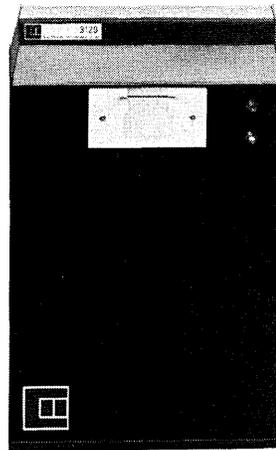
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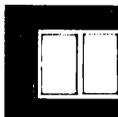
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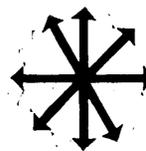
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NOV. 15, 1970



volume 16 number 15

GENERAL

22 Anatomy of a Merger

GE had lots of plans for its computer operations before the faction in favor of selling out to Honeywell won the battle. Here are some details of the planning and maneuvering that preceded the agreement.

32 The Great Brass Brain

After 56 years of operation without errors or downtime, the Coast and Geodetic Survey machine for predicting tides has been retired in favor of a CDC 6600.

66 OCR-A vs. OCR-B

The long-simmering conflict between advocates of the two type fonts comes to a small boil in this Letters to the Editor type article wherein everyone who wanted to has his say.

80 Fall Joint Computer Conference

The emphasis will be on communications equipment in FJCC exhibits in Houston. Large scale devices will be scarce. Our product preview describes new equipment which will be introduced for the first time. And for gourmets going to the show who don't know Houston, our guide to the city's eateries is a must.

Conference particulars and descriptions of technical sessions appear in the Nov. 1 issue.

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DATA MATI⁷⁰ON[®]

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A conference report.

118 ABA Conference

Bar Association hits hard at inadequacies of regulatory system for communications at annual meeting of Committee on Law and Technology.

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Standardized digital cassettes may be the answer to the need for lower cost tape transports demanded by rapid expansion of minicomputer and remote terminal market. Some design problems and approaches to their solution.

54 Remote Inquiry of Data Bases

They started with the problem of file maintenance update verification — now the designers claim to have developed a simple, flexible, and efficient generalized inquiry system.

MANAGEMENT

47 MIS: Data Bases

User acceptance of Generalized Data Base Management Systems is "cautious but growing." The

potential these systems have for improving communication with the computer could be a factor in the development of MIS. But first a common system needs to be developed.

COMMENTARY

71 Perspective

The Canadian computer industry has been lagging in growth in recent years, but estimates from various prominent figures up north put the future growth at a pessimistic 30% a year all the way to 50% for services.

The Pentagon finally issued an RFP for the fabled World Wide Military Command and Control computer systems and everything seems about ready to roll right now, although probably not for a while.

About the Cover

We've got it all together now! Photographer Richard Ley's puzzle pieces come up Texas, bright and clear, as setting for this year's Fall Joint Computer Conference.

NOVEMBER 15, 1970

volume 16 number 15

DATAMATION® This issue 115,381 copies

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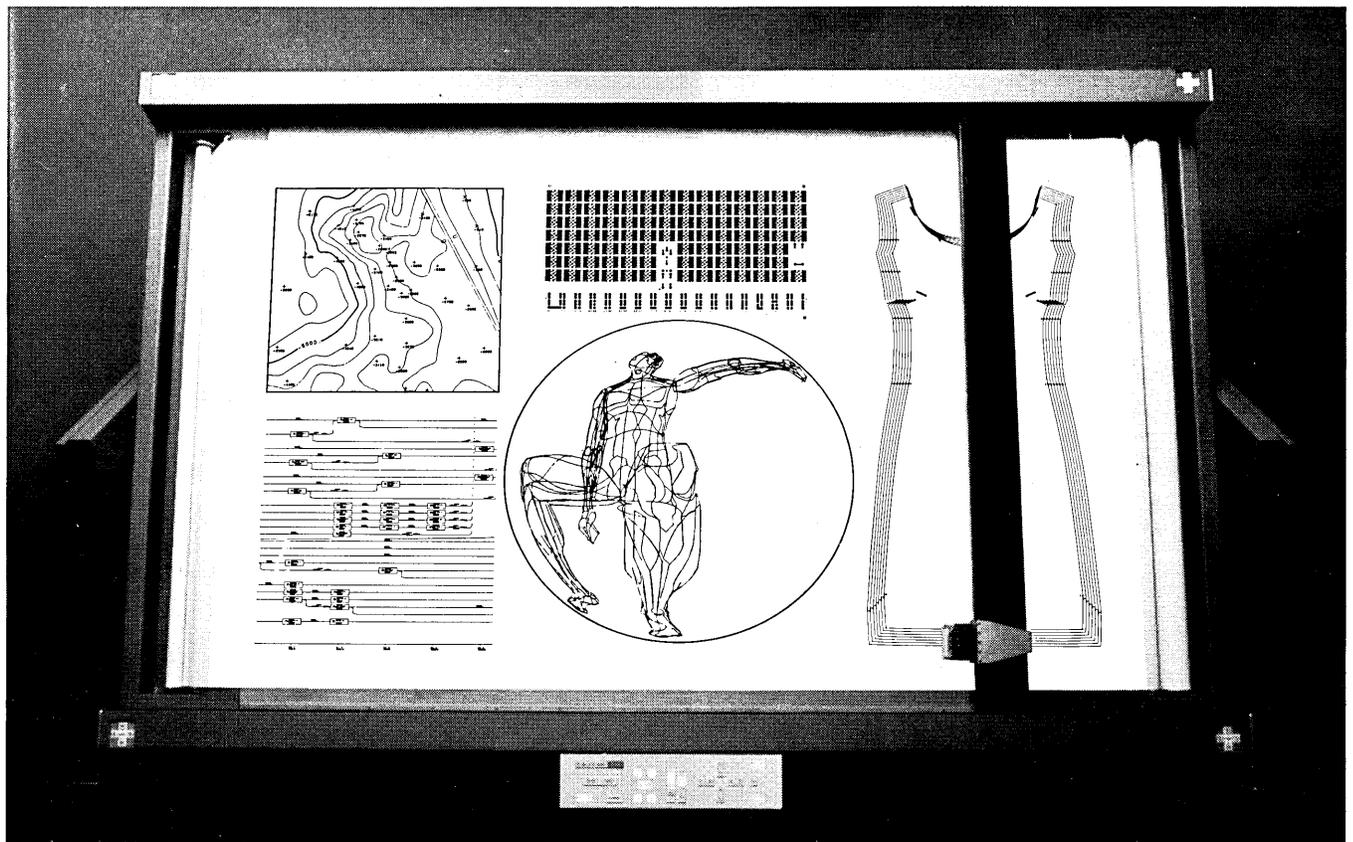
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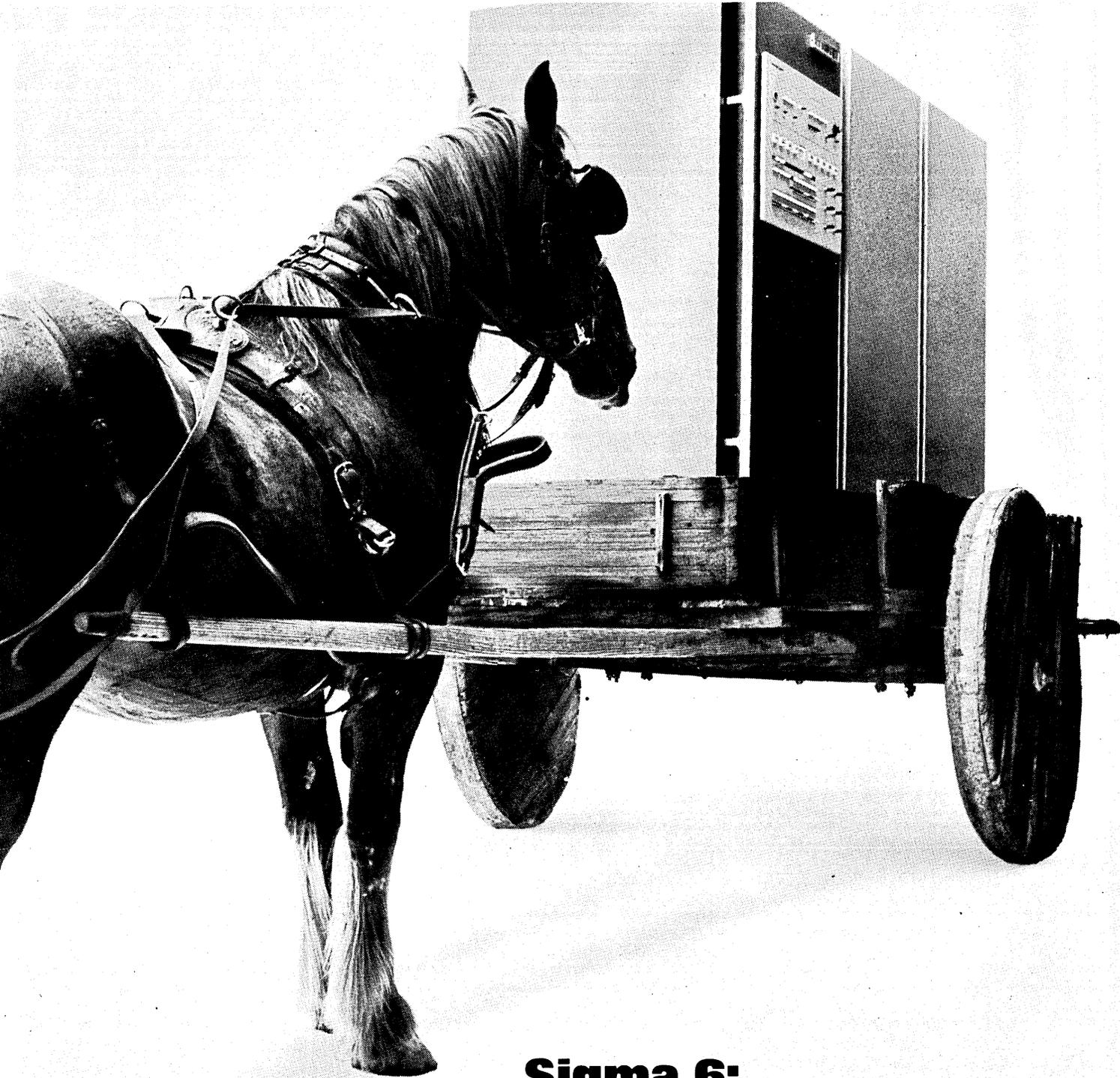
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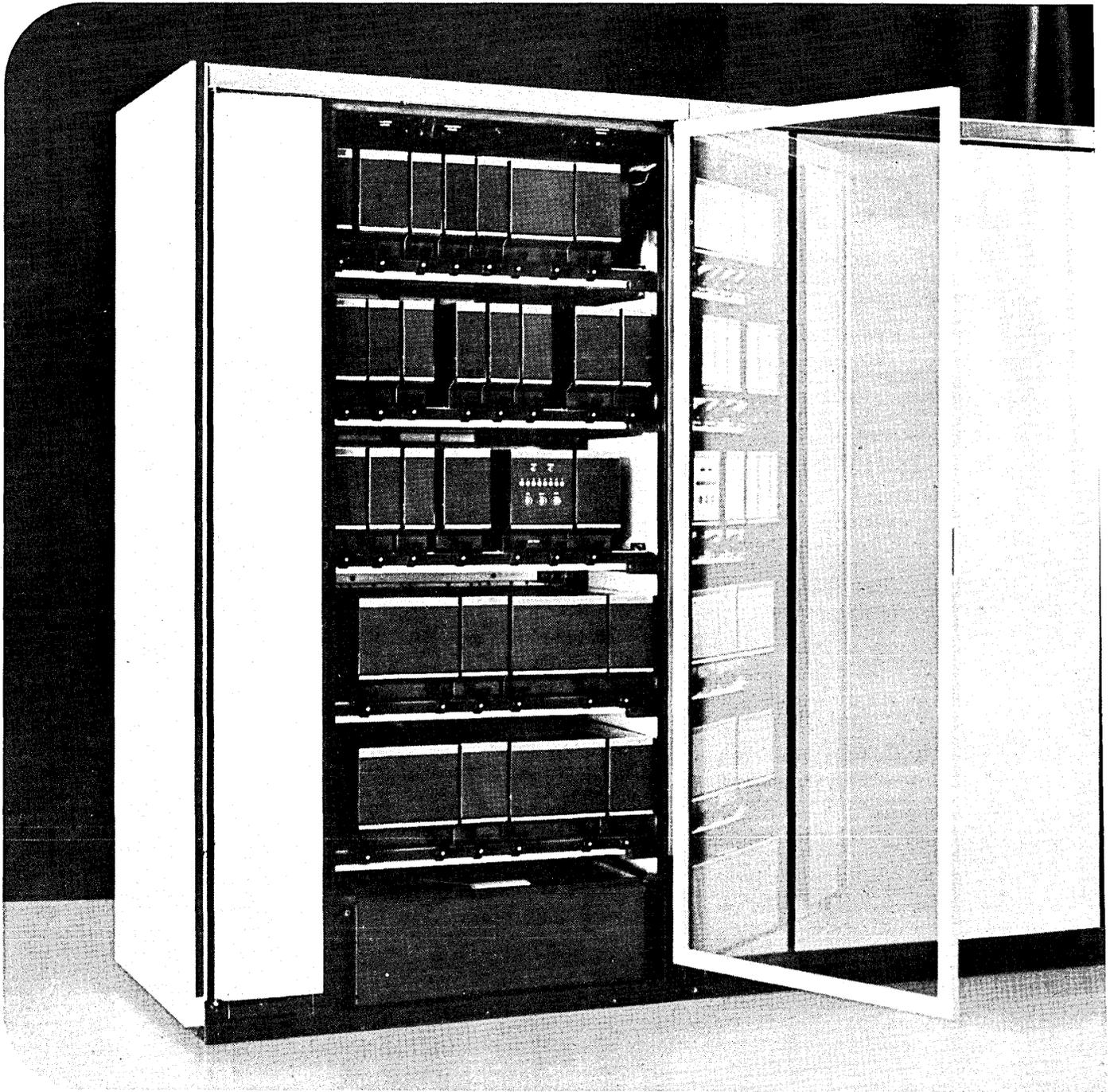
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Nov. 15-16	ACM Data Description & Access Workshop	Houston	Dr. E. F. Codd IBM Research Lab Monterey & Cottle Rds. San Jose, Calif.	\$40, members \$50, others
Nov. 16	ACM Computer Graphics Workshop	Houston	Jackie Potts Box 933, Blair Sta. Silver Spring, Md. 20910	\$40, members \$45, others
Nov. 16	ACM Symposium Academic Education/Computer Science	Houston	Dr. J. Robert Jump Rice Univ. P.O. Box 1892 Houston, Tex. 77001	\$22, members \$30, others
Nov. 17-19	Fall Joint Computer Conference	Houston	AFIPS 210 Summit Ave. Montvale, N.J. 07645	\$20, members \$40, others
Nov. 19-20	DPMA Conference '70 Empire Division	New York City	Conference '70 P.O. Box 1926 Grand Central Sta. New York, N.Y. 10017	Unknown
Nov. 20-26	Biennial Int'l. Instr. & Automation Exhibition	Milan, Italy	U.S. Commerce Dept. BIC-932 Washington, D.C. 20230	Unknown
Nov. 23-25	ADP Military Activities Symposium	Camp Hill, Pa.	FMSO (Code 901) Mechanicsburg, Pa. 17055	\$30, federal; state, local gov't. emps.
Nov. 30- Dec. 2	IBFI 3rd Int'l. Forum on Data Communications	Hollywood Beach, Fla.	IBFI/PIA Center 1730 N. Lynn St. Arlington, Va. 22209	\$195
Dec. 1-3	DPSA Seminar, Data Input with Plastic Cards	New York City	DPSA 1116 Summer St. Stamford, Conn. 06905	\$150
Dec. 7-9	NEC 26th Annual Conf. & Exhibition	Chicago	Nat'l. Electron. Conf. Oakbrook Exec Plaza #2 1121 W. 22nd St. Oak Brook, Ill. 60521	\$3
Dec. 7-9	IEEE Open Workshop: Fault Detection in Dig. Circuits & Sys.	Bethlehem, Pa.	F. M. Towell Western Electric Co. 555 Union Blvd. Allentown, Pa. 18103	\$8
Dec. 9-11	IEEE, ACM Simulation Applications Conference	New York City	IEEE 345 E. 47th St. New York, N.Y. 10017	\$60-80 (late fee)
Jan. 12-14	4th Hawaii Int'l. Conference on System Sciences	Honolulu	HICSS-4 Univ. of Hawaii Honolulu, Hawaii 96822	Unknown
Feb. 9-11	COMPSO East	New York City	Computer Exposition, Inc. 37 W. 39th St. New York, N.Y. 10018	Unknown
Feb. 15-19	Computer Display Equipment Exhibit	Frankfurt, Germany	U.S. Commerce Dept. BIC-932 Washington, D.C. 20230	\$450, exhibitors
March 10-12	4th Annual Simulation Symposium	Tampa, Fla.	Annual Simulation Symp. P.O. Box 1155 Tampa, Fla. 33601	Unknown





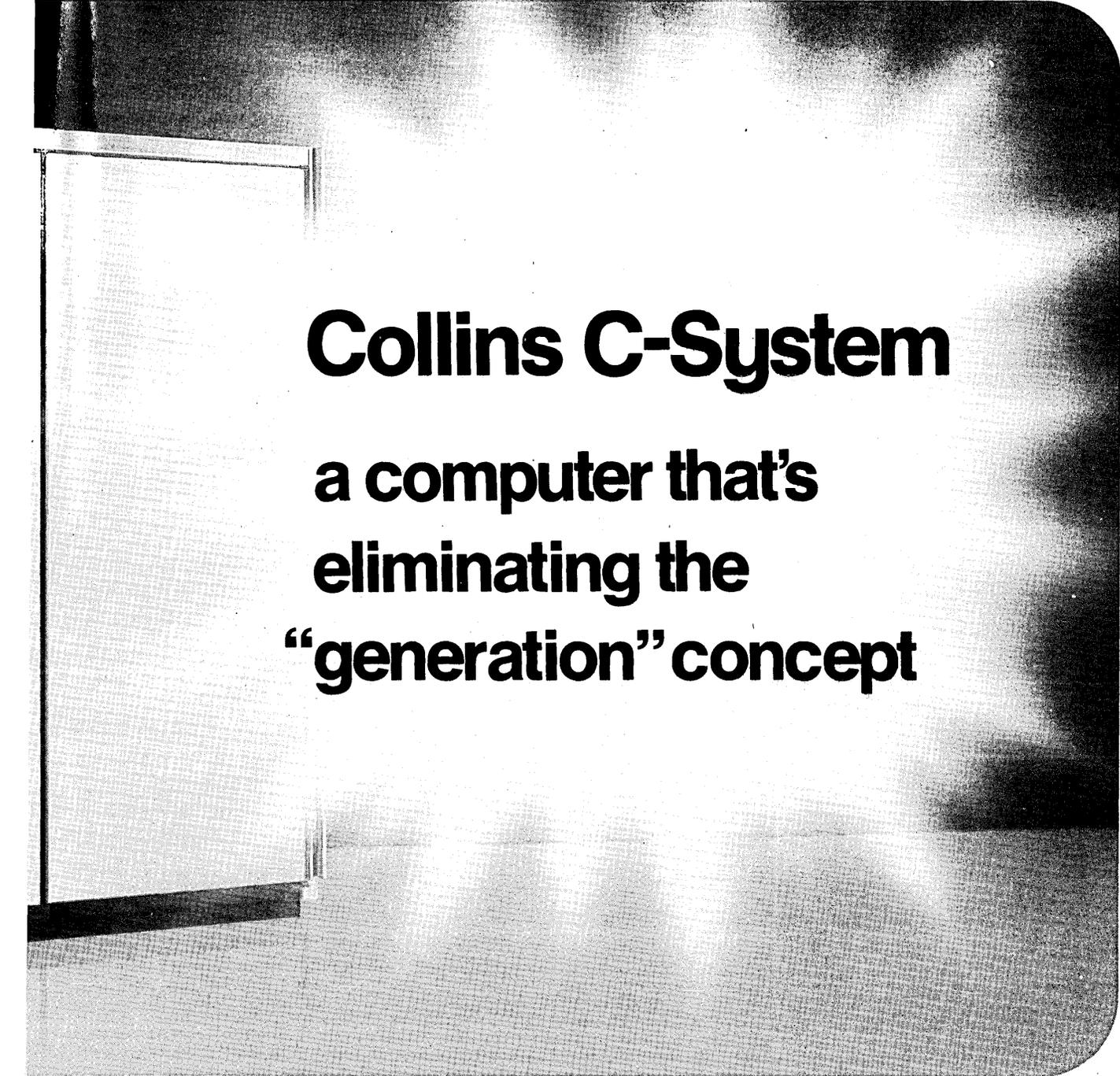
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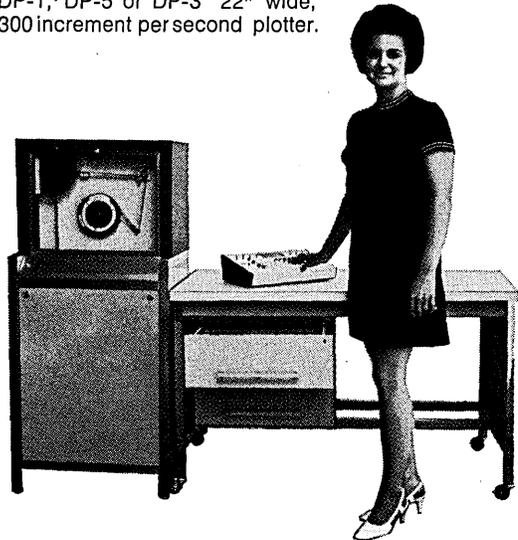


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LETTERS

IBMbarrased

Sir:

How's that again? "At the point that errors are encouraged during compilation, the compiler generates a call to an error routine. . . ." (P. 56, GC28-6596-4 IBM System/360 FORTRAN IV Library Subprograms.)

WALTER C. DAUGHERITY
Cambridge, Massachusetts

Hallett Hollereth

Sir:

In reply to Mr. Robert Bufford's request in the Aug. 15 issue (p. 14). He may be interested to hear of an all magnetic tape system of considerably earlier vintage than 1966, even though in Canada. In September 1958, I began my programming career with the Ontario Hydroelectric Commission here in Toronto. Their UNIVAC II was installed the previous spring.

Off-line paper tape to magnetic-tape converters were used to handle data transmitted from area offices, and UNITYPERS were the key tape devices producing all other input. The tapes and reels were all metallic and exceedingly heavy. All output was also on magnetic tape; the printers were operated off-line.

My first introduction to punched cards was when I became employed by a company using IBM equipment in January 1965. Can you imagine a programmer with over six years' experience unable to decipher a Hollerith punched-card?

JULIE HALLETT
Toronto, Canada

APLause

Sir:

I missed the byline on the "Whither APL" article in your September 15 issue and was halfway through it when I started asking myself, "I wonder who the author is; whoever it is really knows programming languages and really knows how to write." So then I turned the page and there was a picture of the only possible answer to my question—Dan McCracken.

If Dan is planning to write a book on APL, that is an item well worth adding to his list of its advantages.

CHRISTOPHER J. SHAW
Los Angeles, California

Census suspense

Sir:

As an individual who has written to you previously on the subject of Census data (Aug. 15, p. 13), I feel that Mr. Rapoport (American Civil Liberties Union) was also speaking to me in his defense of the present status of the Census (Sept. 15, p. 13). As much as I respect the ACLU for its work, that organization has occasionally been shortsighted in its failure to criticize programs which may not be a danger *now* but are likely to become so in the future. I believe that the continuation of the Census in its present form is such a danger.

As data collected by the Census become more and more technically accessible (via various kinds of software and hardware advances) it becomes more and more difficult to say that those data *should not* be accessed. Can Mr. Rapoport honestly say that if the technology were available, the court system would, for example, deny the Justice Department the right to access Census files to find out where particular individuals resided in 1950, 1960 and 1970, if it could be demonstrated that such information were in the "national interest"? I am certain that the ACLU would oppose such a move, but it would be a bit too late. From "national interest/security" rationales, it would be fairly easy to move on to "organized crime," "narcotics," and other issue areas generally considered to be important. Once such precedents become established, it would be a rather small step for other governmental agencies to find uses. Finally, if one admits the possibility of corruption (and I'm aware of the past good history of the Census Bureau in this regard), the "sacred" nature of such data files will surely be violated. (This progression ignores additional pressures that will come from the recurrent efforts to develop a national data bank from

which omission of Census data is but a dream.)

As a Political Scientist, I am aware of many of the nondangerous uses to which aggregate Census data can be put. The temptation (to which Mr. Rapoport has succumbed) is certainly there to overlook the *potential* harm which might be the result of the existence of Census data banks. I differ from Mr. Rapoport (and, unfortunately, many others) in that I feel that the "potential" is terribly close to becoming a certainty.

I hope that I am not able to say "I told you so" fifteen years from now. It would give me very little pleasure.

MICHAEL R. LEAVITT
Evanston, Illinois

Fearless attack

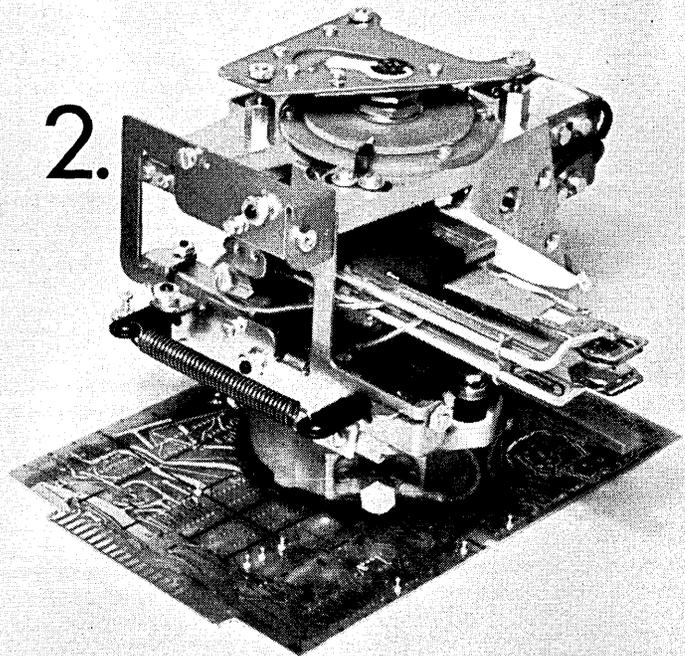
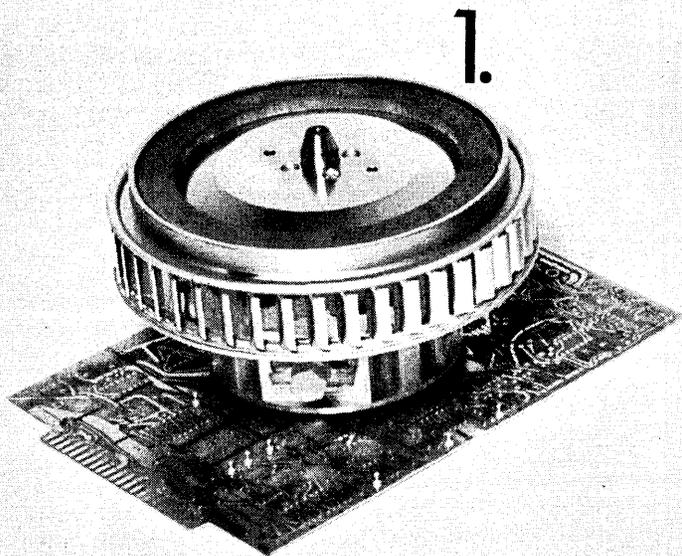
Sir:

Until I see a signed, written statement or hear it straight from the jackass's mouth, I refuse to believe that a man of H. R. J. Grosch's intelligence . . . at least a 110 or 115 I.Q. . . . would risk the alienation of the world's newest technical elite, the world's potentially most powerful group—who literally have their fingers on the buttons of power—who if they were sufficiently organized and united among themselves would be very hard, in a highly computerized state, to keep under control; the only group who possess the proven capability, as amply demonstrated during the past 15 years, of transforming managerial hot air and arm-waving into working programs (subject of course to the speed of light and the fact that there are only 24 hours in a day) by making such a stupid, backstabbing, asinine statement as reported in the July 15, '70 issue of DATAMATION (i.e., "Programmers are jerks!").

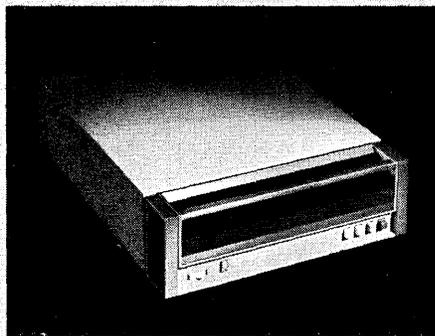
I mean, when one's primary and secondary talents (aside from the above-mentioned God-given artistry) consist of providing comic relief (i.e., panel discussions) between technical papers presented by one's peers, only a moron, a fool, or a brain tortured and twisted by senility or insanity would allow what's left of the pseudo-random neurons in his brain to command hot-air to be passed over a long hollow tube in real time before a live audience and shout out for all the world to hear: "Programmers are jerks!"

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CIRCLE 13 ON READER CARD

Letters . . .

phemy is true, I know not what the reaction of others will be to this latest Communistic-Capitalistic Plot, aided and abetted no doubt by the effete, troglodytical, hornswogging editors of DATAMATION, to depress the salaries of the professional programmer and attempt to make him the scapegoat for the economic, political, racial, and religious ills of the world; but as for myself, I say: "PROGRAMMERS OF THE WORLD UNITE! THE WORLD IS OURS FOR THE TAKING!"
J. WOLFGANG VON HOLSTEINOVITCH

P.S.: Just to be safe, would somebody please slip a muzzle on Herb and start the Pasteur treatments before he bites a programmer!

Omission improbable

Sir:
In the July 15 (pp. 87-98) issue Mr. Cecil Frost has presented an excellent survey of computers designed and/or ruggedized for military applications. We wish to bring to your attention the omission of a very versatile avionic computer, the AN/AYK-8, designed and manufactured by Westinghouse's Systems Development Division. Because of its modular structure and general purpose design, this computer, while originally designed for airborne fire control, has developed into a family of machines which are being used on several Air Force and Navy programs. Designed in 1969 to MIL-E-5400 specifications, over 30 computers of the AN/AYK-8 family have come off our production lines.

The Westinghouse AN/AYK-8 is an 18-bit general purpose computer with 51 indexable instructions. It is comprised of four basic functional modules: a standard control processor module, a standard memory module containing 4096 words (expandable to 64K words by using 16 modules), a standard power supply module and an input/output module comprised of standard printed circuit boards augmented by a few special interface boards to satisfy the unique requirements of each application.

GEORGE SHAPIRO
Baltimore, Maryland

Syncing circuits

Sir:
In The Forum of September 15th, Mr. J. Robert Logan wondered why

parallel logic is not used more often. He implicitly defined parallel logic as logic which does not contain storage elements and feedback lines.

That parallel logic has not found more common usage is not the fault of the designer but is associated with basic properties of sequential circuits: In recent years researchers have been successful in developing methods for designing sequential circuits requiring a minimal number of feedback lines. In the case of synchronous sequential circuits this number is at most one but is nearly always that number; however, the minimization of feedback lines is usually achieved at the expense of increasing the number of storage elements required. Asynchronous sequential circuits can be designed without storage elements, but the minimal number of feedback lines



varies from circuit to circuit and inertial delays may be needed to avoid hazards. If a stable state of a circuit is allowed to be represented by a set of unstable states then an asynchronous sequential circuit can be designed using a single feedback line. Unfortunately, such a circuit requires the use of inertial-delay elements having threshold properties that may be realizable only by circuits involving amplifiers and feedback.

H. ALLEN CURTIS
Williamsburg, Virginia

Porno comment

Sir:
Please cancel my subscription immediately. I do not intend to be humiliated again by having my wife discover that DATAMATION runs hexadecimal pornography. In case you can't figure

it out, I'm talking about "A New Constrained Art Form: The Hexadecimal Core Dump," in the Sept. 15 issue (p. 57).

I read it, thought it was clever, and forgot about it until I heard my wife cackling uncontrollably one night while I'm minding my own business, reading a printout. Seems she had stumbled onto the story, written with the letters, A, B, C, D, E, and F, about a man in bed and the conversation he has with his girlfriend—but you published it, so you remember.

I tried to explain that it had to do with food poisoning, but then she read it to me *her* way. I read it to her *my* way, and all she said was, "Your way takes a lot more imagination than my way."

And to think that you ran it right under the picture of a man who has just graduated from seminary!!!

KOH AMAR JACHWEG

Re citation

Sir:
The following citation should be added to the introduction of my paper entitled "The Pipeline and Parallel Computer," which appeared in the April 1970 edition of DATAMATION.

"The fact that the parallel and pipeline computer designs have inherent limitations which render their performance very sensitive to problem and programming formulation was first pointed out to the author by Dr. Tien Chi Chen, a result which Dr. Chen derived from his extensive unpublished research on the subject."

The citation was omitted as the result of an oversight on the part of the author.

WILLIAM R. GRAHAM
Santa Monica, California

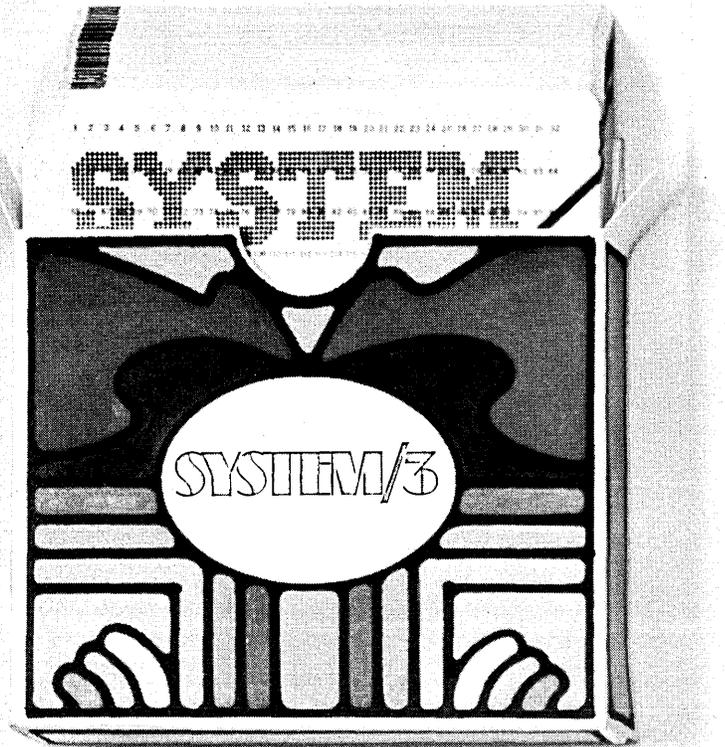
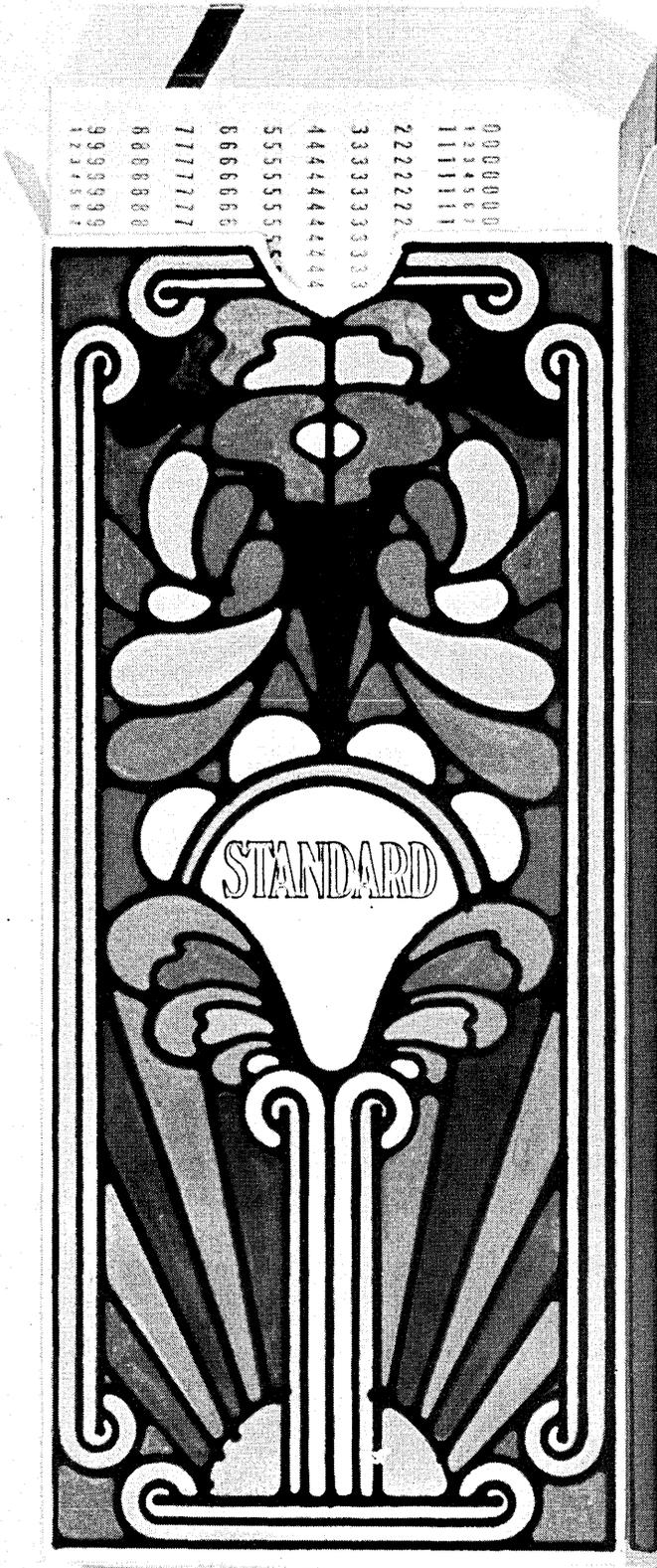
APL polisher

Sir:
Your publication of Dan McCracken's excellent article "Whither APL" (Sept. 15, p. 53) should be very valuable in bringing APL to the attention of your readers.

One additional comment should be passed along to your readers: Don't make the mistake of thinking you can become familiar with APL by reading about it. You have to *use* APL to appreciate it. Even *after* us-

(Continued on page 203)

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WHICH DECK YOU USE



New system/3 card storage is ready and waiting in the Tab Auxiliary products line. Just another case in point for Tab's rightful leadership role in data processing auxiliary equipment. Being first comes next to being best at Tab. So rest easy, because our system/3 card storage will give the same reliable, quality performance as our standard card files. You'll always be a winner.

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LOOK AHEAD

WATSON ALL ABOUT, IVAN?

Thomas J. Watson's two-day visit to Moscow didn't produce any computer business and the IBM chairman told the press he doesn't think there's a market in Russia at present. Observers wonder at this negative stance in view of Moscow's negotiations with Siemens and Olivetti and its recent orders to ICL (Aug. 15, p. 171). But in true IBM tradition — never to come back without an order — Watson could have swung a deal to sell typewriters, which the Commerce Dept. took off its restricted list of exports this summer. Meanwhile, rumors persist that the Belgrade secret police are installing a 360/40 — presumably for nonmilitary use.

STRIKE THREE ON 360 DESIGN TEAM

The last of the three key 360 architects has left IBM. He's Gene Amdahl, most recently an IBM fellow since a supercomputer project he was working on was shot down in June '69. He was preceded out by Fred Brooks and Gerrit Blaauw. An alleged conflict of interest was reported a key point in bringing about the latest separation: IBM felt Gene's position on the board of Compata (run by his brother, Lowell) was somehow a conflict. Gene, in two stints, was with IBM some 12 years. He has served on the Compata board for five. IBM's revenue last year was close to \$7.2 billion; Compata's roughly \$1 million. It's believed Amdahl (Gene), on vacation at this writing, will form a company of his own.

COURT MAKES EARTHSHAKING SOFTWARE PATENT DECISION

Another blow for software patentability has been struck by the Court of Customs and Patent Appeals. October 8, in a decision regarding a seismic data correction method, the court took a stronger stance on patenting mental processes than that in the hallmark Prater & Wei decision (Jan. 1969, p. 78 and April 1969, p. 174). Overturning a Patent Office decision that inventor A. W. Musgrave's method was unpatentable because it involved mental processes, the court said "all that is necessary, in our view, to make a sequence of operational steps a single 'statutory process' within 35-USC-101 is that it be in the technological arts so as to be in consonance with the Constitutional purpose to promote the progress of 'useful arts.' "

Judge Phillip Baldwin, a member of the court, agreed with the results but not the reasoning. He noted that in the second Prater decision, the court did not decide "whether claims drawn to a process consisting entirely of a sequence of purely mental steps would fit within the ambit of the law.

The majority now proposes to answer this question in the affirmative, regardless of the fact that the case could be decided on very narrow grounds — as a machine-implemented process.

PL/I WINS A FEW, LOSES A FEW

PL/I is being used (though not exclusively) in 2,000 shops around the country. And in Europe we hear more IBM customers are hooked on PL/I than on COBOL. There have been some defectors, but their major argument

(Continued on page 18)

against PL/I — that it locks them into IBM equipment — is gradually being dissipated. CDC and Burroughs have announced their compilers will be ready in the first half of '71, and Siemens also has one in the works. Univac's a maybe, and Honeywell and NCR are resisting.

The PL/I standards effort, under ANSI's X.3.J1 and ECMA's TC-10 committees, continues. The general content of the standard should be decided by year end. By mid-'71, the committees should have defined the language they want to standardize. After that there'll be polishing and subset definition. If all goes well, the standard will be proposed the end of 1972.

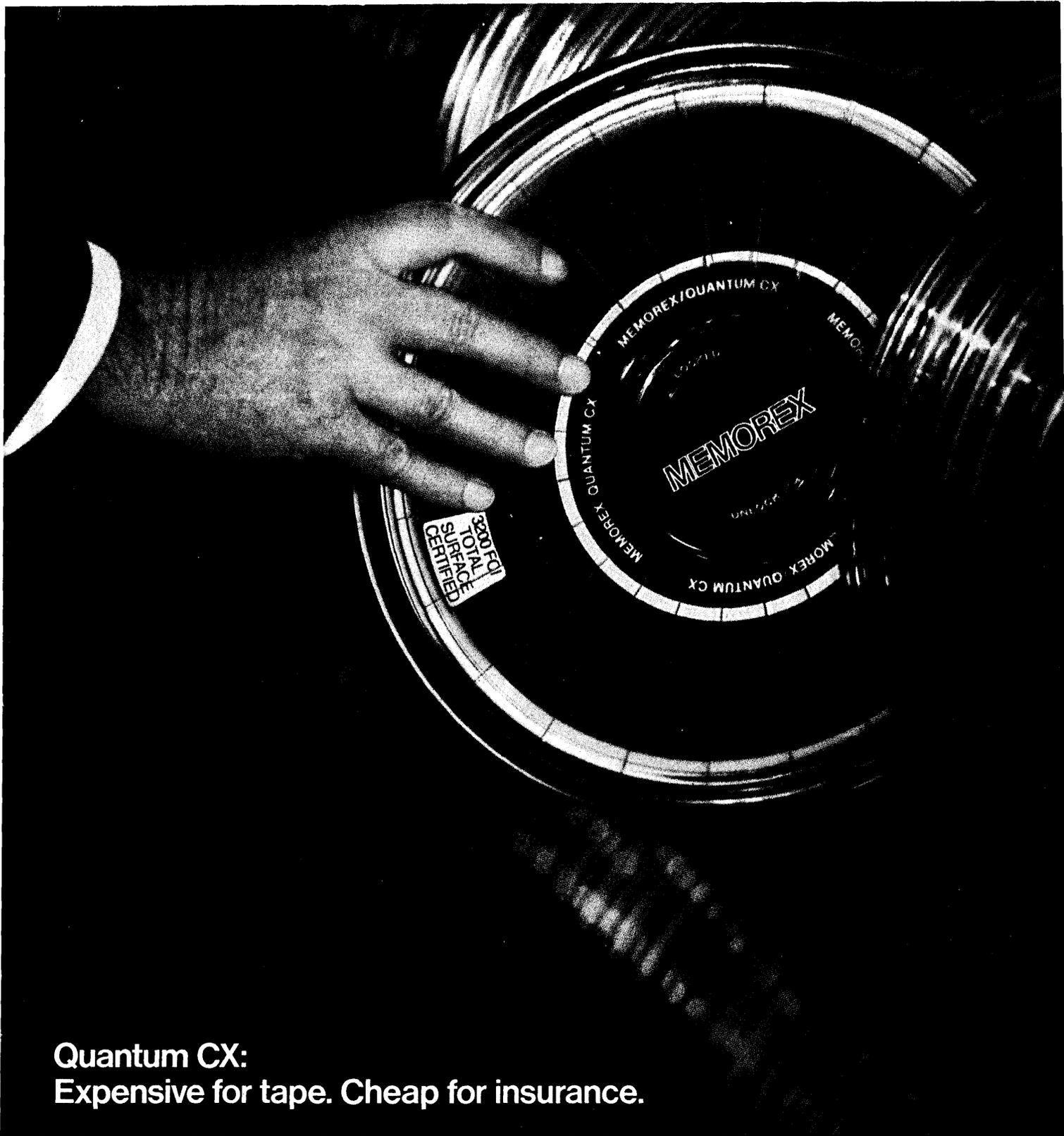
USERS GET ANTSY OVER CODASYL AND ANSI

Some users are upset that they don't know the details of CODASYL's 13 proposals for extensions to COBOL. They include vital data communications and asynchronous processing extensions. ANSI's X.3.J.4 COBOL committee will be considering some or all of them next month in Ft. Lauderdale. The only document in which the proposals have been published, CODASYL COBOL Journal of Development, #110-GP-1a, is published by the (get this) Canadian Dept. of Defense, Ottawa.

RUMORS AND RAW RANDOM DATA

Potter Instrument, instead of going for off-line print stations, plans to come out with a hard-wired communications controller (IBM 2780-like) that interfaces with IBM 360s and 370s...More rumors on IBM's "evolutionary" new operating system are floating out. NSOS, which should be out within two years, will be paged and provided virtual memory management. As expected, 370 will have relocatable hardware; users suspect it's there already... IBM's SE force is rumored down to 4,500 and evolutionarily...dropping Digital Equipment Corp. should soon announce a remote batch terminal for the time-sharing PDP-10. As might be expected, the PDP-8/I will be the heart of the terminal, which will also include a synchronous line interface, card reader, line printer, and software. The price — around \$50K...The dropping of Applied Data Research's plans to sell its West Coast subsidiary, Programmatic, Inc., to Computer Machinery Corp. was attributed by CMC's president Jim Sweeney to a "change in circumstances." That change might be due to ADR's healthier financial position after the \$2 million settlement of the suit against IBM (Oct. 1, p. 72)...Informatics president Dr. Walter Bauer, concerned that Justice has made no effort to learn the nature and extent of damage the independent software firms claim IBM has done to them, plans to contact Justice himself to see if an input can be established.

The advent of a reported \$1110/mo. IBM System 3 with ledger card input means that IBM is going after the market for big accounting machines, led by Burroughs and NCR. It could also herald a line of dedicated System 3s, handling perhaps credit cards, badge reading, etc.



Quantum CX: Expensive for tape. Cheap for insurance.

At this very moment, critical data in your tape files may be deteriorating. Until Memorex Quantum came along, there wasn't much you could do about it.

Now there's Quantum CX. It protects against lost data two ways.

First, with the proven Quantum oxide coating that's more resistant to "growing errors". Second, with a new back coating. It reduces errors caused by static-attracted contaminants and by debris from back scratches.

It costs more to make a tape the way Quantum CX is made. But remember, the premium you pay really isn't for the tape. It's for the insurance.

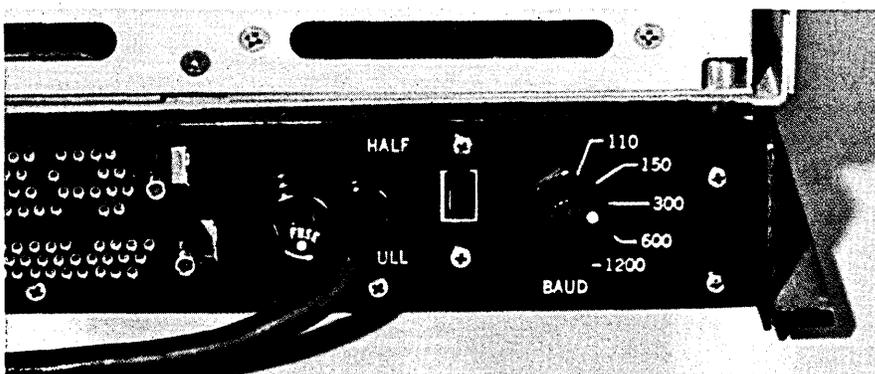
For more information on Quantum CX, write: Memorex Corporation, Information Media Group, Memorex Park, Santa Clara, California 95050.

MEMOREX



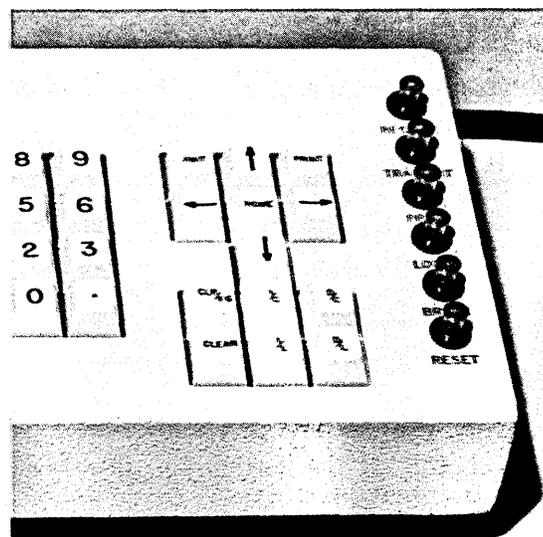
1,998 character display (27 lines of 74 characters each) on a 12-inch screen.
 A true stand-alone unit—includes communications interface and modular power supply,

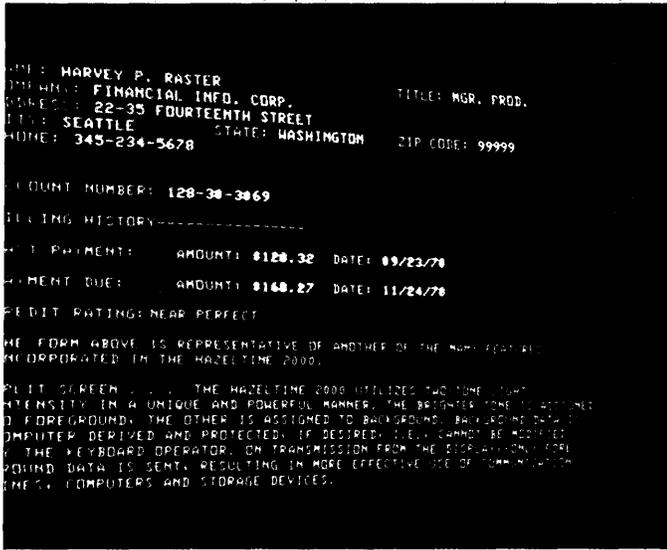
Inside Story of the Video Display Terminal that leaves all the others behind.



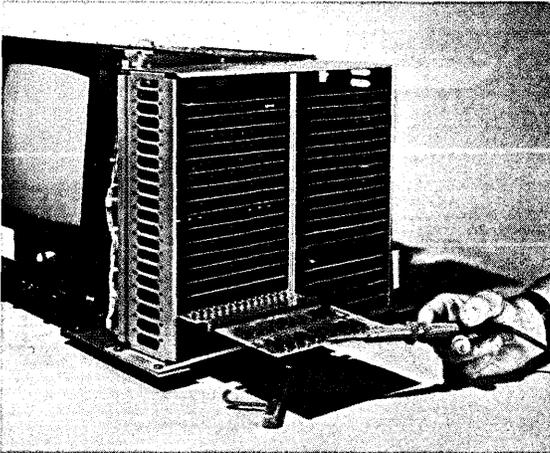
Switch-selectable full- or half-duplex operating modes.
 Selectable transmission rates—110, 150, 300, 600 or 1200 baud. Adjustable up to 9600 bps.

Powerful editing capability—12 distinct keyboard operations, including line and character insert/delete. 10 functions under computer control, including cursor positioning by X-Y coordinates.

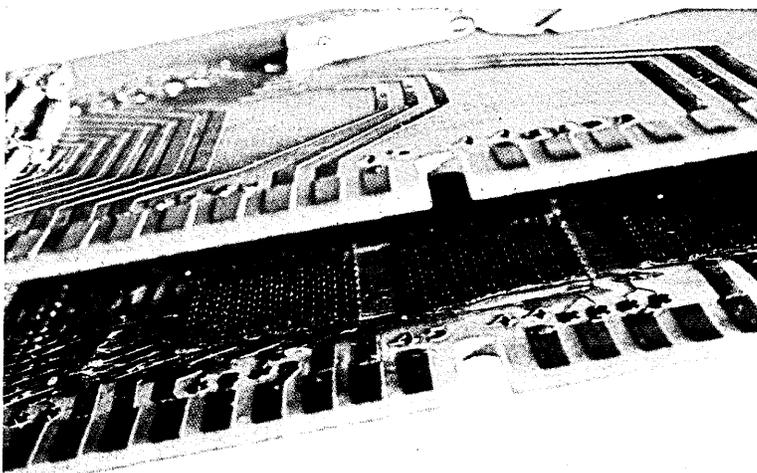




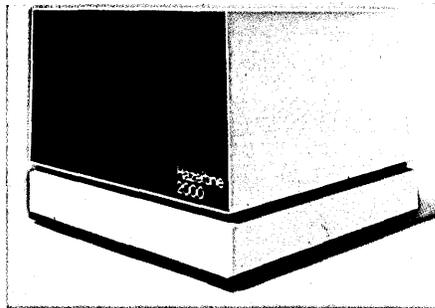
Two-level video intensity. Useful for form fillout. Computer-derived protected data is lower intensity; operator-entered data is brighter. **Selective scrolling** at any line when under program control; automatically at line 1, unless otherwise directed. **Automatic tabulation** in form fillout directs cursor to next entry point.



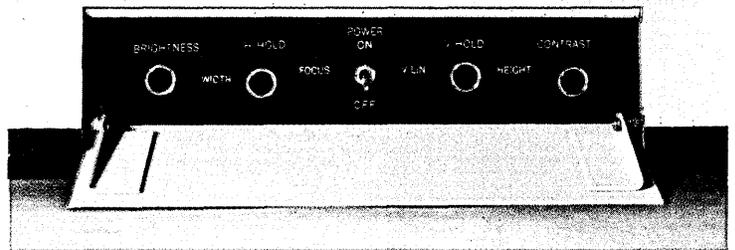
Reliable solid-state circuitry assures virtual trouble-free operation. Maintenance is as easy as opening a drawer.



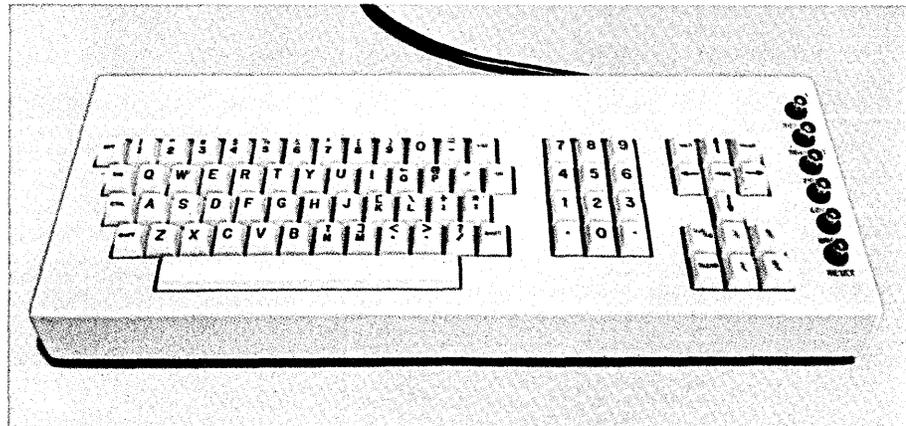
High-speed, random-access core memory (2048 x 8) provides flexibility and efficiency consistent with all the unique design features of the Hazeltine 2000.



3 remote monitors may be connected without amplifiers. With amplifiers added, the number is unlimited.



Individual TV adjustments conveniently located up front for optimum operator comfort.



Quiet, solid-state keyboard in Teletype terminal format may be operated remotely.

Plus: Low Cost!

\$88 per month (12-month rental)
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The planning and the plotting that led to Honeywell's acquisition of GE's computer operations

Anatomy of a Merger

by W. David Gardner, New England Editor

G Money talks. And when it does it usually has something very important to say. For instance: When Honeywell, Inc., announced last May that it would take over the heart of General Electric's computer operations, Honeywell's stock promptly plunged \$16.50 the next day and closed at \$86.50. The following day, as the word got around and as the proposed merger-takeover was examined in closer detail, Honeywell stock nose-dived another 9 points. Meanwhile, General Electric's stock remained fairly stable, although it dropped slightly.

The public had spoken on the proposed combine in the only manner in which it could express itself. Actually, the negative reaction should not have been too surprising given Honeywell's history as operating a well-managed and profitable computer business and General Electric's unmatched reputation among the mainframe companies of fumbling and bumbling with its unprofitable computer operation. Obviously, many feared a dilution in Honeywell's earnings while it digested the General Electric portion.

Also, it should be noted that the announcement took virtually everyone by surprise. The computer industry rivals the CIA in its fetish for secrecy and the merger negotiations must go down as a textbook example of a well-kept industrial secret.

There was, however, one inadvertent slip. In March, Stephen F. Keating, president of Honeywell, was vacationing in Arizona, as had been his habit for years. Although Keating had known that Honeywell and General Electric were quietly talking about get-

ting together, he was not directly involved—at that point, at any rate—in the negotiations. When a group of industrial leaders in Phoenix offered to take Keating on a tour of the business side of Phoenix, the Honeywell executive gladly accepted.

The agenda included a tour of General Electric's Information Systems Equipment Division in Phoenix. Keating was ushered around the plant by the division's vice president and general manager, John F. Burlingame, and almost immediately the Honeywell executive with the distinctive appearance (tall, grey-haired and handsome) was recognized by several former Honeywell employees who had been hired over to GE. The visit created a good deal of internal speculation at the Phoenix plant, but when nothing happened the talk soon dropped off and Honeywell's and General Electric's secret was safe until the firms decided to announce it several weeks later.

Like all stories, this story of the Honeywell-General Electric combine—far and away the largest merger in the history of the computer industry—must have a beginning. Since General Electric instigated the whole thing, it is perhaps best to start off with General Electric and since Hilliard W. Paige was the top man in General Electric's computer effort, it is therefore best to start with him.

In September of 1969, Paige, then vice president and group executive of GE's Information Systems Group, delivered a surprisingly bullish report on his firm's computer operation to a group of security analysts in New York. The report was surprising in that Paige was able to say that GE was doing much

better in the field than it had generally been thought to be doing. "In terms of progress toward profitability," said Paige, "the installed value of (GE) equipment has been rising at an average rate of 22% a year in recent years, while losses have been cut substantially each year."

Paige reported that GE's 200 line was profitable and that its Italian operation, which makes small business computers, was not only profitable, but was "the most successful" unit in GE's computer operation. Also, some time-shared service centers were profitable.

And then the surprise of surprises: Paige said the Bull-GE operation in France was "rapidly approaching profitability." Bull-GE had become a favorite whipping boy of American business publications and the French unit's image in the U.S. appeared to be that of a company wallowing hopelessly in red ink. Paige turned out to be right, too, on the subject of Bull-GE's impending profitability, although the profit was marginal in 1969.

The security analysts listened attentively as Paige tempered his optimism somewhat by saying that some segments of GE's business were "several years away" from the break-even point and he declined to predict when the Information Systems Group as a whole would become profitable. The meeting, though, was a fairly typical example of a security analysts meeting—that is, the good news outweighed the bad news. Besides the strides GE was making with its operations, Paige and his associates ticked off additional favorable information on the group's progress. It was stated flatly that GE's 400 line would be "very profitable"

even though it wasn't at that time; the 600 line—off to a slow and bumpy start—was having a good year and the firm's over-all computer orders in the U.S. were up 61% from the previous year and the order backlog was up 87%.

Paige was clearly after that number two position behind IBM. "When we achieve that position," he said confidently, "profitability will no longer be a problem."

In late 1968 and early 1969, GE top management had been easing Paige into the top spot in the Information Systems Group—and easing J. Stanford Smith out—even while Paige still held his post as general manager of GE's Missile and Space Division. At the time of the security analysts' meeting in September of

... he declined to predict when the Information Systems Group as a whole would become profitable.

1969, Paige had been in charge of the Information Systems Group for about six months. Paige is an aerospace man, not a computer man, and aerospace computers are to electronic data processing as Saturn rockets are to the airline industry—expertise in one does not necessarily guarantee expertise in the other. In this regard, then, GE remained true to its tradi-

Anatomy of a Merger . . .

tional management approach to the Information Systems Group by naming a non-computer man to head up the group.

But the important point here is that Paige and GE were extremely bullish about the company's computer operations in September of 1969. Nevertheless, in less than six months, Paige and General Electric would throw in the towel as far as continuing the operation was concerned and GE top management would be shopping around the computer industry to unload the Information Systems Group or as much of it as anyone would take. In short, GE, after pouring hundreds of millions of dollars into its computer operation without ever reaching the break-even point, would provide the computer industry with its very own Bay of Pigs.

Shortly after Paige assumed control of the Information Systems Group, he decided to convene a broad

Paige and GE were extremely bullish about the company's computer operations in September of 1969.

spectrum seminar or "think-in" for the entire group. Not surprisingly, it was an old military-aerospace technique—getting everyone together from various branches to attempt to reconcile differences and set out anew toward a common goal. The ultrasecret operation was given the code name of Project Shangri-La and General Electric took over much of the Diplomat Hotel in Hollywood, Fla., where the sessions were conducted. Richard M. Bloch, general manager of GE's Advanced Development and Resources Planning Division, and a former Honeywell man, was assigned to run Project Shangri-La. (The Shangri-La proceedings were so secret that they were locked up in bank vaults at night.)

The central idea behind Project Shangri-La was to develop a master plan for an advanced product line (APL), not to be confused with the language of the same initials. As in most companies, different factions within GE's computer operations displayed sibling rivalry from time to time. But in the Information Systems Group these were magnified by GE's profit-and-loss-center approach, which understandably tended to make individual units within the larger group somewhat independent. Furthermore, the international units—particularly Bull-GE—displayed even greater independence, based largely on a combination of the P&L structure, national pride, and distance between GE's headquarters in the U.S. and the international units' headquarters on the Continent.

"We knew there would be a real dog fight," recalls one ex-GE man who was at Shangri-La. "You know what computer design people are like. Each one has his own idea of how to build a computer."

Even before Shangri-La officially got under way, the Advanced Development and Resources Planning Division was pushing for strong central control for development of the new line. In addition, central

control was proposed for software development, which has traditionally been scattered throughout GE. From the start, the independent factions within GE did not look happily upon the idea of strong central control, perhaps understandably so because it would lessen their independence.

Before the start of Shangri-La, bedrooms in the

The Shangri-La proceedings were so secret that they were locked up in bank vaults at night.

Diplomat East were revamped into conference rooms. Bloch moved his staff from New York to Hollywood, a worldwide communications center was established and the session, scheduled to meet for three months, had some 60 permanent participants from all units within the Information Systems Group. Others, from Paige on down through the group's middle management, paid occasional visits. The 60 permanent participants were divided into five teams of 12 each with representatives from each GE computer operation on each team. Each team was given a color—there was a blue team, a red team, a yellow team and so forth.

. . . the session, scheduled to meet for three months, had some 60 permanent participants.

With the ground rules set, Shangri-La got under way.

"Shangri-La was definitely not a vacation," another ex-GE man remembers. "Florida in the summer isn't a vacation. Often the participants were working 18 hours a day seven days a week."

Shangri-La completed its mission in that a master plan for an advanced product line was hammered out (hammered out is the appropriate phase here). Bloch had set down three basic goals for the APL to achieve, and the master plan was drawn up with the thought of fulfilling the three objectives. First, the APL was planned primarily as a major assault on Colossus IBM and, as such, the machines would stress compatibility with IBM equipment. Second, the new equipment would be aimed at picking up 10% of the computer market—enough to firmly place GE in the second place in the industry. And, finally, there would be, as one Shangri-La participant called it, "reasonable compatibility" with GE's existing lines, enough to keep GE's customers from moving over to a competitor. The emphasis throughout, though, would be on taking business away from IBM.

The original plan called for eight machines, A through H, starting with a terminal (A) and extending through a broad-scale series to supercomputers (G and H). The terminal, which would have MOS circuitry, was to rent for \$500 to \$1,300 a month, be compatible with the whole line, and could be converted to a self-standing unit. There was talk of the CRT terminal having a wireless radio communications

The original plan called for eight machines . . .

capability and of special versions, including one with a stenographic keyboard.

Machines B and C were combined at Shangri-La into machine B/C, a computer that would rent from \$1,300 to \$5,000 a month and be designed primarily as an upgrade for users of IBM's Model 360/20 and model 1130. The logic circuitry was to have been advanced TTL (54/74 Series) and the B/C machine was to have received heavy design and manufacturing support from GE Information Systems Italia.

The APL's center machine (D) and the first scheduled for announcement—introduction in late 1972 and deliveries in late 1973—was to have a monthly rental between \$4,000 and \$15,000 and was aimed directly at IBM's 360/50 customers. The logic circuitry was to be an advanced TTL design with a 12 nsec cycle time. Bull-GE was slated to have key development and manufacturing roles in the D machine project.

The E and F machines were aimed at IBM's 65 through 85 customers. The circuitry would have been ECL. The E and F machines were scheduled to come out further along the line with a heavy contribution from GE's Phoenix operation, which, it was thought, would be busy enough anyway in the early 1970s with the 400 and 600 Series and product enhancements of those two lines.

The G and H computers were to have been supercomputers for high level time-sharing. The planning for these, however, was not thoroughly worked out in the master plan, and their future status was being held in abeyance and was therefore vague.

It was proposed that the entire product line be software compatible from the top to the bottom of the line. The APL master plan also included a full set of peripherals ranging from mass storage and magnetic tape units to printers and card equipment. Throughout the line, semiconductor memories would be used where possible.

But one of the most interesting features to come from Shangri-La was a proposed data communications network called Network Service Supplement (NSS). The NSS was proposed for availability with each machine in the APL series and was essentially a remote shared-access information system. One of the chief advantages of NSS was that it would be available to the small user—a user, for instance, who might be leasing the A terminal for just \$500 a month. Normally, such a small user could not have been offered a place in the over-all line at such a low price, but NSS

would have done this for him, and, in the process, hopefully, hook him on GE equipment for good. The NSS plan called for the establishment of several large resource centers connected to a communications network. Each user would have had terminal capabilities. For large customers, NSS would have the advantage of being able to handle their overflow requirements.

Although the APL was aimed primarily at replacing IBM's 360/20, 25 and 1130, its secondary target was all Model 360s using disc operating systems (DOS) and operating system 360 (OS). The pricing was important, too. The participants at Shangri-La decided that the equipment would have to have about a 30% price-performance advantage over IBM equipment and, further, the method of conversion from IBM to GE equipment would have to be inexpensive and simple.

Project Shangri-La very likely produced the most comprehensive and boldest master plan for an assault on IBM ever prepared—certainly far more ambitious than anything any of the other Seven Dwarfs were even considering. It was a program that, if successful, would almost surely catapult GE into the number two position behind IBM. And because of its sheer bulk in size and financial resources, GE with \$8.5 billion in annual revenues was in a better situation than any other computer company to wage a broad campaign against IBM.

However, the risks (e.g., the costs) were frightening, even for a General Electric. The cost of implementing the master plan was generally placed at

But one of the most interesting features to come from Shangri-La was a proposed data communications network called Network Service Supplement . . .

\$450 to \$500 million on the low side, spread out over six or seven years. But many figured costs would be even higher than that. The costs would have included the design and development of the machines, marketing development plans, and the establishment of production lines, but not the actual costs of producing the machines.

Bloch stood for an "all or nothing" implementation of the Shangri-La master plan—either go with it or get out of the computer business. Bloch's supporters viewed him as a conceptual genius, as the man who would lead GE into the Promised Land of computer profits. They felt he had the broad knowledge of the industry and, furthermore, the chutzpah to parlay the APL into a winner for GE. Bloch's approach, however, was said to be based largely on the belief that the rich (IBM) were getting richer and the poor (the Seven Dwarfs) were getting poorer vis-à-vis IBM, and that only a massive assault could hope to reverse the trend for any one of the dwarfs. Bloch's detractors felt

Anatomy of a Merger . . .

otherwise about him and his ideas. They felt his plan was too expensive and would spell disaster for GE's Information Systems Group. They observed that General Electric was gradually turning around its computer operations and that the momentum was towards profits and victory. An expensive APL program would sap the financial resources that were badly needed in the line units.

At the time of the start of Shangri-La, John Haanstra, who had been hired away from IBM by GE, was heading the Phoenix operation. At IBM, Haanstra had unsuccessfully attempted to slow down the introduction of the 360 Series and he tended to follow the same tack at GE in that he was more interested in developing

The cost of implementing the master plan was generally placed at \$450 to \$500 million on the low side . . .

product enhancements for the 400 and 600 Series than he was in developing the APL. But Haanstra was too busy whipping the Phoenix operation into line to involve himself deeply in Shangri-La.

Haanstra, though, was involved in an interesting subplot at this juncture. He was supporting negotiations that were under way between his operation in Phoenix and GE's Japanese affiliate, Toshiba, to produce a computer called the Pi, which was meant to serve as a bridge between GE's 400 and 600 computers which are not compatible. The machine was to have had three or four times the speed of the 400 and would have fit in with Haanstra's basic approach to the GE line by extending the life of the 400 and 600 machines. The original plan was for Phoenix to develop it and for Toshiba to manufacture it, although GE said later that there were plans to make and market the Pi in both countries.

Meanwhile, Bloch was busy with the APL at Shangri-La and had no knowledge of the Pi plan. When he learned of it, he was said to have become upset since he felt it was sabotaging the work at Shangri-La.

When Haanstra was killed in a private plane crash in August of 1969, one of the items on his agenda was a meeting that would attempt to firm up plans to go ahead with the Pi computer. "The Pi plan went to pieces when John Haanstra died," said one former GE man who was close to the project. "The whole project was dropped then."

Haanstra's death in itself represented a real blow to GE's computer operations, because it meant that his strong leadership was gone. But, also, it meant there would be a change in management at Phoenix and this meant there would be a period of adjustment while the new team became settled. It was still another problem in a difficult period for GE. At any rate, GE hired John F. Burlingame to replace Haanstra. Burlingame, who had left GE for RCA when Haanstra was hired, is an old-line General Electric executive with nearly 25 years with the company. Like Hilliard Paige, Burlingame is essentially an aerospace man,

and he, too, had heavy experience in military and aerospace computers. At RCA he had been vice president of Defense Communications Systems. During the early 1960s, Burlingame directed GE's Special Information Products Department where he played a key role in the development of the computers that were to become the 600 Series. When he returned to GE, Burlingame was still partial to the 600.

And the French. The Bull-GE unit has always been like Greta Garbo—it has always wanted to be left alone. The French were said to have resisted the APL plan at Shangri-La more than any other faction. In the end, though, the French, like all the other GE computer units, supported APL, but they were still chafing at the idea that the implementation plan of the APL—and specifically the D machine—would come from the Advanced Development and Resources Planning Division in New York.

But GE Information Systems Italia, the unit that Hilliard Paige called the computer group's "most successful," seemed to present few problems to anyone. "The Italians got along with everyone," a GE man recalls. "They always met their budgets and they were profitable. The trouble was always in the unprofitable units." It is interesting to note that the Italian unit was the only GE computer operation to have had an edp man, Ottorino Beltrami, at its head for an extended period. Beltrami, however, recently left the company.

Essentially, then, it was revealed at Shangri-La that the Advanced Development and Resources Planning Division wanted the APL; Phoenix wanted to concentrate on the 600 series; the French wanted to be left alone; and the Italians wanted to do what they were told. One important aspect of Shangri-La was that the Advanced Development and Resources Planning Division's Bloch was operating from a second

. . . the various other factions in the Information Systems Group all knew they could go over Bloch's head . . .

level in General Electric and the various other factions in the Information Systems Group all knew they could go over Bloch's head, which they did from time to time. In the end, though, all the factions supported the Shangri-La master plan, although it was rough going and Paige was reported to have extracted an oath of support for the APL plan from all of the divisions before the master plan was submitted to a group called "The Three Wise Men" in November of last year.

The Three Wise Men of GE were studying the firm's major venture areas like computers, jet engines, and nuclear operations with an eye to weighing the risks against the potential gains. They examined the Information Systems Group first. The Three Wise Men were Reginald Jones, GE's vice president of finance; Robert Estes, vice president of legal services; and

John McKetterick, vice president of advanced planning. In December, the Advanced Development and Resources Planning Division delivered an execution program to the Three Wise Men. In essence, the execution program was a timetable for carrying out the APL. At that time, GE was suffering from the effects of a costly strike and management was looking for ways to increase earnings. Unfortunately, the APL master plan ran counter to increasing earnings in the near term.

Later, Reginald Jones, who, as GE's financial vice president, had been the most acutely aware of the pressure in the financial community to raise GE's earnings, would say: "Starting last fall, GE undertook an 'arm's length' look at the total computer industry worldwide and our place in it. The task force was a small one. We drew heavily upon talents of personnel knowledgeable in the information systems business. After some four months of intensive work we developed an appraisal of the industry as a whole that formed the basis for our decision making."

Virtually everyone near the Three Wise Men during those days agrees that they made an exhaustive and systematic examination of the company's computer units. They went to Europe to see the international side of the industry first hand, and, in an almost illimitable flow, they received reports, plans and proposals, and talked at length to consultants from both within and without the company. Hilliard Paige acted as the chief interface between the Three Wise Men and the information that flowed in to them.

At first, there was no indication which way the wind was blowing, but at least a couple of GE computer men were suspicious from the start because they felt that none of the Three Wise Men had ever been particularly enthusiastic about GE's computer

... they felt that none of the Three Wise Men had ever been particularly enthusiastic about GE's computer business ...

business, with the possible exception of McKetterick, and he was more taken with time-sharing than the other units. Also, everyone knew that the Information Systems Group was not crucial to GE's future: Remove the computer operation and the General Electric Company would still be the General Electric Company without much change in its over-all profile.

Finally, the Three Wise Men decided that if GE was to go all out for the number two position in the computer industry, then the APL master plan was the answer. "It would have been go-go-go," said one GE man who observed the deliberations. "All that was needed was their say-so. But the Three Wise Men began to hedge. Then Paige hedged. And then everything just crumpled right on down the line."

In January and February of this year others in GE became aware of the hesitancy among the Three Wise

Men and Paige. At that signal, the other key units reverted to the traditional independent profit and loss mentality and last-ditch efforts were made to salvage the GE computer operation. Phoenix came in pushing for the 600 Series and the French wanted to go it alone with the D machine. Meanwhile the Advanced Development and Resources Planning Division was still trying to save the APL program by suggesting that it could go piecemeal and be stretched out further.

But it was too late: there was no way for GE to acquire what it called a "critical mass" in the industry that the company regarded as essential for success. The company was right back where it started nearly a year before, which is to say that it had no really viable

"They didn't quite grasp computers; they thought of it in terms of bookkeepers and banks."

master plan for the future unless it was willing to adopt the Shangri-La master plan and the Three Wise Men felt they couldn't spend the money required to implement that.

In March, it was virtually over; GE top management was moving about the industry looking for a buyer. In late March, negotiations began with Honeywell and it was all over but the paper work.

Perhaps the most cogent observation ever made on General Electric's effort in the computer industry was made by former GE Chairman Ralph Cordiner, who was presiding when the firm decided to make a major effort in the industry. In 1967, in an interview with Forbes magazine, Cordiner said of GE's computer management people: "They didn't quite grasp computers; they thought of it in terms of bookkeepers and banks." (No one, of course, could ever question GE's great technological achievements in the computer industry.)

Cordiner's comment indicated that the problem had been diagnosed in the company as early as 1967. Before that, others had been saying essentially the same thing: that GE's policy of moving good managers about the company might work in the generator business or in the light bulb business, but not in the computer business where a special breed that could "grasp computers" was needed. Obviously, that special breed had to have a background in edp. Yet General Electric never brought in the edp people in the numbers in which they were needed and no edp man ever headed up the Information Systems Group. Indeed, when Honeywell took over the GE computer operation the bargain didn't include one edp man from General Electric in the top management echelon that went over.

Fred J. Borch, GE's chairman, drew the assignment of informing French President Georges Pompidou that Honeywell would be taking over Bull-GE. It could hardly have been a happy meeting since Bull-GE has been the most glaring symbol of a trend which the French find particularly distasteful, the trend in

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which U.S. companies are taking over French companies.

The Honeywell-GE-Bull merger could not help but open up old wounds in France. In 1963, when General Electric attempted to buy into Compagnie des Machines Bull, General De Gaulle blocked the move and the French attempted to work out a "solution Française" for the financially ailing company. But there was no hope and finally the French, after much loss of face and pride, permitted GE to buy in to save Bull.

The old wounds were indeed reopened when the Honeywell-General Electric-Bull merger was publicly announced in France. The strongest reaction came from *L'Humanité*, the official French Communist daily which played up the fact that fate of a French company had been sealed in the U.S. ("Nationalize Electronics," a *Humanité* headline screamed. "Bull, once the leading French computer firm, resold by GE (U.S.) to Honeywell (U.S.)")

At any rate, Borch met with Pompidou in Paris shortly before the public announcement and informed

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the French President of the impending merger. According to *L'Express*, the French newsmagazine, Pompidou is reported to have asked Borch: "Isn't this General Electric's way of getting around the antitrust laws which prevent it from taking over Honeywell?"

Pompidou's comment—whether he actually said it or not—represented a feeling that existed in Paris for awhile. This feeling was that although General Electric may have given up its computer operation, it was gaining control of Honeywell because GE would become the biggest stockholder in Honeywell. (Actually there was some merit to this theory at the time because restrictions on GE's Honeywell stock had not yet been made public. As it turned out, however, GE has no power over Honeywell. The Honeywell stock owned by GE is placed in a voting trust approved by the U.S. Department of Justice and GE is required to divest itself of the stock by 1980.)

The cries for nationalization of Bull-GE came primarily from Communist and other leftist elements. Communist members of the French parliament supported the call from Communist newspapers for nationalization. Also joining in the movement against the merger was C.G.T. (Confédération Général du Travail), the Communist-dominated union that is the largest union at Bull. C.G.T. urged Pompidou and the government to veto the Honeywell-General Electric merger as far as the Bull-GE unit was concerned.

A word here about labor unions vis-à-vis GE. It would be difficult to find another large U.S. company

with as dismal a history of dealing with labor unions as General Electric. At any given time in GE, there has usually been a strike under way somewhere in the company or one looming. While many in GE's top management look upon labor unions as the Hatfields look upon the McCoys, it might be expected that they would have been more unhappy about the Bull union since it is Communist-dominated. Yet, Bull has maintained decent relations with the Bull labor unions and Honeywell likes to point out that the union it is now dealing with at Bull represented fewer lost working days than any other GE union recently. In short, then, the unions at Bull have tended to produce hard work and hard propaganda. (On the subject of propaganda, *L'Humanité Dimanche*, the Sunday Communist paper, won the prize. Shortly after the merger announcement, the paper displayed a Honeywell ad showing a tiger composed of the electronic components that have become the advertising trademark of Honeywell. Under the ad, however, *L'Humanité Dimanche* wrote about Honeywell: "The two specialties of this firm: computers for Europe; cluster bombs for Vietnam, Laos and Cambodia.")

The French tend to see intrigues more than Americans. Whether this is because Americans are innocent and don't see intrigues that exist or whether the French are just intrigue-oriented and see intrigues where they don't exist, is open to question. Be that as it may, "L'Affaire Bull-General Electric-Honeywell" became a subject of great interest last summer in Paris and stories of intrigue abounded.

For instance, the French press observed that General Electric was seeking to assist France develop its nuclear power capability and it was suggested that the French government might use this as a pressure point against GE as the negotiations for the merger continued. There never was any evidence that the French government did so, however.

In the end, the issue of nationalization never came to be regarded as a serious challenge. A far more serious issue to Honeywell and General Electric, though, was presented by the French government-supported Compagnie Internationale de l'Informatique (CII). When GE took over Bull in 1964, the French refused to give up on their hopes for a national computer company; CII was formed and France's "Plan Calcul" was instituted with the idea of

... CII had been holding talks with England's ICL and Control Data . . .

fostering a French computer industry. Between 1966 and 1970 under the aegis of Plan Calcul, the French government has pumped nearly \$150 million into CII, which has remained steadfastly unprofitable and shows little signs of becoming profitable in the near future.

At the time of the merger announcement, CII had been holding talks with England's ICL and Control Data Corp. with the idea that all three might get

together in some form or another. These talks were cut off at the news of the impending Honeywell-GE merger and, almost immediately, the idea was presented that CII be merged into Bull. One theory was that the French government might purchase Bull from GE and merge CII into Bull. The government didn't do this, though, and Honeywell apparently resisted the notion of taking in CII not only because it is unprofitable, but because its products don't mesh into the Honeywell and GE lines well.

Finally, the French government settled everything by announcing it would continue to provide financial support to CII beyond 1971 and, shortly after that, the government granted approval to the merger.

"The feeling now is that CII must step on the gas," Nicolas Vichney, the eminent science editor for *Le Monde*, observed recently. "The new IBM machines and the Honeywell-GE merger will make the going rougher for everyone else in Europe."

So, the French government didn't nationalize Bull-GE and it didn't make the new combine take over CII. But there are indications that the French government drove a hard bargain with Honeywell. The French Foreign Investments Committee could have vetoed the French part of the merger and, since Bull was the largest of the GE computer operations, a veto by the Foreign Investments Committee would have been tantamount to a veto of the whole thing. The new combine filed a "protocol of intention" with the French government. It is not precisely clear how binding this document is. The French seem to look upon it as a list of "guarantees" while Honeywell views it as a list of "assurances."

C. W. (Clancy) Spangle, senior vice president and chief operating officer of Honeywell Information Systems, Inc., says the "assurances" call for Honeywell to maintain a certain level of employment in Bull. Spangle says it won't be difficult to maintain a high level of employment in France and he even expects an increase, primarily because the European computer industry is growing much more rapidly than it is in the U.S., where layoffs have already begun and more are expected.

The "assurances" also stipulate that a certain level of R&D will continue in France. "The approach we are taking is that the total company will assign various missions," says Spangle. "For example, Bull will be

"We expect we'll be exporting more products from France."

making printers. We expect we'll be exporting more products from France."

"These things all make good business sense," says Spangle, who made four trips to Paris during the heat of the negotiations.

The significance of the Bull company to Honeywell is that it accounts for more than half of the entire GE operations it is taking over, in terms of revenue and personnel. Also, it makes Honeywell the undisputed number two firm internationally, whereas Honeywell

had got off to a late start in the international market and its share of the international market lagged behind its share of the U.S. market.

"The computer business is a worldwide business and you can't be successful in it unless you're strong internationally, too," says Spangle.

In one fell swoop, Bull gives Honeywell a strong international position. According to the proxy statement issued by Honeywell, some 6,000 of its 24,000 computer people were stationed abroad while GE had nearly 19,000 of its computer personnel—most of these were Bull people—based abroad out of about 27,000 computer people in the over-all operation.

Where Bull-GE was strong, the Bull units are absorbing the Honeywell units. These countries include Austria, Belgium, France, Mexico, the Netherlands, Spain, Sweden, Switzerland and West Germany. (Likewise, the Italian operation will take over Honeywell's force in Italy while in England, Canada and Australia the existing Honeywell organizations will absorb the GE units.)

The French have been given a fairly wide latitude

"We're shuffling a deck of cards."

to manage Bull and there will be fewer Americans in the new combination than GE had. The French management at Bull will report to W. R. Smart, the top-ranked ex-GE man who came over in the merger. Smart, who is based in Paris, will report directly to A. L. Rudell, International Group vice president, who will be based in the U.S.

"We're shuffling a deck of cards. We're not standing two decks up side-by-side."

That is how Clancy Spangle, the dealer, looks at his job as the chief of Honeywell Information Systems. In many ways, the new company would appear to have been created for the man rather than the man for the company. Spangle is primarily an edp man; he understands both the marketing and technology in the business; he has had extensive experience in both the international and domestic computer markets; and most important of all he is a proven successful manager.

Spangle was brought in to head up Honeywell's EDP Division in 1965 and within two years he had the unprofitable operation, which is the heart of Honeywell's computer business, in black ink. Before 1965, Spangle, 45, directed Honeywell's British subsidiary where he oversaw the establishment of the firm's first European computer sales, service, and manufacturing operations. Before that he managed Honeywell's German subsidiary. Thus, Spangle has the experience in the international field and this is regarded as a particularly important asset since the bulk of the unit acquired from GE is in the international area.

Spangle has already been shuffling the HISI (pronounced hiss-ee) deck of cards and he is finding that they mesh nicely. Honeywell, for instance, has been strong in the medium range while GE was strong in the small and large machines. In addition, GE contributes

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a big international base and Honeywell units have a healthy domestic business.

And GE's computer technology must please Spangle. So, Honeywell gets GE's technology, plus the APL specifications, which should also be particularly valuable to Honeywell since its work on its new line is reported to have bogged down.

"Spangle reads everything," says one former close associate. "And he understands the technical stuff. He has a real feel for the technology and that's unusual for a manager." Spangle is not without technical credentials, holding a degree in mechanical engineering from Yale (he also has a law degree).

Making the merger work (e.g., making profits) will surely test the managerial skills of Spangle and his team. "Spangle runs a very lean operation and he's decisive," says one of his associates. "He gives you latitude to make decisions, but he expects you to make them. If you don't, he'll make them for you."

Three others on the top management team are from Honeywell's former computer operation. Edward C. Lund, the U.S. Group vice president of HISI, had been vice president and associate group executive of Honeywell's Computer and Communications Group. International Group vice president Rudell and Robert P. Henderson, U.S. Group vice president, have virtually been submerged in the computer industry for years. Rudell became manager of internal data processing for Honeywell's Commercial Division years ago. He has headed Honeywell's International Operations since late last year. Ex-IBM'er Henderson has been in Honeywell's EDP Division for 10 years.

Two top men in the management team are from GE.

William Smart was most recently general manager of Bull-GE and he will continue in a similar post at the Bull unit as the International Group's associate vice president. Alva O. Way, the vice president in charge of corporate staff, had served in a top financial post at GE's Information Systems Group.

While Honeywell provides the top edp management, it should be noted that GE key middle manage-

"... He has a real feel for the technology and that's unusual for a manager."

ment people with edp experience have come over to the new company. Spangle estimates that HISI is getting about 90% of the GE people he wanted and he figures that about 50% of the top 50 executives in the GE computer group have joined HISI.

Most important to HISI are the GE customers, who, like all users of computers, tend to be captives of the company from which they purchase equipment. GE has installed more than \$1 billion worth of equipment and most of that is leased equipment; HISI is confident of keeping these customers. On the subject of keeping customers during the lengthy period of merger negotiations, Spangle says: "I don't know of a single customer who was lost."



Domestically the new company has molded Honeywell's seven computer units and GE's domestic operations into one ball of wax with Honeywell's old EDP Division as the matrix. Spangle expects there will be some employee "redundancies," which is his way of saying there will be more layoffs in the U.S. The firm started off with something less than 50,000 employees on Oct. 1.

"I don't know of a single customer who was lost."

In all, the new Honeywell subsidiary will have annual revenues of nearly \$800 million, which will come from about \$2.1 billion worth of leased equipment.

The company does not include GE's U.S. and Canadian time-sharing operation, the Information Services Division, which had been a subject of discussion by the two parent firms in the negotiation stage. (Spangle says GE wasn't necessarily interested in selling the time-sharing unit and that Honeywell wasn't necessarily interested in buying it.) Others close to the negotiations have added that General Electric was asking too much for it—the price tag most often thrown about was between \$150 and \$200 million—and that some in GE top management were reluctant to give up time-sharing because General Electric is number one in the field even ahead of IBM, which, however, like nearly everyone else in time-sharing including GE, hasn't been able to make money in the field. Also, it was becoming obvious to Honeywell that the financial load it would have to carry would be a heavy one and a takeover of the time-sharing operation would add to the difficulties here. Xerox and Control Data were also contacted by GE top management, but Xerox was said to be somewhat tight on money because it was still digesting its takeover of SDS. Control Data was having financial problems of its own.

Spangle is particularly happy about the new company's research and development plans. One of the fundamental problems of competing against IBM, he

Xerox and Control Data were also contacted by GE top management...

points out, is that IBM has a tremendous amount of cash to spend on R&D. Spangle says that his new company will spend the same that Honeywell and GE combined did—about \$100 million a year—but that the research dollars will now go much farther. "A great deal of that \$100 million a year was spent by two companies doing the same thing," he notes. The duplication will be eliminated.

Although Honeywell will take over just some of GE's R&D effort, Honeywell will have the additional financial resources to spend on research. Plus, Honey-

well has GE's APL plan and there are already indications that Honeywell may go with the plan or portions of it.

HSI is supporting both Honeywell and GE lines, and none of the existing lines in production is expected to be dropped in the near future. Indeed, product enhancements in both lines can be expected with emphasis on bridging the two lines, and, of course, to providing IBM compatibility where economically possible.

"We hope eventually to have one product line, but we hope to evolve towards that, and not revolve towards it," says Spangle. "I don't expect to see a whole cloth product line again like we had in the early 1960s."

The HSI chief sees the small GE computers as good entry machines to the Honeywell 200 Series and, in turn, the 200 Series as leading into the GE 600 Series.

"We think," says Spangle, "we can eventually develop a common family of peripheral equipment that will service the entire combined central processor

... Honeywell may go with the plan or portions of it.

product line. In the long run, we will want to develop a line of computers that has program compatibility, at least within the major segments. We think we know of a method that would allow computers to be developed that will be compatible among themselves, and with earlier machines of our own manufacture or of a competitive manufacturer."

Honeywell had been directing its new series—called the Advanced Computer Series (ACS)—at IBM's 360 as well as planning to make it compatible with its own 200 Series. However, it turned out that the project proved to be much more difficult than had been anticipated, and conversion would eventually be quite expensive for the user. These difficulties turned out to be somewhat irrelevant when the 200 line continued to sell extremely well, so Honeywell continued to emphasize its 200 line.

Honeywell can be expected to incorporate at least some of GE's APL specifications and concepts into its new machines, but it is doubtful whether Honeywell—or anyone else for that matter—will mount a major family-wide assault on IBM of the scale that GE's APL master plan had envisioned.

All this brings us back to where we started—to the subject of money talking and Honeywell stock. Since the announcement of the merger last May, Honeywell stock has made a strong recovery. It is apparent that the new company is not only keeping its customers, but should be able to mount a strong marketing effort. Not only has Honeywell's computer operation been profitable, but it was revealed the GE operations that Honeywell took over were profitable in 1969. Honeywell, which has billed itself as "the other computer company," will become precisely what that implies—the number two company in the field. ■



THE GREAT

**Here's a machine
that did its job for
56 years. Will
the replacement,
a CDC 6600,
last as long?**

G After 56 years of predicting the tides without errors or downtime, the Great Brass Brain has been retired. Still in perfect working order, it is enshrined in a glass case in the lobby of the Coast and Geodetic Survey building, Rockville, Md.

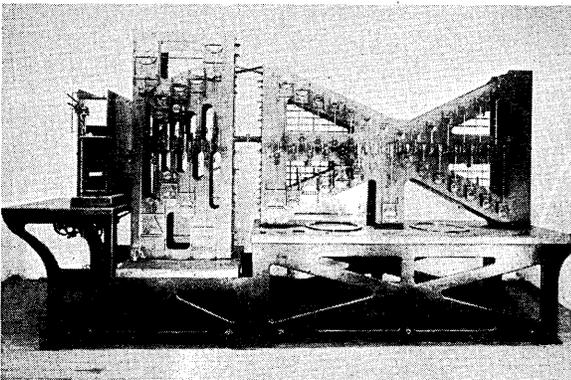
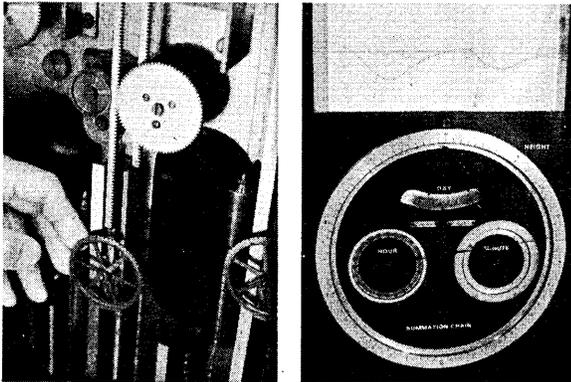
The Difference Engine of Mr. Babbage—and even more so the Analytic Engine—were really never live things, because of construction problems, financial difficulties, and the like. But this machine was built, and it ran, and it was useful.

Now, according to the legends of silicon, core and Watson, nothing useful can be accomplished by machines unless they are digital and electronic. But here is a mechanical, analog machine—using a built-in program—firmware, I believe it is called today—with 37 input variables and output of numbers, letters and on-line graphics.

The accurate prediction of tides and tidal current is a matter of considerable practical importance and the theoretical nature of the problem has occupied the attention of such mathematicians as Newton and De Laplace. In its full ana-

BRASS BRAIN

by Al Collins



lytical array, the problem contains some rather nasty differential equations and to this date no analytical solution is known.

In view of the practical importance of the problem, a commission was formed by the British Association for the Advancement of Science in 1867 for the purpose of the promotion, extension and improvement of tidal predictions by means of harmonic analysis of tidal observations. The final report was prepared by Sir William Thomson (later Lord Kelvin) and published in 1868. The committee proposed a method by which a series of tidal observations at any one place could be analyzed into a series of harmonic components and by suitable calculation the tide predicted for any time in the future—or shown for any time in the past. The practical algorithm involved an immense amount of calculation for any given location—many thousands of sines, cosines and multiplications. Thompson proposed a machine that would do the necessary work by an analog model, and the first one was built to handle up to 12 components.

Professor William Ferril and Dr. Rollin A. Harris, two American mathematicians, were working for the Coast and Geodetic Survey and made important contributions to the mathematics of tidal prediction. In 1882, Ferril completed the design and construction of a tidal prediction machine that would handle 17 input parameters and give the times and heights of low and high water. No intermediate results were available and no curves were drawn.

These were the forerunners of the Great Brass Brain. After their success, Dr. Harris and E. G. Fisher, who was the chief instrument maker for the C&GS, started to design a

The Great Brass Brain . . .

machine that would handle the necessary equation up to 37 significant terms, give continuous output in the form of graphs, and be able to make predictions of tidal currents as well.

Science wasn't a very big thing in those days for the government; there was no DOD, ARPA, AEC, or NASA. Apparently, at least part of the money for the construction of the machine came from the pockets of Dr. Harris and Mr. Fisher, along with those of other workers in the department. The effort was started in 1905 and by 1910 the machine was in use to predict the tides for 1911.

The results were impressive, both physically and mathematically. The machine is about 11 feet long and 7 feet high—2,500 pounds of iron and brass, with a mahogany desk topped in green felt for the operator. The power source is a large crank. To make the machine go faster, the operator cranks faster. Interrupts, for coffee and the like, are trivial; just stop cranking. To restart, just turn the crank some more. No air conditioning; no power failures.

Operation of the machine is quite simple. Set in the necessary input data on the appropriate dials, load the reel of paper for the graphs, and turn the crank. At any time the output consists of the stage of the tide to the nearest 1/10 of a foot, the month, the date, the hour and the minute on the appropriate dials. In the automatic mode the machine stops at high and low water times. The operator copies down the appropriate data, pushes in on the crank handle, and continues to crank.

A look at some sample curves (Fig. 1) will reveal that tides are not simple sine curves and at many locations can be quite complex. The range can be from 40 feet to a few inches.

Not so simple

Since the earliest of times it has been recognized that tides are periodic phenomena and that they are in some way closely connected with the seasons and the phases of the moon. But unless you have taken the trouble to look at tidal data or curves, you might think that they are rather simple occurrences—a high tide followed by a low tide and some simple interval. Actually, tides may have a very large range of amplitudes, even in one place, and a changing period and waveform. For instance, in Korea on the east coast the tide range is in the order of 10 inches while on the west coast of Korea the average range is about 20 feet and may be as high as 33 feet. Some places have several tides per day, some only one, and others none.

How does one go about predicting the tides?

Using the principles of classical physics and astronomy, one can calculate the forces generated by the moon and the sun for any given place on earth at any given instant of time. Now this in itself is not a simple calculation, since the distance and position of the sun and moon with respect to any point on earth are constantly changing, the earth wobbles on its axis, and there are other complicating factors. The phases of the moon, the change in time for the rising and setting of the sun and moon, the seasons of the year, and the necessity for a leap year indicate these complications.

However, these forces give calculated tidal ranges

that are far from agreement with observed data. Around the turn of the century Dr. Harris proposed a hypothesis that tidal waves were primarily stationary in nature—standing wave—and that large portions of the oceans and bays had natural periods of oscillation; thus the tides observed were the result of a combination of these periods and the astronomical forces.

For example, consider a large rectangular pan of water. If one end is moved up and down rapidly, the water moves back and forth in a stationary wave, so that when it is high water at one end of the pan it will be low water at the other and somewhere near the middle there is no rise or fall. This middle point is called the nodal line. Using the data available at the time, Dr. Harris prepared a map of the world indicat-

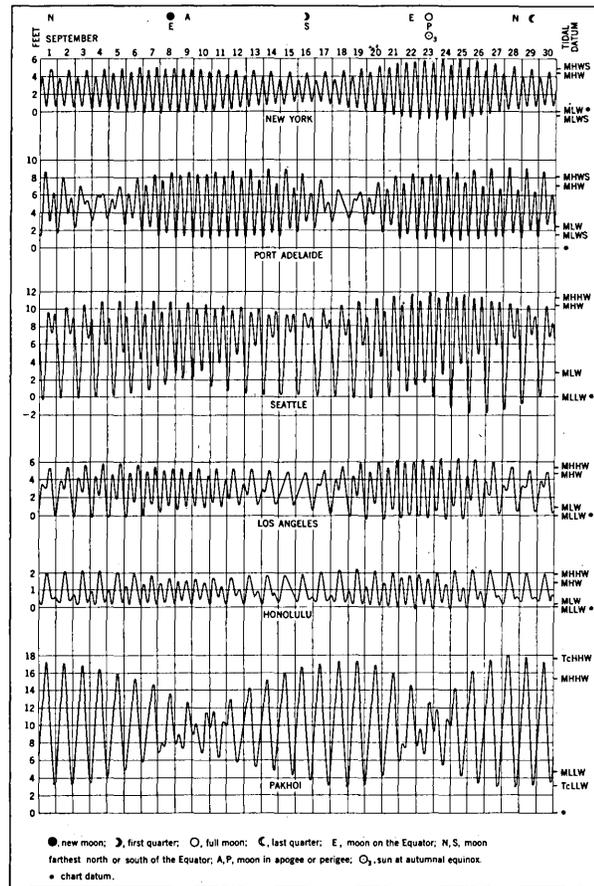


Fig. 1

ing the area within which the water oscillates and the appropriate nodal lines. While this work has been greatly elaborated upon in the past 50 years, it is still considered to be the basic description of the mechanism of the tides.

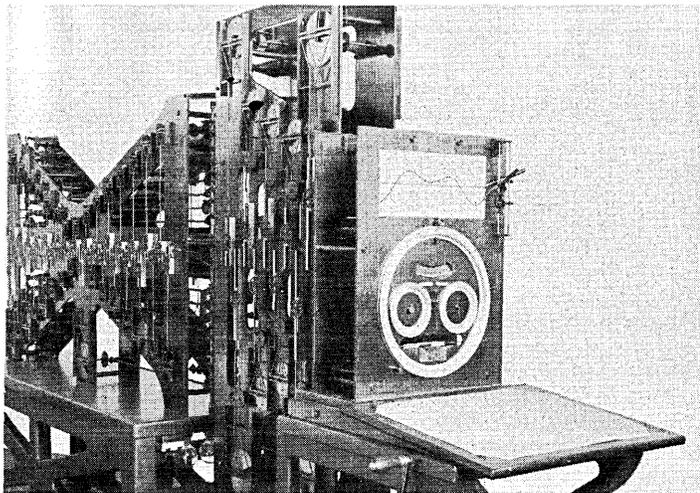
The resultant model is rather complex and, because of local geographical and bottom conditions, no tidal theory has yet been developed to predict the tide analytically except in the most simple cases. In practice, what happens is that tidal observations are made at a given location for some period of time. The resulting waveform,¹ while quite complex, can be reduced to a series of sine and cosine functions and appropriate coefficients. Since the astronomical forces of the sun and moon can be calculated independently, the terms peculiar to a given location can be

separated. Once these appropriate factors are known for any station, the stage of the tide at any given time can be determined by computing the astronomical forces and the periodic functions for this particular station. For example:

$$h = H_0 + \sum_{i=1}^{i=37} f_i H_i \cos [a_i T + (V_0 + u) - K_i]$$

where h is the height of the tide.

Just for a warm-up on your time-sharing terminal, you might try evaluating the above 8,760 times—if you are satisfied with just an hourly reading of the tide—or 525,600 times if you want results to the nearest minute. Since there are 37 terms in each evaluation we get something like 19,447,200 calls on



the cosine routine. This will give you a complete record of the tides, at one place for one year.

To find the times of high or low water, solve

$$\frac{dh}{dt} = - \sum_{i=1}^{i=37} a_i f_i \sin [a_i T + (V_0 + u) - K_i] = 0$$

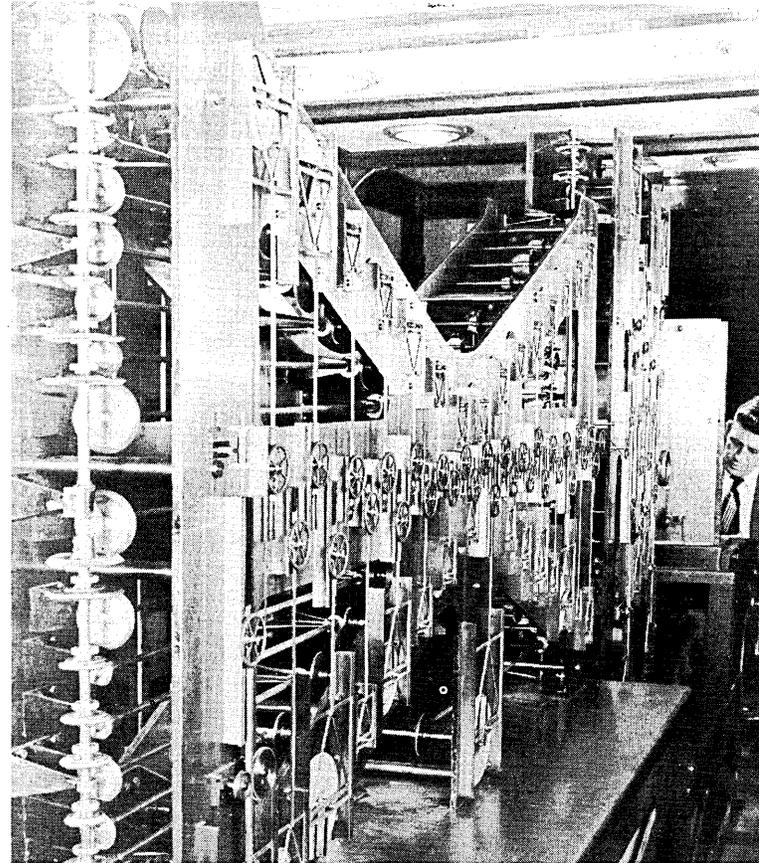
for each tide.

To make numerical evaluation of these equations more efficient, the designers of the Great Brass Brain considered certain mechanical principles. A simple gear as it rotates is a wonderful source of sines and cosines. If the gear is engaged with a rack, the rack's displacement is a function of the gear diameter, the number of teeth, and rotation.

Each term of the equations above has a mechanical counterpart in the form of a gear. These gears are connected by a small chain. The movement of one end of the chain represents the algebraic summations of all the terms.

Now that is a bit simplified—like saying that a large digital machine is full of flip-flops, AND gates, and OR gates—but that is the basic principle. On the machine, each of the gears has an index and a clutch mechanism that allows it to be set to an initial position on its shaft and then locked. After all the initial data is set into the gears for a given starting time, the crank is turned. It is geared, via many shafts, to drive all the other gears and the sum of all the functions is represented by the movements of the end of the chain,

1. In their spare time, the gentlemen at the C & GS invented an automatic gauge, operated by the motion of the tides, to draw curves showing these waveforms.



which is attached to a dial—to give a direct readout of the height of the water—and to a pen, which draws an actual curve of the tide vs. time.

The turning of the crank represents the function time and is displayed on a dial for month, day, hour, and minute. A second pen also draws a base line on the tide chart and marks by small pips special times of interest: midnight, noon, each hour and the occurrence of either high or low water.

In operation, the particular value for each term of the equations (up to 37) is set into its appropriate gear and the date dials adjusted to the starting date.

The reader may be interested in some excerpts from the slim volume covering theory, operation, and maintenance of the machine—in contrast to the complex procedures involved in digital computers. For example, on maintenance:

“Adjustment of machine. The adjustment of the machine should be tested at least once each year and at any other time when there is any reason for believing that a change may have taken place.”

And note this entry on debugging:

“After the setting of the machine for any station has been completed an excellent check on the work is afforded, if the predictions for the same station for the preceding year are available, by turning the machine backward several days and then comparing the predicted tides with those previously obtained.”

Did you ever try and debug your payroll program by stuffing a paycheck in the printer and watching a time card come out of the reader?

More complications

One might think that, with this wonderful machine, once a set of curves for any place was drawn that would suffice—since tides are periodic. Not so. Many of the influences for a given location change. The shape of the bottom, the prevailing winds, dredging, the shape of the shoreline—all can significantly affect the local tides. (The wonderful huge waves that

The Great Brass Brain . . .

the surfs love in California are caused by storms far off the coast of Mexico and South America several days earlier, not by the local winds.)

Also, by a very careful study of tidal data, long term effects such as the settling of land masses and the change in sea level can be detected. So the study and collection of tidal data, new predictions, and new stations added to the list of places where tides are computed is a continuous process like the tides themselves.

For the average prediction it took about three hours to set up the machine with the appropriate data; verify the setting by running backwards for a check; crank, crank, crank, for the predictions, and copy down all the digital data for heights, times, and dates. The usual prediction was for one year in advance, although in some special cases two-year predictions were run.

In 1868, tides were published for 19 control stations and 124 secondary stations. By 1967 the volume had grown to 251 control stations and 7,822 secondary stations. There were often special cases to be considered, such as requests from construction companies, shipping companies and foreign governments. Thus, although the basic problem had not (and still has not) changed and they had a demonstrated, elegant solution to the problem, the volume of work became a burden.

Assuming the prediction of two to three tide tables per day for an average of 300 working days per year over a 50-year span, the equations previously shown were evaluated some 6×10^{11} times. That certainly fits the famous criterion of Von Neumann that a problem should have a million arithmetic steps to be worthy of a computer.

The most difficult part of the whole operation was the operator's transcribing output from the dials to paper so the tables could be printed. In 1960, an automatic readout device connected to an electric typewriter was added and photo-offset printing could be done directly from these listings. At the same time, a small electric motor was added as a supplement to the crank.

Beginning of the end

The predictions branch of the c&s is not a large operation. Its staff has averaged about five skilled tidal analysts for many years. With more and more work to be done, and the availability of a large digital machine in the environmental sciences service (weather bureau), it was decided that perhaps a program could be written and the analog machine retired.

Mr. R. A. Cummings, who is now chief of the tidal predictions branch, and who had personally turned that crank for some years, developed a program—first used on a 7094 and now in production on a CDC 6600. It gives almost the same answers, but no curves—because of those nearly 20,000,000 calls on the cosine routine for each of several hundred stations. Special tables were computed and the trig functions are done by table look-up rather than direct evaluation. Another compromise to conserve machine time: the program now only looks for high and low water and then searches in .1-hour intervals on either side of this for a

few auxiliary entries. No more curves, special runs to get the stage of the tides for any minute, fewer answers and no more accurate—but Mr. Harris no longer has to turn the crank. Still, one wonders if the computer will do as well, especially in accumulating an equivalent record of error-free operation.

It is interesting to speculate why the tidal machine has only recently been replaced by the digital engine.

One gets the impression in talking with the people at the tidal predictions branch that they understand their job and the problem that they wish to solve. Several hundred years of very high grade mathematical talent has gone into the construction of the algorithm and related mathematics. The problem has to do with nature, not the corporate controller or the latest super-programmer's notion of what he thinks the problem is or should be. The machine did not stretch the state of the art. It was designed to do one thing and only one thing, with the convenience of the user kept in mind by the designers—perhaps because they were the same people. Speed was desired, but only in terms of the person using the machine, and not speed for speed's sake.

The moral, I believe, is clear. Understand the problem. Devote your whole attention and talents to that and only that problem. Do not change the problem. The job to be done is solving the problem, not advancing the "state of the art" somewhere else.

As I stood and looked at the shining brass machine in its glass case, and thought about the parity errors, the machines that did arithmetic wrong (because of design errors), the xsRTF that worked most of the time, and the number of times that I had submitted a run and was sure that it would work (never), I could not help but think that maybe change is a scalar and progress a vector. And wonder just how much progress we really have had lately.

I would like to thank Mr. Harris, chief of the tidal predictions branch, for his most generous contribution of time and information and a most pleasant visit to the c&s. And while we have the greatest respect for his professional ability and integrity, having been in the computer business for many years I would like to call the attention of my fellow amateur sailors to p. 131 of H. O. Publication No. 9 Bowditch—how to construct a lead line. ■



Mr. Collins is now with the Burroughs Corp. Starting in the computer business as an IBM customer engineer in 1952, he has been a technical support manager for CDC in Australia, operations manager of the computing center at Stanford Univ., and a project manager at the Univ. of Utah. He has long been interested in the specialized machines that were the forerunners of digital computers.

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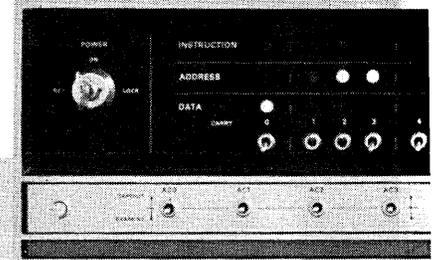
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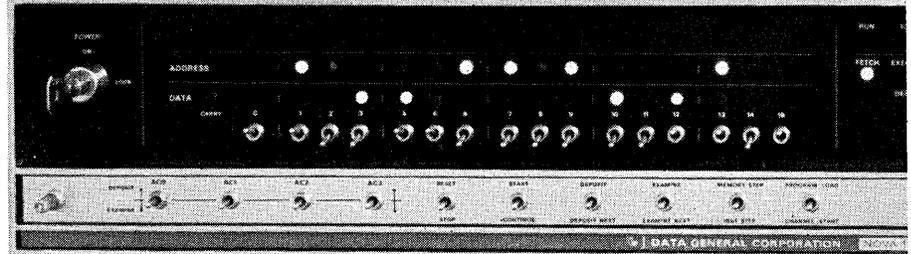
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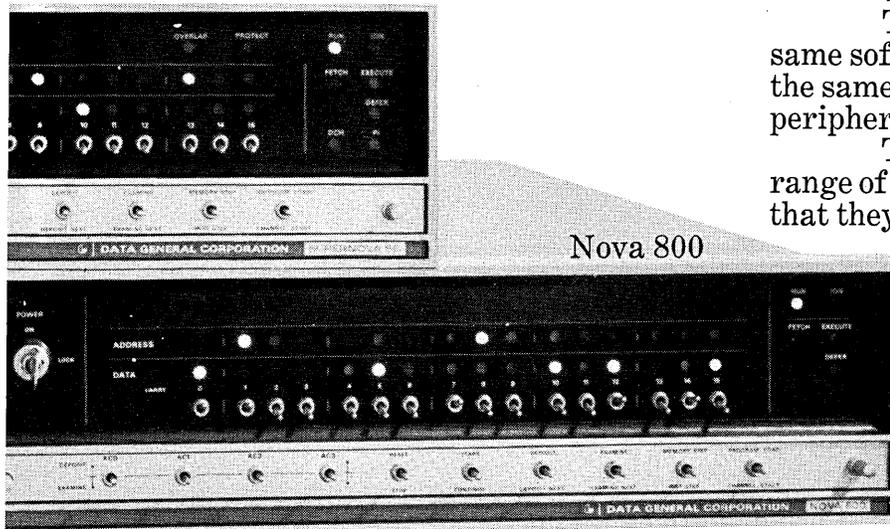
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Improved and standardized digital cassettes may be the answer to lowering tape transport costs

Tape Transports

by Frank W. Loeschner, Dale A. Spencer, and William M. Barton, Jr.

The growth of the minicomputer and remote terminal market has ushered in the need for lower cost digital tape transports. How can the industry achieve lower cost transports? What, if anything, should be the basis for standardization?

IBM-compatible transports have certain built-in cost factors which make reasonable performance at quantity prices under \$2000 per unit difficult to achieve. For the transport manufacturer, head and motor costs are about \$500. The 9-track, read-after-write head alone, in 1,000 quantity, sells for about \$350. The motors are expensive because the control of the reels requires a substantial amount of torque.

Alternative solutions offer the only possibility of significantly reducing transport costs. IBM-compatibility has been the standard of the industry to date. With the trend toward remote terminals, very inexpensive data acquisition, and keyboard entry with transmission over telephone lines, the need for user compatibility has diminished. The need for manufacturer compatibility is nevertheless vital, since mass production and mass acceptance are the keys to lower cost.

To determine what is required for the market, let's analyze the data capacity, the data rates, and the cost factors involved in a non-IBM-compatible recorder. A typist typing at 60 wpm could enter approximately 100,000 characters per day onto magnetic tape. Therefore, the data capacity should be at least 100,000 characters so that the user seldom needs to unload tapes. The data rate should be high enough to provide for transfer of data during the carriage return time of the typewriter or for the latest 1200-cps telephone line devices. The recorder should be fool-proof. Even an inexperienced operator should be able

to load and unload tapes. Reliability should be at least as good as the current transmission devices which claim 1 part/10⁶ error rate.

Applications

The applications for such a non-IBM-compatible recorder are exciting and varied. Any time the cost of an intermediate storage device can be dropped by 50% or more, the applications which were previously infeasible suddenly become very practical. Data terminals are a good example of this. Until recently, the cost of minicomputers, keyboards, and tape recorders has made remote terminals relatively expensive. Now, with the advent of lower cost modules, it is forecast that the market will quadruple to \$4 billion before the end of 1972. Of course, not all terminals will use tape transports; but, to eliminate high on-line costs, batching will form a substantial segment of the market.

Another important application exists in the minicomputer market for source and object program I/O. Many of the people using minicomputers need only modest storage but great I/O capability, transferability, and versatility.

In the data acquisition market, cash registers of the future in the retailing industry may be viewed more as batching data terminals than as cash registers, having intermediate storage within the device for transmission after data is collected. The banking industry and the accounting industry could also accumulate data in an intermediate storage device based on magnetic tape recorders. For inventory purposes, a low-cost, lightweight, portable recorder has great advantages.

One of the most significant magnetic tape record-

ing markets today is the keyboard entry market. Until recently, this market has been based on IBM-compatible tapes. However, with the advent of terminal keyboards with transmission, there is no need for IBM compatibility. Another factor in the keyboard market which reduces the importance of IBM compatibility is pooling. IBM-compatible tapes can be generated while pooling from non-IBM-compatible recorders in the keyboard entry stations. This reduces keyboard station costs while still providing IBM compatibility.

Available recorders

One of the recorders available that has been widely used in this market for lower cost is the punched paper tape recorder and reader. A punched paper tape system has the advantage of economy, keeping the concept simple, and having a widely accepted format. The medium is easily handled, transferred, and stored. The disadvantages, however, are numerous. It is very slow, and higher speeds are prohibitively expensive. Most economical considerations drive the speed down, even though the user would prefer higher data rates. The mechanically driven punches have low reliability and generate considerable noise. The storage density is less than 20 cpi.

Over five years ago, IBM designed an alternative to punched paper tape called the *MTST* system, which provides for a sprocketed magnetic tape device with a flying head going across the tape at a 90° angle. As it exists today, it is a complex design, but it has wide business acceptance. The approach is one that deserves attention, although it can never achieve significant data rates, and the complexity removes the possibility of lower costs.

Consider the possibility of a modified reel drive. Reducing the inertia of the reels by limiting the amount of tape, and using only one or two tracks on the head, achieves lower cost, although the tape handling and threading problems remain.

The first magnetic cartridge to receive wide consumer attention was the endless loop cartridge recorder and its application for the automobile stereo industry. The advantages of this drive are considerable. The cost is reduced by virtue of the fact that an endless loop device allows all the driving to be done with one motor. The tape is pulled off the center of the reel and fed onto the outside. For digital applications, however, this device is not acceptable. The reliability and the number of passes based on the pulling, stretching, twisting, and sliding of the magnetic tape on itself would be unacceptable to the bulk of the computer industry. Furthermore, bidirectional operation is impossible.

There are many types of reel-to-reel cassettes available. Theoretically this type of recorder eliminates the problem of poor tape handling, since the tape is never twisted, slid, or pulled against itself.

The cassette

Although to date few companies have shipped a significant number of cassette recorders, the industry seems to have accepted the cassette device as the most likely candidate for standardization. Its greatest feature is simplicity. The storage, the data rates, and

the cost factors of the cassette drive can all be brought into line with those required by the industry today.

The Norelco-type cassette offers the most perplexing aspect of this new market. This cassette has caught the imagination of many new recorder manufacturers. It is interesting to note, however, that major manufacturers of digital tape recorders have been slow to follow this trend. This is probably because the Norelco-type cassette was not designed to be used as a digital storage device with bidirectional, fast stop/start capability.

The standard cassette is a challenge to any digital recorder designer. Because of the sloppy tolerances and troublesome skew angles produced by poor tape guiding, the audio cassette devices have a great deal of edge-wear and rubbing of the tape within the cassette. This reduces reliability because the particles rubbed from the edges cause dropouts. The thin tape within the audio cassettes adds to the grief of tape handling.

In audio applications, no tension is required on the supply reel, and the tape feeds off freely, relying on a pressure pad in the cassette and a single, fixed-head guide to locate the tape. This technique is unacceptable in digital applications. The pressure pad reduces the number of passes on the tape since it produces higher tape and head wear, and the single capstan provides only for forward operation.

Reliable bidirectional, high-performance operation must be achieved in order for the cassette recorder to be acceptable in computer applications. Either the cassette itself must be improved, or the transport mechanism must be designed to overcome its deficiencies, or both. If the cassette is to operate as the standard of the digital industry, the axial motion of the reel hubs must be restrained and other tolerances reduced. One possibility would be to open the cassette in the head area for transport-referenced guiding to reduce the effect of limited guiding that is currently in the standard cassette. Another possibility would be to add guiding and improve the tolerances and tape handling capability of the cassette within the cassette configuration. Several manufacturers are now offering certified cassettes upgraded for digital applications requiring higher performance and reliability.

Transport considerations

Approaching the problem from a different angle, a more sophisticated tape drive can be designed to eliminate some of the deficiencies of the cassette. In the development of a cassette transport, consideration must be given to various aspects of the design:

Incremental vs. continuous operation. Many real-world phenomena happen in an incremental, or asynchronous, manner. Thus, by making the recorder incremental, or able to record whenever data is presented to it, one allows for this random operation of the real world. As has been seen, however, from the IBM-compatible transport market, reliable incremental performance is difficult to attain. The technique requires controlled jerking of the tape. Packing densities must be lower in an incremental than in a continuous recorder, since one must allow for starting and stopping on each character. This reduces the

potential data rate and the use of 4800 and 9600 bps modems for transmission. Furthermore, no satisfactory technique has yet been devised to guarantee the data on the tape, although one might consider the development of a flux-sensitive head for incremental applications. Current research indicates this offers potentially lower costs for both incremental and continuous recorders.

Most of the large markets for the recorder call for data from keyboards or from telephone lines. Both of these produce data synchronously, since they are usually equipped with an intermediate correction buffer. Asynchronous data may also be stored within low-cost MOS registers which buffer the data. Dual 50-bit MOS registers are available at prices less than \$30. With a buffer memory on a keyboard, corrections of the data can be made before entry onto magnetic tape.

Forward only vs. bidirectional operation. There are some applications for forward-only operation. In keyboard entry, an error character could be inserted after incorrect data is detected by a read-after-write process. The system could go on with a rewrite rather than backspace to the same bit of tape found to be incorrect.

More applications, however, demand bidirectional operation. Most keyboard entry systems provide backspace, rewrite, or retry capabilities. Computers for programming and I/O require bidirectional search and retries. Libraries of data also require bidirectional search capabilities.

The technical problems of bidirectional operation are significant. Normally, tape is pulled over the head. One must have a capstan on either side of the head or must assume the reels to have rapid enough response to take up any variations in tension, since no tape compliance is provided in the cassette. Omitting the capstan and driving from the reels requires specially prepared tapes and reduces operating convenience and reliability. Using a capstan on each side of the head and synchronizing their start and stop profiles in the head area, complete isolation from the problems of the cassette device is obtained. This provides identical operation in both directions.

Tape speed. To provide for good digital recording and reproducing, one must keep within the range of 10% bit-to-bit jitter. To accomplish this, the capstan, or the tape speed variations, must be held below 4%. An optical encoder directly connected to the capstan motor provides both position and velocity information. The position information allows exact measurements of tape distances. The velocity information, derived from the position information, provides very precise speed control, since the rate information from the optical encoder can be synchronized to an internal reference. It is extremely difficult to synchronize two capstans by velocity feedback only. Another possibility for sensing tape velocity is provided by a clock track prerecorded on the tape and read by a read head. This requires, however, that the user buy specially prepared tapes and ties him to a small number of suppliers.

The tape motion command rate must be rapid enough to assure that the ability to make retries and repasses be unlimited. Since there is no compliance between the drive capstan and reels, the possibility of very fast start and stop times is remote. Therefore a

tape operating speed must be chosen that allows the required command rate and is within the capabilities of the mechanism and tape limits. Beginning and ending of tape sensing should be provided so that the user may be assured that he has not run out of tape, even when the recorder is unattended. The clear leader at both the beginning and end of tape in the cassette can be used for this purpose.

From a control standpoint, the machine should be made as foolproof and low cost as possible. Push buttons and solenoids add cost and complication, so they should be eliminated wherever possible. A power switch is not required, since the transport is a component and not a system. Some technique must be devised to activate the head and pinch rollers without using a solenoid or a mechanical push button. The recorder should be easily removable for maintenance, allowing minimum down-time.

Recording techniques

There are several techniques currently available that would provide satisfactory recording. Of these, there are two with which the industry has had considerable experience. Phase encoding places both clock and data on a single track, therefore producing simplicity and easing transport skew requirements. Non-Return-to-Zero-Interrupt (NRZI) recording implies at least two tracks since NRZI data is not self-clocking. Although it would seem that two tracks would allow higher data rates, exactly the opposite is the case. Tape distortion problems become limiting factors with more than one track, requiring the packing density to be substantially reduced. If economy is considered, the single-track head used with phase-encoded recording is lower in cost than a dual-track head.

Consideration must be given to error detection and correction. A dual-gap (read-after-write) head provides the user access to the exact data within. Read-after-write allows the user to do a check on the data immediately after it is written and assure himself that the data is correct. Another possibility, however, is not to detect errors but to provide redundancy on the tape through dual tracks. This increases the parts cost and reduces reliability. In addition to read-after-write, one might use error detection and correction schemes, reducing the error rate to any required level.

Proposed standards

The cassette would utilize 300 feet of certified .5 mil tape and would be redesigned for improved performance based on better guiding, tighter tolerances, and the elimination of the pressure pad. Data would be written or read only while the tape is moving at a constant velocity. This provides for relatively high data rates and allows for convenient buffering and handling of data, as well as read-after-write checks. There would probably be a family of two recorders—one bidirectional, one unidirectional—since significant savings could be accomplished in a unidirectional transport. The number of motors and controls in the unidirectional version could be substantially reduced. However, for the bulk of the applications and for the most universally accepted applications, the bidirec-

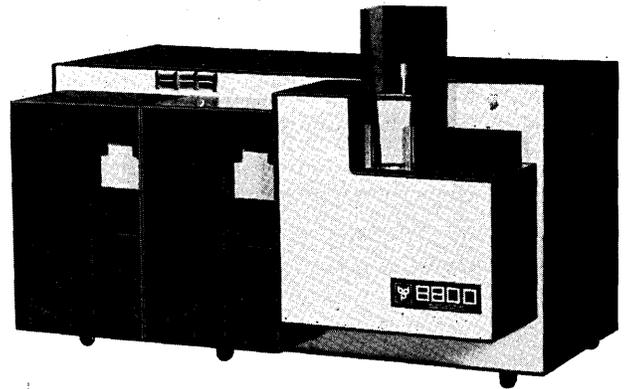
tional capability would be imperative. This would be accomplished by dual capstan as well as dual reel motors, allowing for relatively fast start and stop times and isolation of the head from the reels to reduce cassette deficiencies. The transport could utilize both standard and improved cassettes. The dual capstans would be synchronized through dual optical encoders to a master clock and the tape tension held slightly higher in the head area. Speed control would be exact using optical encoders, and the command rate would be high. There would be no controls on the front panel. Closing the dust door would actuate the head and pinch rollers. There are two indexing holes in the standard cassette. Lights in these holes shining through the tape to photo cells can easily detect beginning and end of tape. The unit would be a plug-in, very similar to a Tektronix oscilloscope plug-in, not having very much of the interface or the power supply within the unit. This allows it to be relatively small and light and permits the user to do his own interface, providing flexibility with lower costs. The recorder would use a phase-encoded single-track technique and provide read-after-write guarantee of the data on the tape. The transport manufacturer would have head and motor costs of \$100, compared with \$500 for the IBM-compatible transport. The savings in these key cost areas allow the cassette recorder to compete in the new markets described.

A great deal of progress in the area of the tape transport and the tape cassette will be made in the next 12 months since new heads, new recording techniques, and new transports will be available in increasing numbers. Now is the time for standardization, and the standardization should be based around a logical approach to this design problem. The transport, as outlined in this article, might cost slightly more than other simplified techniques. It is the belief of the authors, however, that it provides the most satisfactory and complete approach to this design problem. ■



Mr. Loeschner (left) was a founder of Cipher Data Products, a San Diego-based manufacturer of digital magnetic tape transports, where he served in the past as president and chairman of the board. He holds a BSEE from Stanford University. Mr. Spencer (center) is another Cipher founder, and currently director of engineering. His BSEE is from California Polytechnic College. Mr. Barton (right), also a Cipher founder, designed the mechanical portion of all Cipher transports.

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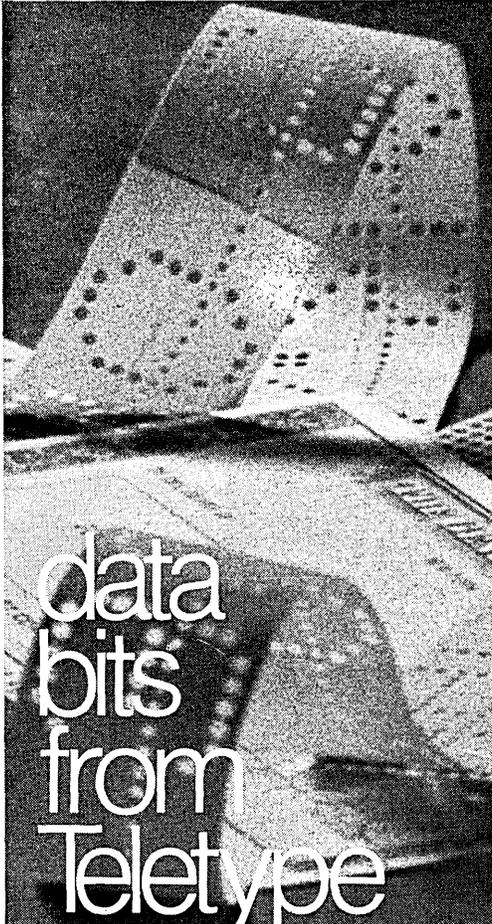
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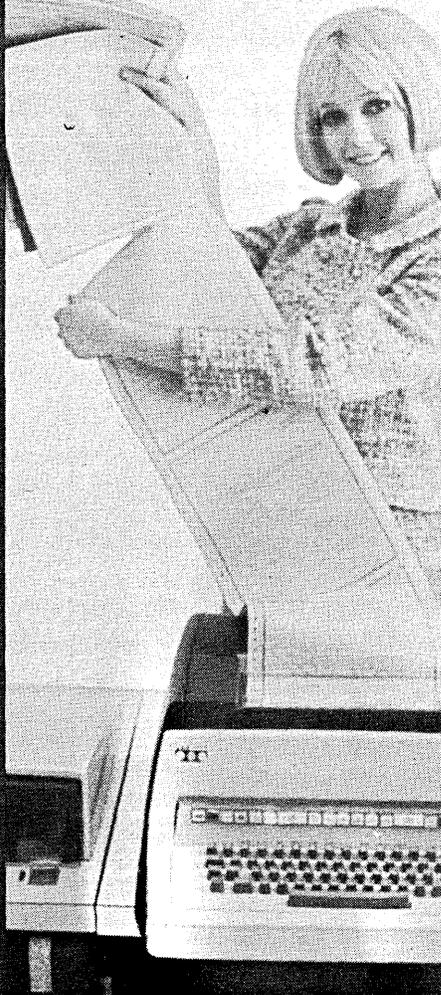
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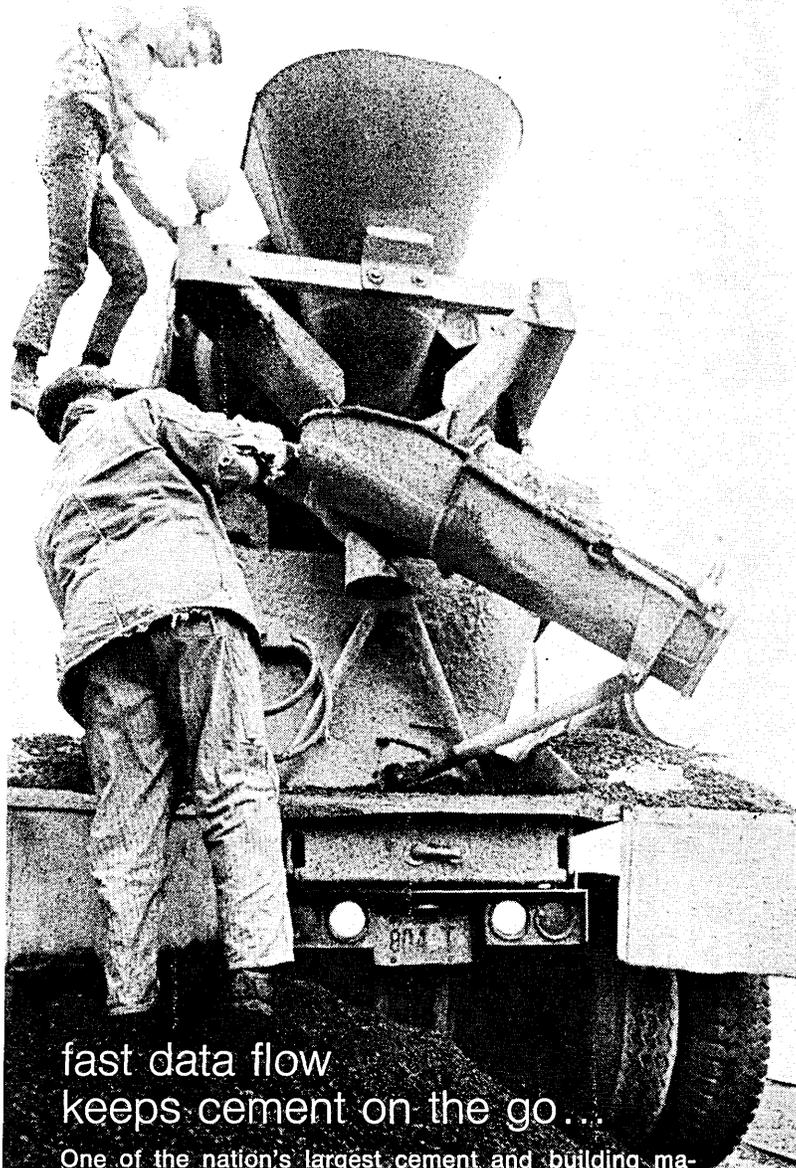


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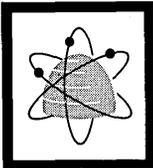
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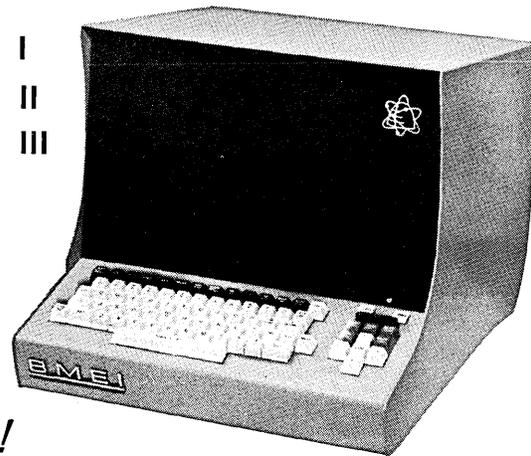
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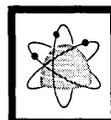
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Generalized data base management systems, under many names, proliferate, as do associated problems; a common system would help

MIS: Data Bases

by T. William Olle

M The class of systems which may be referred to as generalized data base management systems (GDBMS) represents a phenomenon which has been evolving in a mushroom-like way over the past six years. There are now many systems which can claim to be GDBMS but which frequently are identified by some other name. Examples of such names are: data management systems, file management systems, generalized information retrieval systems, and many others. An extensive list of possible names has been given in a footnote to a recent DATAMATION article by Byrnes and Steig¹.

Many articles have been published which introduce the concepts and capabilities in such systems. It is not the purpose of this article to go over that ground again, but rather to examine the role which such systems are coming to play in management information systems today, and to try to project what their role is likely to be over the next decade. In addition to various introductory articles which have been published, there have also been two in-depth surveys to which the reader is referred. The first of these is the survey prepared by the Mitre Corporation², for which most of the work was performed during 1967 although it was not released until January, 1969. This author has been involved in the more recent one, by the CODASYL Systems Committee³. This has been available since May, 1969. Both of these surveys define a set of features to be found in such systems, and then describe a set of systems with respect to the identified features. There is a difference in approach between the two surveys—the Mitre sur-

vey uses a tabular format to describe the systems while the CODASYL one uses a narrative presentation.

In the work of the CODASYL Systems Committee, one of the most important distinctions observed among existing GDBMS is the difference between what the committee calls "host language systems" and, for want of a better term, "self-contained systems." Examples of host language systems are IBM's IMS, General Electric's IDS, and Auerbach's DM-1. Examples of self-contained systems are IBM's GIS, the Navy's NIPS/FFS, SDC's TDMS, Informatic's Mark IV, and RCA's UL/1.

The Systems Committee has in fact been debating how broad the current difference is between host language systems and self-contained systems. While the difference to be discussed is clearly present on a functional level, it is questionable to what extent some systems can be classed one way or the other. It is safe to say that certain features typify one class while other features are found only in the other. A thorough analysis of all features is currently being prepared by the committee.

Three major categories

The difference between host language systems and self-contained systems was noted in a paper by Fry and Gosden⁴ who divided systems into the following three major categories:

Own Data Management

Language

self-contained

Forms controlled

self-contained

Procedure-Oriented Language

Embedded

host language

The middle class is a special class of self-contained systems. The main difference is the form of the language, which is based on checking squares in elaborate forms as opposed to the more frequent approach of a free-form language.

Several feature articles tend to treat self-contained

Although the author of this article is the chairman of the CODASYL Systems Committee and a member of the CODASYL Executive Committee, the opinions expressed are strictly a personal viewpoint and must not be construed as representing a consensus of opinion or a policy of any CODASYL committee.

1. C. J. Byrnes and Donald B. Steig, "File Management Systems: A Current Summary," *Datamation*, Nov. 1969, Pp. 138-142.
2. J. Fry et al. "Data management systems survey," Mitre Corporation report. AD684707, Jan., 1969.
3. CODASYL Systems Committee technical report. "A Survey of Generalized Data Base Management Systems," May, 1969. Available from ACM, New York City and IAG Headquarters, Amsterdam, Netherlands.

4. J. Fry and J. A. Gosden. "Survey of Management Information Systems and Their Languages." Published in *Critical Factors in Data Management*. Prentice Hall 1969.

and host language systems as identical. It is extremely important to identify the basic difference between the two classes.

The host language systems are basically enhancements to a host procedural language, usually COBOL, but for some systems it can be PL/I, FORTRAN, or even basic assembly language. The enhancements are always oriented toward transferring data between one level of memory and another, and the user of the host language system needs to be proficient in programming with the host language.

There are two ways in which the system may be embedded in the host language. Usually, this is achieved through the CALL statement in the host language, which means that the host language compiler does not need modification. Programs written to use this system tend to contain a large number of CALL statements. This approach was chosen with IMS and DM-1. The other approach is to add new statements to the host language, which mean that its compiler does need modification.

A self-contained system (sometimes called an information retrieval system) provides its own language, which claims to be more user oriented and which is designed for use by persons such as managers and others who do not necessarily understand procedural programming. The self-contained systems always imply a processing algorithm for interrogating and updating the data file or data files.

The most common processing algorithm is, of course, the sequential pass of the file, although some systems (notably CDC's TDMS) embody sophisticated indexing techniques to obviate the need for the sequential pass.

Information needs

In order to assess the use of the two classes of systems, it is necessary at this point to categorize information needs in a user organization as predefinable and unpredefinable. The predefinable information needs tend to be those of the lower levels in the management hierarchy, and are therefore those most frequently handled with conventional programming techniques. However, several organizations are handling their predefinable needs to their satisfaction and are anxious to give a more timely response to their unpredefinable information needs, which usually originate from the higher management echelons. In this case a timely response would often mean a matter of hours, rather than the several days or weeks which are usually required to write and check out a procedural program.

It is not a simple matter at this point in time to classify satisfactorily those applications which are appropriate for self-contained systems, applications which are appropriate for host language systems, and applications which cannot be handled by either class. However, it can be observed that applications can be divided in terms of the complexity of their data base structures. A data base is here defined as a set of files which may or may not be logically interrelated. The self-contained DBMS, particularly some of the simpler ones, tend to be restricted to a class of problems which may be identified as one-file problems. Such problems have one main master file and, in addition,

may have transaction files and output files; but the important point is that there is only one master file.

Another class of applications is that requiring three or four master files linked together, and such applications are typically found in a manufacturing environment. The self-contained systems are rarely suitable for handling such applications, since they require network structures of the type offered by GE's Integrated Data Store.

It would be useful if, at some point in time, an accepted taxonomy of applications could be developed so that an application could be categorized in terms of its complexity. With the present state of our knowledge there is a considerable level of intuitive understanding for the relative complexity of data processing applications, but no accepted way of classifying them.

Task group proposal

One of the most significant host language systems is that contained in the proposal of the CODASYL Data Base Task Group to its parent committee, the Programming Language Committee⁵. In its proposal, which was released in October, 1969, the DBTG proposes that network structures should be added to the JOB COBOL (*CODASYL Journal of Development COBOL*). These proposals represent the culmination of three and a half year's work by the DBTG and also represent one of the most significant changes ever suggested to the COBOL language. The proposals will be considered by the Programming Language Committee for inclusion in the COBOL language. If they are included, this will mean that the data base management facilities of the host language systems (now provided separately from COBOL) can be handled with the expanded COBOL. Some of the host language systems, notably IMS/360, are products which provide transaction management as well as data base management.

Management information systems

The term management information system tends to convey the idea that the data processing in the organization is now something more than it was ten years ago. Hopefully this is true. All too often it is a new name for an old concept. At best the term management information system should convey two capabilities.

Firstly, many data processing applications with the organization are now being coordinated with each other and are being applied to a common data base, where the data base is an interrelated set of the organization's files. In the pre-MIS approach each application would be handled separately without regard for other applications which might use some of the same data.

Secondly, the term should also convey that higher level management, who as indicated earlier tends to have the unpredefinable information needs, is now able to get information it requires without the delays which have, unfortunately, become widely accepted. The issue rests very securely on the predefinable and unpredefinable information needs. Just what informa-

5. CODASYL Data Base Task Group. October 1969 Report. Available from ACM, New York City.

tion a manager requires at any time to fulfill his function, only he can decide. Some managers are developing an expertise in pinpointing the information they need to make decisions; others prefer to rely on intuitive feeling—taking the attitude that the information they require probably cannot be made available to them.

It must be pointed out that many GDBMS are promoted on the hypothesis that they can be used by management level people. This is a rather unfortunate factor and is to be compared with the idea promoted in the late 1950's that a language could be developed for use by accountants. We now have in the industry many tens of thousands of people who are called COBOL programmers. It is questionable how many of them are actually accountants.

Over the past fifteen years in which computers have been used for business applications, the person who communicates with the machine has always been thought of as a programmer. Particularly with the advent and increased acceptance of GDBMS, the levels of user are stratifying considerably and it is useful to identify what these levels should be in a typical corporate environment.

Levels of user

The first level of user is the data base administrator or data base manager. This individual would normally understand some of the space/time and people/machine tradeoffs which are available and which his GDBMS should allow him to influence. The data base administrator, by definition, should have had experience in conventional programming and systems analysis techniques, and would be the prime person responsible for the well-being of a data base, or possibly for only a single file in it. This does not mean that others would not use the data base or that they might not change its value content. However, the initial establishment or creation of the data base and the decisions on record structure and on file structure would be made by the data base administrator. He would also decide which queries, updates, and application programs are used with sufficient frequency to merit permanent storage.

Another important role for the data base administrator is that of revising the data base. The word revision here is chosen to have a meaning different from that of update, where updating means a changing of the value content. Revision would mean that the data base administrator could redefine either the record structure or possibly the file structure, using the tools and facilities provided to him in the GDBMS.

The next level of user is one we know today as the applications programmer. He is the typical user of the host language class of GDBMS, and would be responsible for writing procedural programs which operate on the data base.

The third level of user is the one at whom the self-contained systems are aimed. He does not need to understand conventional programming but does need to understand the nonprocedural, user-oriented language provided to express interrogations and updates to be performed against the data base. He may be a manager of sufficient responsibility to be posing interrogations which represent unpredefinable information

needs identified by himself. On the other hand, he may be a lower level employee, simply encoding an interrogation to obtain information from the data file which has been called for by somebody on a higher level of management. Alternatively, he may be assigned the task of defining an interrogation or update in the language of the self-contained system which may be a transaction designed for very frequent use by the lowest level of user. The present author has previously⁶ given the name of specifier user to this level. The thrust is, of course, to emphasize that such users do not have to be programmers in the 1970 meaning of the word. It is rather unsatisfactory to call them nonprogrammers as this word also includes the fourth level discussed next.

Parametric user

The lowest level of user is referred to here as the parametric user. The parametric user needs to have no understanding of programming or even of the language of the self-contained system. His interaction with the data base is always one which has been predefined for him by a higher level of user, such as the applications programmer or the one mentioned in the previous paragraph. He may retrieve information from the data base or he may enter it. In either case he communicates by invoking predefined queries or transactions, and he only needs to understand how to invoke such things—not how to define them. In some cases the transactions may have parameters and he would be responsible for providing values to such parameters. Examples of parametric users today are airline clerks, stockroom clerks, bank tellers, and so on.

It is hard to assess today's level of acceptance of GDBMS. Articles and technical papers containing user experience are far harder to find than glowing promotional presentations of commercially available systems. However, informal discussions indicate that the systems are being bought and used. The interest in self-contained systems tends to be most noticeable in the large, sophisticated user environment, where the predefinable information needs are already being met and the data processing department is ready to respond to the new challenge of handling undefinable needs.

As indicated earlier, the self-contained systems typically address only a portion of the applications found in a user environment. Just how large this portion is varies from one corporation to another. Complaints of machine inefficiency are frequently heard. The self-contained system is a further step in the optimization of the *user* of the machine as opposed to the machine itself. It is well known that for the same application, a carefully coded assembly language program will always be more efficient in machine time than a program written in a higher level language. By the same token, a processing algorithm tailored to a specific application in a procedural language such as COBOL can be expected to use less running time than the generalized self-contained system. However, if the self-contained system is coded in assembly language, as many are, the processing may

6. T. W. Oille, UL/1: A non-procedural language for retrieving information from data bases. Proceedings of IFIP Congress 1968. Pp. 572-578.

will be better than that of an amateurishly coded COBOL program.

There is a risk that GDBMS may be currently experiencing an oversell. Not one of them is all things to all people, and this should be realized. With so many systems currently available it is easy to be confused by the large number of capabilities which are important in the choice of such a system.

Another issue affecting the present acceptance level of GDBMS as a tool in building the corporate management system, is that the very users who are interested in responding to unpredefinable information needs are also moving to on-line inquiry-response systems for handling a set of predefinable information needs. The transaction volume and response time required then justify the expense of an on-line system. It is for such applications that host language systems are suited. Large inquiry-response systems also require communication management capabilities, either generalized or tailored, and this topic is on a complexity level equal to GDBMS.

Present acceptance of GDBMS may be summarized as cautious but growing. Several systems are becoming more sophisticated with on-line capability. They therefore require processing algorithms other than the all-too-common sequential search.

Current disparities

A study of the numerous systems which are being developed and marketed today shows that there is a good measure of similarity in capability, especially among the self-contained systems. There is great disparity in language used to describe the systems, and also in the user-oriented language which the systems provide to the specifier user.

Developers of host language systems have found it necessary to extend the data structure capability of the host language. This phenomenon is also noticeable in the development of self-contained systems. Self-contained systems designers, including this author^{6,7}, have tended to aim at more complex record structures than those available in COBOL, while the designers of host language systems have aimed at more complex ways of storing records in files. In some cases this also provides more complex hierarchical record structures, where the record may consist of a number of separately stored segments which have to be read individually by the host language program.

The net result is a complete tower of Babel. It is obvious by the amount of development that is going on in all kinds of GDBMS that the conventional procedural programming languages available today, such as COBOL, leave something to be desired. The situation can be compared with that in the late 1950's, when as many as three or four languages for business programming were emerging from different hardware manufacturers. At a conservative guess there must be about 10 to 15 host language systems commercially available, and probably as many as 100 self-contained systems of one kind or another. Some of the self-contained systems are restricted to a simple sequential search interrogation capability where the files

operated on are limited to a fairly simple record structure.

The CODASYL Systems Committee, which, as was previously pointed out, produced a comprehensive survey of GDBMS in May, 1969⁸, is currently extending its work to a more in-depth study of such systems. It had intended to use the May, 1969, survey as a basis for the development of a common system. However, study of the survey by the committee itself revealed that a more detailed and in-depth study was necessary, particularly in the area of host language systems. The committee is currently preparing another report, which will be released in the spring of 1971, and will go far more deeply into the capabilities of host language systems. It will contain the CODASYL Data Base Task Group proposal as one of the host language systems.

Out of this study should emerge some specifications for a common generalized data base management system. Such a system should be a unified one containing the capabilities of host language systems and self-contained systems. The basis for the host language system has already been defined by the DBTG, and the Systems Committee is maintaining a close liaison with that group.

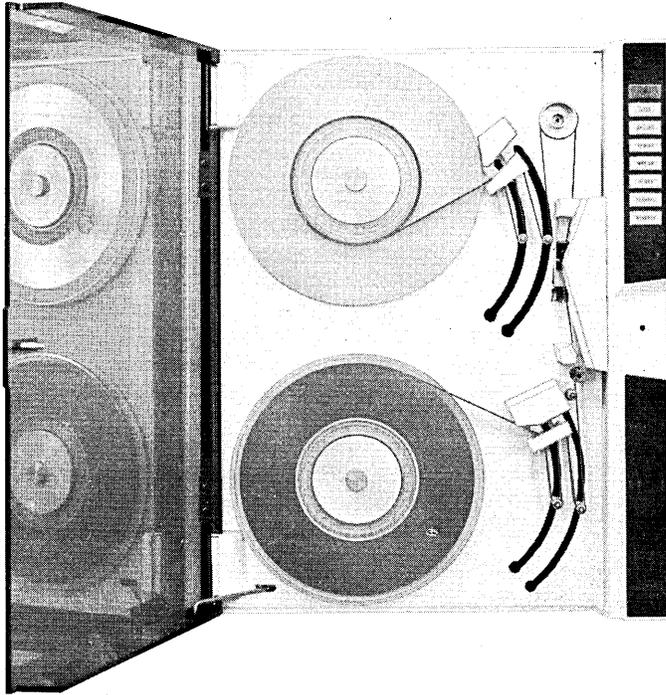
Unlike the situation in the late 1950's, there does not at present appear to be a significant movement in favor of a common system. This is because the industry is now considerably larger and therefore considerably more complex than it was in 1959 when the CODASYL organization was founded. In addition software and software ideas now have a commercial market value which was not the case 10 years ago. Nevertheless, the need for a common system has to be recognized. COBOL may in retrospect be judged to be something of a political success, in that its development was sponsored by a cooperating group of hardware vendors and major users. Despite its many shortcomings in the eyes of the academic community, it has gained worldwide acceptance. It is unlikely that it will be replaced overnight. Accordingly, the next step appears to be not to replace COBOL with a self-contained language, but to try to build on the foundation of COBOL, as some of the available GDBMS's have done, and to develop a powerful common system which will serve the industry for many years to come. ■



Dr. Olle is currently manager for Data Management Systems with RCA's Computer Systems Division. Prior to joining RCA, he held a managerial position with CDC. He was ACM National Lecturer in 1969-70, and has lectured frequently on data base systems in both the U.S. and Europe. He has been chairman of the CODASYL Systems Committee since 1968 and during 1967 served as a member of the DBTG. He obtained his PhD in 1957 from Manchester University, England.

7. T. W. Olle and A. M. Gagnoud, A solution to the ASIS file management exercise using RCA's UL/1. Journal of the American Society for Information Science, May 1970. Pp. 214-218.

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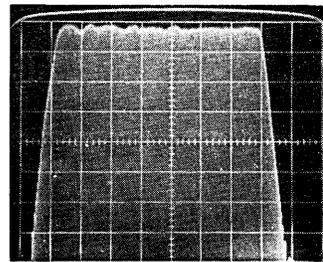
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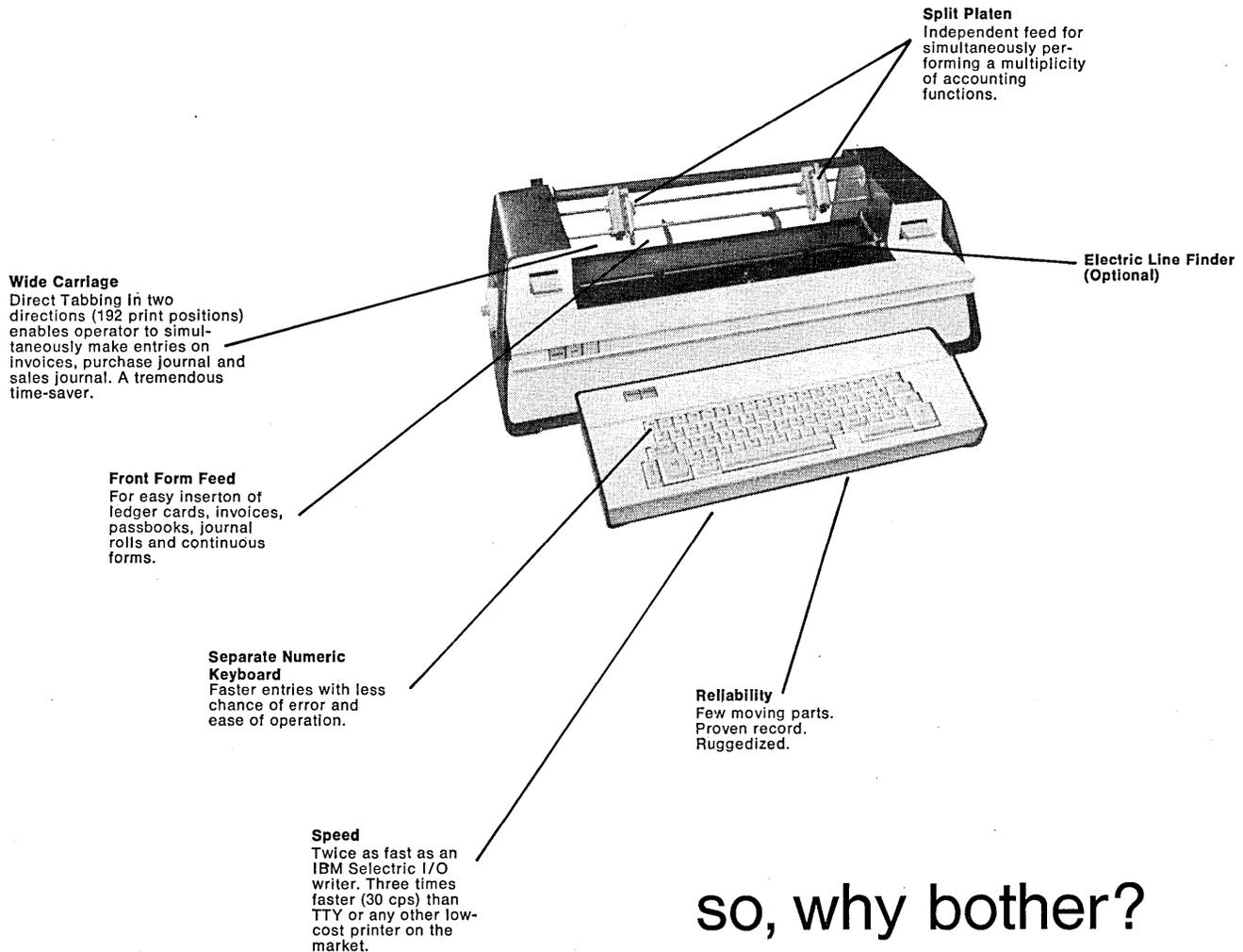
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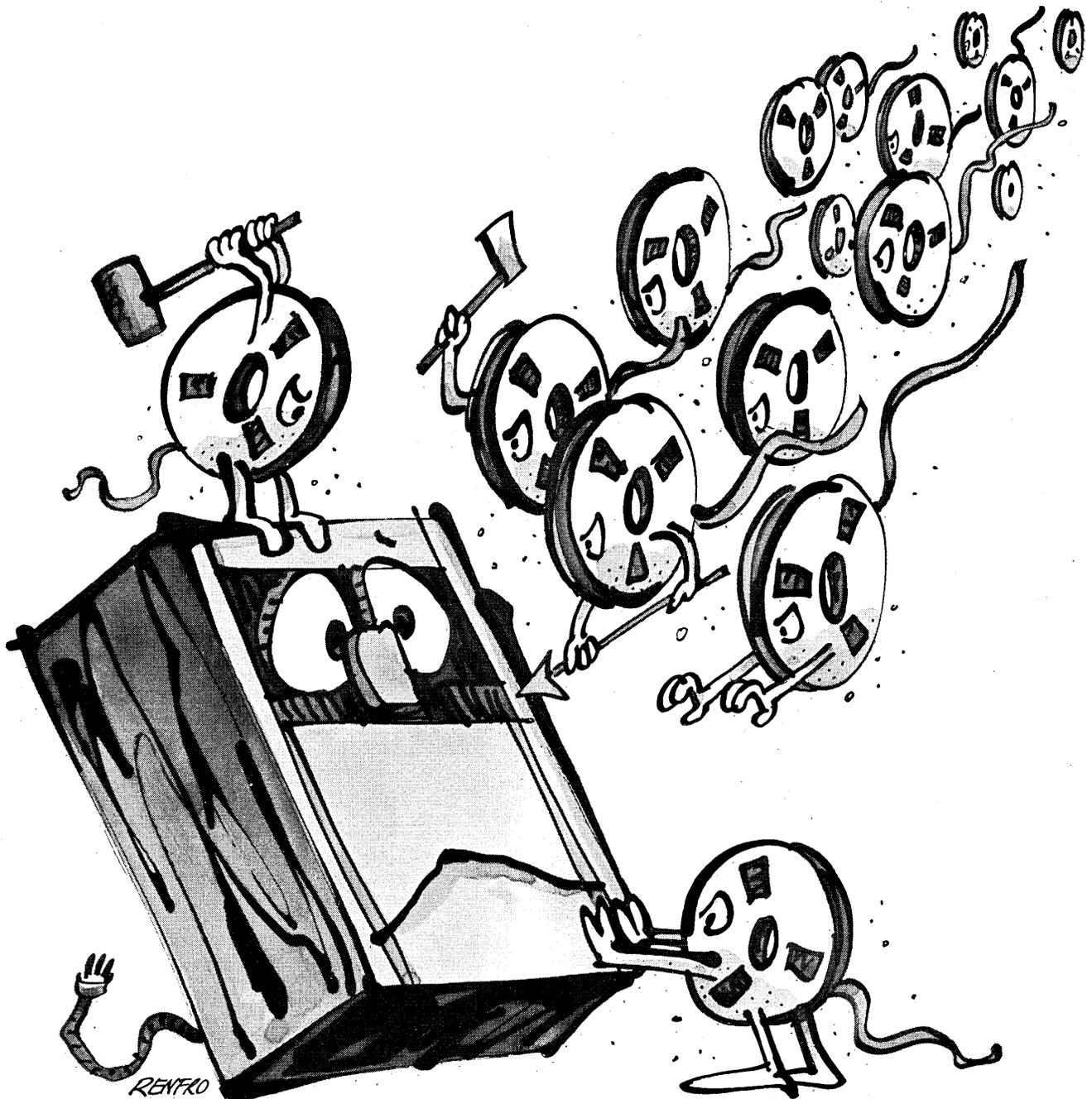
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Can an untrained clerk find happiness with this generalized inquiry system?

The Remote Inquiry

by Steven A. Holland

The purpose of this paper is to present the design of a highly flexible and extremely efficient generalized inquiry system. Specifically, the system was installed to facilitate the verification of file maintenance updates to a set of master files. The master files themselves (containing freight rate and freight carrier data) were much too large to list, and so the inquiry technique was used to expedite program checkout. The remote inquiry capability was to be available from Teletype terminals, IBM 2260 video display units, and IBM 2740 typewriter terminals.

Our initial assignment consisted of implementing only a few specific inquiries into the master files. These inquiries could have been programmed in a straightforward manner, but we felt that as soon as the technique was demonstrated there would be many demands for new inquiries. A straightforward approach would continually require additional programming and documenting to handle new inquiry requests. Furthermore, from a systems point of view, core requirements would soon become excessive, and control would be lost due to lack of a uniform scheme. For these reasons we decided to create a generalized inquiry system.

The most salient feature about the system is that a new inquiry type can be entered into the system in less than a half hour and a whole new file can be added in less than two hours. Also, as the system is general in nature it is by no means limited to verifying file maintenance transactions. Many inquiry applications (for example, inventory availability, order status, customer credit, etc.) could be easily implemented with this system.

Design goals

There were a number of design goals established:

1. The man-machine interface must be simple enough to allow use by untrained people. However, it must also be efficient from the data entry point of view. This combination would enable a manager to use the system on an occasional basis, or an operator or clerk to use the system on a frequent basis.
2. Core was precious.
3. Multitasking of inquiries was desirable.
4. The system must be able to process a wide range of inquiry requests. This should include the capability to manipulate fields in the desired record, such as doing arithmetic operations on the fields. Furthermore, the way the data is coded (packed, binary, etc.) and the length of the data should be transparent.

5. The system must be independent of the data sets being used with regard to organization (access method), record layout, and data contained.

6. The input device type must be flexible. The system must be able to service inquiries entered from local IBM 2260 units as well as via remote IBM 2260, Teletype Model 28 ASR, and IBM 2740 terminals interfaced through a QTAM system.

7. The effort to add a new inquiry (or a new file) must be minimal.

Terminal language

A terminal language was designed to be the interface between the system and the outside world. One of the design goals was that this man-machine interface be simple. As a sample of the terminal language consider the inquiry:

```
DISPLAY THE GEOGRAPHIC HEADER FOR TCA-NO  
12345 TYPE A.
```

All words known to the system exist in a dictionary within the system. Dictionaries are built automatically when inquiries are defined to the system. (This procedure is described in a later section.) Each word in a dictionary is designated as a "part of speech." The parts of speech are nouns, verbs, adjectives, keys, and key qualifiers. An inquiry may contain one word from each part of speech and these words can be entered in any order. The digits for the key and key qualifier must immediately follow the corresponding words.

In the above example, DISPLAY is a verb, GEOGRAPHIC is a noun, HEADER is an adjective, TCA-NO is a key, and TYPE is a key qualifier. The words THE and FOR are not in the dictionary and will be ignored. They serve only to allow the user to enter the inquiry as a complete English sentence.

The most important word is the noun. The noun points the system to the data set being referenced. For example, GEOGRAPHIC indicates a particular master file (data set) that contains geographic freight-rating information. Synonyms are permitted in the system. Thus, different words could point to the same data set. If it were desirable to use the same GEOGRAPHIC file, but call it by another name that was more suited to the inquiry, the word MOTOR-FREIGHT

(The author would like to acknowledge the efforts of Mr. Jerome A. Martin, Mr. Michael E. Merriman, and Mrs. LaVon Green of Applied Information Development, Inc., who are the coauthors of the system, and, in particular, Distribution Sciences, Inc., Oak Brook, Ill., who is the sponsoring client.)

might be used in an inquiry such as:

DISPLAY MOTOR-FREIGHT CARRIERS FOR TCA-NO 12345.

The word MOTOR-FREIGHT is more suited to this particular application area, although it actually references the same data set as the word GEOGRAPHIC in the first example.

The word DISPLAY is a verb. The purpose of a verb

provides the capability for using English language inquiries, as well as being able to provide enough information in a concise fashion to direct the system to produce the desired output. In turn, the use of the English language inquiry entry, combined with the use of synonyms if brevity is desired, provides for a simple man-machine interface to satisfy one of the design goals.

of Data Bases

is to indicate the action the system will take with the inquiry request. Examples of potential verbs in the system are ADD, UPDATE, and the like.

The word HEADER is an adjective in the system. It is so designated because it qualifies the noun. The adjective determines which inquiry is to be chosen from the group pertaining to the GEOGRAPHIC data set.

The word TCA-NO is a key, and the word TYPE is a key qualifier. In this paper, the term "actual key" will denote the search argument of a record. This will avoid confusion with the word "key" used as a part of speech in the inquiry system. The digits following the words designated as keys and key qualifiers are combined and used as an actual key in a file lookup. When an inquiry is defined to the system, the proper lengths of keys and key qualifiers are specified. This enables the system to decide if a key qualifier exists for the data set, and, if required, the system can left fill zeros in the key and key qualifier. If the key qualifier is present, it is appended to the right of the key. (If a key qualifier exists for a particular data set, and is not specified for a given inquiry, the system appends zeros to the key.)

As an example, assume the actual key for the GEOGRAPHIC data set is eight characters. It is made up of a key of seven digits and a key qualifier of one character. In the HEADER inquiry shown above the requested key is TCA-NO 12345 TYPE A. The system knows the proper lengths of the key and key qualifier, and would create an actual key of 0012345A. If the key qualifier were not needed for a particular inquiry, and only TCA-NO 999 were entered, the system would produce the actual key 00009990.

As mentioned before, the system has provision for synonyms. For operators who are constantly making inquiries, the keying of:

DISPLAY THE GEOGRAPHIC HEADER FOR TCA-NO 12345 TYPE A.

may be too lengthy. By use of synonyms, the inquiry may be reduced to

DSP GEO HDR TCA 12345 TYPE A.

or,

D G H TCA 12345 T A.

Thus, for either the occasional user or for the frequent user, the inquiry process can be made quite simple.

The system provides another technique to reduce entry time. After a response has been received for any inquiry, the user only has to enter the portion of the next inquiry that differs from the preceding inquiry. This is most useful when one merely wishes to change the key (and key qualifier).

Thus, the use of the "parts of speech" concept

One requirement in the design of a generalized system is that one program (or set of programs) be able to process all requests. To accomplish this, a set of programs was designed that is completely table driven. Additional inquiries are implemented by changing the tables, not the programs. The task of processing an inquiry was broken into a number of functions, and each function is represented as a subtask. A multitasker (called the TASK CONTROLLER) was designed to control all of the inquiries and their associated subtasks. The functions required to service an inquiry request are inquiry input, interpretation, processing, data set handling, and output.

Inquiry input is accomplished by a device interface routine. Presently available are a local IBM 2260 interface (READ2260) and a QTAM interface (READQTAM). (Our QTAM system coding makes all messages from any remote device look the same in core, so we need only one QTAM interface to handle remote IBM 2260, 2740 and Teletype Model 28 ASR terminals, or any others that might be added to the QTAM system.)

Interpretation (by the INTERPRETER) is the parsing of the inquiry as entered in the terminal language. Each word is looked up in a dictionary, the data set referred to by the noun is located, and, based on the other keywords, pointers are set to the proper inquiry in the proper table. The PROCESSOR takes over next. It builds an answer to the inquiry by means of a method to be described later. The PROCESSOR uses the FILEWORK module for any data set handling that is required.

Inquiry output is also accomplished by device interface routines. A local IBM 2260 interface (WRIT2260) and a QTAM interface (WRITQTAM) are available.

The system is structured as shown in Fig. 1. When

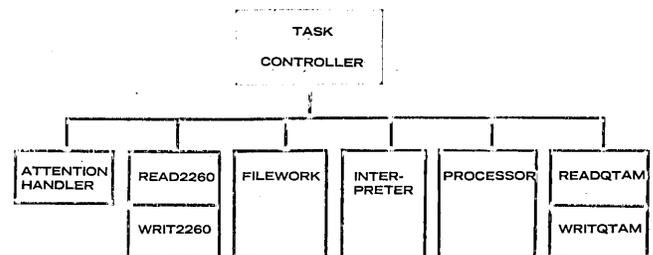


Fig. 1.

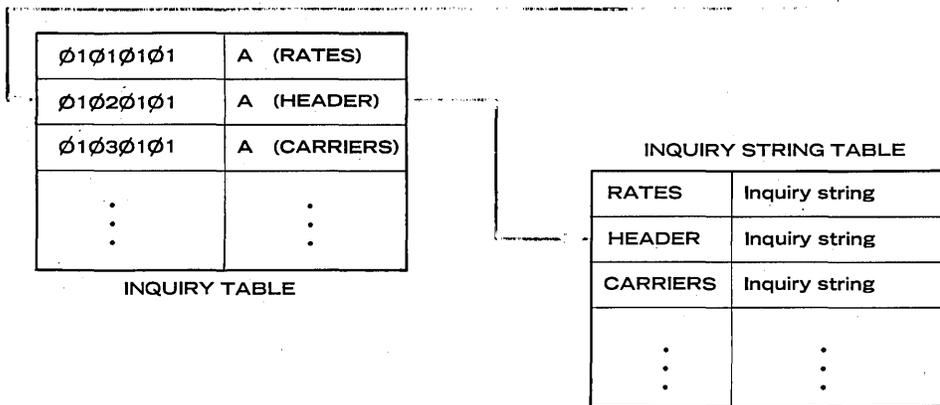
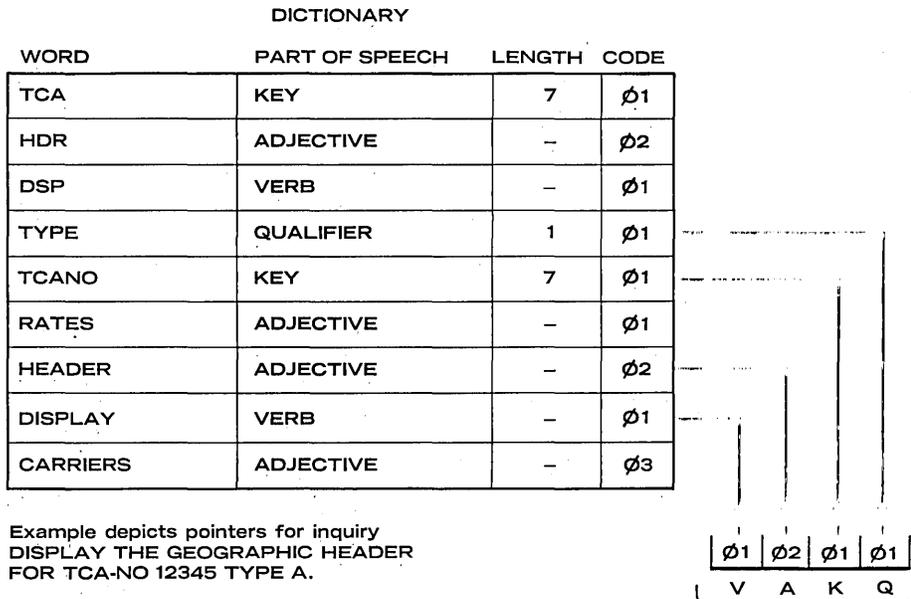
a subtask wishes to relinquish control, it issues an inquiry system IPOST macro. IPOST signals the TASK CONTROLLER that a subtask has completed (or needs a service such as FILEWORK), and, if required, informs

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the TASK CONTROLLER of the next subtask to be activated. If another subtask is to be activated, the TASK CONTROLLER issues an OS/360 POST for that subtask. If the inquiry is complete, it purges the work areas and Inquiry Control Block for that inquiry. The TASK CONTROLLER then issues an OS/360 multiple WAIT. The highest priority subtask that had been POSTED ready to be activated will then be dispatched. If no subtasks are ready, the program will wait for an external interrupt (giving up control to a lower priority region or partition).

the same time (multitasked), and control is always given to the subtask waiting to be activated that has the highest priority. For example, READ2260 and WRIT2260 have the highest priority, FILEWORK is next, then come the INTERPRETER and the PROCESSOR, and, finally, READQTAM and WRITQTAM.

The entire code in the system (TASK CONTROLLER, device interface routines, INTERPRETER, PROCESSOR, FILEWORK) totals fewer than 7,000 bytes. Control block and work area space is developed in pools, and a tradeoff will exist between core used and response



- Notes:
- The words are actually stored in hashed form, and are in order by hash value to facilitate binary searching.
 - The above table exhibits the synonym capability. E.g., DSP is a synonym for DISPLAY as they have the same code.
 - The noun GEOGRAPHIC caused this particular File Module to be loaded.

Fig. 2.

An external interrupt (such as the depression of the ENTER key on the 2260) causes the system to allocate work areas and an Inquiry Control Block. These areas are allocated from pools to minimize the core needed. The proper device interface routine is dispatched, and the input is read into one of the work areas allocated. Control is then passed to the INTERPRETER as described above.

Note that the flow just presented is single thread. Actually, each of the routines in the system has an associated priority. Many inquiries can be active at

time in large systems. Thus, the design goals of low core and a multitasking system were fulfilled.

Interpreter

As mentioned, a device interface routine acquires the inquiry request, and passes it to the INTERPRETER. The INTERPRETER scans the input character string, using blanks as delimiters. Each word encountered in the string is hashed down to a two-byte length (after

dashes and line control characters have been removed). The hashing process is simple and fast. Each hashed word is stored in the dynamic work area. Also, each word is compared against the entries in the master noun table. The master noun table has all of the words that are valid nouns in the system, and the name of the data set to which they refer. (Note that digits following the key and key qualifier will be hashed, but this will not harm anything.) At the end of the scan, one and only one noun should have been found. If this is not the case, the request will be rejected.

Each data set has a FILE MODULE associated with it. The FILE MODULE contains the dictionary for that data set. It also contains the INQUIRY TABLE, inquiry

the work area is tested for a match in the dictionary (by a binary search routine). Associated with each dictionary entry is the part of speech of the word and an arbitrary, unique one-byte code. These codes are formed when the dictionary is created, and are merely consecutive numbers. A one-byte code allows for a least 255 words of each part of speech for a given data set. Synonyms have the same code. The INTERPRETER fills in a four-byte keyword with these codes. The first byte is reserved for the verb, the second for the adjective, the third for the key, and the fourth for the key qualifier. When each dictionary match is found, the code for that word is filled into the proper slot in the keyword for that part of speech. If the slot is already filled, that means that two of the

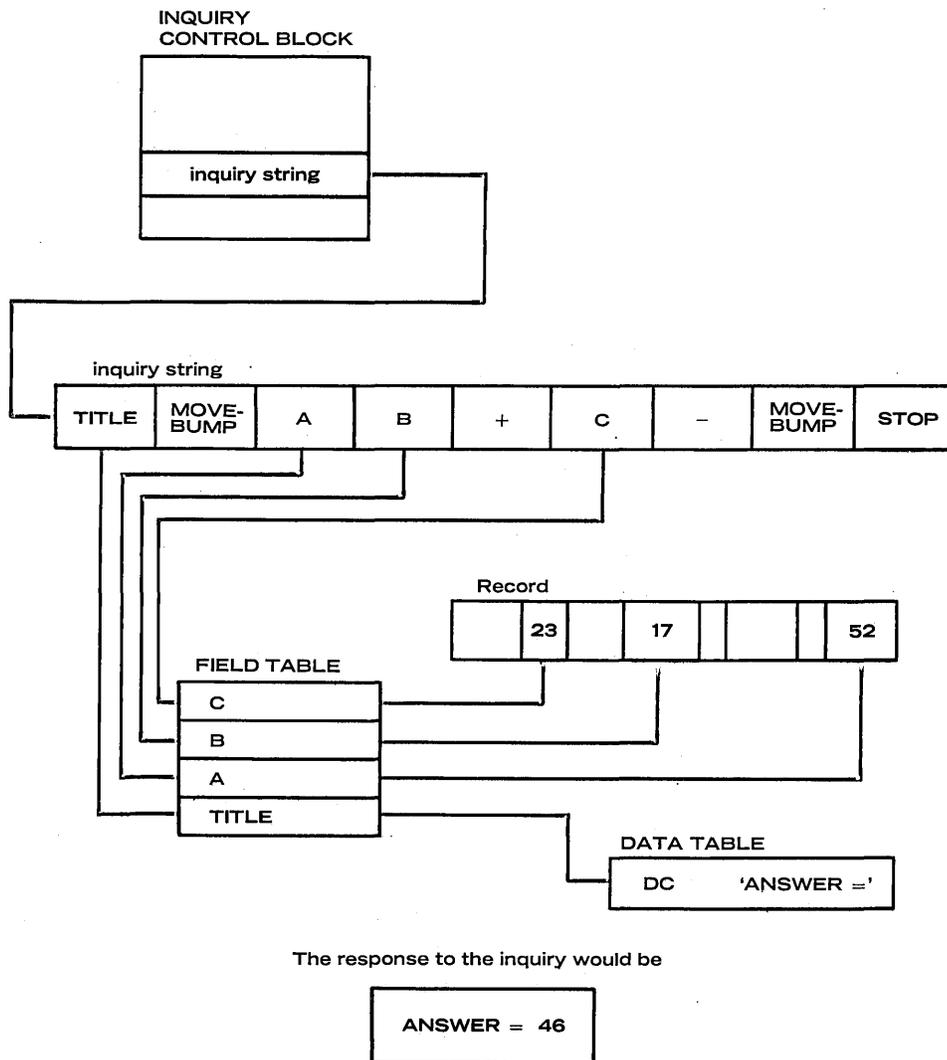


Fig. 3.

strings, record descriptions, and internal data for that data set; each of these will be described later. If the FILE MODULE corresponding to the noun is in core, the INTERPRETER locates it and proceeds. If not, the INTERPRETER requests that it be loaded, and, after this happens, is free to proceed.

Fig. 2 should be referenced for the following discussion. The dictionary for the data set contains (in hashed form) all of the valid words that can be used with the given noun. Each hashed word as saved in

same parts of speech were entered, and the inquiry is rejected. When a key or key qualifier is found, the next hash entry in the work area is skipped because it would be filled with meaningless hashed digits. The proper lengths of the keys and key qualifiers are stored in the dictionary, and the INTERPRETER uses this information as previously described in building the actual key.

Note that the parts of speech do not have to be entered in any specific order, as the INTERPRETER fills

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the slots in the keyword by part of speech, not by order of entry. This relaxes restrictions on the terminal language interface. Also, it is not necessary to have all of the parts of speech represented. The only required part of speech is the noun. When a word does not find a dictionary match it is simply ignored. This allows the user to add words such as *OF* and *AND* to enter an English sentence.

Thus, up to now the *INTERPRETER* has created a four-byte keyword. The *FILE MODULE* contains an *INQUIRY TABLE*. This table is a list of all valid four-byte keywords (inquiries) and an associated pointer to the proper inquiry string to be used by the *PROCESSOR*. If the keyword is not found in the table, the *INTERPRETER* rejects the request. If it is found, the *INTERPRETER* puts the pointer to the inquiry string into the Inquiry Control Block, and *IPOSTS* to the *PROCESSOR*.

In keeping with the design goals, the *INTERPRETER* is an efficient parsing mechanism to implement the power of the terminal language, and the dictionary of hashed words gives significant core economy.

Processor

Fig. 3 (p. 57) should be referenced for the following discussion. The *PROCESSOR* uses the pointer to the requested inquiry string that was left in the Inquiry Control Block by the *INTERPRETER*. This inquiry string will drive the *PROCESSOR*. Each inquiry string is composed of a mixture of two-byte operands and one-byte operators (the high order bit distinguishes). The operands and operators are strung together in a Polish suffix type of scheme. An operand is actually an offset into the *FIELD TABLE*, which is another part of the *FILE MODULE*. Each *FIELD TABLE* entry gives the location and characteristics of a field in either the record being accessed or in the *DATA TABLE*. The *DATA TABLE* is also part of the *FILE MODULE*, and is made up of constants, output titles, and the like. Examples of characteristics maintained in a *FIELD TABLE* entry are the length, data type, and scaling factor of a piece of data.

The *PROCESSOR* scans the inquiry string. Each time an operand is encountered, the corresponding *FIELD TABLE* entry is placed in the "stack" which is created in the dynamic work area. When an operator is recognized, the subroutine to implement that operator is called, and the operation is performed. For example, two operands are placed in the stack, and then the addition operator is recognized. The addition subroutine will pop the top two operands off the stack, retrieve the data that these entries reference, and add together the two pieces of data. The result will be stored back in the stack. The next item in the string could be another operand, which would be stacked. This might be followed by the subtraction operator. The subtraction subroutine would pop the top two items off the stack, and subtract them. The result would be stored back in the stack.

Note that the first item in the stack was the result of the original addition. Thus, the item in the stack currently represents $A + B - C$. The next item in the stack might be the operator to move data into the output area. This operation subroutine would take the top item off the stack, convert it from coded to display form, and move the characters to the output

buffer. In this way, complicated manipulations of the data may be accomplished to build the answer. *FIELD TABLE* entries for constants in the *DATA TABLE* can be put into the stack, and then moved into the output buffer to create headings in the response. Virtually any type of inquiry request can be serviced using the power of the Polish suffix type of construction. If additional operators become necessary to handle some new manipulation, they can easily be added to the *PROCESSOR*.

The implementation of the *PROCESSOR* meets the design goals of low core and the ability to process a wide range of inquiry requests. The Polish suffix string processing capability enables the user to perform complex data manipulations. The use of the *FIELD TABLE* makes transparent the characteristics of the data being used, and the use of the *DATA TABLE* allows for formatted responses to be produced.

File handler and interface

The file handling routines (*FILEWORK*) maintain the modular design of the system. *FILEWORK*, like the rest of the routines in the system, is invoked as a subtask. This enables input to be overlapped with processing of other inquiries for those access methods which permit it. Currently, *FILEWORK* is implemented for the Indexed Sequential Access Method (*ISAM*), but is designed to be able to be expanded to handle any supported or nonsupported access method.

For each data set available to the system there is an entry in the *FILE TABLE*. Each *FILE TABLE* entry includes some space for control information and the Data Control Block (*DCB*) for the data set. Using the *FILE TABLE* entry, *FILEWORK* can maintain control of the data set, such as determining whether the data set is open, or, for *ISAM*, which inquiry has the current *SETL* in control. *FILEWORK* meets the design goal of keeping the system independent of the organization of the data sets being used.

As previously noted, interfaces are available for *IBM* local 2260 video display units and for terminals handled by the *QTAM* system. The interface routines are geared to the characteristics of the terminals they are servicing. In keeping with system modularity, routines for additional devices can be easily added.

Each device type routine can have its own priority. For example, the *READ2260* and *WRIT2260* routines have the highest priority in the system. This is to keep the 2260 lines as fully utilized as possible and provide the best possible response. Also, the 2260 input-output can be overlapped with the processing of other inquiries that are active. On the other hand, the *READQTAM* and *WRITQTAM* routines have the lowest priority in the system. This is because there is no overlap while the *QTAM* *GETS* and *PUTS* are being performed, and because a slight delay will be insignificant compared to the line time for receipt of the inquiry and transmission of the response.

An interesting problem arose in the implementation of the *QTAM* interface routines. When a message entered the *QTAM* system, it was necessary to cause an interrupt for the inquiry system, notifying it that such a message was present, and dispatching the inquiry task. For the *IBM* 2260 interface, the depression of the *ENTER* key caused the corresponding action. The *OS/360 POST* routine will not allow the *POSTING* of another

task. The solution was to code an svc routine for cross partition posting, called xpost. xpost simulates an os/360 post, creating an "interrupt," and entering the os/360 dispatcher.

Thus, the design goal of multitasking capability is met by making the device interface routines into subtasks. The design goal of a flexible input-output device is satisfied by the concept of being able to add interface routines for each desired terminal type.

Macro system

Most of the sections of this paper have made reference to the FILE MODULE. One FILE MODULE exists for each data set accessible to the system and is composed of the INQUIRY TABLE, dictionary, inquiry strings, FIELD TABLE, and DATA TABLE for that data set. Each of these components has been described. These would be coded in assembly language with the use of DC statements, and a great deal of effort. However, a set of macros has been developed that can create almost all of the FILE MODULE. The macros are INQUIRYS, INQUIRY, DICTION, STRINGS, STRING, OPGRP, FIELDS, FIELD, and DATA. (See Fig. 4 for sample coding.)

The INQUIRYS macro simply generates a list of address constants to the origin of the inquiry strings,

```

INQUIRYS
INQUIRY      RATES,
              V = (DISPLAY,DSP),
              A = (RATES),
              K = (TCANO, TCA),
              Q = (TYPE)

INQUIRY      HEADER
              V = (DISPLAY),
              A = (HEADER),
              K = (TCANO),
              Q = (TYPE)

DICTION
STRINGS
STRING RATES
OPGRP  ...
OPGRP

.
.
STRING HEADER
OPGRP  ...

.
.
FIELDS
FIELD

.
.
DATA

.
.
DSECT

.
.
END

```

Fig. 4. Sample macro coding for a FILE MODULE. (Space limitations preclude exhibiting an assembly listing.)

FIELD TABLE, DATA TABLE, and the dictionary.

Every inquiry is defined to the system by the INQUIRY macro. The verb, adjective, key, and key qualifier are named (with synonyms). Also, the key and key qualifier lengths are given. An address constant will be generated from one of the macro operands to point to the corresponding inquiry string, and this name must be used later when building that string. The INQUIRY macro collects all of the words defined to it in a global dictionary. It checks all new words against all previously collected words for that

part of speech. If the word is new, it assigns it the next sequential code number. If the word already exists, its code is temporarily stored. Synonyms are handled the same way as base words. If the synonym does not exist it is added to the table, with the same code as the newly added base word. If the synonym already exists, then the base word must have already existed, and the code should be the same as the one saved from the base word. If this is not the case, the user tried to define the same synonym for two different base words, and he will be so notified. The INQUIRY macro then builds the four-byte inquiry keyword from the proper codes. At the end of the INQUIRY macros the global tables will contain all of the words in the system by part of speech, their codes, and their lengths (if applicable).

The DICTION macro creates hash values for all the words. It then spills the dictionary in hash value order. If two words have the same hash value, the user will be notified. The user must then change one of the words. Actually, experience has shown that a duplicate hash value is usually the result of the user specifying the same word as two different parts of speech (in the same FILE MODULE).

The STRINGS macro provides a delimiter for all the inquiry strings. The STRING macro defines the origin of each inquiry string. The operand must be the same as that in the corresponding INQUIRY macro.

The OPGRP macro is the basic building block for creating an inquiry string. The set of OPGRP macros following a STRING macro constitutes an inquiry string. The first operand of the OPGRP macro specifies zero or more FIELD TABLE entries. Each suboperand will be placed in the dynamic stack when the inquiry is interpreted at execution time. The second operand specifies zero or more operators. Each suboperand will cause an operation to be performed at execution time.

The FIELDS macro delimits the FIELD TABLE. The FIELD macro allows the user to specify the location of the data (e.g., in the record, in the DATA TABLE), the characteristics of the data (type, length, places, display width for output), and the offset of the data (in the record or DATA TABLE). Alternatively, and easier, a DSECT can be included in the assembly describing the record. In this case the macro can determine all of the information needed for a FIELD TABLE entry by use of the assembler characteristics for the data and a few default assumptions.

The DATA macro delimits the DATA TABLE. Entries in the DATA TABLE must be filled in longhand with the DC statement.

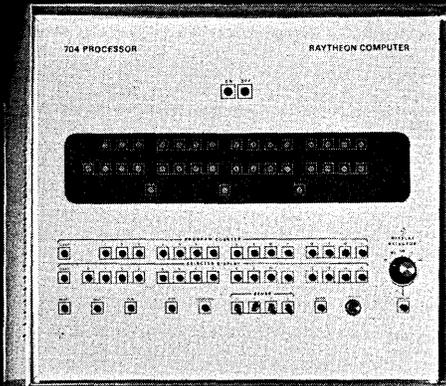
The consequences of the above set of macros is worth noting. For each new data set desired in the system, the user can code the delimiter macros and the FIELD TABLE entries for all of the fields in the record. Also, the DSECT (if desired) is coded. This process takes less than an hour. Thus, it is quite possible to have implemented a new data set in the system in less than two hours.

To create a new inquiry string the user must code the INQUIRY, STRING, and set of OPGRP macros. Any DATA TABLE and corresponding FIELD TABLE entries must be coded. This coding is done easily, and a new inquiry can be ready for use in a few minutes.

Thus, the design goal of minimizing the time and effort to add a new inquiry (or data set) is achieved.

(Continued on page 62)

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Inventory File Control	393313
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Sort/Merge-Control	393306
Sort/Merge-Intermediate Merge	393308
Sort/Merge-Merge	393309
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Shop Schedule Report System	393311



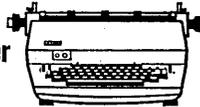
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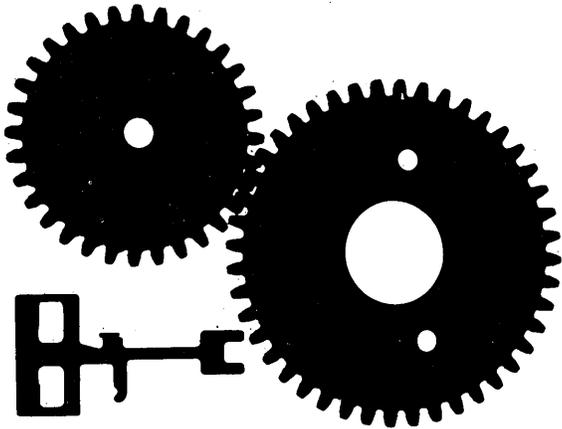
There is further interesting information on the new Facit 3851 in this publication.

Facit 3851 – the conventional typewriter with input/output



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CIRCLE 59 ON READER CARD

Remote Inquiry . . .

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There are a number of functional improvements that we plan to add to the system. The four most important are:

1. Paging
2. More powerful string generation macros than OPGRP
3. Generation of the inquiry system
4. Security

Paging, for the video display units in particular, is required when the response takes more than one screenful. The most important application of this is when the user wishes to scan the data set. The user will have the ability to "page forward" or "page backward." The "greater than (>)" and "less than (<)" keys will be used to signal the user's choice to the system. The implementation of this feature will undoubtedly require data sets structured in a particular fashion.

The OPGRP macro (as explained in a previous section) provides a good general purpose tool to create inquiry strings. However, more powerful language can be created. Instead of coding

OPGRP	(ONHAND, DUE), ADD
OPGRP	UNSHP, (SUBTRACT, MOVEBUMP)

the programmer could code

ADD	ONHAND, DUE
SUBTRACT	UNSHIP
MOVEBUMP	

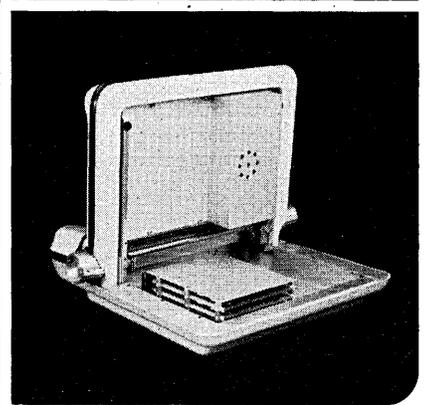
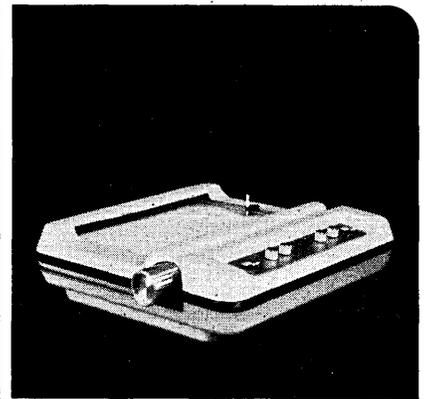
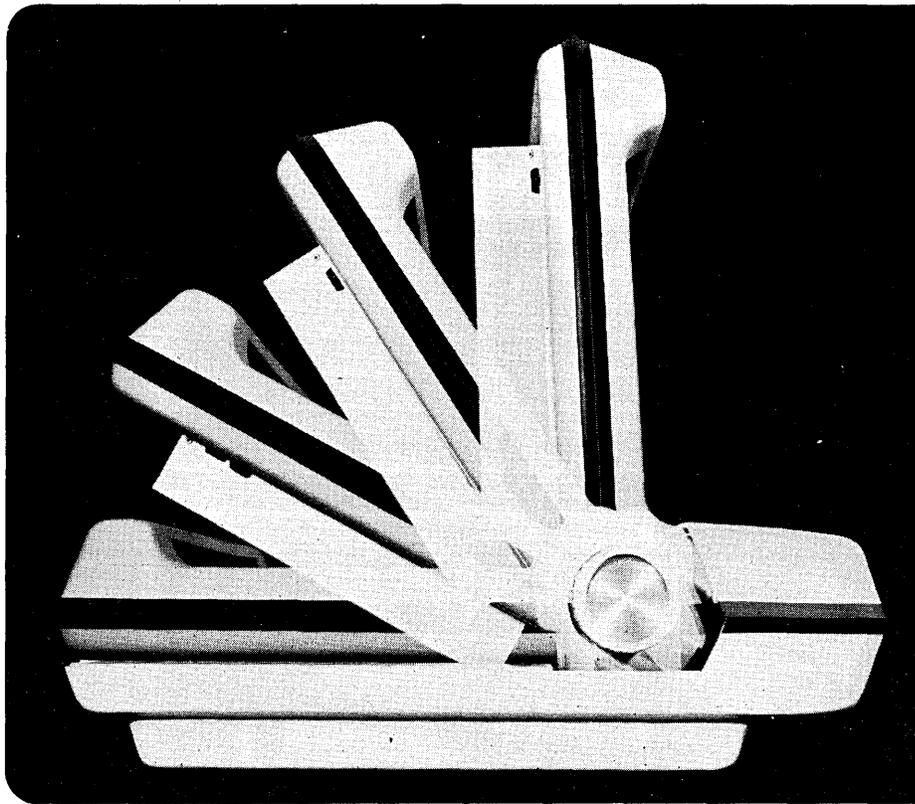
The latter form is much more readable, and becomes a language in itself.

The third functional improvement would be to provide user capability to generate a system tailored to his use. This would be done in much the same fashion as the Operating System is generated. Some of the options would be types of terminals desired, space allocated to work areas, operators desired, and the like.

Fourth, security will be a necessary addition. Current thinking is that each inquiry will carry a one-byte lock, and each terminal will carry a one-byte key. If the result of an "and" is non-zero, the inquiry will be allowed. Furthermore, there will be a password override capability. ■



Mr. Holland is one of the founders of Applied Information Development, Inc., of Oak Brook, Ill., a consulting and software company which specializes in the development of on-line systems. He is also an instructor in the Illinois Institute of Technology Information Sciences Dept. His BS in physics is from the University of Chicago.



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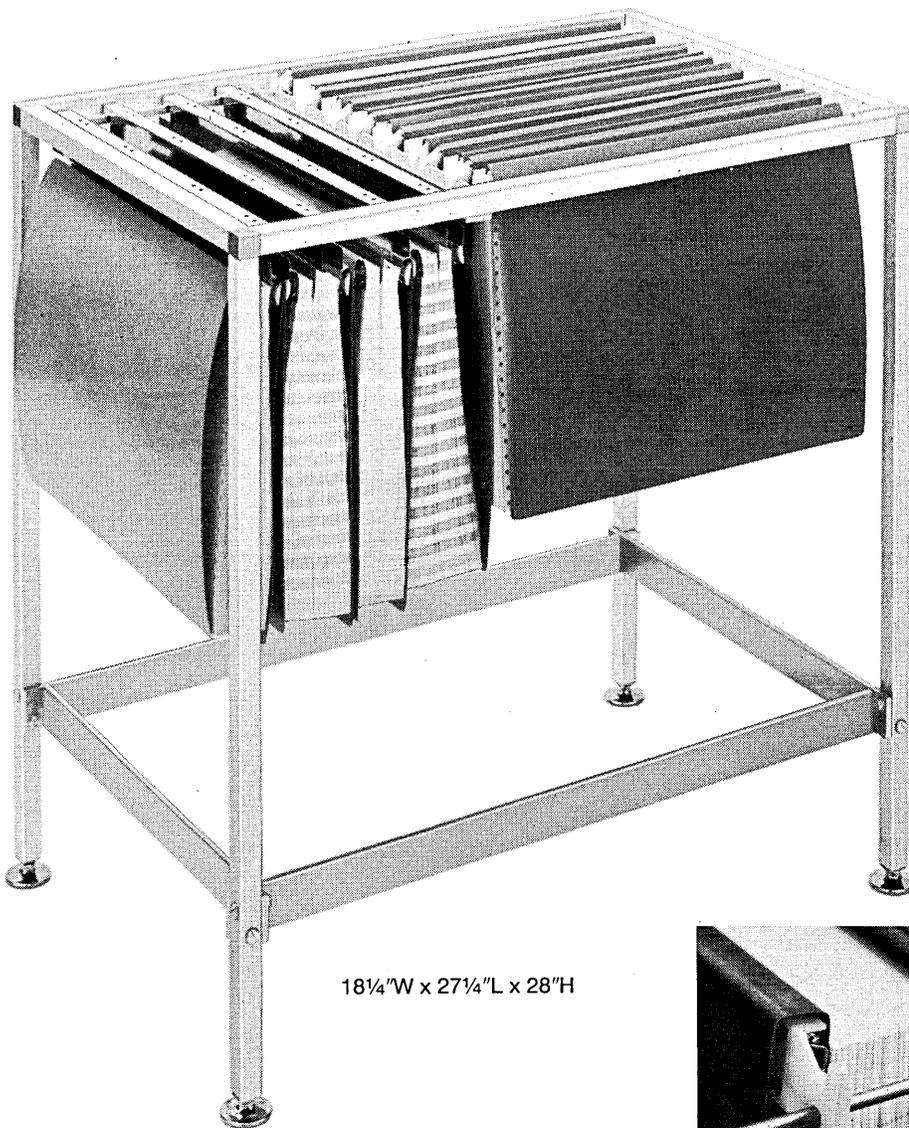
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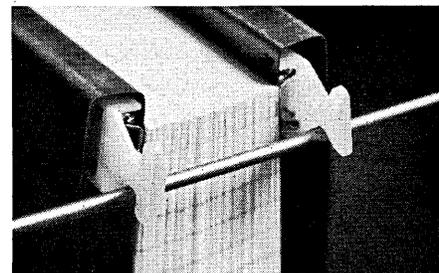
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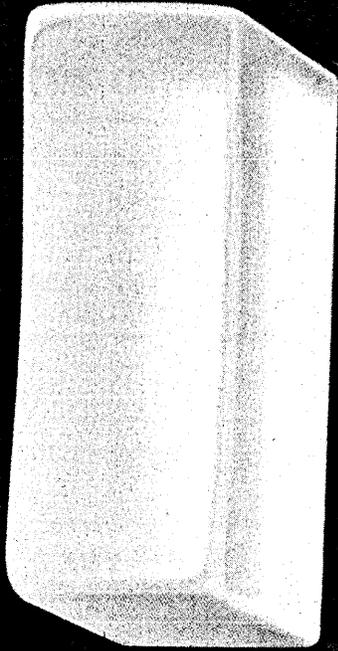
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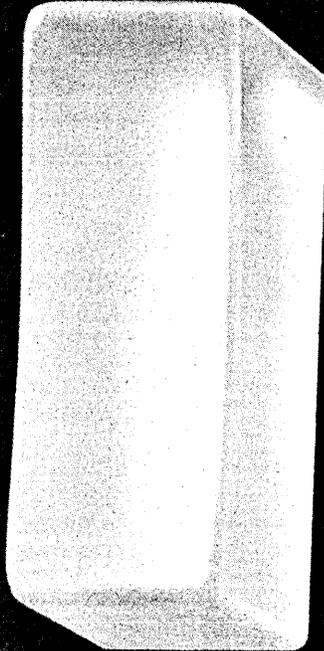
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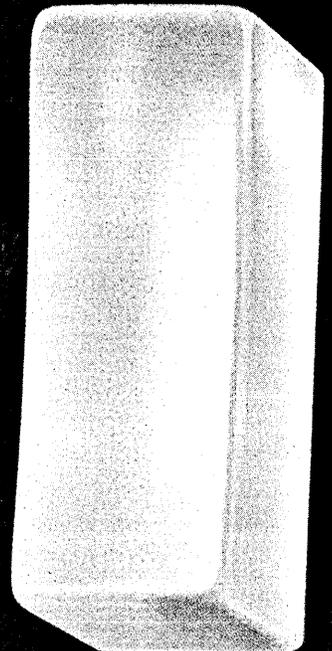
10 CPS



15 CPS

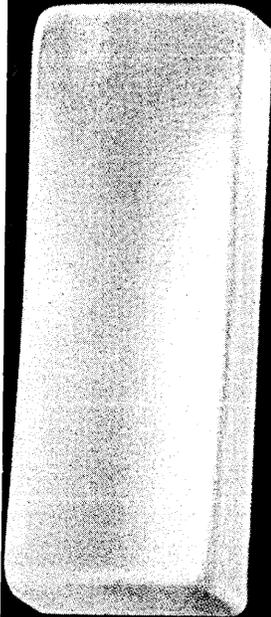


30 CPS



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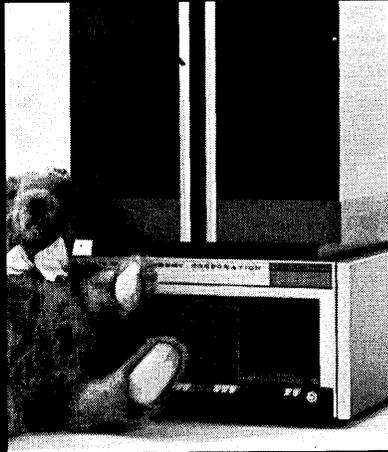
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CIRCLE 20 ON READER CARD

PERSPECTIVE

an interpretive review of significant developments

Canadian Computer Industry Rouses Itself and It's Happening Up There

J. E. Bieser, president of International Computers of Canada Limited, might be classified as something of a pessimist on the subject of the Canadian computer industry: He thinks the Canadian industry will grow at a rate of only 30% a year over the next few years.

That rate, nevertheless, is pretty healthy, and Bieser is a pessimist only in that many others are predicting a higher growth rate. Most Canadians close to the industry feel that the 30% figure may be large enough to give Canada the fastest growth rate in the world of any country with a substantial revenue base in the industry.

Among the more optimistic are John H. Greenhough, manager of Canadian Datasystems, who sees the Canadian market growing at a minimum of 40% each year through 1974. Drawing heavily from computer census figures from the Information Processing Society of Canada, Greenhough feels the hardware will be growing at a rate of 25-30% each year and the service industry portion at a rate of about 50% a year. Annual revenues of the Canadian market are generally placed between \$400 and \$600 million, depending upon whom you talk to.

Question: Why the tremendous projected growth rate?

Answer: Primarily because the growth of the industry had been retarded for years. There are about one-third the number of computers per person in Canada compared to the U. S.

Question: Well, then, why and how was the Canadian computer industry's growth rate retarded?

The answer to that one is a little more complicated, and several reasons are given. One of the problems has certainly been the "brain drain" from Canada to the U. S. of many scientists and technicians trained in the field.

Conservative Canadians

But more important perhaps, and one that virtually everyone agrees on,

is the basic conservatism displayed by Canadians when they approach the computer industry, whether as vendors or as customers. IBM is generally given between 70 and 75% of the Canadian market — some say that IBM dominates the Canadian market more completely than any other market in the world — and much of that chunk comes from customers too timid to take a chance with anyone but Number One.

There are other theories on IBM vis-a-vis the Canadian computer market. It has been argued that IBM has tended to make more sales of simple and relatively uncomplicated equipment in Canada than elsewhere, with the result that the Canadians haven't become as sophisticated with computers as they might have. IBM scoffs at this notion, however.

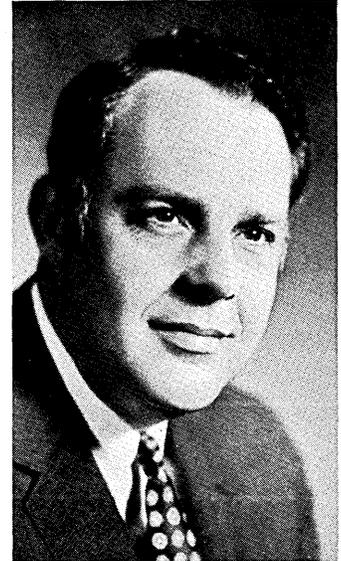
"Canada has traditionally been conservative in the computer industry," says Ronald L. Walsh, an industrial development officer in the Canadian government. "For instance, obtaining venture capital is a real problem in Canada. Canadians just don't take to venture capital entrepreneurial situations like Americans."

However, Walsh, who serves in the



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Datagen's president Juan A. Monico. "It's now or never for us and I'm willing to bet that it's now."

Electronics Div. of Canada's Dept. of Industry, Trade and Commerce, believes that things are improving. The government, Walsh notes, saw trends in 1966 and 1967 that the computer



James E. Bieser, president of International Computers of Canada Limited. "We're an independent company — 50% owned by ICL. I think that gives us the best of both worlds."

industry would generate a wide gap in the balance of trade, particularly with the U.S., whence about 90% of computer sales in Canada originate.

Ottawa began formulating plans to remedy this situation. For a starter, computer firms doing business in Canada were encouraged to do more Canadian manufacturing, and lately efforts are being made to stimulate the establishment of new firms in Canada.

The most impressive example here has been Control Data Corp.'s decision to locate two major plants in Canada — one in Toronto, the other in Quebec. The endeavor is expected to cost some \$56 million, with governmental funds accounting for about 40% of that figure. But, as far as Canada is concerned, the best part of the deal is that CDC is reported to be planning to hire some 300 people for r&d assignments, which could indicate that somewhere along the line



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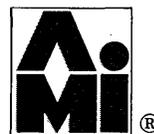
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PERSPECTIVE

CDC would be designing and manufacturing products in Canada for export to the U.S. and other world markets. This measure could be a great boon to Canada's balance-of-trade difficulties.

In addition, IBM Canada Ltd. has announced plans to construct a plant in Quebec for the production of circuits, most of which will be exported to the U.S. IBM has had a plant for years in Toronto, but the great bulk of the computer giant's equipment sold in Canada has been manufactured in the U.S.

Another interesting firm is Datagen of Canada Ltd., which is the offspring of Data General Corp., a leading U.S. minicomputer manufacturer. "We are finding that there is valuable assistance available from the provinces, the federal government, and local communities," says Juan A. Monico, Datagen's president. The firm has established its headquarters in Hull, Quebec, a suburb of Ottawa which, in turn, just happens to be where the best-trained technicians in Canada are located.

"Hull gave us assistance in getting the land," recalls Monico. "The Province of Quebec is paying 25% of our building, and we expect to get some assistance from the federal government."

Datagen has been manufacturing Data General's Nova and Supernova and will be manufacturing the U.S. company's new line of minicomputers. Beyond that, Datagen has designed and manufactured a crt display and a general-purpose digital I/O system, which it expects to export to U.S. and worldwide markets.

The eventual plan at Datagen is to go public in Canada, which will make it a Canadian company. Currently, Data General holds controlling interest.

If Canada gave a gangbuster's computer company award for the fastest-growing company, it would have to go to Consolidated Computer Ltd., of Toronto.

Formed in 1968, Consolidated had sales of \$650,000 last year, expects \$12 million in revenues this year, and has just signed a \$50 million sales agreement with England's ICL, which will purchase the Canadian firm's data entry system.

"We've been given heavy financial

assistance from the Canadian government," notes William G. Hutchinson, Consolidated's vice president in charge of international marketing. "And this has been helping us, particularly now, because some of our competitors in the States have had to slow down or bail out because of the financial crunch."

Consolidated's big product now is its multistation data preparation system called Key-Edit. The shared-processor system is designed to provide time-sharing of multiple key-station operations.

While the \$50 million contract with ICL is the big deal at the moment, Consolidated has been systematically building up a marketing force to market Key-Edit and other Consolidated products in the U.S.

Jeffrey M. Donahue, executive vp of Consolidated's U.S. subsidiary, says the U.S. marketing force currently numbers about 30 with more expected to be added soon. Consolidated has delivered Key-Edit systems — which sell for about \$110,000 in an average configuration — to several customers in the U.S.

The Canadian government has agreed to underwrite 90% of Consolidated's leasing business up to \$12 million and also is paying for 50% of the firm's development costs. Production is in Ottawa. In the U.S. the company operates a small engineering facility in Santa Clara, Calif.

Fe fi fo fum

But the real sleeping giant in Canada could well be International Computers of Canada Limited, which is affiliated with England's ICL. President J. E. Bieser says flatly that he looks at ICL as the means of getting a foothold in North America through Canada. "All you have to do is look at the trade treaties between the U.S. and Canada and the U.S. and England and you can see that they are more favorable between the U.S. and Canada."

Bieser, who is an American, having most recently been manager of IBM's data processing office in Pittsburgh, reports that ICL "has been and is" discussing the establishment of a manufacturing facility in Canada. ICCL is moving quickly: The operation officially started in January with its head office in Toronto. It now has some 30 employees — all professionals — and

has established a regional office in Montreal and a branch office in Saskatchewan.

"We think we're the most likely Canadian computer company base in Canada," says Bieser. "Eventually, we want to go public and be Canadian-owned."

"We're an independent company — 50% owned by ICL. I think this gives us the best of both worlds: We're not dominated by ICL, but we have all the strengths of ICL and we can sell according to Canadian practices."

ICCL is marketing ICL's 1900A Series in Canada, and Bieser reports that the Canadian firm has installed equipment in the vicinity of its three Canadian offices. One interesting sidelight to the new endeavor is the fact that 1900A Series had its roots in the design of what the company claims was the first solid-state computer and other equipment designed and built at Ferranti-Packard Electric Limited in Toronto. Ferranti Ltd. was later merged into ICL.

Computer equipment shipments between the U.S. and Canada are not strictly a one-way street. There is what might be best described as a small sidewalk of shipments to the U.S. from Canadian firms. For instance, the Canadian Marconi Co. has traditionally shipped most of its avionics equipment to the States.

D. K. Ritchie, president of ESE Limited of Ontario, is expecting to sell its high-speed modems in the U.S. The company, which is a spin-off of Ferranti-Packard, believes it can carve out a nice piece of the U.S. telecommunications market for itself.

No one expects Canada to represent a major factor in the U.S. or worldwide industry in the near future, but the computer industry north of the border — both vendors and users — appears to be on the threshold of a take-off. The situation was perhaps best explained recently by Datagen's Juan Monico:

"We have the technology, the people, and the resources. Our internal market is large enough to sustain a viable domestic industry. Our international trade image is beyond reproach. It's now or never for us and I'm willing to bet that it's now."

—W. David Gardner

(Continued on page 77)

If you don't think looks are important, ask your computer to describe Vicky Lane.



The computer is a wonderful invention. But, so is a pretty girl. And no computer description can do her justice until it's interfaced with our 410. Because our 410 shows her face. And that's pretty important when she needs to be identified in a hurry.

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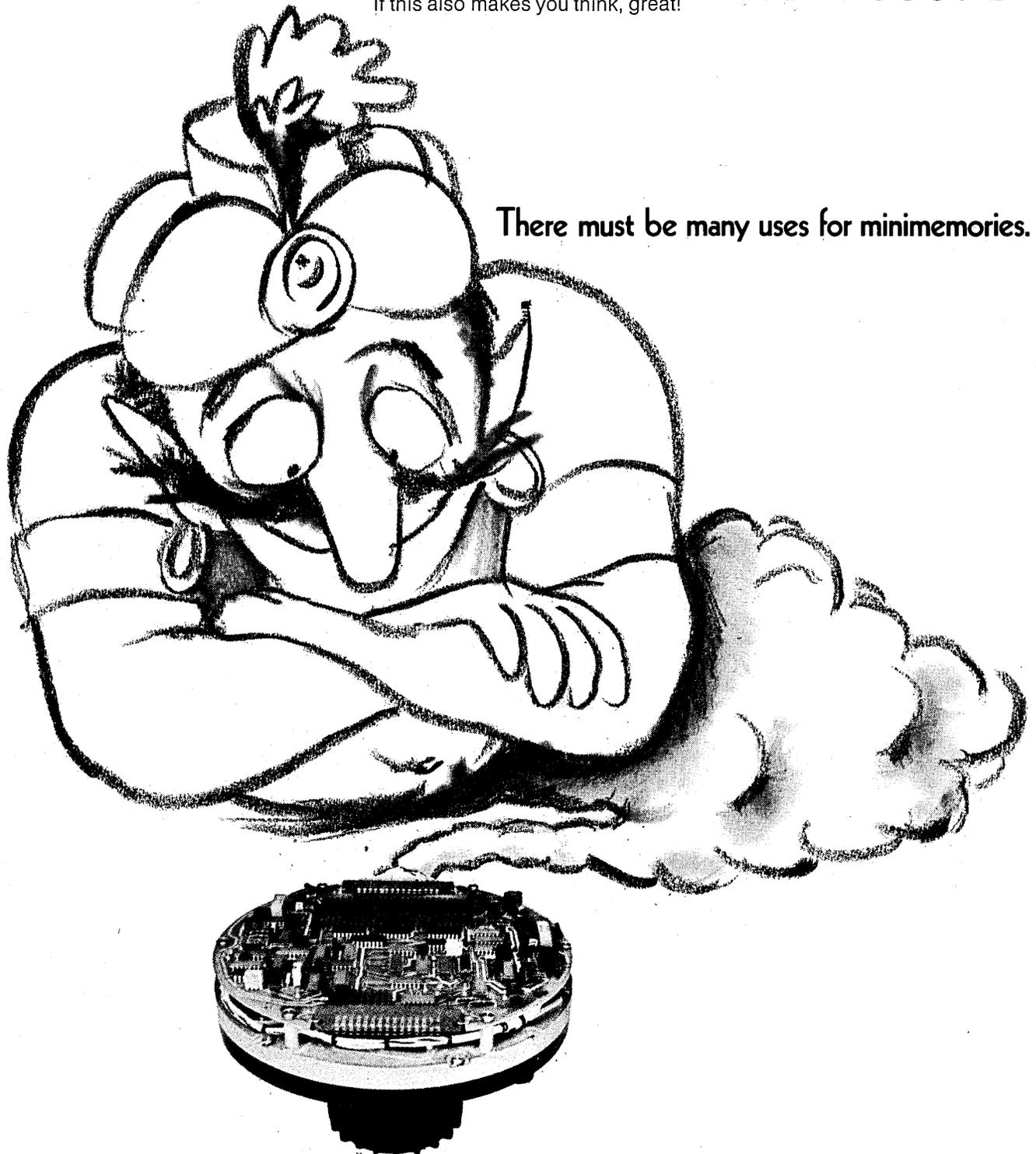
Last year we introduced our ½-megabit, 9" x 9" x 6" minimemory, and it sold well. People found it excellent for minicomputer auxiliary storage, communications terminals, inventory-control systems—and several things we hadn't thought about.

Which made us think: what about a full line? Four capacities—½, ¾, 1, 1½ megabits—each in the same 9" x 9" x 6" size. As for prices, you'll like these (all in 1-9 quantities): \$2750, ½-megabit model; \$3150, ¾-megabit; \$3530, 1-megabit; \$4350, 1½-megabit.

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DOD Releases Wimmix RFP as House Kills Funds for First Two Computers

An RFP covering new computers for the World Wide Military Command and Control System was finally issued by the Pentagon early last month, but more delays are likely, and cancellation of the entire buy remains a possibility.

Shortly after the RFP came out, the House Appropriations committee killed the Defense Communications Agency's request for \$6.4 million to buy what would have been the first of the new Wimmix computer systems.

In an accompanying report, the committee explained that DCA's request was denied because "as late as Sept. 30," the implementation program was still being reviewed "as a result of the (Fitzhugh) panel's recommendations."

The committee added that, before appropriating any money for Wimmix, it wants to look at a GAO study of the project. The study will be finished well before hearings begin on DOD's FY'72 budget.

Other sections of the report were extremely critical of Pentagon management/procurement practices. The committee stressed the need for making sure that systems work before awarding production contracts.

One knowledgeable source who has seen a preliminary draft of the GAO report says it recommends going ahead with the Wimmix buy, but only to get a clearer idea of costs and benefits. GAO's evaluation of the project's management isn't known, but it's likely to be critical.

These trends and portents suggest that the House committee is upset about DOD mismanagement, suspects that Wimmix planning exemplifies the problem, and isn't likely to be disabused by GAO. It seems probable, as a result, that the committee will demand changes in Wimmix management before it approves money for the project next year.

In addition to the Appropriations committee, DOD must get its FY'72 budget request past the Office of Management and Budget. As we reported last July 15 (p. 82), OMB feels that the Joint Chiefs of Staff, who have management responsibilities under the current Wimmix implementa-

tion plan, can't do an effective job and that what's needed is an adequately staffed manager at the Assistant Secretary of Defense level whose duties can evolve gradually, in parallel with implementation of the Wimmix system. Significantly, the Fitzhugh panel also concluded that JCS should be relieved of its operational responsibilities, and that adp management should be upgraded on the DOD organization chart.

Alter course

Possibly, the Pentagon will be persuaded by these developments to alter its Wimmix management setup. Perhaps the JCS team will be replaced by a higher level group. It is more likely that a new manager will be appointed at the Assistant Secretary of Defense level to monitor and control the JCS team's activities. If that happens, Wimmix system requirements probably will have to be redefined in much greater detail; the reasons for installing new equipment at each site will be examined more intensively; and there will be greater pressure for standardizing and sharing system resources.

It is also possible that the House Appropriations committee will deny funds for Wimmix in FY'72, pending further refinement of the blueprint. Alternatively, the current plan to order 9-13 systems next year may be reduced.

Meanwhile, out in the real world, Wimmix bidders will continue jockeying for leverage. One vendor estimates the out-of-house cost of 35 Wimmix systems — the total buy projected by last month's RFP — at \$110 million. This figure includes related nonfunctional software. Whoever wins Wimmix, he adds, is likely to be hired by the Defense Intelligence Agency to upgrade a number of non-Wimmix sites, at an estimated cost of \$86 million. Communications processors and related gear for both Wimmix and the DIA systems will be awarded separately, adding \$36 million. And Wimmix system integration and conversion contracts, which will also be awarded separately, should be worth \$25-30 million.

Totaling it all up, our source says that the company that wins the Wimmix bidding derby stands to gross somewhere around \$260 million, just for the first round. If there is a follow-on, and he considers this probable, the total would double, at least.

Double standard

It is generally agreed that IBM is ahead of the pack at the moment, partly because several IBM systems are already installed at Wimmix sites, and partly because of the "second standard" Deputy Defense Secretary Packard promulgated last June. (July 15, p. 82).

In essence, the second standard means that even if a non-IBMer wins the pending buy, IBM will still have a good chance of winning the follow-on. This is significant because to make a substantial profit, and possibly to make any profit at all, the winning bidder will have to take both halves of the doubleheader.

Packard said the second standard would cover 16 sites leasing "medium or large IBM/360 machines." (Actually, the 16 sites are using 50 small, medium, and large 360s.) He added that no further sole-source procurements would be authorized for these sites. Knowledgeable DOD sources added that Packard also meant to bar any expansion of IBM's existing foothold through equipment transfers from sites covered by the second standard to those not covered.

Recently, at least two of IBM's competitors have complained that the Defense Communications Agency has asked permission to replace one of its 360/65s with a 370; also, Defense Intelligence Agency allegedly has transferred a 360/50 to U.S. Army/Pacific, a site not covered by the second standard.

Sale source out

A JCS official reports the DIA transfer did occur, but it didn't increase the number of second standard sites. Another DOD source says that whether an increase did or did not occur is "a matter of interpretation." Our JCS contact denies that DCA has asked for sole-source procurement of a 370 and emphasizes that if the request is made, it will be denied.

PERSPECTIVE

The RFP obligates DOD to order a minimum of 15 and a maximum of 35 systems during FY'72 and '73, provided vendors price their bids on the basis of a 35-system contract and the prices allow 15 systems to be purchased for \$46.2 million or less. The whole buy can be cancelled if this latter condition isn't met.

Bids are due next Feb. 1, and the contract award is scheduled for the following July. The first system is to be installed by Jan. 1, '72.

Three equipment configurations, designated GSS/M (General Staff Support/Medium), GSS/L (Large), and FC (Force Control), are specified in the RFP. The GSS/M needs a minimum core of 80K bytes, expandable to 500K, while for each of the other two configurations, the minimum core is 500K, expandable to 1 million bytes.

The RFP says bidders will be evaluated on their ability to supply enhanced capabilities, rather than these minimums. The idea, apparently, is to acquire bigger equipment in the hope of prolonging the life of the investment. Bigger cpu's as well as faster/-bigger peripherals are specified. For example, the GSS/M core can have a minimum of 125K bytes (instead of 80), and the FC core, 625K (instead of 500).

IBM seems virtually certain to bid its new 370 system, together with NIPS, a data management system already used by several Wimmix components. A 360-based bid is also likely. Probably the 370/145 or 155 will be offered for GSS/M sites, and the 165 for the others.

The others

GE, according to the best-guess estimate of a knowledgeable source, will bid its 635 and 645 systems, plus a data management system called ISS. CDC probably will offer its 6400 for the GSS/M and its 6600 for the other two configurations. A 6600-6700 bid is also possible. CDC's dms is expected to be MARS. RCA is likely to bid the Spectra 70/61 for GSS/M and let others fight for the rest of the buy. Univac's entry probably will be the 1106 or 1108 for GSS/M and the 1108 for the others. The 1110 is a possibility, but getting it ready by Feb. 23, when Wimmix benchmarks are scheduled to start, will be difficult.

Burroughs may not bid at all. The company disbanded its Wimmix development team some time ago, and currently is vying for the Air Force's Advanced Logistics System as well as another big kludge needed by the Defense Supply Agency.

Wimmix critics say the RFP is premature because basic system design and management problems still haven't been resolved — notably the dms question.

A dms or else

The RFP requires each bidder to demonstrate a data management system at benchmark time that can be made operational later on. If he doesn't offer a dms, or asks more than \$2.97 million for it, DOD will add that amount to his bid and shop elsewhere for the dms. These provisions are part of a DOD plan to use essentially two data management systems if a non-IBMer wins the pending competition.

One dms would serve the second standard sites; the other, the sites to be equipped under the pending RFP. DOD says an interface will be developed between these two data management systems, allowing file data (but not queries or responses) to be moved directly from one side to the other.

The critics say that a single dms can probably be developed without significantly delaying deployment of the new Wimmix computers and that the benefits more than balance the risks.

They cite TRW's GIM as one candidate. Developed originally for the 360, it's now being rewritten for the 1108. Meanwhile, a machine-transferable COBOL dms is being developed by the Defense Intelligence Agency.

Apparently, both packages require considerable additional work. But, according to a source who should know, GIM is the dms that Univac plans to offer in its Wimmix bid. And recently, DIA's COBOL dms became a standard for the entire military intelligence establishment.

By February '72, says a knowledgeable source, the DIA dms should be operational on GE 600 series equipment, and should provide real-time file access. The current version operates only in batch mode, on 360/30s and 40s. A Mod 50 version is

scheduled to be operational by next February.

Cockpit decisions

But the dms problem is far removed from the cockpit where the key decisions regarding Wimmix bidders will be made. Both DOD and Wimmix bidders prefer not to discuss the matter, because the overriding objective for both is to get contracts signed, appropriations spent, and equipment orders placed so that field commanders will be mollified.

Bidders can justify their attitude, legitimately, by arguing that their primary aim is to make a profit, not to provide advice that might jeopardize or delay that profit — particularly since DOD has technical experts who are supposed to provide that sort of criticism.

The technical experts also have a legitimate point when they say that if the money isn't spent, it may be reprogrammed or taken away completely. Besides, system design and cost effectiveness considerations often have to be compromised because the users are hollering for new equipment.

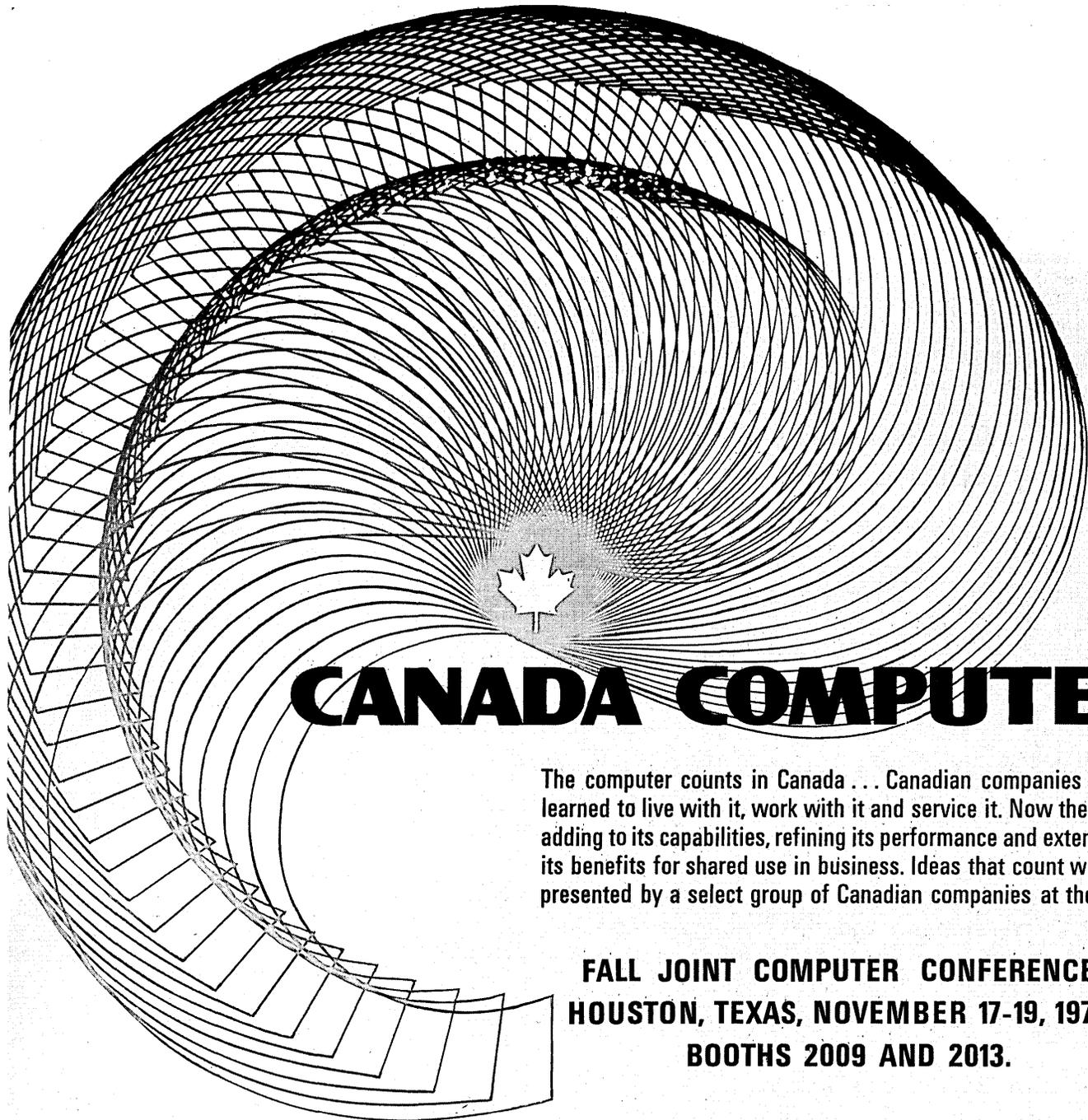
But the net result is that in buying computers, airplanes, missiles, tanks, or any of several other complex, expensive systems, the Pentagon has come to believe that optimizing performance is secondary to other considerations.

A few government officials outside the Pentagon, plus an even smaller number inside, have tried to oppose this philosophy. But their chief weapon — Congress — lacks the expertise, time, and often the inclination, to even understand the problem most of the time.

Currently, Congress seems to be up in arms about the way the arms program is being managed. Last month's House Appropriations committee report reflects this concern. Probably, the critics have gained some political clout as a result. It remains to be seen whether they have gained enough to affect DOD management/procurement practices.

The answer to that question will be determined at least partly by what happens to Wimmix next year.

—Phil Hirsch ■



CANADA COMPUTES

The computer counts in Canada . . . Canadian companies have learned to live with it, work with it and service it. Now they are adding to its capabilities, refining its performance and extending its benefits for shared use in business. Ideas that count will be presented by a select group of Canadian companies at the —

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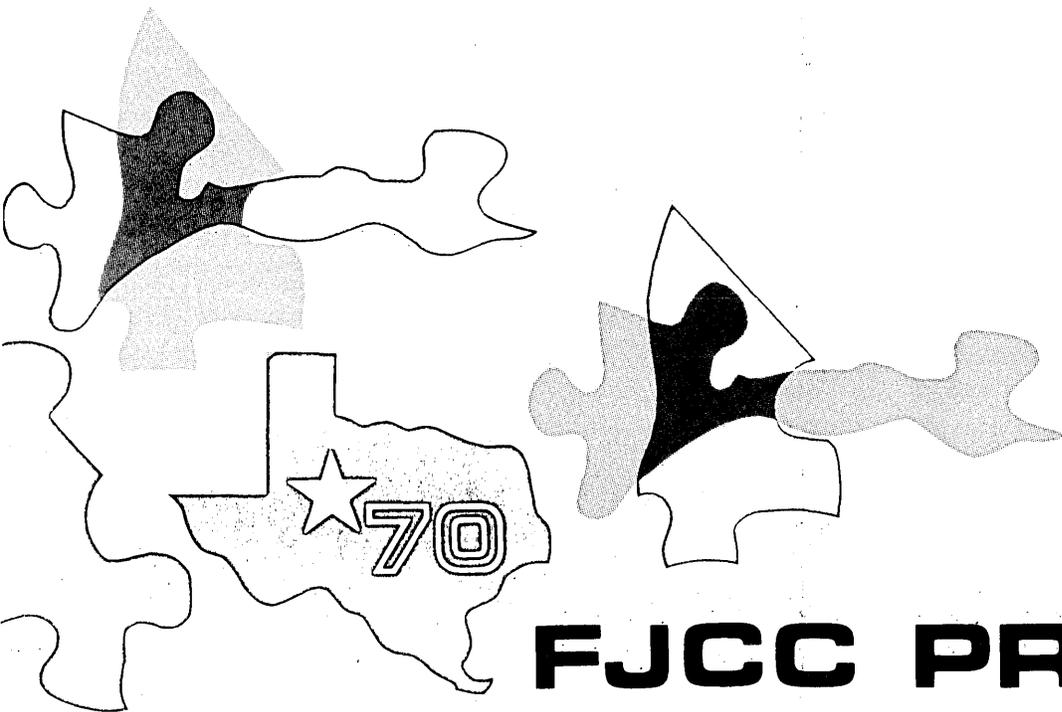
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Department of Industry, Trade and Commerce, Ottawa, Canada

CIRCLE 41 ON READER CARD





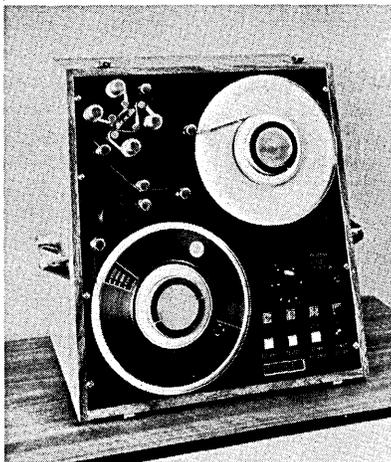
FJCC PRODUCT

ADVANCED TRANSDUCER SYSTEMS LTD.

Toronto, Ont.

Booth 209 and 213

The Magnetic Tape Inspector is in-



tended to be economic for tape libraries of 2,000 or more reels. It not only inspects for dropouts, but removes dirt and oxide particles from the tape surface. Cleaning is repeated until dropouts are reduced to an acceptable level. Threshold is adjustable to 50, 60, or 70% of normal signal strength. Both 800 and 1600 bpi tapes are handled, and a model is

available for Honeywell 3/4-inch tape as well as standard magnetic tape.

Operating speed is 150-200 ips for cleaning, with rewind of 100 ips for inspecting. Options include a foot counter and a digital printer for recording dropouts and footage. Price is about \$6K, with delivery in 30-45 days ARO. For information:

CIRCLE 201 ON READER CARD

AMPEX CORP.

Culver City, Calif.

Booth 3013

Plug-to-plug replacements for the IBM 2314 equipment gain another member with the announcement of



the DM-312 disc drive and the DC-314 which controls up to eight DM-312s on-line plus a spare off-line. Access times vary from 8 to 58 usec with 32 usec being the average. The same transfer rate (312KB) and capacities as the 2314 characterize the unit.

With IBM's 2314 listing for \$244,440 (full 8 + 1 configuration), the DM-312/DC-314 alternative is offered for \$217K. Similar reductions apply to leasing arrangements. For information:

CIRCLE 202 ON READER CARD

ADVANCED TERMINALS INC.

Herkimer, N.Y.

Booth 1133,35

Microfilming computer printout has inspired a new acronym: POM, Printer Output Microfilm. The POM unit, called the model 1000 Forms-copier, transfers data from continuous fanfold forms onto microfilm at up to 20,000 lpm (adjustable from 15 to 56 form-inches/sec). The unit operates off-line and consists of an input tray for loading fanfold forms, a sprocket drive for carrying forms through the copier, a rotary camera with dual lens, and a receiving or output tray for stacking copied printout. It holds a stack of up to 15 inches of forms. A sequential index number

PREVIEW

is automatically encoded on the film for each page of information. Two 100-foot reels of 16mm film are simultaneously exposed.

The system can process single-part to six-part standard continuous fanfold forms of any length, in widths from 4 to 18 inches. Single documents of like width and up to 30 inches in length can also be microfilmed, with a receiving tray capacity of two inches. Price of the Formscopier is \$5200, and first deliveries are expected around the end of the first quarter. For information:

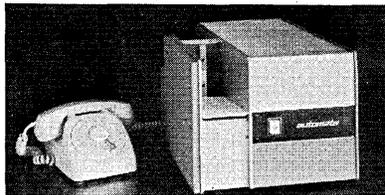
CIRCLE 200 ON READER CARD

AUTOMATA CORP.

Richland, Wash. Booth 2212,14
Pencil marked, preprinted, or key-punched source documents can be read at rates to 60 cpm with the model 3600 optical mark reader. Variable length documents can be intermixed in the input stack. Only three moving parts are needed to handle documents, and the vendor claims that the device is easy on them. Other features of the 3600 include optical compensating electronics to assure reliable mark detection, and solid state modular construction. The unit is priced at

\$2500.

Options include a package for transmitting data via the dial net-



work at up to 1,200 baud, an interface to either 7- or 9-track tape, and an interface to IBM model 029 key-punches. Delivery for the model 3600 is within 60 days. For information:

CIRCLE 203 ON READER CARD

AURICORD DIV., SCOVILL MFG.

Long Island City, N.Y. Booth 3225
The CAS-10 oem digital cassette deck features variable speed and bidirectional read/write under dual capstan control to minimize inter-record gaps. Sensing is performed optically, with separate sensors for beginning of tape and end of tape. Cassette-in-place and file-protect sensors are also employed. Three variable speed DC motors are used, two for direct reel drive and one for the capstans. Sample price is \$300, including head but exclusive of elec-

tronics. Delivery requires six weeks ARO. For information:

CIRCLE 204 ON READER CARD

BUCODE INC.

Hauppauge, N.Y. Booth 2113,15
The model 2045 magnetic tape system handles standard 7- and 9-track tape at speeds to 45 ips and packing densities to 800 bpi and 1600 bpi. Configurations available are read after write, read only, and write



only. Price range is \$3000-\$4500, depending on configuration, options, and quantity. Delivery requires 30 days ARO. For information:

CIRCLE 206 ON READER CARD

(Continued on page 82)

Product Preview . . .

BRIDGE DATA PRODUCTS, INC. **Philadelphia, Pa. Booth 3311, 13**

Three card readers will make Houston the site of their coming out party. Oem's can buy them complete with hoppers, transport, stackers, electronics, cover panels, and interface, or obtain just the transport, hoppers, and stackers. In the future the 8800, 8060, and 8800 models will be offered to end users also.

The 8800 can handle either 80-column cards at 650 cpm or 96-column cards at 1,000 cpm. The model 8060 reads 80-column cards only and is rated at 650 cpm, while the 8600 reads "funny cards" exclusively at up to 1,000 cpm.

Features common to the three peripherals include a clutchless feed-mechanism and the lack of a reciprocating knife to pick cards. Cards are read photoelectrically before being positively pushed into



the output stacker. Off-punched holes are compensated for automatically, according to the vendor.

In lots of 100 the model 8800 80/96 card reader will be priced at \$2500, the model 8060 for \$2K, and the 8600 for \$2250. For information:

CIRCLE 205 ON READER CARD

BUNKER-RAMO CORP. **Stamford, Conn. Booth 2014**

The latest crt terminal in the evolutionary development of this firm's products is the BR-2210, intended for applications where non-typists are employed, such as bank teller windows, factory work stations, hospitals, credit departments, etc. The 3 x 4-inch screen displays up to 198 characters on 10 lines. The integral keyboard has a block of alphabetic characters in alphabetical order, plus adding machining numerics and programmable symbol and function keys. External measurements of the unit are only 8 x 11 x 16 inches.

The 2210 communicates with either local or remote processors at speeds of 1200 to 2400 baud. Entry and interrogation calls to the processor appear on the screen as they are entered on the keyboard. Each message is stored in the control unit's delay line for verification before transmission. Rental of the 2210 is \$39/month (which might be considered a "magic number" for crt terminals). Necessary communications and control equipment for a typical interface with a System/360 rents for another \$16/month.

For information:

CIRCLE 207 ON READER CARD



COMDATA CORP. **Niles, Ill. Booth 1227**

The Series 200 frequency division multiplexor features equal opportunity access for multiple drop channels and the elimination of high-speed modems. The new unit also provides: busy-out of remote dial-up data sets; loop-back test features on private line and individual channels with manual and computer control; 12 110-baud channels on an unconditioned line and 14 with C2 conditioning; mixing of 110, 134.5, 150, and 300 baud channels; voice-plus-data to permit simultaneous telephone service along with several data channels; and a line test unit

that determines the quality of private lines. A complete system with local and remote stations starts at \$1440 for the first channel plus \$610 for each additional channel. Deliveries from stock. For information:

CIRCLE 230 ON READER CARD

COMPAT CORP. **Westbury, N.Y. Booth 3702**

Punched card data entry and program assembly capability is now available for this vendor's COMFILE 88-23 and -33 batch terminals. The new peripheral, designated the 88-130, is a vacuum feed optical card reader with a speed of 300 cpm. It allows either direct punched card data transmission or recording of card data onto the COMFILE random-access tape file (Sept. 1, p. 89) for processing, manipulation, keystroke verification, and subsequent transmission. The 88-130 also permits assembly of programs written for the 88-23's 4K, 16-bit computer. The new card reader rents for \$95/month, including maintenance. For information:

CIRCLE 208 ON READER CARD

COMPUTER AUTOMATION, INC. **Newport Beach, Calif. Booth 3614, 16, 18**

The 8-bit model 108 and 16-bit model 116 minicomputers are the successors to and identical in every way to the vendor's 208 and 216 models except for the incorporation of new memories that plummet the cycle time from 8 to 1.6 usec. The 108 is available with from 1-16K, and the 116 is expandable to 32K. The 116 features "immediate" instructions and relative addressing, not available in the 108. A 4K 116, including power supply and control panel, is priced at \$8490. A 108 in the same configuration is \$5490. In quantities of 50 or more, oem's can buy these models for \$5400 and \$3500. For information:

CIRCLE 209 ON READER CARD

COMPUTER COMMUNICATIONS, INC.

Inglewood, Calif. Booth 3108, 10, 12, 14

The TOTELCOM CC-335 can display up to 960 characters in 12 lines of 72 or 80 characters. Compatible with tty models 33 and 35 both electronically and logically, the unit features

(Continued on page 91)

FOR SANDERS CIRCLE 142 ON READER CARD →

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We're plugged into
some of the
busiest computers
in America.

OCCUPATIONAL

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12 OWNER 1 DIVISION

16 APL 19

14 SERVICE

35

**For an international airline,
15,000 flight reservations
every day of the week.**



CRT terminals in an airline reservation office are nothing new.

But CRT terminals at airport counters and in city ticket offices are a real innovation.

The economics of our hardware have made it practical. In the instance we're talking about here, there are 300 Sanders terminals installed at counters and ticket offices throughout the airline's stateside service area.

The efficiency of the system is startling. A request for a seat on a given flight will get you a confirmation in four seconds or less.

We have similar systems on-line for several regional carriers. And for yet another airline, we're on the input end of a passenger revenue accounting system

that processes about a million ticket sales a month.

We're also into automobile rentals in a big way. And hotel and motel room reservations.

The point to be made is this: we've got considerable real-world experience under our belt. We're prepared to do more than simply talk-up our hardware. We think in terms of systems. Yours and ours.



For a major railroad, a way to find one freight car in 600,000.

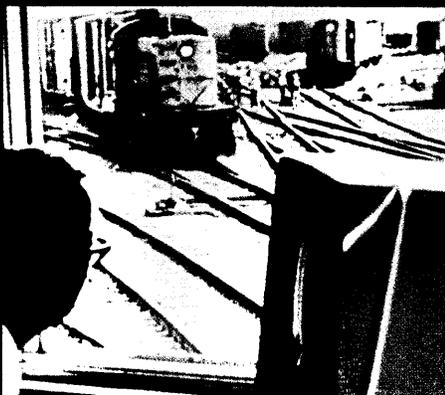
It happens thousands of times a day. A consignee calls one of the railroad's offices, seeking to pinpoint the whereabouts of an enroute shipment.

A tall order, that. But it's delivered in short order. While you wait, as a matter of fact.

A quick turn at the keyboard of a Sanders CRT terminal is all it takes. In a few seconds the requested information is displayed on the tube, having been transmitted by data line from the disc files in the railroad's headquarters.

It's no secret that many of the CRT terminals on the market could be handling this sort of job. How come Sanders got the nod? Possibly because of our field organization. It's big. Big enough to provide service wherever our terminals are. Fast, local service.

If you had a half-million freight cars to keep tabs on and about 12,000 inquiries a day to answer, wouldn't you want that kind of security blanket?



For a credit card system, 12,000 on-line transactions every hour from 9 to 5.

Credit cards are good for business, and merchants honor them gladly. But what merchant can afford to operate on the honor system?

It's common practice for department stores, for example, to set a maximum limit on the dollar amount of any one credit card purchase. Exceed the limit, and your willingness to pay will be discreetly checked before the package is wrapped.

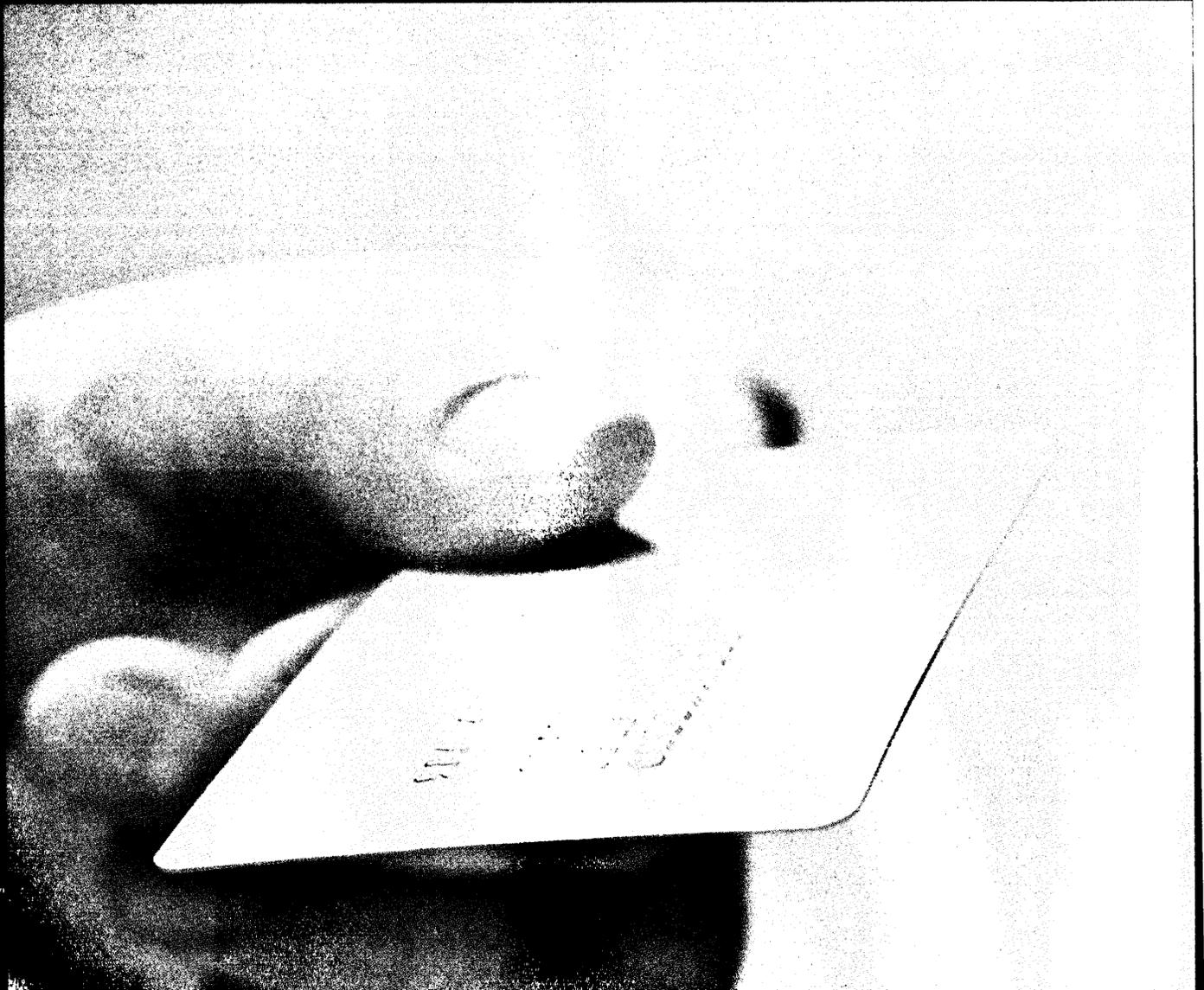
The check is conducted by phone. The salesperson calls the regional credit card office and is directly connected with an operator at a CRT terminal. The authorization, assuming you're not a deadbeat, is immediate.

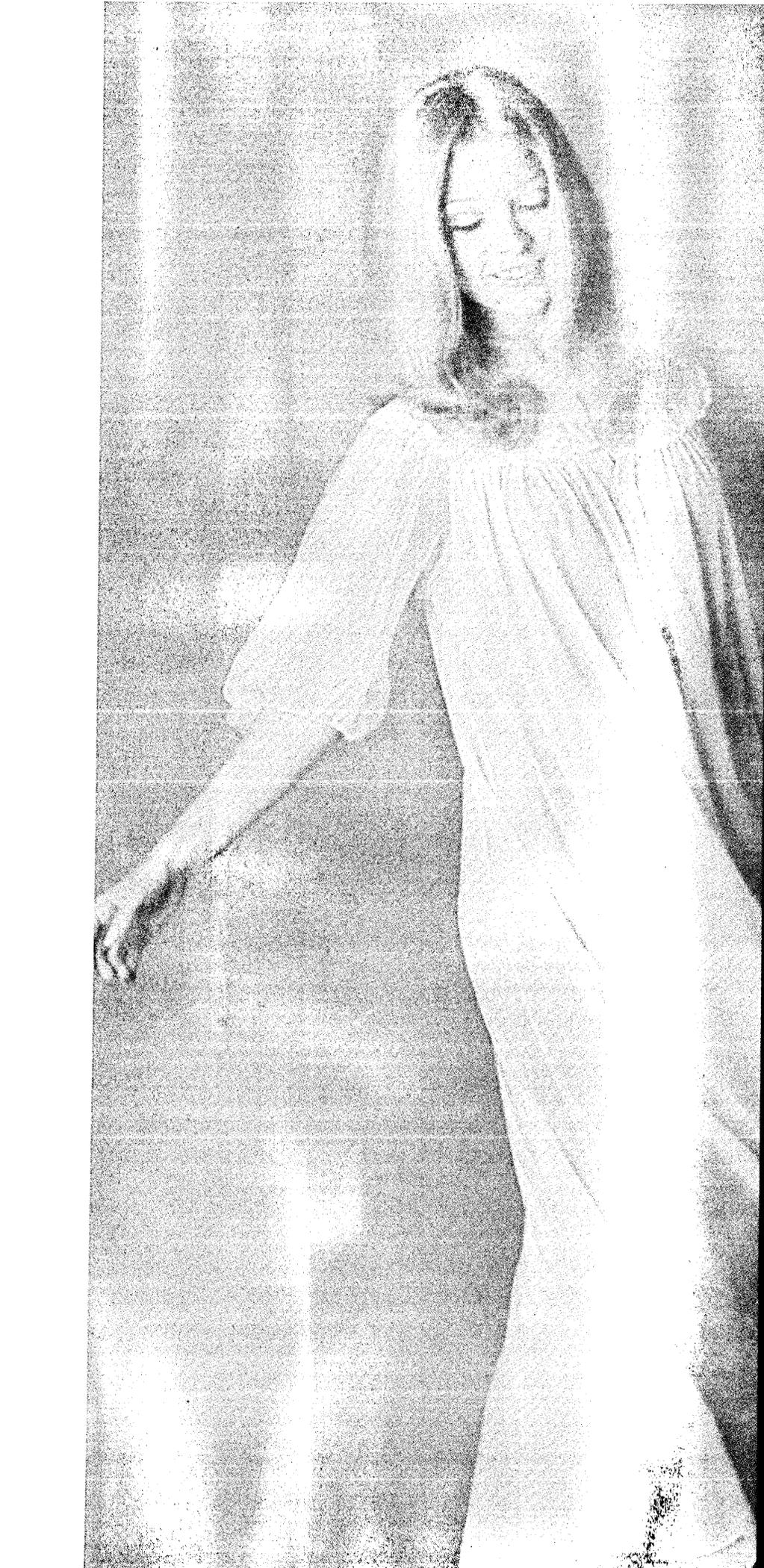
The terminals - there are 70 - process about 100,000 transactions daily. Not all of these are credit checks. Card-holder data



is originally entered on-line via the terminal keyboard, and changes in the data base are handled the same way.

This particular application, incidentally, uses our Model 720 System, an expandable multi-terminal system package with a central control unit. Economics favored this approach over stand-alone terminals. We favored neither, since we make both. The size of the foot determined the size of the shoe.





**For one catalog
sales center
of a mail order
retailing chain,
18,000 order forms
a day.**



The mail order catalog is an amazing document. It's nothing less than a living-color, code-numbered handbook on the artifacts of American civilization, circa 1970. A summation of life as it's lived: eight-penny nails, ignition testers, and high-fashion cocktail dresses.

But no CRT terminals. Not in this year's catalog, at any rate. Nonetheless, we're helping to produce revenue from catalog sales.

It's a substantial contribution. Our terminals enter customer orders on-line, directly from the mailed-in order forms.

The process is expedited by having the terminal screen display a replica of the standard order form bound into the catalog. The operator has merely to fill in the blanks with the appropriate information from each form.

This same Sanders system is applicable to order entry situations where many different order forms are used. Any desired blank format can be displayed on the tube by typing a code name. The format data is stored in the system's control unit—not in your CPU, which has enough work to do already.

For brokerage houses on the Street, a saving of a dollar or more on every trade that's made.

Receive, Deliver, Verify, Box, Fail, Transfer: this is the backroom language of Wall Street. The words the men in the "cage" use to denote various stock transactions.

Behind those words there's a flood of paperwork that started as a trickle when you called your broker to buy or sell. Typically, each trade entails 25 separate documents.

A Sanders CRT system, specifically designed for the task, eliminates 15 of those 25 pieces of paper. Depending on the operational setup in a given brokerage firm, this can amount to a cost saving of \$.91 to \$2.18 on each and every stock transaction.

The computer is as essential to Wall Street as food is to you. Our "backroom" data terminal system has made it possible to feed the computer an enriched diet, in a form more palatable to the machine, more profitable to the men who run it.





For a medical insurance plan, 300 terminals on-line running full steam.

Most of you reading this aren't yet ready for Medicare (though you may have some subordinates who feel otherwise). But when you do come under the coverage of the Act, you'll have no trouble under-



standing why certain administrating companies require 300 terminals to process claims and payments.

The paperwork and accounting load is crushing. Particularly so, because it's additional to the already heavy burden imposed by the medical insurance companies' own private subscriber services.

The system is a rather complex one, involving extensive remote data links and regional computer centers in three out of the country's four corners. If the fact that it incorporates 300 of our terminals seems to imply a prodigious production capacity in the Sanders plant, the implication may be taken at face value. Or confirmed by a visit to Nashua.

For the small system, the same service and support the big ones get.

We've just dropped some heavy numbers on you. And maybe you're impressed a little.

But please don't get the idea that all of the work we've been doing is on a monumental scale. We do a lot of business in two's and three's. And we welcome it.

In fact, we're uniquely structured to handle display terminal systems of any kind or magnitude. We have the

industry's largest field organization specializing exclusively in the sales, systems engineering, and servicing of CRT terminals.

And we also have the product line to go with it.

SALES OFFICES*

Eastern Region

400 Totten Pond Road
Waltham, Mass. 02154
Phone (617) 891-1710

2005 Sheridan Drive
Buffalo, New York 14223
Phone (716) 873-7263

1 Decker Square
Bala Cynwyd, Pa. 19004
Phone (215) 667-1715

100 Constitution Plaza
Hartford, Conn. 06103
Phone (203) 246-7289

529 Fifth Avenue
New York, New York 10017
Phone (212) 687-1050

361 Franklin Avenue
Room 21
Nutley, New Jersey 07110
Phone (201) 667-5030

Midwestern Region

19675 West Ten Mile Road
Suite 409
Southfield, Michigan 48075
Phone (313) 358-4260

O'Hare Plaza
8501 West Higgins Road
Chicago, Illinois 60631
Phone (312) 693-2087

7801 Metro Parkway, Suite 312
Bloomington, Minnesota 55420
Phone (612) 727-1454

Atkinson Square, Suite 2805
11750 Chesterdale Road
Cincinnati, Ohio 45246
Phone (513) 771-2615

River Center Bldg.
21360 Center Ridge Road
Rocky River, Ohio 44116
Phone (216) 331-7230

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Pittsburgh, Pa. 15220
Phone (412) 563-3313

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Suite 2-A
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Phone (404) 261-9565

299 Alhambra Circle
Suite 309
Coral Gables, Florida 33134
Phone (305) 444-1674

Blake Building
Suite 500
1025 Connecticut Ave., N.W.
Washington, D.C. 20036
Phone (202) 659-8505

Suite 202-204
2317 West Broad St.
Richmond, Virginia 23220
Phone (703) 358-1583

*A list of our Field Service Offices is available on request.



SANDERS
DATA SYSTEMS, INC.

Daniel Webster Highway South
Nashua, New Hampshire 03060

Product Preview . . .

editing and formatting capabilities. Transmission rates of 110, 150, 300,



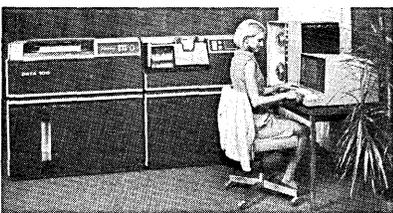
600, and 1200 baud are accommodated over voice-grade lines.

The 25-pound package includes the keyboard, crt, refresh memory, all logic, communication interface, built-in coupler, and power supply in a carrying case. The single unit price is less than \$5K. For information:

CIRCLE 231 ON READER CARD

DATA 100 CORP. Minneapolis, Minn. Booth 1517, 21, 23

The model 78 programmed terminal will initially be available in two versions: the model 78-1, electronically (plug-to-plug) compatible with IBM 2780 terminals; and the model 78-2, which is designed for plug compatibility with IBM 360/20 terminal systems. Depending on a customer's requirements, the systems can be configured of paper tape equipment, card readers, tape units, crt displays, communication equipment, printers, etc. A model 78-2, consisting of a 300-lpm printer and a 300-



cpm reader, is priced at \$44,050. Including maintenance, the same unit would cost \$1028/month on a three-year contract.

Functions performed by the 4K (expandable in 4K chunks to 32K of 16-bit words) controller include format checking, character set translation, error checking and recovery, message assembly/disassembly, decoding, I/O buffering, and storage. EBCDIC, ASCII, or even SBT codes are understood by the 80-instruction, 1.1-usec processor. Both synchronous and asynchronous data transmission through standard EIA RS-

232B/C/D interfaces are possible. For information:

CIRCLE 211 ON READER CARD

DATOTEK, INC. Dallas, Texas Booth 2229

Except for "solid-state devices," this vendor refuses to comment on what's inside the DC-108 and DC-110 Datocoders. This may be just as well since they are for use in encoding and decoding information. The model DC-108 is designed for off-line point-to-point transmission for paper-tape equipment. Code wheels allow 2 million different code combinations. (Aha! Now we know *something* about what goes on inside.)

Essentially the same unit, the DC-110 is set up for time-sharing applications for communication between remote terminals and the cpu. Four



trillion unique code formats are possible in this version, which can operate over dial-up and dedicated phone lines, and even microwave links. The speed of the DC-110 is given as 100,000 baud through tty or RS-232 interface. Prices for the DC-108 and DC-110 are \$2950 each—and don't forget that you need at least two of them. For information:

CIRCLE 212 ON READER CARD

DIGITAL INFORMATION SYSTEMS CORP.

Seattle, Wash. Booth 2313

Not every product comes complete with a name and model numbers — which is the case with this crt terminal. Among "its" features are complete editing capability; on-line and off-line operation; an on- and off-line hard copy option; color tube; and cassette storage.

The 12-inch diagonal crt can display up to 1K characters arranged in 16 lines of 64 ASCII characters each. Dot matrix (5x7) patterns are refreshed at 60 Hz. The standard data transmission rate is 110 or 330 baud. Optionally available is a 9,600-baud

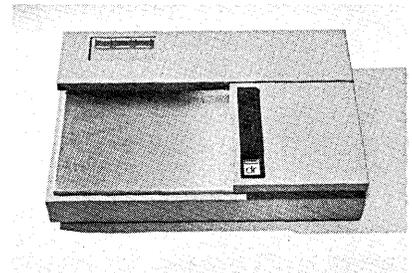
modem, and if that still isn't enough, custom interfaces up to 8.75 million baud can be supplied. Cassette storage of up to 240,000 characters can also be provided, with read/write rates to 500 cps.

Complete turnkey installations, including software to support customer needs, is offered, or the basic yet-unnamed crt can be purchased for \$3K. For information:

CIRCLE 213 ON READER CARD

DIGITAL RESOURCES CORP. Houston, Texas Booth 2006

DATATERM-3 is an optical mark reading data capture peripheral that reads documents that have been



manually or machine coded with ordinary bar marks and converts the data to digital signals using MOS and MSI circuitry.

Document sizes accommodated range from a minimum 8 x 6 inches up to 18 x 12 inches. Characters can be converted into ASCII, EBCDIC, or SBT, depending on what kind of computer equipment is used. Documents can be hand-fed into the DATATERM-3 20-column read station for reading at rates of from one to 20 ips, or an automatic feeding option is available.

Available three to four months ARO, the unit is base priced at \$4K, but there are enough options to run the price to \$7K. For information:

CIRCLE 214 ON READER CARD

ELECTRONIC ARRAYS, INC. Woodland Hills, Calif. Booth 1427

Called the MOSTOR 100, this read/write serial memory is 1K by 8 or 9 bits and in operation acts like a delay line. It could be used for sequential memory applications, or in applications where relatively slow access times (300 nsec/bit) can be tolerated. A price of 2¢/bit is quoted, including decoding logic and necessary drivers. The MOSTOR 100 is both DTL and TTL compatible, and 1K is priced at approximately \$160. For information:

CIRCLE 232 ON READER CARD

(Continued on page 95)

How to evaluate DEC and SYSTEMS and other small real-time computers.

Go to a company that makes a complete line for the OEM and end-user markets. Which leaves only DEC and SYSTEMS.

Forget everything you've heard. Take a hardnosed look for yourself. Compare dollars against performance—right down both lines.

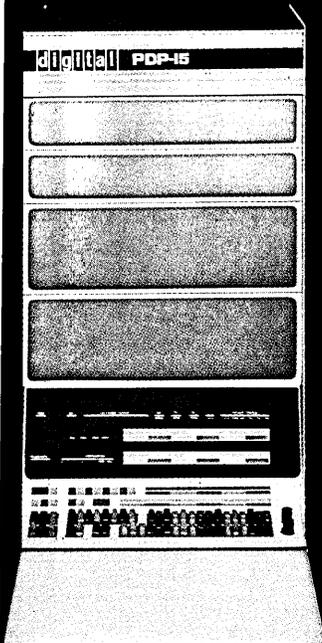
If you need large memory, compare SYSTEMS 72 with the PDP-8 and PDP-11. You'll find the SYSTEMS 72 has a little more speed and a lot more memory (max. 65,000 words of programmable memory—almost twice as much as the other two). On many applications, this will cut cost as much as 40%.

If you need more speed, you'll find the SYSTEMS 82 is 4-5 times faster than the PDP-8 or 11. And because it's designed for real-time systems use, you can hang on a wide variety of analog front ends and peripheral equipment.

If you need even faster speeds and heavier software, check out SYSTEMS 810B—the fastest field-proven 16-bit machine in the business. It comes with a whole library of software including FORTRAN IV and a foreground-background-midleground programming system called Real-Time Executive.

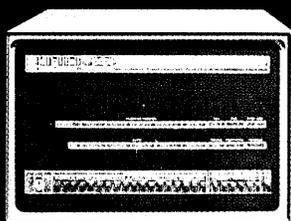
SYSTEMS also makes some very large, very fast real-time computers. But that's another story.

As far as small real-time computers go, don't take our word for it. Send the coupons.



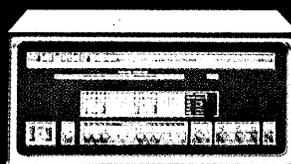
PDP-15

Word length—18-bit
Cycle time—800 nanosec.
Maximum core memory—131



PDP-11

Word length—16-bit
Cycle time—1200 nanosec.
Maximum core memory—32



PDP-8 Series

Word length—12-bit
Cycle time—1200-1600 nanosec.
Maximum core memory—32

Digital Equipment Corp.

146 Main Street
Maynard, Mass. 01754

I'd like to compare the DEC and SYSTEMS lines of small real-time computers. Please send me more information.

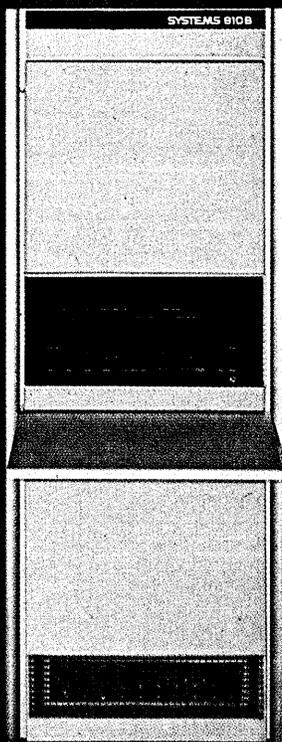
Name _____

Title _____ Tel. _____

Company _____

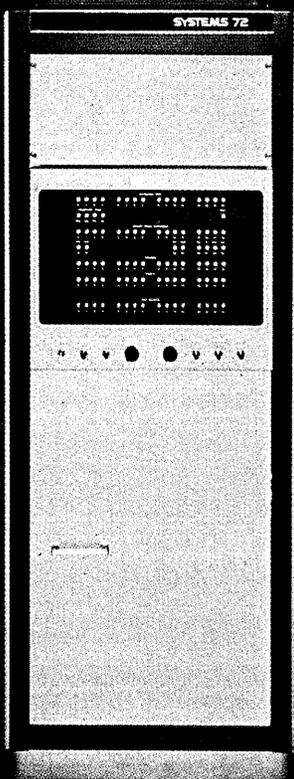
Address _____

City _____ State _____ Zip _____



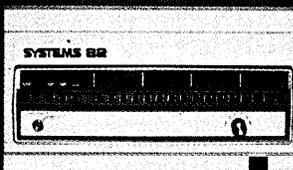
SYSTEMS 810B

Word length—16-bit
Cycle time—750 nanosec.
Maximum core memory—32



SYSTEMS 72

Word length—16-bit
Cycle time—880 nanosec.
Maximum core memory—65



SYSTEMS 82

Word length—16-bit
Cycle time—900 nanosec.
Maximum core memory—16

SYSTEMS Engineering Laboratories

6901 West Sunrise Blvd.
Ft. Lauderdale, Fla. 33313

I'd like to compare the SYSTEMS and DEC lines of small real-time computers. Please send me more information.

Name _____

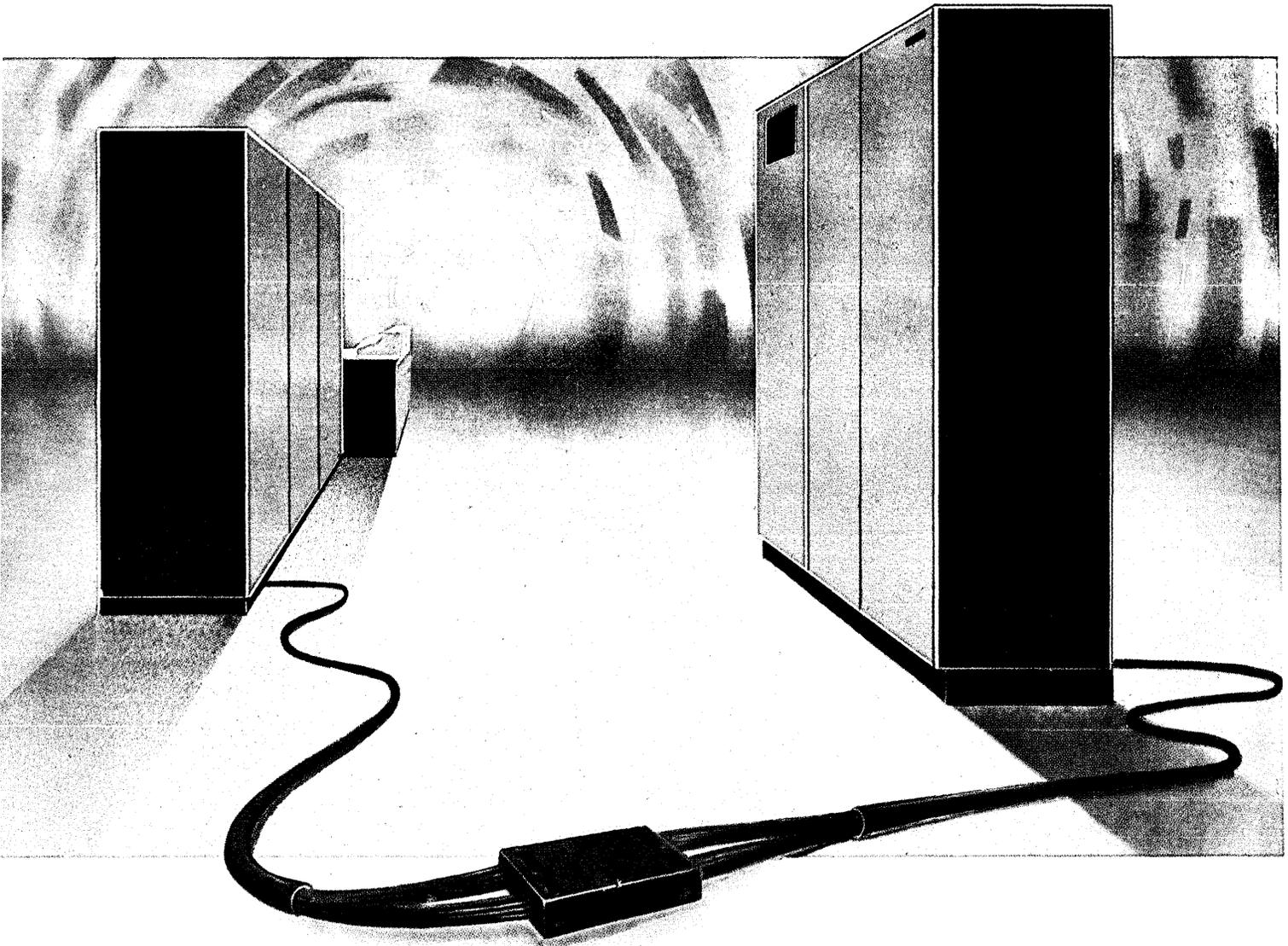
Title _____ Tel. _____

Company _____

Address _____

City _____ State _____ Zip _____

SUPERTHINK



For your 360. Our LCM+.

FAST LARGE CORE MEMORY UPS PERFORMANCE OF 360/50, 65, 67, 75's

Is your 360 overloaded? Or under-utilized? Short on capacity? Long on cycle and access times? Slow on throughput?

If you think IBM's 2361 LCS or a bigger 360 or 370 are your only alternatives — think again.

Fabri-Tek's LCM+ is plug compatible with the LCS 2361. PLUS it's almost three times as fast. Fast enough to use as a sensible, low cost replacement for Main Memory in Mod 50 applications. PLUS it's available in 1, 2, 4 and 8 megabyte capacities.

LCM+ boosts 360 performance way up. Cycle time is as fast as 2.8 micro-seconds, which means

increased throughput, lower cost-per-bit, super-capacities that can add up to huge total dollar savings over a bigger CPU.

Think SUPERTHINK. The LCM+ by Fabri-Tek. Leader in memory technology for over a decade. Available leased or purchased, with complete service from Fabri-Tek regional centers.

For more information, write or phone: Fabri-Tek Inc., 5901 South County Road 18, Minneapolis, Minnesota 55436. Phone 612-935-8811. TWX 910-576-2913.

FABRI-TEK INC.
MEMORY PRODUCTS DIVISION

SEE US AT FJCC...BOOTH NO. 3021

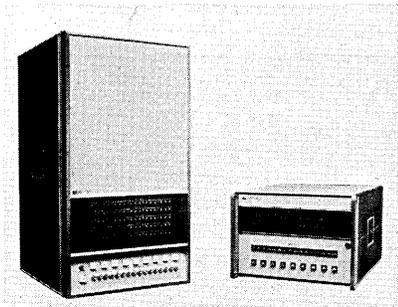
Product Preview . . .

HEWLETT PACKARD CO.

Palo Alto, Calif. Booth 3002

Smaller sizes for smaller prices is the theme. It's all due to the vendor's folded planar memories being compact enough to allow up to 32K to be packaged right next to the cpu. The technology has been applied to the model 2114B and 2116B 16-bit minis, changing the model designations to 2114C and 2116C.

Up to 16K is on tap for the 2 usec 2114C — double the old 2114B allotment. The basic 4K unit with a



direct memory access channel, seven other I/O channels, and 70 instructions is priced at \$8500. For each additional 4K chunk add \$4500; a 16K 2114C costs \$22K.

Like its predecessor the 2116B, the 2116C has up to 32K of 1.6 usec core. The folded planar memory used here costs about \$5K for 4K increments. A 2116C with 70 basic instructions, multilevel priority interrupt scheme, dma, etc., with 8K of core lists at \$20K. A 32K version is \$50K. For information:

CIRCLE 215 ON READER CARD

INFORMATION DATA SYSTEMS INC.

Walled Lake, Mich. Booth 3115,17

With 10 megabits of storage, these fixed head-per-track disc units debut as the Series 10,000. Recording density is 80,000 bits/track on as many as 128 tracks, and the data can be accessed in 25 msec with transfer rates of 2 MHz. Options include power supplies, write lockout, and 2- and 4-bit parallel operation.

For end users a 10,000 series disc unit is priced at \$11,730; the controller's price varies from \$3-3.5K depending on what machine the disc system will be interfaced with. For information:

CIRCLE 234 ON READER CARD

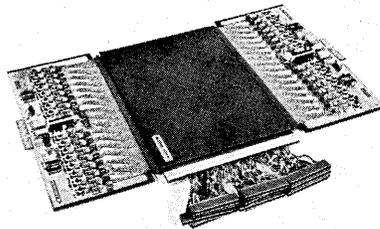
MEMORY SYSTEMS, INC.

Hawthorne, Calif. Booth 1234

This manufacturer has 294,612 plated wire bits for sale. Depending

on how the electronics are attached, this factors into 8K of 36-bit words, or 16K of 18-bits/word, etc. Characteristics of the oem mainframe product line include access times of 150 nsec and read/write cycle times of 300 nsec for the non-destructive readout.

A price of 3½¢/bit includes the decoding, sensing, and driving electronics, and excludes only the power



supply. This price is based on an order of 100 of the TTL memories. Deliveries are scheduled for January. For information:

CIRCLE 217 ON READER CARD

MOBARK INSTRUMENT, INC.

Sunnyvale, Calif. Booth 2131,33

A completely interchangeable data rate — of 110, 150, or 300 baud — is the principal feature of the model 400T incremental cassette recorder. This flexibility allows a user to receive data at the maximum speed of the unit for subsequent printing at any slower speed. The 400T also features both EIA RS-232 and tty interfacing. The recorder uses the standard Philips cassette and is single-quantity priced at \$1830 with a built-in controller. For information:

CIRCLE 219 ON READER CARD

Also being shown is the synchronous model 205 recorder. Packing densities are either 500 or 800 bpi, and tape speeds are 6 or 12 ips. Read/write electronics are provided. Oems may purchase the tape deck portion only at unit prices of less than \$1K. For information:

CIRCLE 218 ON READER CARD

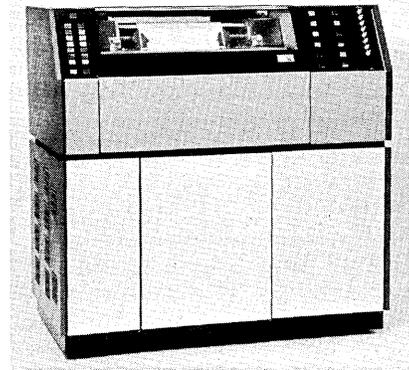
MOHAWK DATA SCIENCES CORP.

Herkimer, N.Y. Booth 3004

This vendor felt there would be a number of advantages in sticking a mini-computer in a line printer. Then such functions as printing output tapes written in any recording mode, on any number of tracks, in any density could be controlled by

internal software. Perhaps they're right — many installations have so many different brands of computers that the 2501 programmable print station might come in handy.

The controller can be expanded from a basic 4K to 8K and additionally can perform such tasks as net balance accumulation, with the ability to print accumulator totals at signalled times within the run as well as



at the end of printing; and reformatting, expanding, or editing data before a line is printed.

Software for the 2501 is currently written by the vendor on a fee basis to a particular installation's requirements and is loaded from a read-only tape unit, but there are plans to soon allow customers to start programming the 2501 themselves. A selection of programs to handle the usual tape formats already exists in the manufacturer's library.

The printer is capable of 1250-lpm operation while printing 160 columns. A standard 64-character set is supplied, with 128 characters optionally available. A card reader can also be configured onto the 2501. A bottom of the line 2501 programmable print station, including the printer, a 4K controller, and an mtu, is priced at \$67K, or can be rented for \$1415/month. For information:

CIRCLE 235 ON READER CARD

IN/OPAC DIV. NUMERIDEX TAPE SYSTEMS

Chicago, Ill. Booth 2207

The No. 760 Data Center is actually a tape winder and center feed unwinder for the simultaneous feeding and collection of paper tapes which attaches to Teletype model 32 and 33 terminals. No modifications to the tty are required, and no tools are necessary for installation. Price is under \$100. For information:

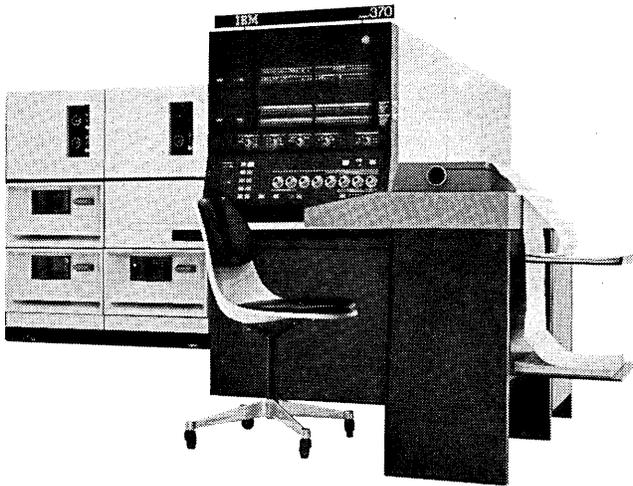
CIRCLE 229 ON READER CARD

(Continued on page 99)

**IBM
introduces
all-monolithic
technology,
memory and logic.
And a new
computer that
makes the most
of it:**

**System/370
Model 145.**

You might call it a new era of computers, or a new generation, or a technological breakthrough. But what really counts is what it means to you.



The hottest concept in computer technology

System/370 Model 145 is the first general-purpose business computer with 100% monolithic circuitry. Including main storage.

The use of this technology with its very high circuit density cuts main storage space in half.

Monolithic technology also speeds up the computing process. And improves reliability as well.

New advancements in speed

Model 145 is 3 to 5 times faster than System/360 Model 40. 5 to 11 times faster than System/360 Model 30.

And that's another reason it's the natural system to move up to if you're a Model 30 or 40 user.

Features, features, features

Like the other computers in the System/370 line, Model 145 is newly engineered inside and out. It's loaded with features.

Like four selector channels. So you can run more jobs and get more work done in the same time.

Like reloadable control storage. So you can have features like block multiplexing, 1400 and 7010

compatibility, and DOS emulation at no extra charge.

Like our new low-cost, high-speed disk facility (the 2319) that holds 87 million characters. And attaches directly to the system without the need for a separate control unit.

System/370: IBM's computer line for the '70s

With System/370, whatever you've got to get out gets out a lot faster.

With any model, you can get our new high-speed printer (the 3211). It fires out numbers and letters at the rate of 2000 lines a minute. Faster than you can blink.

With any model, you can also get our new high-speed disk facility (the 3330). It can hold up to 3½ times more information than our current files. 800 million characters in all. And it can send it into your computer up to 2½ times faster. At a rate of 806 thousand characters per second.

We think it's the best file around.

Revolutionary new product line

But perhaps the most amazing thing of all is that we've been able to make System/370 this advanced while still making it compatible with System/360.

And you also know with IBM you have the support of the most complete program library in the world. As well as the support of our Systems Engineering and Education services.

We've used a lot of words to describe System/370 Model 145. Like 100% monolithic circuitry. Like faster speeds. Increased performance. New features. Greater reliability.

These words aren't empty chatter.

Everything we've said is backed up by hard facts.

Our products change. But our philosophy doesn't. We want you to get the most out of your computer system.

System/370. The performance computers for the seventies.

IBM®



Our new data entry system is so simple to operate you can hire the operator on looks alone.

Simplicity is what the ENTREX™ System 480 is all about. We build in a comprehensive visual display because the operator who sees what she is recording, prepares data faster and more accurately. Simplicity is a good idea (foolproof is a nice word for it), and we've made it into a good system. With its own computer and disk, the System 480 controls up to 64 individual DATA/SCOPE™ CRT keystations. You can train a girl to run it in a couple of hours. If she can type, she can enter data on the 480. Verifying on the DATA/SCOPE's 480 character display is about as difficult as watching T.V.

And if she still manages to get into a jam, our exclusive "Help!" button gets her out. Now there's no reason anyone can't find happiness in data preparation. Especially you: your computer gets a magnetic tape containing 100% accurate data, fully edited and formatted. No re-systematization is necessary. But you'll believe it when you see it, right? Then write: ENTREX, INC., 113 Hartwell Avenue, Lexington, Mass. 02173. Or phone (617) 862-7230.



Product Preview . . .

NOVAR CORP. **Mountain View, Calif.** **Booth 1422,24**

No need to be disappointed that the vendor's old buffered data communications terminals didn't come equipped with a numeric keyboard — for this one can be readily plugged into a socket in the rear of any of them.



Ordinal numbers and additional keys for decimal point, plus sign, minus sign, asterisk, pound sign, field tab, and line return make up the 5-02 keyboard. The extra keys allow an operator to separate fields in a variable length record that might contain information such as payroll numbers, hours worked, hourly rate, and withholding information. The unit can be purchased for \$490 or rented for one year for \$15/month. For information:

CIRCLE 220 ON READER CARD

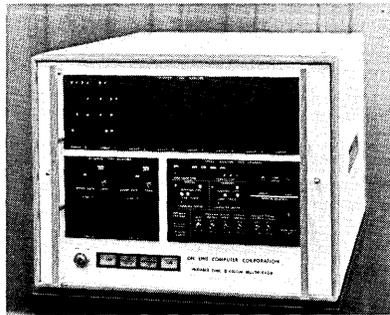
ON LINE COMPUTER CORP. **Stamford, Conn.** Booth 3709

The first product of this firm, which may also introduce a second — perhaps a computer — at the FJCC, is a variable time division multiplexor. It's intended primarily for time-sharing use, with direct reduction of communication line costs the goal. The hard-wired unit operates asynchronously for low speed lines. Its low-speed channels contend with each other for non-dedicated computer ports; thus, high-speed lines are not wasted. Up to 128 mixed low-speed channels are available for rates to 1800 baud.

Up to four high-speed (to 9600 baud) channels can be handled synchronously, and high-speed back-up is provided through line contention.

An automatic terminal type identification feature enables a variety of terminals to be handled on a single low-speed line. Thus, any terminal type can phone a single number and be connected with any available low-speed channel. A cross-mapping

feature incorporated in the multiplexor at the computer end allows for the low-speed line contention for



computer ports.

A typical system of 32 low-speed lines and one high-speed line sells for \$22K. Delivery requires 90 days ARO. For information:

CIRCLE 221 ON READER CARD

OMNITEC CORP. **Phoenix, Ariz.** Booth 1603, 5, 7

The 703A acoustic coupler answers the telephone, establishes communication, and releases the line after asynchronous transmission at rates up to 300 baud. It is tty and RS-232 interface compatible, and is a replacement for Bell 103A2 type couplers. Half- and full-duplex operation is provided. The unit is available for \$495. For information:

CIRCLE 236 ON READER CARD

OPTEL CORP. **Princeton, N.J.** Booth 1330

Images displayed on the model D-10 cathodochromic dark trace storage tube remain forever or until 200 degrees centigrade is applied — whichever occurs first. This technology is another attempt to solve the problem of flickering images, the necessary cpu refreshing, and fading displays.

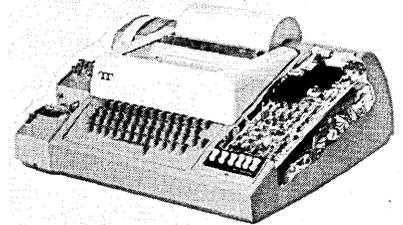
The tube is 4 x 5 inches and contains 1,000 resolvable points in the horizontal axis and 750 points in the vertical axis allowing graphic or textual data to be displayed. Alpha-numeric data is displayed 80 characters per line, and up to 40 lines are possible. Images can be written and erased in five seconds, and the writing rate is 5,000 cm/sec.

Options include variable raster scan and sync generation capability. The price is \$4K. For information:

CIRCLE 237 ON READER CARD

PENRIL DATA COMMUNICATIONS, INC.
Rockville, Md. Booth 1727, 29
The model TRY-300, do-it-yourself

modem enables a standard 110 baud Teletype to operate over the dial-up network under Data Access Arrangement F-58118 at up to 300 bps. It is a direct replacement for the Bell System modem 101C. The modem consists of a single circuit card that mounts directly in the tty; it is provided in kit form and requires no special tools for installation. Six pushbuttons on the front cover establish operating modes, including

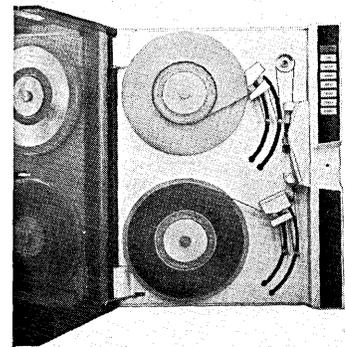


originate, answer, half/full duplex, on-line/local, and automatic answering. The unit's price is \$400, with delivery from stock. Discounts are available to oem's. For information:

CIRCLE 222 ON READER CARD

PERIPHERAL EQUIPMENT CORP. **Chatsworth, Calif.** Booth 3016

There are few vendors that could announce 72 new models of anything, but this is one of the fortunate few. Various combinations of densities (200, 556, 800, or 1600 bpi), speeds (up to 45 ips), and tracks (7- or 9-track) make for the mix of series



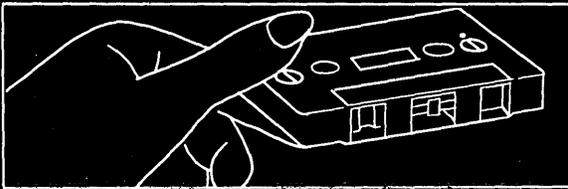
6000 and 6600 oem tape transports. Since the 6000 series consists of synchronous read-only units, their primary application areas will be for use in computer output microfilmers, off-line printing and plotting, and photo typesetting. The 6600s are read/write units. Error recovery features and a choice of any two densities are standard.

Optionally available to both the 6000 and 6600 users is 75-ips capability without vacuum columns. The
(Continued on page 102)

There are Term-mi

**Try one for yourself
at the FJCC, Booth 3316.**

Anyone can operate this tiny
\$75-a-month key-to-cassette video
terminal to cut computer input
costs 20, 40 even 60%. Or, write
DID — Data Input Devices, Inc.,
Derry, N.H. — for complete
product literature including
price lists.

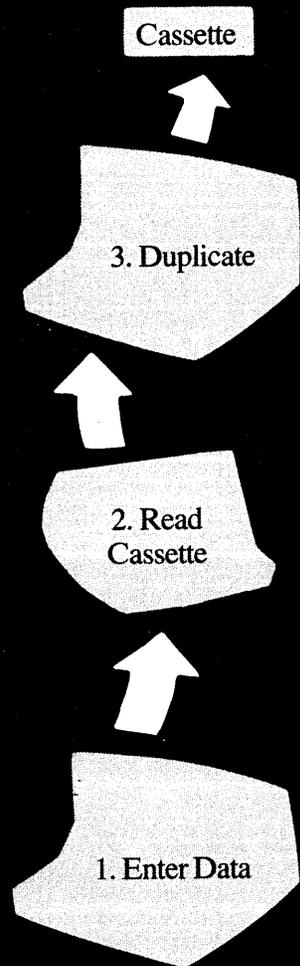


The flow diagram illustrates just some of the different ways that the Term-mite can be used to capture and record data at the source. You simply eliminate the key-punch or key-tape room with its expensive equipment and highly trained operators. You eliminate the old two-step. It's no longer necessary to have one girl write out or type up data in one place so another girl can key it onto cards or computer tape somewhere else. It's that easy. And, you can start saving now. We're shipping production models.

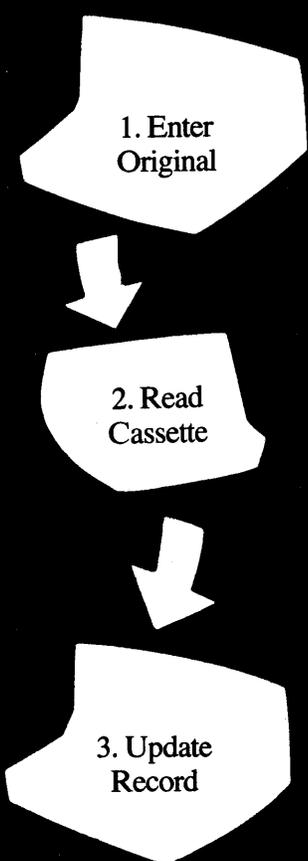


tes in the Astrohall

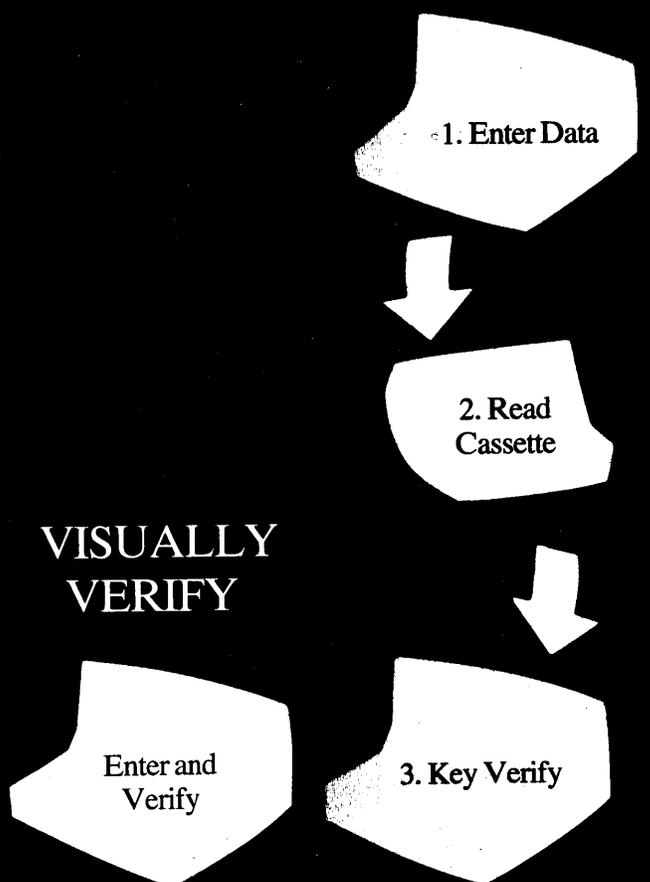
DUPLICATE



UPDATE



KEY VERIFY



VISUALLY VERIFY

Pooler accepts direct input from Term-mites within 500' radius or reads DID Tape Cassettes to produce computer compatible tape.

Your Present Computer

Product Preview . . .

single capstan units have four mechanical buffer arms instead of two for tape control, and might possibly be the first devices to control tape at this speed without compressors and their associated plumbing. Also available as an option is a feature allowing constant transfer rates whether reading NRZI or phase-encoded tapes.

The prices of these specialized units in lots of 100 start at \$2900 each. For information:

CIRCLE 223 ON READER CARD

RECORTEC, INC.

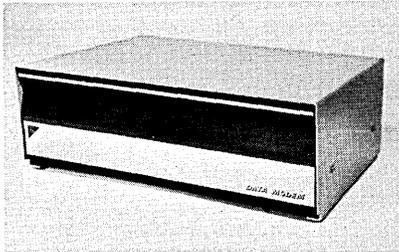
Mountain View, Calif. Booth 3707
Both lateral and longitudinal parity of computer tape data can be validated with the Computer Data Verifier. Set up for half-inch tape, the device completes a full verification cycle on a 2400-foot tape in 5.3 minutes, reading at 120 ips and re-winding at 360 ips. A counter tallies the total number of parity errors, and an option is available for printing the location of all errors detected.

Blank tapes can also be certified by the \$12,500 unit. The verifier is available 60 days ARO. For information:

CIRCLE 238 ON READER CARD

RFL INDUSTRIES, INC.

Boonton, N.J. Booth 2537
The Model 4604 data modem transmits and receives serial binary data



over a voice bandwidth line at a synchronous rate of 2000 bps. It is compatible with the Western Electric 201A data set and conforms to EIA RS-232 specifications. It is available in either cabinet or standard 19-inch rack mount assembly. Price is \$2100, with delivery in 30-60 days ARO. For information:

CIRCLE 225 ON READER CARD

RUSCOM LOGICS LTD.

**Downsview, Ont., Canada
Booth 2009 and 2013**

Lower accuracy permits lower price on this digitizer with .01-inch resolution, suitable for digitizing maps, strip charts, photographs, and engineering drawings. The unit includes

an adjustable working table and an operator's console. The latter includes a keyboard for entry of incidental data. A large unit with a 36 x 60-inch table sells for \$9K (U.S.), while a smaller 12 x 30-inch table unit is \$6K. Interface options permit recording of data on cards, paper tape, magnetic tape, printer, or cassette, at an additional cost not exceeding \$1K. It's the first time this vendor has tackled the U.S. market. For information:

CIRCLE 240 ON READER CARD

SIGNAL GALAXIES, INC.

Van Nuys, Calif. Booth 1627, 29
Building thick film planar array memories for oem applications, the vendor offers them either in array, stack, or module form. Claimed to be as inexpensive as core, but with faster times, "flux ring" memories are also supposed to be less susceptible to noise than MOS semiconductors, and sell for less than half the cost of plated wire. Non-destructive read-out cycle time is 250 nsec for a 100,000-bit stack, and the access time is 40 nsec.

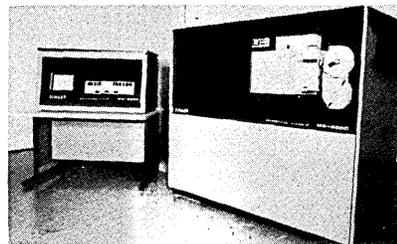
Orders of 100 128-word 64-bit arrays are priced at \$80 each; 1K x 64-bit stacks will be available in December for \$786 each on an order of 100. Modules of 4K x 16-bit words, including drivers and decoding sense amplifiers, will sell for approximately 3¢/bit in quantity. For information:

CIRCLE 239 ON READER CARD

SINGER, LINK DIV.

Sunnyvale, Calif. Booth 1435
The models MS-5000 and MS-6000 computer output microfilm printer-plotters differ basically in that the MS-6000 contains an internal controller. Other than that the specs read the same, both units operating either on or off-line and using stroke generation techniques on crt's.

Any character codes are accommodated by the units. Forms overlay



as well as data input rates from 14-120Kc are standard. The frame advance rate is 110 msec, and up to 20,000 cps are printed — or perhaps more meaningful is a through-put

rate quoted as up to 9,000 132-character lines per minute. Many fonts are available with flexibility in scaling, rotation, and aspect ratio choices, eight light intensities, and eight line widths.

Roll film is used for cine or comic frame orientation, and the film widths possible are 16, 35, 70, and/or 105mm.

The controller in the MS-6000 is a 24-bit, 1-usec mini with 4K of memory supplied, and up to 64K offered as an option.

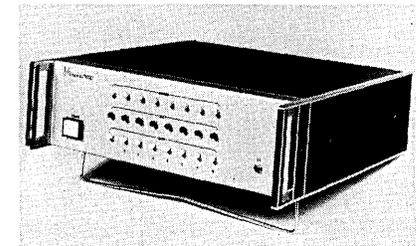
According to the vendor, an extensive graphics package, other applications software, and conversions for most plotters are available, and systems support assistance is standard. Prices start at \$135K. For information:

CIRCLE 241 ON READER CARD.

SONEX INC.,

Philadelphia, Pa. Booth 3636,38

The Model 300 Autoset is a Bell 103 replacement and automatic answering unit for use with the Bell Data Coupling Unit (F-58118). Each Autoset contains up to eight channels, each displaying the "ringing," "busy," and "data" status on indicator lights. One Bell DCU is required for each channel, and a cable interfaces directly with the DCU. Speed is



up to 300 baud, asynchronous; EIA interface is RS-232C compatible. The price for an eight-channel unit is \$2350. For information:

CIRCLE 216 ON READER CARD

STORAGE TECHNOLOGY CORP.

Boulder, Colo. Booth 2220,22

Designed as electronically compatible replacements for the IBM 2803 tape controller, the Models I and II of the ST3800 feature self-contained microprogram diagnostics, MSI circuitry, and a read-only memory for controlling up to eight tape drives. Requiring half the floor space of the 2803, the 3800 I is for 800 bpi mtu's, while the 3800 II controls both 800- and 1600-bpi drives. A proprietary error correction technique is used for handling phase encoded data.



The Dual Personality Computer

Foreground-background capability, that's the new MODEL 5. One or many real-time tasks can be handled simultaneously in foreground while doing mathematical operations on the real-time data or batch processing in the background. And there's no danger of destruction—critical foreground operations are totally protected from background processing.

The MODEL 5 is a perfect example of using the 3rd generation architecture and firmware capability of the whole INTERDATA line to create a special performance edge in an upwards compatible computer... In this case A Dual Personality Computer.

A few of the Key Powerful Features include:

- Inner processor built around a High Speed Read-Only-Memory, provides over 100 powerful instructions including built-in floating point arithmetic.
- Priority interrupt levels expandable in groups of sixteen.
- Advanced memory bus controller for inexpensive multiple connection of devices and processors to a common bank of core memory, allowing operating overlap and I/O transfers without processor intervention.
- Programmable I/O Processor.

- Software includes: Basic Operating System, A Tape Operating System, a Real-Time Operating System and USASI FORTRAN IV.

For complete information on the Dual Personality MODEL 5 (at a very personable \$15,600) call 201-229-4040 or write: INTERDATA, Crescent Place, Oceanport, N. J. 07757



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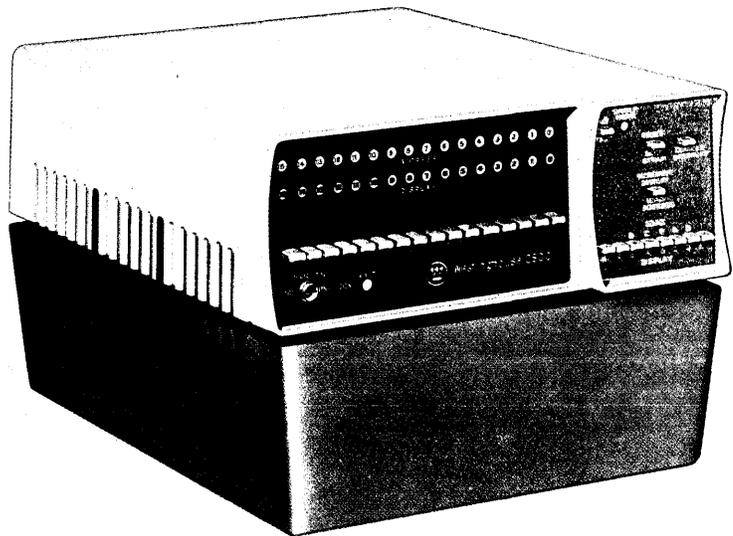
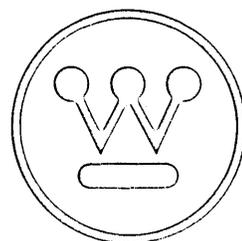
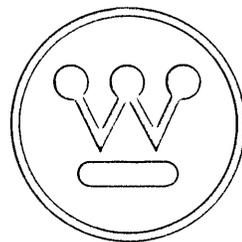
CIRCLE 35 ON READER CARD



Computers by Westinghouse ...the new/now 2500

In the computer industry, as in any business, the product is only as reliable as the company behind it, **to be sure!**

The new Westinghouse computers are presented to you with an established, reliable and successful performance history. Over 400 are incorporated in Westinghouse installations, domestic and foreign. So the **new** Westinghouse 2500 comes to you with a **now** posture. User tried and tested, both hardware and software, Westinghouse computers provide complete systems with field-proven program packages, a full line of peripherals and nationwide service and support. The Westinghouse 2500 is especially designed for the general purpose, industrial and communications markets. Available in both portable and cabinet-mounted models, the Westinghouse new/now computer features a 4K basic configuration and meaningful modularity characteristics, attractive to the original-equipment-manufacturers. Singles or systems, Westinghouse 2500's can be ordered today to service customer needs.



The Westinghouse 2500: 16-bit word. 4K magnetic core memory expandable to 65K. 850 nanosecond memory cycle time. Hardware multiply/divide. **Software:** Real time monitor. Assembler. Fortran IV. Library routines. Diagnostics. **Options:** memory protect, parity check, power fail safe, floating point hardware. Write Westinghouse Computer Department for detailed literature. **Sales Locations:** Regional offices in Chicago, Houston, Cheverly (Maryland), and Los Angeles. Sales offices in all major cities. Field service and parts throughout the United States.

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Westinghouse Electric Corporation
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MEDIA
CABINETS**

Tab Data Media Cabinets are designed for storage of whatever needs storing. Reels, disk packs, printouts, manuals, binders, cards, microfilm rolls, cartridges or fiche, even the company coffee pot! It's the clear-span interior and roomy 36" by 16 3/4"

width and depth that do it. Plus a wide selection of roll-out trays, shelves and inserts to tailor Data Media Cabinets to the exact storage functions you need. Two, three and five compartment models in your choice of computer-compatible colors. For full information, write Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

TAB
PRODUCTS CO.

CIRCLE 54 ON READER CARD





Ten Outstanding Restaurants in Houston

G That old programmer's tale that restaurants in Texas haven't learned to cook anything but steak and fried chicken just isn't so. A surprisingly sophisticated selection awaits those attending the FJCC in Houston. However, no seafood enthusiast should leave Houston without sampling the best of the Gulf. The local flounder, red snapper, oysters and shrimp are excep-

tional and always fresh from the briny.

These ten eating establishments are the author's own recommendation developed from personal experience. The selection has been tempered slightly to afford a cross section of cuisine to fit all tastes. Each is outstanding in its specialty and has never proved a disappointment.

The French touch with a flair

Maxim's has received the accolades of gourmets at home and abroad . . . one of the truly great French restaurants in the U. S. An exceptionally comprehensive menu offers everything from seldom-found appetizers to fresh strawberries every day of the year. Try the Red Snapper Amadine or boneless capon prepared in any of a dozen ways. Excellent wine list. Located downtown at Milam and Lamar. Reservations a must—phone 227-9595. Closed Sunday.

French-Creole cooking from New Orleans

Brennan's in Houston offers the same delightful French-Creole cooking that made Brennan's the most popular dining spot in New Orleans' French Quarter. Impeccable service with continental elegance. The Turtle Soup au Sherry can't be duplicated. Enjoy entrees of meat, fish or fowl but don't count calories. Flaming Bananas Foster should tempt the dessert eaters. If you're staying over, you might sample the Famous Breakfast at Brennan's Saturday or Sunday morning from 9 a.m. South of downtown at 3300 Smith—522-9711 for reservations.

Beefe in an authentic old English inn

The **Red Lion Inn** offers English fare like you'll never find in England. This is a fun place to eat, drink and be merry. English ales, of course. The fine Prime Rib of Beef is tops on my list, followed by the London Mixed Grill (Steak and Kidney Pie for the real An-

glophile). The "landlords," George and Marjorie Crowder, will make you welcome. Near the Shamrock at 7315 Main. Call 665-9225.

Try dining in a tree house

Los Troncos is perhaps Houston's most unusual restaurant. Built over a period of three years with tree trunks from the forests north of Houston, Los Troncos combines atmosphere, entertainment and a South of the Border menu. Some of the "wood" weighs as much as five tons and measures 22 feet. All sorts of balconies and nooks are stacked three stories high. Try the Huachinango a la Veracruzana—goes well with the Spanish guitarists. Sort of midtown at 1516 Westheimer—phone 528-8684.

Exceptional beef in a fish atmosphere

The **Ten Fathoms**, as you might guess from the name, specializes in seafood. As a matter of fact, the fish you eat here will have been caught by Ten Fathoms' fishermen. You can't beat the Snapper a la Maison; however, if you or your guest prefer good red meat, ask for the Beef Stroganoff—across from the Sheraton-Lincoln at 740 Polk (phone 223-5121) and way out west (\$5.40 by cab) at 1641 South Voss (phone 785-1234). Closed Sunday.

Old World charm off Old Market Square

The **Bismarck**, boasting authentic German and Viennese cuisine, appears to have been operating in this

**Computer Utility
users
help design
our products!**

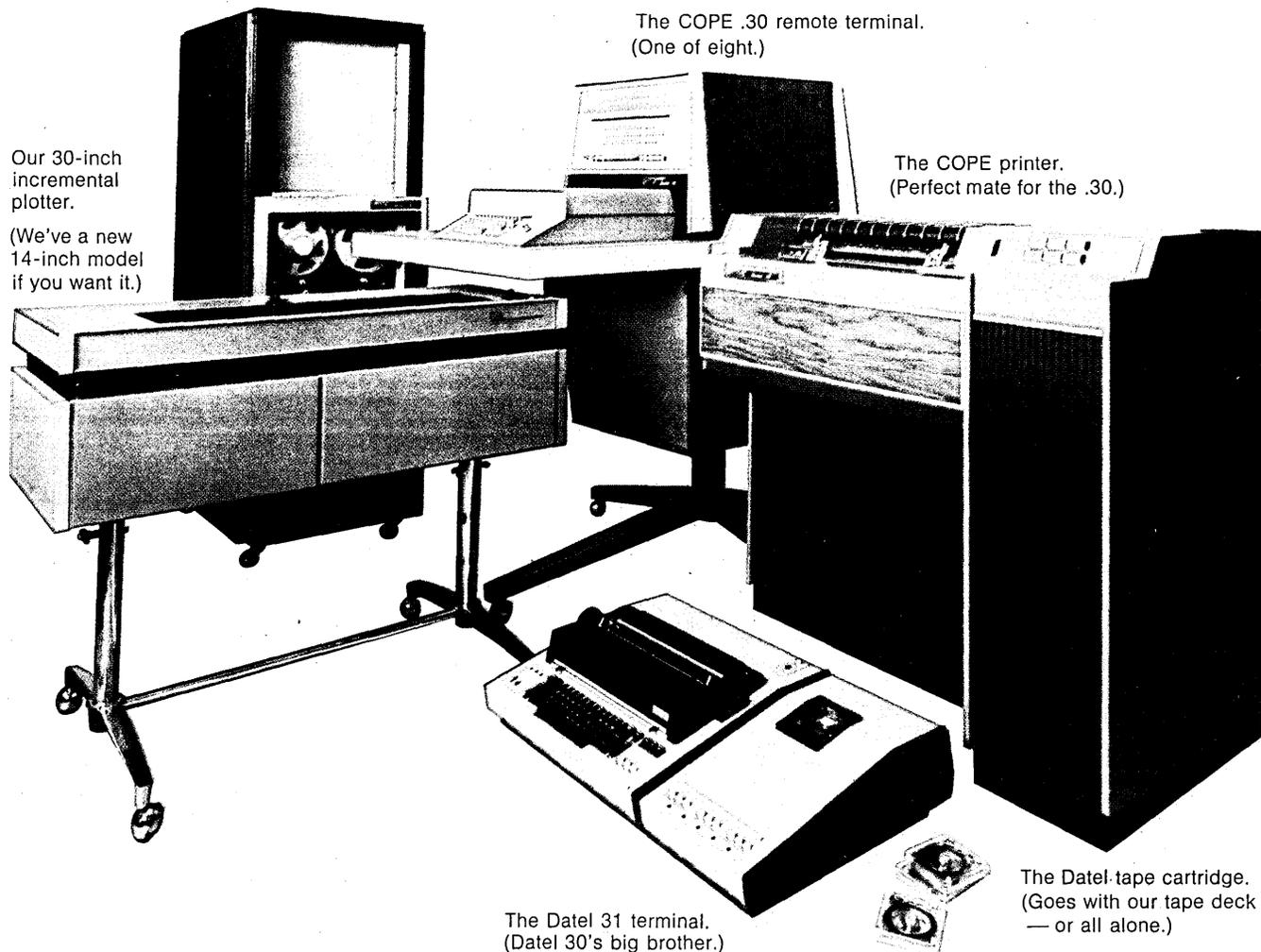
The COPE mylar tape punch.
(There's a reader, too.)

The COPE .30 remote terminal.
(One of eight.)

Our 30-inch
incremental
plotter.

(We've a new
14-inch model
if you want it.)

The COPE printer.
(Perfect mate for the .30.)



The Datel 31 terminal.
(Datel 30's big brother.)

The Datel-tape cartridge.
(Goes with our tape deck
— or all alone.)

Look what they've done for us lately.

We built the Computer Utility Network when most people, except a handful of computing engineers, said it couldn't be done. And through the Network, UCC and its customers have evolved a wide range of products to allow users to realize the full advantages of computer power... by accessing UCC's large-scale computer centers from terminals at their own locations.

For instance, our COPE line of high speed remote batch terminals is industry's broadest (ranging all the way from the new COPE .25 to the proven .45). For the timesharing user, the UCC-Datel keyboard data terminals provide point-to-point communication and computer interface, with the model 31 offering an added benefit — a simple, reliable magnetic tape recorder which gives an off-line data capturing capability that results in greatly reduced transmission costs.

Other UCC products include incremental plotters and computer output microfilm (COM) equipment, tape decks, multiple speed modems and even tape

cartridges — but for computers instead of stereos. Whether or not you're now using our Computer Utility, you'll find UCC products best for accessing computer systems — yours or ours. And if you're making systems to sell someone else, remember ours are *user designed* components.

For more information on how UCC computing products can work for you, contact: Corporate Marketing, Dept. 11DA, The UCC Tower, P. O. Box 6228, Dallas, Texas 75222 (214) 637-5010.

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We have the right combination. The 6155 Dual-Processor.

Another combination of unique features from *The System Builders!* The 6155 Dual-Processor Computer System . . . offers complete big system concepts and capabilities for the medium-scale computer market. In spite of today's mounting costs, we offer this highly sophisticated dual system for the same price that often accompanies a single computer from our competitors.

The 16-bit 6155 provides fast concurrent processing, with the dual processor configuration yielding a high order of reliability for a relatively small investment. Users may perform batch oper-

ations of various kinds simultaneously with real-time functions. The shared disc/shared core capability of this system enables either processor to handle the critical application when necessary.

A considerable number of special features have been developed to enhance system dependability: power fail detection, parity checks on all input/output, dual power entry capability, and a watchdog timer which monitors all system operation. Allowing continuous processing of critical jobs are the Common XIO interface, enables either pro-

cessor to control any peripheral, and the Disc Exchange gives disc memory access to both processors. System recovery from a malfunction is automatic and instantaneous.

Sales or lease plan, employee-oriented equipment, complete training programs, and "total" customer service. Contact your nearest EMR Computer Sales Office or our National Sales Manager at 8001 Bloomington Freeway, Mpls., Minn. 55420, (612) 888-9581.

EMR COMPUTER
the system builders

CIRCLE 34 ON READER CARD

EMR Division of Weston Instruments, Inc., A Schlumberger Company.



Ten Outstanding Restaurants in Houston . . .

location for the last century. Just like its counterparts in Europe, there is an atmosphere of quiet elegance in the high ceilings, aged wood and Tiffany glass. This is an excellent starting point for an evening on the square. All the usual German-type dishes, well prepared and tastefully served. Franklin at Milam, call 227-4168.

The Far East on Westheimer

Tokyo Gardens is Houston's only real Japanese restaurant. The full treatment (low tables, stocking feet and true Japanese service) is yours with a few Western comforts. Your floor cushion comes with a backrest, and there's a place for your feet under the table. Sukiyaki, Tempura, Teriyaki and Hibachi Steak prepared at your table. The decor and entertainment will take you out of Houston. Phone 622-7886-4701 Westheimer, just off the West Loop.

Steak, lobster and showmanship

Sonny Look's Sir-Loin Inn serves the ultimate in Texas-size steaks—big, thick and cooked the way you like them. The Tudor English decor is surpassed only by the elegance of your host, who may wear a half-dozen different jackets during the evening. Try the avocado salad dressing with bacon added—a truly different house dressing. Entertainment, pleasant surroundings and great food. Close to the action at 9810 South Main, call 666-4181. Also at 6112 Westheimer, phone 782-1520.

Texas is known for its bar-b-que

The Cellar Door offers the best in smoked cookery amid a red plush Victorian-Western atmosphere. If bar-b-que is your bag, you won't find better than they serve at the Cellar Doors. There is one downtown at Lamar and Louisiana, the original (not too far) at 6732 Stella Link, and my favorite (looks like a Western movie set) at 5930 Westheimer.

Learn to yodel and cook at the same time

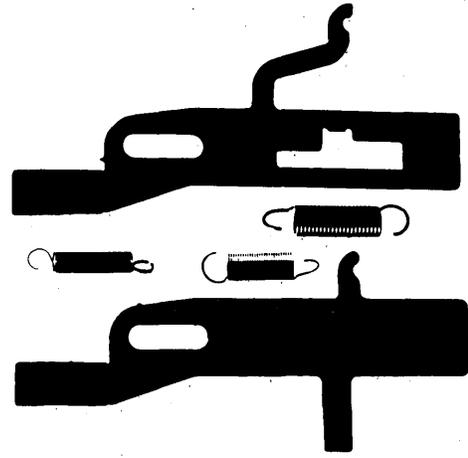
Try the Swiss Chalet for fun and fondue. You'll expect to find snow on the mountain when you leave the Alpine atmosphere of this out-of-the-way restaurant. Cheese Fondue and Beef Bourguinonne will keep you busy throughout the dinner hour(s). Farther out, but easy to get to via the West Loop at 511 South Post Oak Lane, phone 621-3333.

The choice is yours—bon appetit!

—Jim Gerrard

Cocktails? Texas liquor laws prohibit the serving of mixed drinks except in private clubs. You will find that most hotels, motels and major restaurants have private clubs available for their guests. Ask the management about membership. ■

November 15, 1970



MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohall) during the FJCC.

TRACOR DATA SYSTEMS



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CIRCLE 60 ON READER CARD



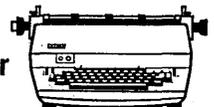
There are holes in the type bar.

A phototransistor unit detects code holes in each type bar to provide photoelectric readout. This is a unique sensing method and enables you to make:

- Parity checking right from the source
- Type bar velocity check
- Echo check

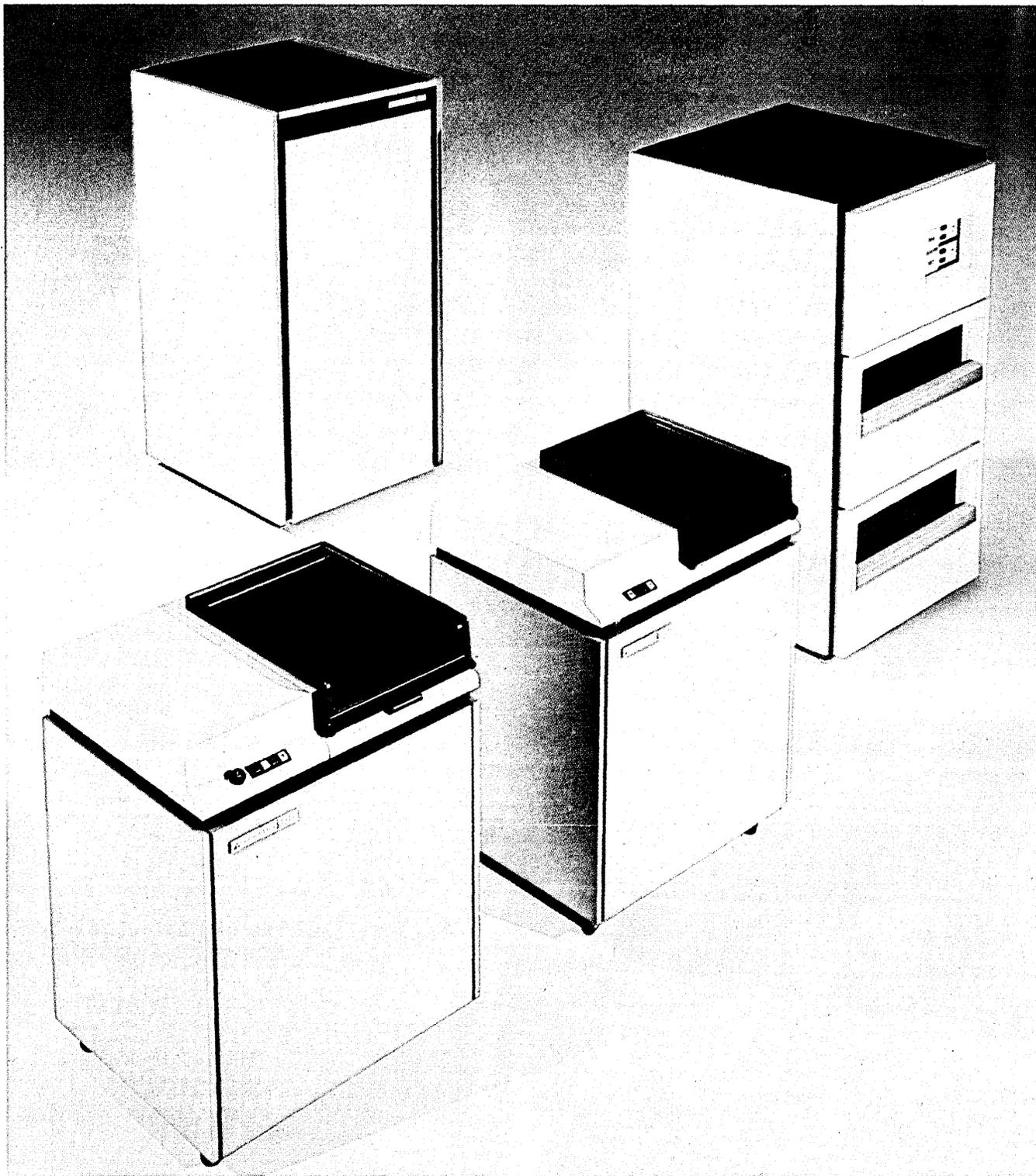
There is further interesting information on the new Facit 3851 in this publication.

Facit 3851 - the conventional typewriter with input/output



For further information, contact in US: Facit-Odhner Inc., 501 Winsor Drive, SECAUCUS, New Jersey outside US: Facit AB, Albygatan 102, 171 84 Solna, Sweden

CIRCLE 93 ON READER CARD



ONLY CENTURY DATA'S DISK DRIVES ARE AVAILABLE
IN 53 DISTINCT MODELS

AND THEY ALL COME IN THE SAME HANDSOME PACKAGES



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SYSTEMS

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A Conference Report

Data Transmission

by Phil Hirsch, Washington Editor

G Letting MCI, Datran, and other specialized carriers offer services at reduced rates would be contrary to the public interest, according to AT&T vp William Ellinghaus.

Speaking at a recent conference in New York City on "The Revolution in Transmission of Business Information," Ellinghaus said:

"Where competition will serve the public better, as in most instances it does, it ought to be encouraged. At the same time, we believe quite as strongly that the question of whether and where and how competition in communications will be permitted ought to be resolved—not with a view to preserving the status quo . . . or creating competition for competition's sake, but in the light of the consequences to users of communication services."

AT&T apparently has resolved this question as it applies to specialized communication services, for Ellinghaus explained that if given a choice between charging for these services on the basis of average costs or actual costs, "the Bell System can play it either way. . . . But before we abandon the system of average pricing that has worked so well over the years, all parties must consider the impact on the using public. Would competition serve the broad public interest or would (it) work to the disadvantage of smaller towns and less heavily populated states? Would we in the long run be denying the public at large the economies of scale that derive from the use of common facilities?"

Times are a changin'

Historically, the Federal Communications Commission has been extremely receptive to such pronouncements from Ma Bell. But FCC Common Carrier Bureau Chief Bernard Strassburg, who shared the speaker's platform with Ellinghaus, indicated that things are changing:

AT&T appears to deny that "it is

opposed to competition in the development of new communication services," said Strassburg; "at the same time, its opposition to each and every proposal that has been filed thus far with the commission leaves this disclaimer in substantial doubt. . . . It is becoming increasingly evident that . . . AT&T cannot be all things to all people in the intercity communications field and AT&T must, therefore, reevaluate its role in future communications markets in terms other than total market control."

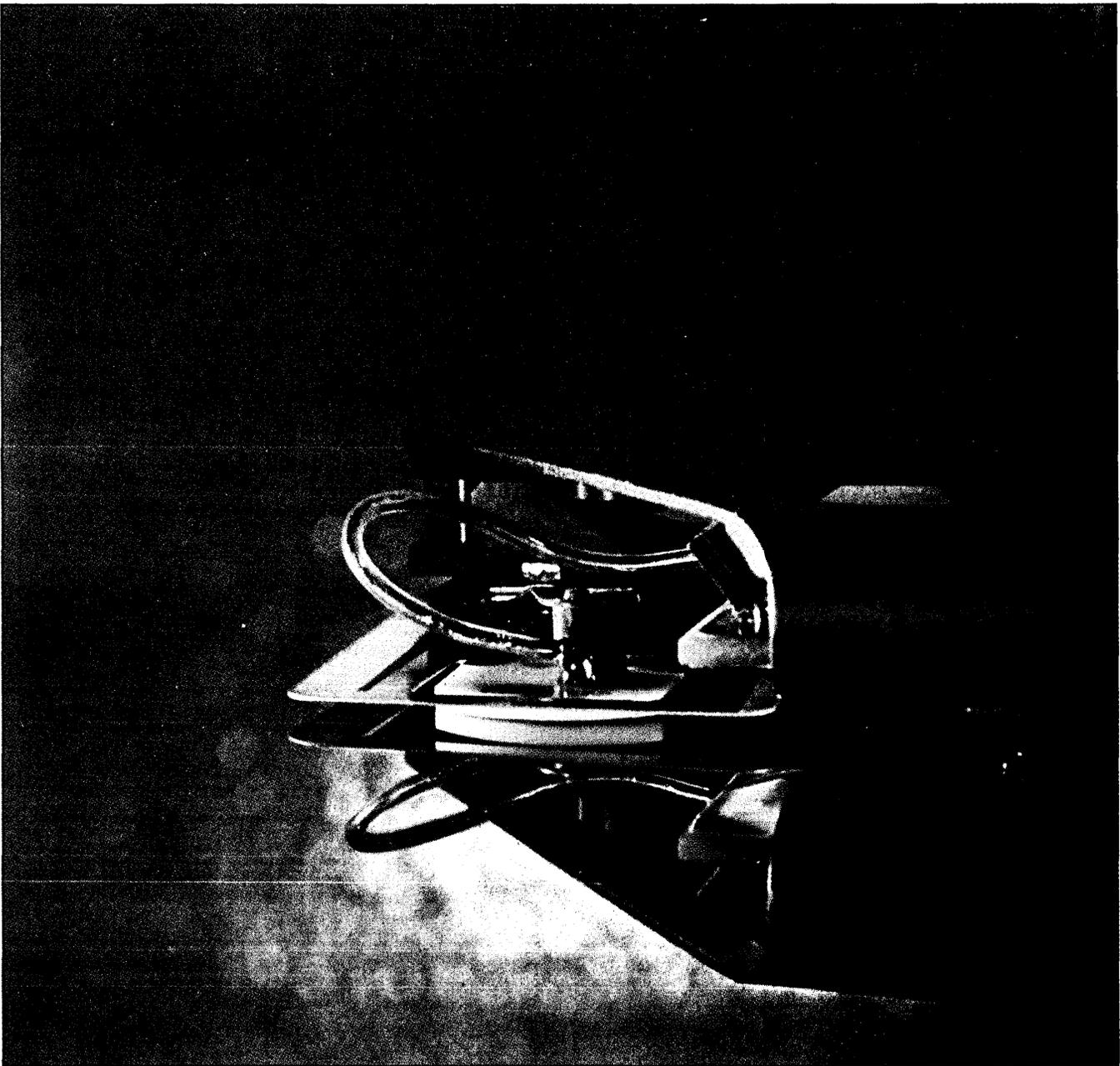
During a question-and-answer session that followed Strassburg's speech at the meeting, which was

held at the Waldorf Astoria by the Conference Institute, the FCC official said he thought the telecommunications market could be made "more competitive without losing the benefits of price averaging." He indicated that new services like those proposed by Datran and MCI could be offered by all suppliers, including the established carriers, on an actual cost basis while leaving the economics of other communications services unchanged.

Ellinghaus, who became president of the New York Telephone Co. the day after he addressed the Waldorf-Astoria conference, admitted that Bell was having trouble servicing its



"The first step, as I see it, is to sell him to his immediate family."



**The best heads in the industry run our Large Disc Store.
They're on top of 2 billion bits of data.**

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seek time is 55 milliseconds. We've even made it so that you can hook up as many as eight LDS units to a single controller. Result: a massive 16 billion bits. Tell your customers that you can provide disc store speed and reliability at a magnetic card storage price. Then call us at Data Products. We'll deliver.

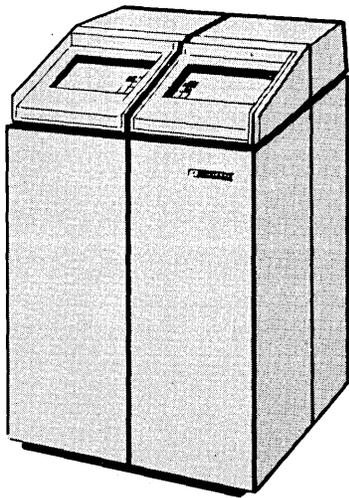


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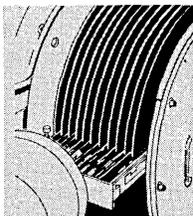
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Data Transmission . . .

customers, but he insisted that the company is trying as hard as it can to improve things. He listed a number of improvements on the way:

Promises, promises

By the middle of this decade, a long-haul digital network serving "approximately 60 cities" will be in operation, Ellinghaus promised. Private line service will be available by "late 1973 or early 1974." The new circuits will provide "a variety of data speeds, including something in every speed range that equipment manufacturers say they will want or need over the next decade. Call completion times—and that includes dialing, switching, and ringing—will be only a few seconds." Ellinghaus also predicted maximum error rates of 1:10⁻⁷.

By 1973, he added, AT&T will have an eight-city Picturephone network in service, capable of carrying data as well, at speeds of up to 1.3 megabits/sec. And, before the end of this year, "our direct dialed network will be able to handle 4800 bps, while private line voice channels will be able to accommodate 10.8K bps."

Another speaker, Ralph Clark, associate director of the Office of Telecommunications Policy—the communications policymaking directorate recently established within the White House—said he was "quite bearish" about the short-term economics of fixed point-point domestic satellite service, but "quite bullish" about the long-term future. He specified that by long-term, he meant "a couple of decades."

Clark's basic point was that terminals represent the major expense of both satellite and terrestrial systems, and so today satellites don't offer a significant advantage to communications users who must transmit voice or data signals overland between fixed points. The limited frequencies available to domestic satellite operators put them at a competitive disadvantage, he added, because earth stations have to be located far from load centers, and have to be connected via expensive land links.

Frequency solution

He thought the frequency problem eventually would be resolved by earmarking bands above 10 GHz for satellite communications. But, before satellites can become competitive with terrestrial systems, "the cost of

putting a pound of satellite in orbit" will have to come down substantially. Also, the successful satellite operator will have to attract "a substantial chunk of message telephone business." Clark indicated that broadcast services would be transferred to satellites long before message services.

There was an extensive discussion of interconnection at the meeting, which attracted a total audience of about 200—consisting mainly of communication facility managers, representatives of equipment manufacturers and common carriers.

J. E. Cox of Western Union said the promise of lower rates and more flexible service created by the emergence of special service carriers is dimmed by the lack of interconnection standards. In switched analog systems using multiplexed channels, for example, channel overload limits must be standardized, otherwise signal or test tone levels which are acceptable to one system are likely to disable another, interconnected system.

Handling user complaints is another problem. The customer will complain to the carrier he does business with, even when the problem is within an interconnecting carrier's network. "This split responsibility . . . is expected to cause a great deal of customer dissatisfaction," said Cox, "and increases the cost of maintaining and administering jointly interconnected networks."

But the prospects of interconnecting foreign attachments to the telephone system are apparently more inviting. Herbert Granger, director of communications for American Express, and formerly with Pittsburgh Plate Glass, explained that he has been involved in the installation of four dial telephone systems using independently made terminals. His conclusions:

"Many (more) service features are available from the various independent equipment suppliers (than from the carriers) . . . Some items, such as abbreviated dialing, are only offered in a few of the existing all-electronic common carrier PBX's. Space saving is another plus factor that many (independent) equipment suppliers offer . . . In one case, the telephone equipment room specified by the common carrier was 12x24 ft., or 288 sq. ft., compared to a self-contained 'stand-alone' system offered by an (independent) supplier with floor space requirements (of) approximately 10 sq. ft." ■

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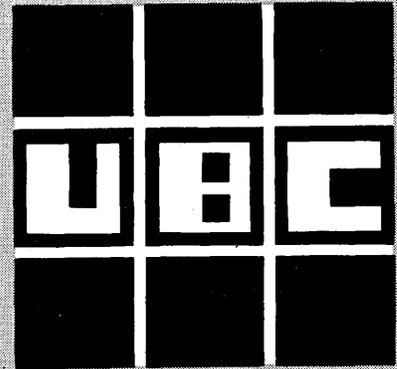
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ABA Conference

G The inadequacy of the regulatory system for communications was forcefully brought out at a meeting sponsored by the American Bar Association's Committee on Law and Technology at the annual meeting of that association in early August. Speakers were Robert L. Werner, executive vice president and general counsel of RCA; Harold J. Cohen, general attorney of the Bell System; and Robert V. Evans, vice president and general counsel of CBS.

Mr. Werner noted that one very important result of technical communications developments "is the abolition of the distinctions that have separated the various forms of communication by sight, sound, and signal. . . . The technical unity of services is becoming general. The telephone line that links us with a friend or relative or client can now carry our images as well as our voices. Over the same line we may interrogate and receive data stored in the tape file of a distant computer. The wideband cable which now brings television into many homes can just as easily link us tomorrow in two-way exchange with stores or banks, with offices or computerized reference libraries."

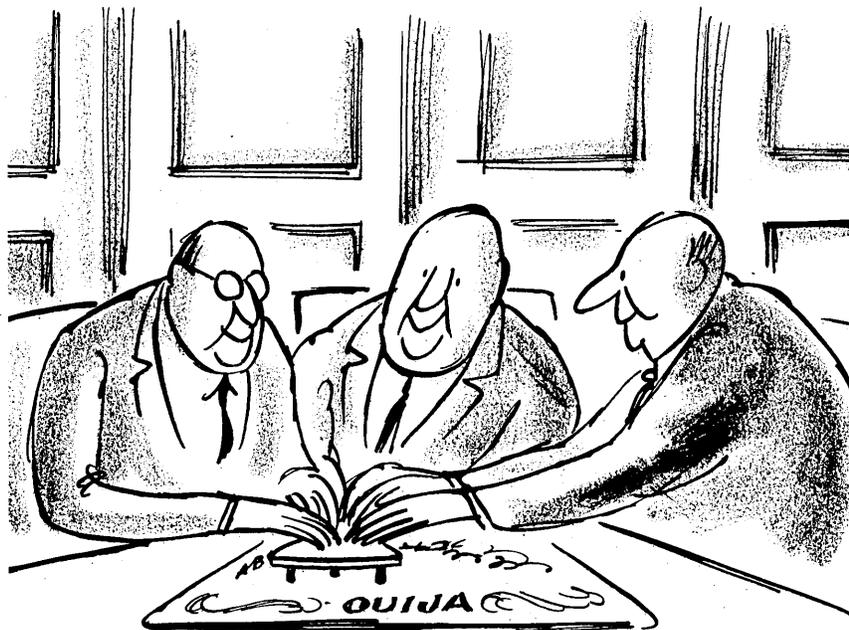
Legal generation gap

Mr. Werner then reviewed the status of regulation, pointing out that it was basically established by the Communications Act of 1934 and was devised to meet a technology no longer in existence. "Across the whole spectrum of communications, we have tried to compensate for a legal generation gap by devising new

interpretations, rules, and regulations to accommodate significant technical advances as they appeared. The result is a condition of ad-hocracy. It is a random assortment of measures—each, perhaps, sufficient unto itself, but forming a whole which is ill-adapted to the effective administration of a highly sophisticated and increasingly unified communications technology."

Noting that there is "a bewildering

array of policy questions," such as how much competition and what kind, how much regulation and what kind, the steps to be taken to assure privacy of communication, Werner called on the legal profession to re-examine the entire area and consider the possibility of a "wholly new national communications law . . . free of provisions which could be made obsolete by future technology or by foreseen applications of present sys-



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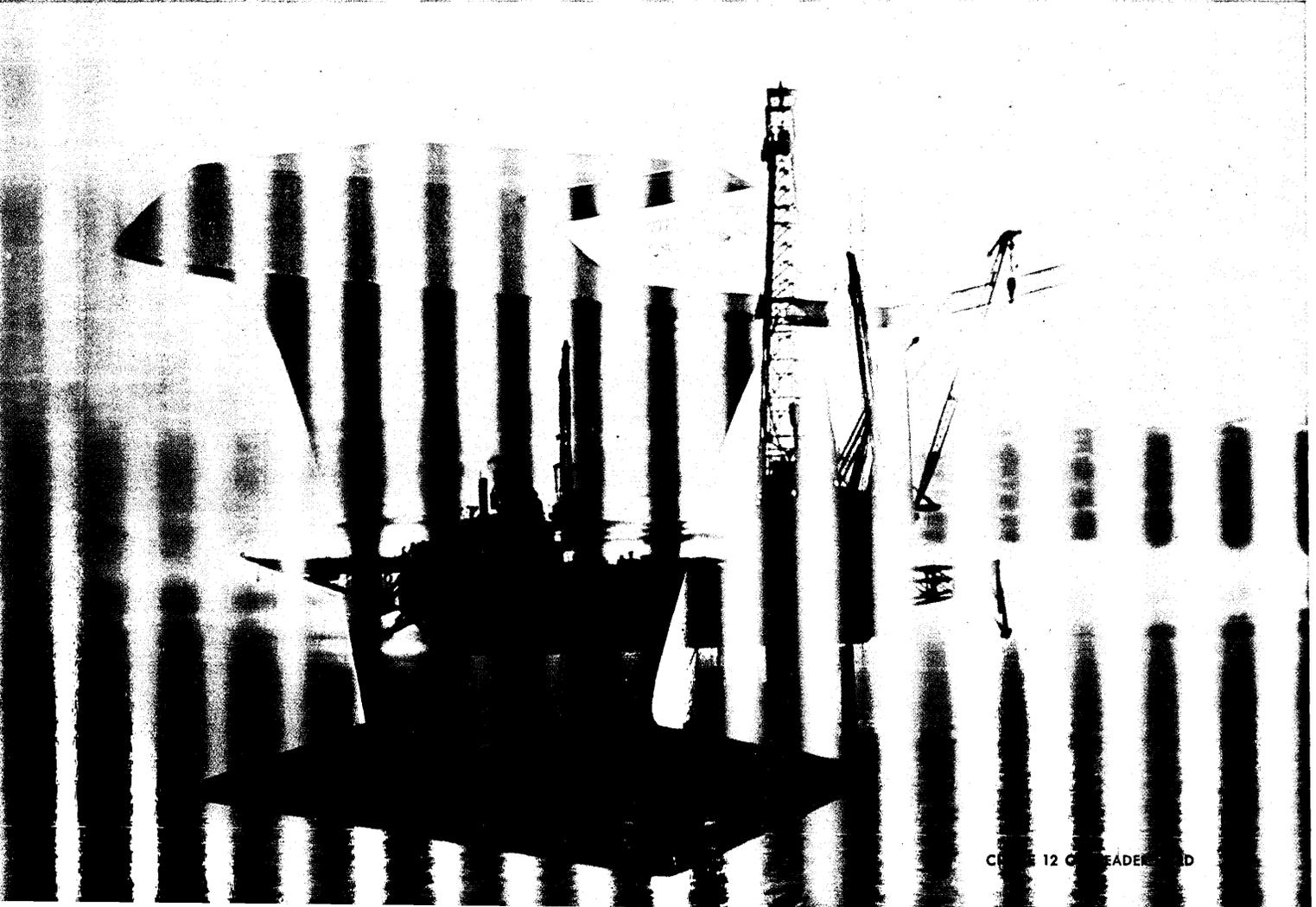
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tems and services."

Robert Evans spoke feelingly of the difficulties in establishing international communications by satellite, outlining the numerous governmental, quasi-governmental and private bodies that cbs had had to deal with and the multitude of rates and charges which had to be paid to these various entities. He called for a study of protection against the unauthorized use of satellite communications, noting that interception of signals from satellites was comparatively technically easy and raising the specter of advanced industrial espionage as well as copyright infringement.

Mr. Cohen, noting the tremendous increase in telephone traffic (1969 messages were 12% more than 1968 and double 1955), also favored revision of the communications regulatory system, particularly in coordination with foreign nations. He commented extensively on three matters before the FCC: international satellites, domestic satellites and specialized common carriers. With respect to the first, he noted that the relative values of cable against satellite required much study and raised the question of whether they are complementary or competitive. He stated that the Bell System feels that the domestic satellite has a place in the communications environment and noted that it improves liability; but the relative values of cable satellite and microwave must be considered in any usage.

In the field of specialized common carriers, particularly microwave, Mr. Cohen was especially emphatic. He noted there are now about 500 companies in this field, stemming from a decision of the FCC about ten years ago to permit *private* point-to-point microwave communications without regard to the adequacy of existing common carrier facilities. Commenting on the MCI decision (18 SC2d 953) which has been appealed by the Bell System to the courts, he noted that the National Association of Regulatory Utility Commissioners entered the case on the side of the Bell System, presumably to preserve those rights the states still have over communications.

Mr. Cohen also noted the decision of the FCC in July (Docket #18920) to obtain public response and opinion as to the policies and procedures which should be established for considering applications of various companies to provide specialized common carrier services to the public by

microwave (Sept. 1, p. 71). Mr. Cohen did not comment on Bell's position on this inquiry though it is well known. He did note, in answer to a question from the audience about the adequacy of the telephone system for data communications, that the Bell System was making vigorous efforts to improve its capacity to handle the traffic.

Mr. Cohen was also asked about the Bell System's reaction to the tentative decision of the FCC in the computer-communications inquiry and commented that it was a step in the right direction. He stated that it was Bell System policy not to furnish data processing services, regardless of possible interpretations of the FCC decision.

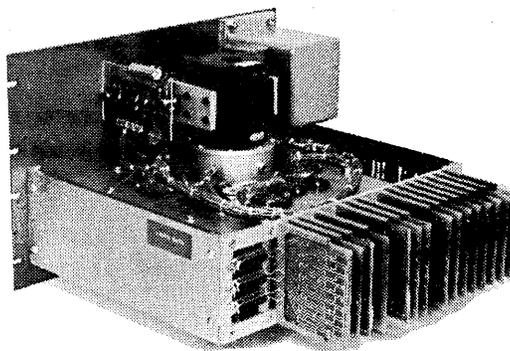
Lack of sophistication

At another meeting held during the Bar Association convention, David C. Acheson, vice president and general counsel of Comsat, reviewed the history of domestic satellite developments and attacked the White House proposal of last January (subsequently implemented in fact by the

FCC in March) proposing such services be provided by any entity with the technical and financial capacity to do so. He questioned whether the White House memorandum "represents a truly sophisticated view of the domestic satellite question. 'Competition' is an attractive word, but not every policy carrying that name is necessarily the real goods, union-made, pre-shrunk and Sanforized. For the near future there are probably only two uses of domestic satellites that would support the large requisite investment: they are the domestic telephone network and commercial broadcast distribution including CATV. It is not particularly meaningful to speak of competition in satellites when entities that generate their own traffic can justify a satellite system, whereas entities that do not control such traffic cannot justify satellites. In this Pickwickian sense of competition one may say that the ant and the ant eater are also governed by the rule of competition." Acheson did note, however, that Comsat would shortly file a proposal for a domestic satellite.

— R. P. Bigelow

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NEWS SCENE

Burroughs' New Series: December (70!) Delivery

Burroughs uncorked a well-kept secret last month, announcing three "series" of models in its new 700 line — the B5700, B6700, and B7700. They compete with everything in IBM's basket from the 370/145 to the 360/195 — and beyond.

Burroughs watchers give this analysis of the effort: The 700 is meant to: first, "stave off the 370 attack on the Burroughs customer base"; second, give medium-scale users more options on an upward move and restore some faith lost through late 6500 deliveries and the 8500 failure; third, capture the user who has a big multiprocessing data base and needs big data communications — and hasn't already sunk a bundle into 360 programs for them.

In a mind-boggling two-hour press conference, Burroughs executives unleashed every technological buzz word. They spouted concepts already used or promised in the B5500, 6500 and/or 8500: multiprogramming and multiprocessing, exchange orientation involving a grid of processors and memory systems, dynamic allocation of resources, programmer-independent virtual memory, data communications processors (dcp's), and memory hierarchy ranging from tiny buffers through large-core storage to billions of bytes of random access storage.

And the phrases "code compatibility" or "conversion through recompilation" were heard for the entire edp line. No mention was heard, on the other hand, of 360 emulation.

The speed of Burroughs deliveries — December of *this* year for the 5700, February, '71, for the 6700, and "early '72" for the 7700 — belies the fact that the machines are upgrades of predecessors. "Constant redesign" is a Burroughs hallmark. For instance, the 5700 is an improved version of the 5500 (which in turn is an improved version of the 5000); so Burroughs users will get more mileage out of this old, technically sound machine. The 6700 is a more significant improvement over its counterpart, the 6500 of '69, itself an improvement over the paper tiger 6500 of 1966. More than 200 of these earlier coun-

terparts, 5500 and 6500 systems, are now said to be installed, and Burroughs will replace them *with no installation fee*.

The big 7700 — up to four cpu's and \$15 million — is called a new machine. But it's also called a realistic substitute for the as yet unborn 8500. Then again, it must also contain improvements over the two processors called the 7504 and 7506, announced in 1967 and never heard from again. The 8500 continues as an experiment, by the way, so we may have an 8700 some day.

The move from the 5700 through the 7700 is a move from "simple" multiprocessing to distributed proc-



The Burroughs secret: a good attack is an early delivery.

essing, as is the 8500 and Control Data's 7600. Burroughs insists the 6700 and 7700 single-cpu configurations can beat out IBM's 155 and 165. But its most attractive feature is in multiprocessing, never an IBM strength.

The 5700, unlike the other machines announced, uses 6-bit characters and 48-bit words to retain its compatibility with the 5500. It can be configured with one or two cpu's, up to four I/O channels, and a bewildering variety of kinds of memory that includes extensions to the 4-usec main core, 1.2-usec auxiliary core (faster than main memory?), disc pack drives and fixed-head discs. Prices range from \$15K-\$50K/month.

The 6700 has a 6x6 maximum exchange orientation, which means it

can have up to three cpu's, three I/O processors, and up to six memory subsystems (meaning up to 6 megabytes of core). It can also have up to 80 billion bytes of disc and can handle, they say, over 3000 communications lines. Core comes in boxes rated at 500 nsec, 1.2 usec, or 1.5 usec. Compared to its predecessor, the 6500, the 6700 offers twice the storage, two extra channels, more communications systems, and cpu modifications providing a claimed "60-70% overall performance improvement."

Burroughs says that a single 6700 has a better price/performance ratio than the IBM 370/155. The 6700 runs between \$30K to \$180K per month. Contrasts are difficult without really pinning down the configurations, but a 155 processor with 512K bytes goes for \$24,550/month; a 6714 (5MHz) cpu, I/O processor, and 492K bytes goes for \$21,500. Burroughs can further sweeten the mix by adding a second processor for a total bill of \$31,200; second cpu deals like this are a Burroughs tradition by now.

The 7700 is the only machine of the line that offers buffer memory, a 30 nsec 32-word stack, and a 62.5 nsec 32-word lookahead IC memory. When asked why IBM buffer memories are a thousand times larger, a B spokesman noted that IBM adds more and more buffer storage "in hopes that somehow it will improve throughput."

The 7700 comes with up to four 16MHz processors, up to eight I/O processors and eight memory controllers. The aggregate data rate is equivalent to that of the 370/165, 8MB/sec. Disc can be had in quantities to 112 billion bytes, core in sizes to 6MB. In single cpu versions, the 7700 and 370/165 seem to run neck and neck. One 7700 cpu and one I/O processor go for \$35K/month; two of each cost \$63.5K. Configuration prices range from \$60-300K/month.

Of course, performance for all that hardware heavily depends on the perfection of the Master Control Program ... which in its latest B6500 version was called "young and immature" by one user.

Other software includes the whole range of stuff offered with the 500 line — compilers, network definition lan-

guage, data management packages, and application programs for scientific, financial, and manufacturing use — plus a new COBOL for the 5700. And since all Burroughs compilers are written in higher level languages, the programs on the 6-bit 5700 require only recompilation for the move to the 8-bit 6700 and 7700.

User support is still bundled, and Burroughs is trying to correct its past marketing problems with its newly instituted 100-man squad of computer specialist salesmen. The toughest job that this staff will face will undoubtedly be in explaining the 700 line to potential customers, especially to those not already familiar with Burroughs' idiosyncrasies. Always sort of off on its own tack, Burroughs has been described as a band of purists in an age where compatibility is the watchword. Still, Burroughs' estimated customer loyalty of 90% could indicate that once someone understands what he has, he likes it.

CAI Saga Ends in Court When Bank Closes Funds

For nearly 10 months, Computer Applications, Inc. had been fighting a holding action against changing markets, accelerating costs, tight money, and time.

Time ran out early this fall when its remaining working capital was seized and the big 10-year-old software house went into receivership. Villain of the piece was the Bank of New York, long-time agent of transfer for the company and holder of a \$2.3 million loan.

The bank closed out CAI's \$470,000 account to assure itself of some return on the loan. Reportedly, it expected holders of \$18.7 million in debentures to remain opposed to converting the notes to equity security — a stand that would have prevented a merger CAI was negotiating with Volt Information Sciences, Inc. The bank's action, of course, ended the merger possibility, anyway.

The bank's action and the resulting voluntary petition for bankruptcy is the finale of the CAI saga. One of the behemoth software houses created by the big contract software business of the mid-1960s, its troubles started last year when an SEC ruling influenced it to start writing off deferred development costs of its SPEEData grocery movement reporting system.

This resulted in a \$6 million contribution to the \$10 million loss reported for the year. The declaration appeared to demoralize the company and its creditors. Its president John DeVries, who tried to offset the losses by reducing his staff and dropping money-losing operations, was replaced last June by Joseph Delario who then sold off two of the company's publishing operations and its New York City and Northeast region software activity. He also arranged the Volt Merger proposal, which if consummated would have resulted in the continuance of the CAI name.

Since 1965, CAI has been trying to redirect its business. That was the year SPEEData was started. At that time it could still count on the big contract program jobs from IBM and other manufacturers, the large users,

and the government. In 1967 most of the manufacturers' work was finished or the companies had their own capability. There was still good business in conversion and applications programming, systems engineering and the like, but CAI was bound into a growth cycle. E.B.S. Data Processing, acquired in 1963, was extended through service bureau acquisitions. New Era Letter and Lithograph companies were expanding with the addition of other direct mail and printing companies. And the company was buying into publishing operations. This program of investment and expansion probably is the reason CAI had only two years — 1964 and 1966 — in which earnings increased with revenue.

Nevertheless, revenue growth was impressive — from \$15,300 in 1960 to \$41.9 million in 1969 — and the financial community was interested. In 1967 \$6 million in debentures was sold to fund programs, and in 1968 \$15 million in debentures was issued. The money went to SPEEData along with \$1.14 million from sale of SPEEData stock and \$4 million on loan from CAI.

SPEEData as yet had produced no profit. It was initiated in the Chicago area, and when this limited service did not produce the necessary customers, the system was extended to Florida and New England. Operating costs were increased, and customers still found it wanting. The next step, which the big infusion of money was to fund, was expansion to a national scale. It wasn't enough. Reportedly yet another \$4 million was needed to put SPEEData on a firm footing. The money could not be raised. CAI's extended finances and the age of the SPEEData effort did not make a very attractive investment package at a time when cash was at a premium.

SPEEData was closed last April, leaving \$11 million to be written off in FY 1970. Its termination also resulted in losses for E.B.S. which did the data processing for the service. All in all, in its last report, for the nine months ending June 30, CAI reported a loss of \$14,341,000 on revenues of \$22.1 million. The revenues were \$1 million less than reported for the same period in 1969.

In July CAI announced merger negotiations with Volt and reported the agreement to sell its Northeast



The Credit Bureau of Greater Kansas City is taking credit for having the "most modern and efficient computerized credit reporting installation of them all." These three output terminal operators and 35 more like them have access to every file in the bureau where, before the files were computerized, one or two operators were assigned to specific alphabetical groupings. The 360/40-based system includes two disc drives, four tape drives, one high-speed printer for written reports, and a central control console.

business to Programming Methods, Inc. PMI reportedly paid about \$100,000 for some six contracts and 30 people. The initial requirement of the Volt merger was the conversion of the \$18.7 million in debentures. CAI asked the holders to vote 40 shares of a new Participating Cumulative Preferred Stock for every \$1000 of the outstanding notes. Votes were to be in by September 21 and 70% approval was needed. The response from the holders was not what CAI had hoped for and the response period was extended to October 21. The bank ended it all by seizing the company's working capital on September 29. CAI tried to sell E.B.S. and remain afloat, but could not make a fast deal. It also petitioned for reorganization under Chapter 10 of the Federal Bankruptcy Act. This was denied and on October 5 the bankruptcy petition was made and a receiver appointed.

CAI's more liquid assets, some 40 contracts, the majority with government agencies, were auctioned off Oct. 9. Programming Methods and System Consultants, Inc., Silver Spring, Md., combined to buy them. The price was assumption of all back salaries and vacations for 400 employees when their name replaces CAI's on the contracts. In addition, they paid \$300,000 in cash.

The split of the package puts PMI strongly in government business with a facilities management deal at the NASA Goddard Center and the bulk of CAI's Washington operation. It amounts to some 25 contracts worth \$2-3 million, and possibly some 200 people.

System Consultants took the work that was being handled by CAI's system engineering group. The other bidders at the courtroom auction included Planning Research Corp., Computer Sciences Corp., and Volt Information Sciences. Computing and Software and Booz Allen were represented but took no part in the bidding.

At this writing the CAI subsidiaries — E.B.S., Mercedes Book Corp., and Home Testing Institute/TvQ — were operating. A company spokesman said their continued operation would be at the discretion of the referee. He noted that accounts receivables for the remaining companies, except those of E.B.S., are pledged to the Bank of New York.



Digitek president Herbert Hoover III, a motorcycle enthusiast for 30 years, uses this Honda 750 to maneuver 65 to 100 miles a day over Southern California's crowded freeways. The activist president travels 32 miles from his San Marino home to Marina del Rey offices and usually another 25 miles to Digitek's data center in Gardena, Calif.

Who Needs Computers in This Business?

A company formed some 10 years ago to build a computer today is deemphasizing computers in its marketing efforts, although it still is involved with them.

And it's headed up by a self-professed non-computer expert who just happens to be the grandson of the 31st President of the United States and who happens to commute 30 miles to work each day on a motorcycle. So whatever else, the next decade for Digitek Corp., Marina del Rey, Calif., should be quite different from its first.

The company, which never did build a computer but instead turned to designing compilers and compiler kits as its initial operation and doesn't even do that any more, mushroomed through acquisitions into a multidivision company in 1967 and this year, under Herbert Hoover III, has reduced its operations to two, neither related to the company's early efforts. These are a time-sharing division with a data center in Gardena, Calif., and an automotive research division with a 13-acre auto testing facility at Mira Loma, Calif. Hoover is banking most on the former and is investing heavily in expanding the operation in fiscal 1971.

Digitek sells its time-sharing service, principally to wholesale distribution companies with revenues of from \$1 to \$10 million a year, not as a computer service but simply as a service that solves the paperwork problem. "The user doesn't have to know and usually doesn't want to know what's

at the other end of his terminal," says Hoover.

As for the original, more computer-oriented Digitek, the compiler operation is still going as half of the efforts of a new company headed up by one of Digitek's original founders, Don Ryan, and a former Digitek vice president, David McFarland. Ryan-McFarland Co. began doing business July 5 of this year. At the end of July it acquired the Systems Programming Div. of Digitek for "a percentage of participation" over a two-year period. The new company's other efforts are in commercial software packages. It has a billing package for orthodontists it put into operation last month with a small test group of orthodontists in the Los Angeles area for a "six-month shakedown period" and an inventory control package for small businesses which still is in the development stage. Ryan-McFarland also is talking to a medical consulting firm in Minneapolis which is interested in developing an operating system for small machines specifically tailored to hospital applications.

With acquisition of the Systems Programming Div. of Digitek, Ryan-McFarland got all contracts, warranties and maintenance rights for existing customers.

Ryan formed Digitek in 1961 with Jim Dunlap, who served as its president for eight years. Both had left Hughes to found the company with the intent of building a computer. An almost immediate order from Max Palevsky of Scientific Data Systems for a compiler for the first SDS computer was the beginning of diversion into the

(Continued on page 129)

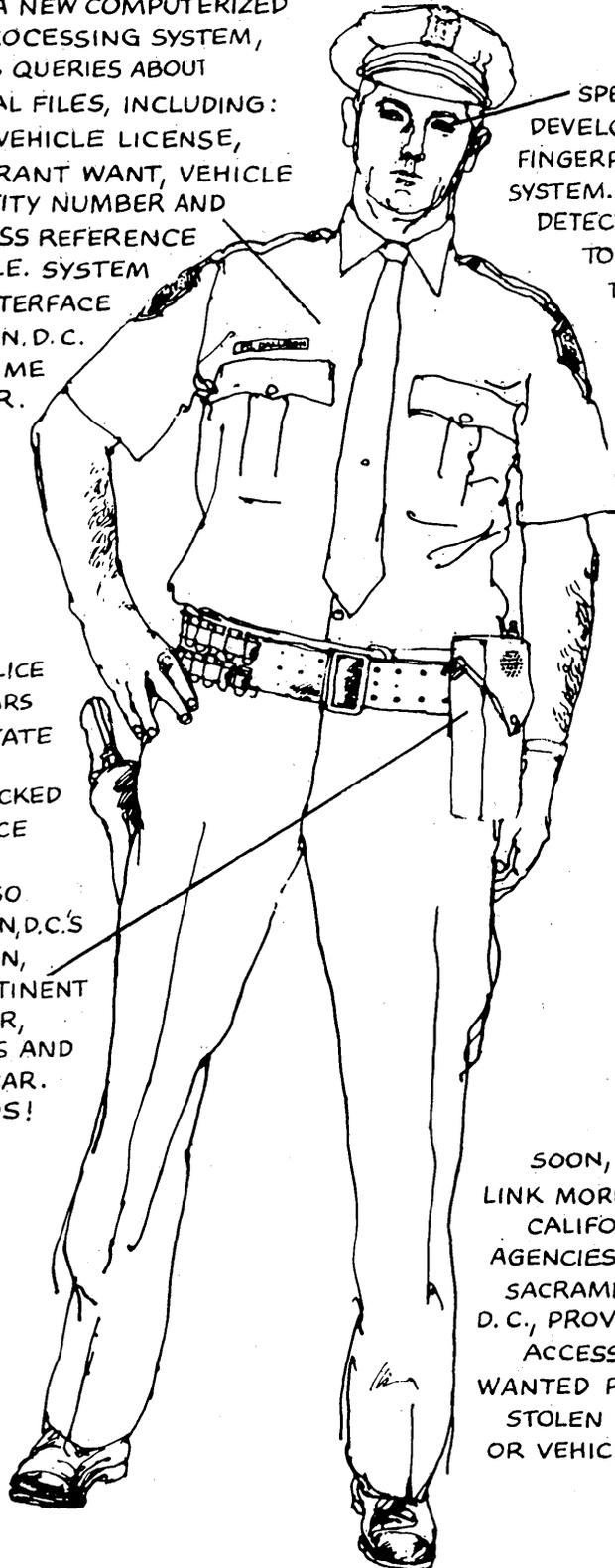
OUR NETWORK ALLOWS AN UNDERMANNED POLICE FORCE TO PROTECT LARGE POPULATION AREAS. IN SECONDS, ALERT, A NEW COMPUTERIZED TELEPROCESSING SYSTEM, ANSWERS QUERIES ABOUT SEVERAL FILES, INCLUDING: NAME, VEHICLE LICENSE, WARRANT WANT, VEHICLE IDENTITY NUMBER AND CROSS REFERENCE INDEX FILE. SYSTEM

CAN ALSO INTERFACE WITH FBI'S, WASHINGTON, D. C. NATIONAL CRIME INFORMATION CENTER.

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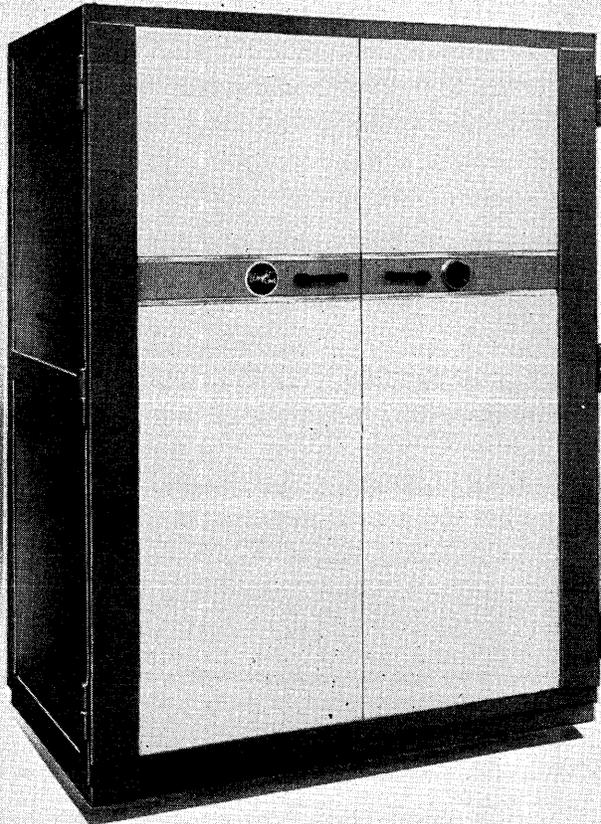
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At 150°F or 85% relative humidity, information stored on tape or disks is subject to read out loss. The cost of losing records could put many companies out of business, but you can guard against losses by properly protecting EDP records.

Wright Line Data Bank Safes were the first storage equipment to carry the Underwriters' Laboratories 150°-4 hr. label for safest protection of vital EDP media. They are available in four sizes and with a variety of internal configurations for the storage of tapes, and disk packs.

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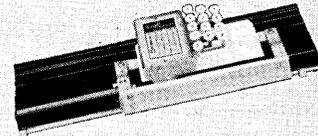
GOLD STAR FILES The most beautiful and versatile card files available. Line includes three wide files and counter-top model with plastic-laminate surface. For details circle Readers Service No. 103



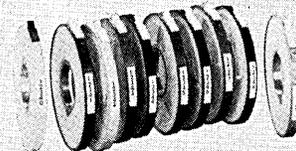
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NEWS SCENE

software business.

One of the industry's first proprietary software firms, Digitek continued peddling compilers and compiler kits through a series of financial ups and downs, until, during one of its down periods in 1967, it was decided expansion and diversification through acquisition was the answer. They set up an advertising agency under a Digitek umbrella and acquired Measurement Analysis Corp., Distribution Engineering Control, Inc. (basis of the present Digitek time-sharing operation), Applied Research Corp. (basis of the automotive research division) and Marina Research. All have been sold since Hoover took over as president shortly after Dunlap resigned early in 1969.

When last heard of, Dunlap was said to be "fooling around with applications of computers to analysis of the stock market" under the banner of Dunlap Computer Corp., Boulder, Colo., of which he is the sole employee.

Meanwhile Ryan is building his new software firm slowly and cautiously. He says if it ever becomes a two-part or multipart operation, those added parts will have been created, not acquired.

And as for the new Digitek, it remains to be seen, but maybe computer deemphasis and motorcycle commuting have something in their favor.

POS Now Respectable; NCR Has It!

Point-of-sale systems continue to be the subject of greatest interest at National Retail Merchants Association edp conferences, but there was a big difference at this year's 12th annual Information Systems Division edp conference held in Miami. The recent announcement of a point-of-sale (POS) system by NCR (see p. 157) has apparently given POS more respectability than the TRADAR failure (Feb., p. 163) could have taken away from it.

As a foreign visitor put it, "NCR's got to make it work!"

As one might gather from what the initials "NCR" actually stand for, NCR is to cash registers what IBM is to computers. So when NCR develops a

Terminal/900

A new 2741-type terminal for \$2315

This is the lowest priced conversational computer terminal on the market. It's also the most for the money. Here's why:

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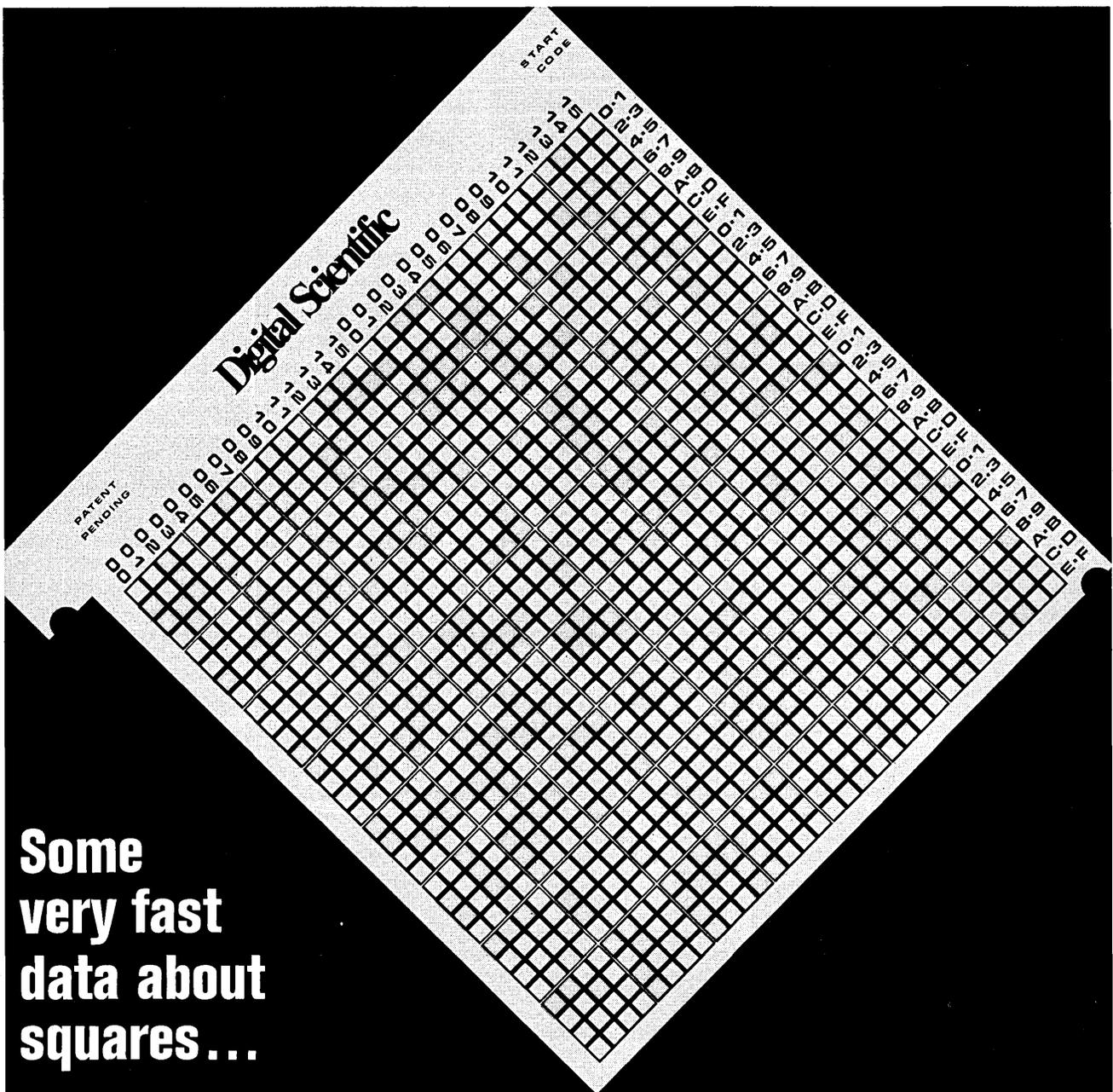
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You microprogram this ROM like software... and, with Digital Scientific's assembler and simulator, debug your codes. □ The final pass of the assembler generates a ROM pattern; then, pattern boards can be prepared by us or by you at your facility. □ Best of all, you can alter code and make changes, easily and simply, also at your facility.

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SPECIFICATIONS

□ Up to 4,096 16-bit words ROM (35-nanosecond access) □ up to 31 16-bit directly addressable registers □ up to 256 16-bit words of scratch-pad □ up to 65,536 18-bit words of 900-nanosecond core memory per memory I/O register □ up to 8 8,192-word banks per memory I/O register with 4 ports per bank □ real-time clock □ storage protect □ stall alarm □ firmware floating-point with a 14-microsecond multiply of 32-bit numbers.

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NEWS SCENE

POS system, it is likely that users will actually implement POS. Thus, even NCR competitors were pleased that NCR had finally announced a system. Now potential users will "stop holding their breath," said one POS supplier.

Attendees had indeed almost held their breath until the NCR announcement. A presentation by NCR of its new POS equipment at the conference was attended by about 500 persons, a few more than were registered.

The standing-room-only crowd looked on with hushed reverence as NCR demonstrated its system, using technology that represented little new, but merely the effective utilization of existing capabilities. But it was NCR. Some of the competition even photographed the NCR slides during the presentation.

But there was a lot more than NCR at the conference.

For example, there was Singer-Friden. The keynote address was delivered by Donald Kircher, president of Singer. He began with a familiar theme, pointing out that computer use is in a transitional phase. Whereas engineers dominated computer design in the sixties, the users of data processing equipment will dominate the age of the seventies. User requirements will determine the direction of the computer industry. And innovations will be primarily in peripherals, specifically terminal equipment, according to Kircher.

Kircher, of course, sees Singer and its Friden division, which has developed POS equipment of its own, both for in-house use and for sale to others, following this trend towards user dominance. It would seem appropriate that Singer, a large user of cash registers, should develop a POS substitute for them. But it wasn't easy.

Kircher related Singer's early involvement with POS, which began with a 1964 study of its own requirements that led Singer to seek a remote batch system with one large central computer. Major suppliers were either unwilling or unable to meet the firm's needs, however. Specifically, the weakness of then-available hardware was in terminals. Then the company acquired Friden, which also had little interest in Singer's POS desires; but once Friden was owned by Singer, it was just a

matter of pressuring the subsidiary into action. And, according to Kircher, heads rolled where necessary until Friden was properly interested.

So the Friden Modular Data Transaction System was born. It is scheduled to be implemented in all of Singer's 1,500 U.S. retail stores by the end of next year, replacing standard NCR cash registers.

The meat of the NRMA conference was in the more than 50 workshops which ran the gamut of edp applications and problems. Those sessions that dealt with POS and credit authorization were usually jammed, while attendance at others often lagged as meeting goers sought the rival attractions of golf and swimming at the plush Doral Country Club.

A particularly crowded session was the so-called "IBM workshop" which was really not a workshop at all. Rather, it was the announcement of the 370/145, a machine aimed at a slice of the market that includes many retail stores. But even this didn't arouse anywhere near the interest of the NCR announcement.

A session on current utilization of terminals included an interesting comment by Richard P. Shaffer of Associated Merchandising Corp.: When a good credit authorization system is implemented, criminals favor other stores — forcing the others to implement similar systems. This certainly portends well for vendors once they make the first sale. Another desirable feature of POS systems is that they may prevent thefts by store employees who would falsify tags on merchandise. Thus, a particularly biting jab against NCR was leveled by William H. Burkhart, president of Transaction Systems, Inc., a firm that markets a POS system using a magnetic tag. Said the gentleman about color coding tags, such as those used by the NCR POS system: A store employee bent on substitution could easily duplicate a color coded tag by using a Polaroid colorpak camera "bought in your store for \$25, minus employee discount."

There are still many approaches to POS (see Nov. 1, p. 91), and most present POS installations are at least partially experimental. But now that NCR is marketing a system, POS should come of age.

—F. Barry Nelson



Kings County Hospital Center, Brooklyn, which serves an average of 53,000 patients a year, will streamline its patient records-keeping next spring when it takes delivery of a \$3 million Ampex Videofile information system. Sixty-two remote terminals such as the above will permit hospital personnel to retrieve a patient's complete history or selected documents in that history in 15 seconds. Priority printed copies can be produced and delivered in minutes.

RAND to Study L.A. School Integration

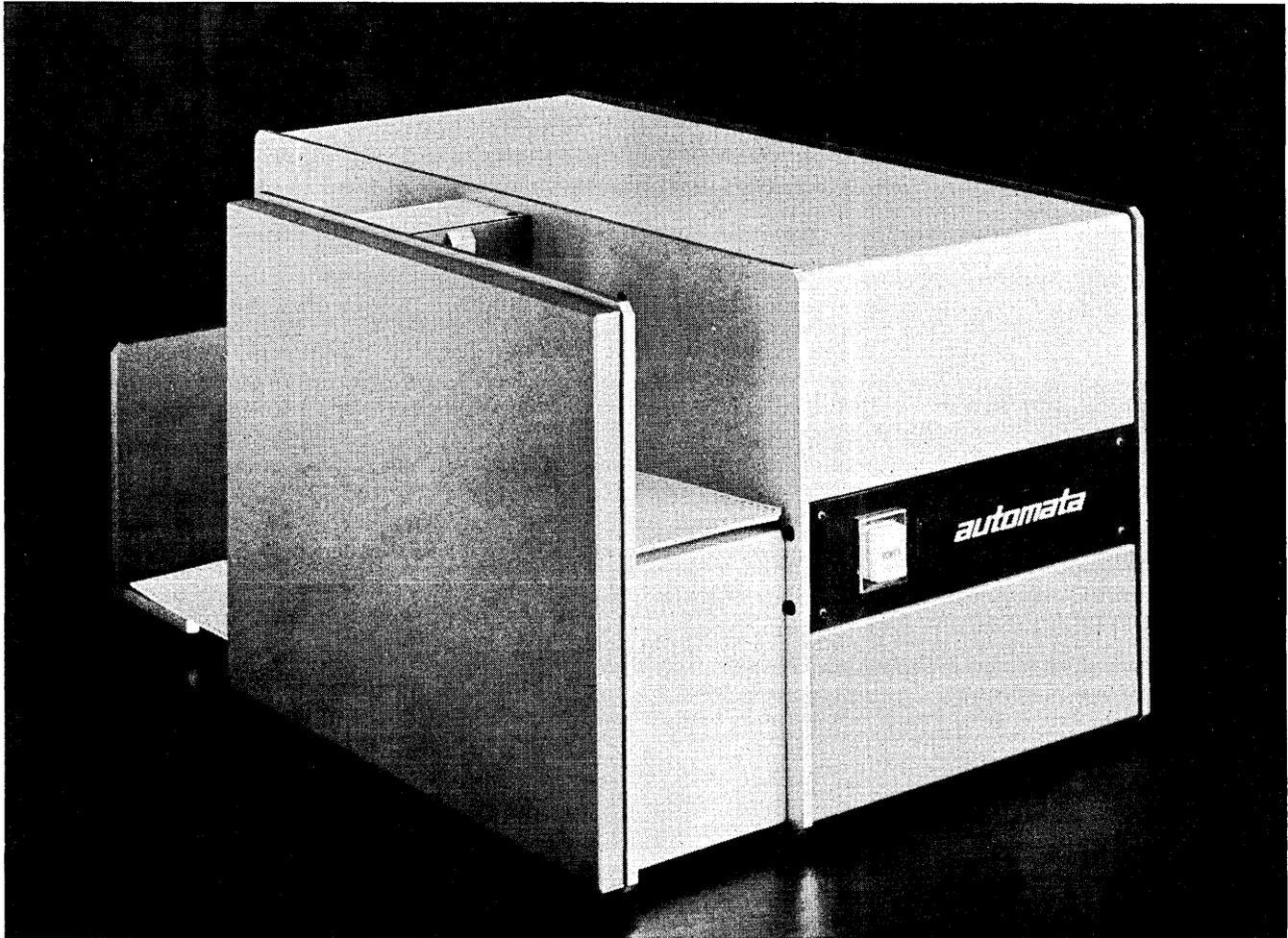
Prestigious RAND Corp. is going to come up with some how-to-do-it suggestions to desegregate the nation's second largest school district if \$262,300 applied for by the Los Angeles city Board of Education comes through as expected from the Office of Education, Dept. of Health, Education and Welfare. The rest of the \$412,262 study would be paid for by the Los Angeles city school district.

Los Angeles schools, under a court ruling by Superior Judge Alfred Gitelson, face a September 1971 deadline for abolishing de facto segregation. The RAND study would be completed by that time.

Dr. Anthony Pascal, who will head the RAND team undertaking the study, called Los Angeles' segregation problem "the toughest in the United States because of the physical extent of the city and the unbroken expanse of the ghettos." He said an effective set of plans developed for Los Angeles could be applied in other cities.

Dr. Pascal emphasized that the RAND study is aimed at providing the

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school board with feasible plans for effecting integration and not with "studying whether or not integration is desirable."

He said the first phase of the study will be concerned with shifting populations and changing neighborhood ethnic patterns within the Los Angeles area. Data from the 1970 and 1960 censuses will be used to build econometric and demographic computer models that will make possible predictions of future shifts and changes.

Next they would examine integration targets, probably four. One would be based on racial balance guidelines now under study by the state Board of Education. Another would be based on the Gitelson order; and RAND would develop two more, one tougher than either of these and one easier.

For each of the targets, linear programming would then be brought into play (RAND is developing its own software) to test various combinations of seven different methods for achieving racial balance, subject to such constraints as transportation needs and building limitations, for cost effectiveness.

The seven methods are bussing; altering grade structure by age groupings so that one school might have only first and second grades and another only third and fourth grades and all schools would serve wider geographic areas; changing boundaries of attendance areas; sharing programs via school pairings; expanding existing schools; building new complexes; and getting adjacent districts to cooperate by taking students in two-way exchanges.

On completion of the study, RAND would provide the school board with a number of alternative plans for achieving each of the selected targets. The board would have to take it from there.

Committee to Get Plan to Automate the House

Computerization will provide members of the House of Representatives with some additional services "sometime in the next Congress," but what they will be hasn't been determined, reports Rep. Joe D. Waggoner, Jr.

The Louisiana democrat is chairman of a House administration sub-

committee which has contracted with Stanford Research Institute and several others to develop a plan to give the House automated information services. The plan should be completed next month.

Waggoner said in an interview his committee then will have to "determine which applications should be tackled first, develop a detailed system design for each, and obtain the necessary funds." The hardware would follow.

He said House members will be told about a proposed electronic voting system when they return to Washington after the election. The system would consist basically of 49 terminals on the House floor, a computer, two display boards on the wall of the House chamber, an input console at the Speaker's desk, and possibly an output printer in the Speaker's lobby. Members would vote by inserting a plastic identification card in one of the terminals and pressing one of three keys ("aye," "nay," and "present"). The system would be based on either a small dedicated computer in the office of the Clerk of the House or on a 360/50 recently acquired for House bookkeeping and mailing chores.

Waggoner said an information retrieval system operated by the Congressional Research Service (formerly Legislative Reference Service) will become part of the system being planned.

Waggoner's ultimate aim may be to give House members and committees on-line access to all federal data bases containing needed information, including those managed by the Clerk of the House, Congressional Research Service, the General Accounting Office, and the Executive Branch. Last month, Congress voted a legislative reorganization act into law which authorizes the Comptroller General, Secretary of the Treasury, and Budget Bureau Director to develop, establish and maintain a "standardized information and data processing system for budgetary and fiscal data."

Two House committees — Banking and Currency and Judiciary — now have on-line terminals connected to the CRS system which runs on a 360/40. A knowledgeable source says "four to six more committees, including some in the Senate," are

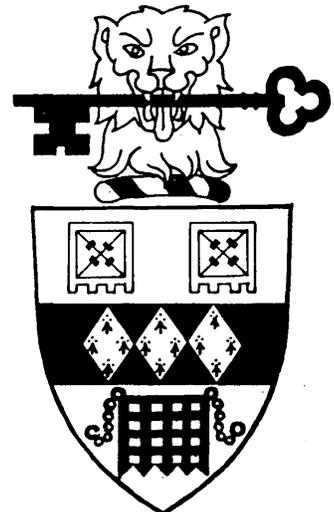
likely to obtain terminals during the next calendar year.

Developing an interface with the Executive Branch probably will be the biggest single system implementation problem, Waggoner thinks. He didn't elaborate, but executive agencies have a well-known aversion to giving information to Congress; they fear it will be used against them in hearings.

Developing a computerized information retrieval system for both chambers "will take quite a while," Waggoner says. Largely this is because the Senate has been "dragging its feet." He indicated there won't be any progress on a joint system until the Senate "shows that it wants to cooperate."

Now It's a Coat of Arms for British Computers

The British Computer Society, now 12 years old, has adopted a code of ethics with a formal mechanism for enforcement, added new grades of membership to delineate its professional standards — membership is now based on a set of exhaustive examinations — and has been granted an official heraldic symbol by the Kings of Arms. The next step in the



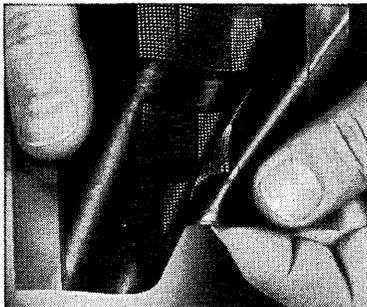
traditional British process, a royal charter, is likely to take a few more years.

Bodies of men with similar business interests date back as early as the 11th century in England. The fledgling BCS has a "friendship," marked by the occasional exchange of dinners, with the ancient wheelwrights guild, which has chosen the computer

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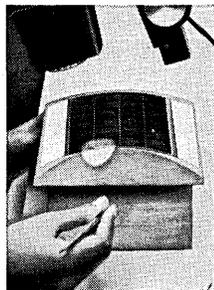
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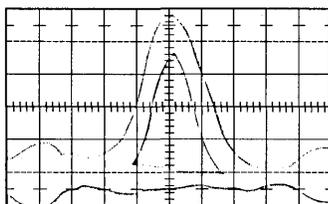
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Stacks are tested on Dataram-built equipment with capital investment savings passed on. Pinpointed around core specification criteria, the tester displays an output envelope, dra-

matically showing up cores out of specification. "Solid" envelope is actually a mass of core traces (as many as 72,000) showing range of all core outputs in the stack.

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disc as its favorite example of a "modern" wheel. BCS president, the Earl of Halsbury, tells of a plaque in Westminster Abbey, in honor of a mass commissioned there in the 12th century by the Sadlers' guild to commemorate its friendship with another member-supported group.

In the new BCS coat of arms, the "general moral principles of a learned society" are commemorated — the field of the shield represents the gulf between human aspirations and achievements, and is divided by a contrasting band symbolizing the "Bridge of Absolute Truth, by which only may the gulf be crossed."

The two devices above the bridge are heraldic representations of ferrite core memory store matrices, while the portcullis below provides a link with the City of Westminster, where the BCS headquarters is now located in the old Swedish embassy, and is supposed to remind members of the society's responsibility to the whole community and environment in which it exists.

The leopard with the key in its mouth denotes "unlocking the store of knowledge" (or data retrieval). Its stern face also signifies eternal vigilance over the society's integrity, and the key is also a symbol of the society's constant concern with problems of computer privacy.

The lozenges with ermine tails that adorn the bridge are a "gift" from Lord Halsbury, dating back to about 1200 on his own armorial bearings. The Kings of Arms approved their inclusion, with his blessing, to emphasize the importance of continuity in the society's development and to stress "the wider historical role it stands ready to play in the story of the human endeavor."

In a slightly modified design, Lord Halsbury presented to the society a presidential jewel of the symbol when investiture ceremonies were held for the incoming president, Alex d'Agapeyeff (managing director of Computer Analysts & Programmers) in London on Oct. 8.

DPMA Asks for Stamp of Approval

J.D. Parker, Jr., international president of the Data Processing Management Association, has petitioned Congressman Edward J. Derwinski (R. Ill.), a member of the House post office and civil service committee, for a U.S. postage stamp to commemorate the computing and data processing industry.

In a letter to Derwinski, Parker said "DPMA is entering its 20th year in 1971, and feels that the commemoration of computer technology during that year by means of an appropriate U.S. postage stamp would be fitting recognition not only of the industry, but of its many contributions to society."

One industry contribution has been the fouled-up customer's bill. Perhaps a commemorative stamp arriving with such a bill would remind the receiver how fortunate he is.

(Continued on page 137)

COME SEE WHY —

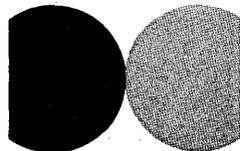
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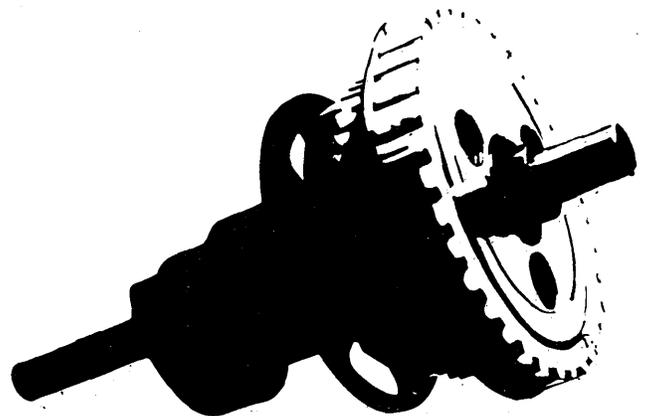
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Our new CD drum remembers twice as much as it used to.

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Along with the better memory, the drum has a bit transfer rate that's double what it was before. This gives the new unit a transfer rate of up to 4.4 mhz.

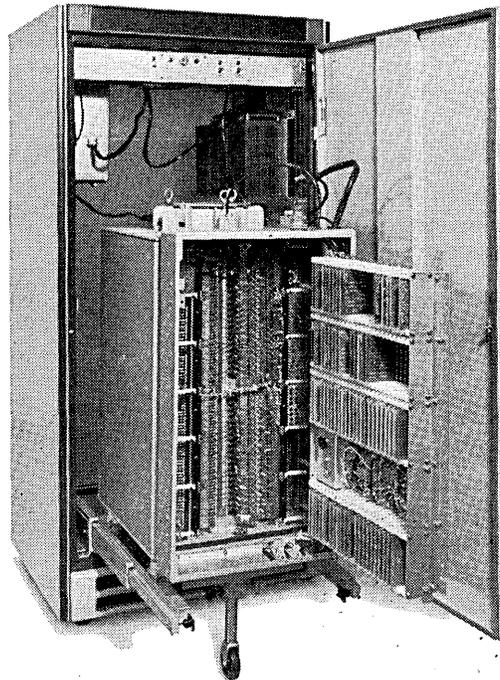
Nothing else has changed. This new drum continues to feature Bryant's

patented AUTO-LIFT® mechanism for reliability and long life. And average access time is still 8.5 milliseconds.

In addition, the interface can be easily designed to accept upward compatibility of our standard drum family. We've simply done our bit for progress. And doubled the bit capacity.

Like to know more about this brand new series? Interface with a Bryant representative, or drop us a line. Bryant Computer Products, 850 Ladd Road, Walled Lake, Michigan 48088.

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Proceedings Sales May Cover Big ACM 70 Loss

ACM 70 has resulted in, among other things, an \$83,000 deficit for the Association for Computing Machinery. In keeping with the convention's objective — to begin a dialog between other industries, their public, and the edp community — the loss has become a conversation starter.

ACM executive director, Gordon Smith, quiets the talk, noting that the association had budgeted for a \$23,000 loss when it abandoned commercial exhibits and that the printed proceedings for the affair have yet to go on sale.

Mr. Smith believes that interest in the digest of the September convention discussion is sufficiently strong to reduce the remaining \$60,000 loss. He said the full transcript of the session is being reviewed preparatory to editing. The text is expected to be ready at the end of the year. There is also talk of publishing a pamphlet covering highlights of the interindustry discussion. In the meantime there will be some streamlining at ACM.

Software Firms to Hold Astromeeing in Houston

The Association of Independent Software Companies will hold a meeting open to nonmembers during the Fall Joint to discuss the common concerns of software firms everywhere — protection in business practices, and how to make money.

Three speakers are formally scheduled, along with Herb Bright, president of AISC, who will say a few words (he promises), and Robert Krueger, president of Planning Research Corp., who will detail the origins and objectives of the association. The first speaker will be S. Schechter, chief of the contract branch, adp procurement division of the General Services Administration, who will discuss federal government software product procurement programs and how companies can get on the federal supply schedule.

The second speaker will be J. S. Chollar, of the Department of Commerce's bureau of international commerce, who will expound on the program of the Joint Export Association

and the possibilities for financial support by the Dept. of Commerce in the development of overseas software markets. The Joint Export Association comprises both government representatives and members of the commercial community.

Boston attorney Roy N. Freed will be the final speaker on the program.

The meeting will be held Tues., Nov. 17, at 1:45 p.m. in the "A" room of the Astroworld Holiday Inn.

Will TeleMart Come Back, Bill Bailey?

If too much business can ever be a bad thing, perhaps it was for TeleMart Enterprises, Inc., the San Diego firm that tried to offer busy housewives computerized grocery shopping by phone (March, p. 163).

TeleMart opened its phones in mid-September and two weeks later was forced to file for credit arrangement

CASE

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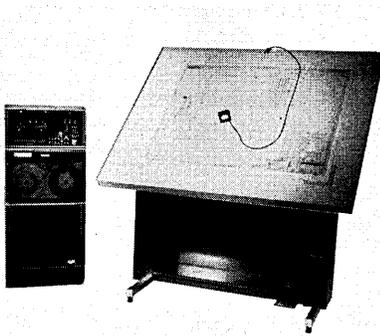
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The digitizer you thought wouldn't work.



proceedings under Chapter 11 of the Bankruptcy Act.

The trouble?

According to A.G. Bill Bailey, the firm's founder-chairman, it was in the warehouse, where they simply couldn't get the goods off the shelves and into the 75 delivery vans fast enough to satisfy the order volume (about 10,000 in three days, which pretty well crippled the operation).

So it would appear that those who said computerized shopping could never catch on may be wrong, that there is a market for it — if the operation can handle it. Bailey had high praise for the telephone company (Pacific) and the Rohr Corp., which set up and operated the computer response system with two 360/65s at its computer facility. At present, Rohr has put its people who were handling the TeleMart project to work on "a similar project for another industry" while awaiting further developments in the possible resurrection of TeleMart.

And Bailey is convinced his company and its service will come back. "Our experts, both engineering and legal, are still investigating specific warehouse difficulties, and we are looking for and talking to qualified engineering companies to determine how we can get a workable warehouse and distribution system that would allow us to reorganize and reopen."

Another spokesman for the firm stated that not only had the response in number of orders been extraordinary, but that there had not been a single complaint from those who did receive their orders. Apparently, stay-at-home shoppers are willing to give up the privilege of pinching the tomatoes for the convenience of having them delivered. The produce and meat were given "100% guarantees" by TeleMart. Too bad it couldn't guarantee delivery.

Dallas 18 Year Old Solves Perfect Puzzle

The lowest "perfect number" is 6. Its divisors — 3, 2, and 1 — total 6. Next is 28 — with divisors of 1, 2, 4, 7 and 14. From here on upward there are huge gaps. Some 20 of these perfect numbers had been identified, but any-

thing beyond that was thought to be virtually unattainable.

That was true until May of this year, when the identity of the 21st was announced. It contained 5,688 digits.

Responsible for this breakthrough is a grizzled veteran of man-plus-computer assaults aimed to liberate the locked-up perfect numbers in the high altitudes. He is Roy Ferguson, 18 years old, then a senior at Kimball High School in Dallas. Shortly after the 21st, he announced the identity of the 22nd and 23rd perfect numbers. In the case of all three, the program in FORTRAN was less than 25 lines.

Ferguson's approach to these problems in theoretical math bypassed the traditional method of starting with a large number as a single quantity. Instead, he considered the wanted number to consist of segments of modules of smaller numbers that aggregated a large number.

Needed was a technique for extended accuracy. The ordinary computer is accurate up to 6 or 8 digits. Ferguson needed to assure computer accuracy up to thousands of digits. He took the existing equation for perfect numbers and expanded it to write his program. In doing that he also proved deductively the validity of what he believes is an original theory. The known quotation is $(2^N-1) (2^{N-1})$. Mersenne Primes are precalculated values. In the above they are represented by N. Ferguson's Theorem holds that the sum of all integers from 1 to 2^N-1 equals the perfect number. It may also be expressed: $\sum (2^N-1) (2^{N-1}) (2^N-1)$.

This provides an alternative method of identifying perfect numbers. The application of this method is regarded by some mathematicians as of greater significance than the actual identifying of the perfect numbers, because it provides a method for obtaining accuracy with large numbers.

Work on the 21st number was begun in February of 1968 on a Tymshare terminal to the company's Palo Alto headquarters. Thereafter, Ferguson, getting through from Dallas via Teletype to an SDS 940 computer — in evenings, early morning hours, and on weekends when he could pick a clear track to California — put in about 1,000 hours of his time until the calculations were completed.

Upon his graduation and his deci-

sion to attend Southern Methodist Univ. in Dallas, he applied his program through SMU computer facilities, a Digital PDP-10, for the 22nd and 23rd perfect numbers. In less than three hours he had identified both, containing 5,985 and 7,723 digits, respectively.

At this point, however, a new start must be made before the 24th and subsequent perfect numbers can be identified. Up to now it has been practical to use known values precalculated by others. For further research Ferguson must establish his own precalculated values. This will be accomplished by extensive trial-and-error effort to find the necessary variables. It is possible that this study may uncover an almost infinite number of these variables that can then be incorporated into a program to provide the identities of a long series of perfect numbers.

While Ferguson's achievements represent an extraordinary personal triumph in his chosen field, the question arises, as it does in connection with breakthroughs in pure science or theoretical math: "So what?" Can the new knowledge be used to win wars, stop pollution, effect personal weight reduction, or provide ample parking space for everybody? The answer: Well, maybe. At this stage nobody knows.

The Fibonacci sequence of numbers was given to the world about the time of Christ. Not until a couple of decades ago were they found to have a relationship to the movements of planets and other natural phenomena. "Boolean logic," says Ferguson, "was once considered just an abstract philosophical concept until it emerged as the basis for the logic in the modern electronic computer." Meanwhile, he goes on with his freshman studies and his extracurricular research.

FCC Order to AT&T May Cut Rate For DP Users

A seemingly minor semantic dispute has given on-line dp users and suppliers a good chance of winning a major victory against Ma Bell.

If they win, the FCC will take jurisdiction over "information system access lines" that cross state borders.

(Continued on page 143)



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“Someone in East Nowhere is going to get just as close attention as someone in Manhattan. If we sell it, we’ll keep it running, no matter where.

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Mohawk Data Sciences Corp.
Herkimer, New York



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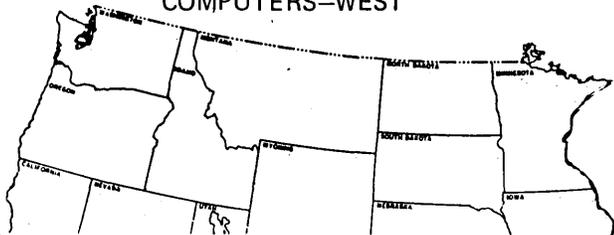
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This is a new service classification established by a number of telephone operating companies during the past several months. ISAL customers, who consist mostly of t-s service bureaus, must pay up to 400% more than they formerly did. The hope is that if FCC takes over, ISAL rates will be reduced or abolished.

The semantic dispute began last spring, when the commission asked Ma Bell why it had filed interstate tariffs to cover only a portion of Type 2006 foreign exchange service — the portion represented by the foreign exchange line. The remaining link, consisting of the line connecting the customer's terminal to the end of the foreign exchange line, is charged for solely on the basis of an intrastate tariff even though each end of the message path is in a different state.

Ma Bell answered that f-x service is a combination of toll and local exchange services, so the charge for the latter part of the message path, in effect, is none of FCC's business.

The commission disagreed, saying that any communications service that connects parties in different states is "interstate" under the Communications Act and hence subject to federal regulation. Last September, AT&T was told to file tariffs with the commission covering "the complete interstate foreign exchange service."

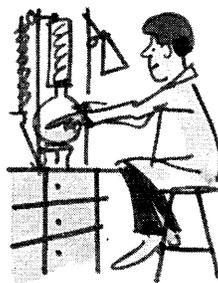
It will be some time before these rates are filed, says an FCC official, because the ruling affects literally thousands of foreign exchange lines.

While the f-x fight was going on, another was under way between the Defense Dept. and AT&T. This one involves the question of whether terminals connected to a "command post alerting network" (COPAN) in Hawaii should be charged for under intrastate or interstate tariffs. Recently, the FCC ruled that interstate tariffs must be filed for COPAN terminals because they are being used partly for interstate service. By implication, the same rule holds for any other terminals used the same way.

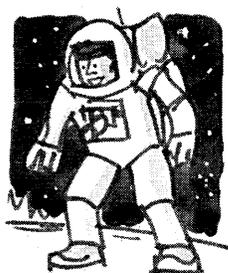
A commission spokesman says there's nothing unusual about these two rulings. The law, for years, has required the carriers to file interstate tariffs for interstate service.

The fact remains, however, that when the carriers established information system access lines several

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NEWS SCENE

months ago, they notified the states, not the FCC — even though many of these lines are links in an interstate message path. And it was at the state level that users counter-attacked (this battle is still going on).

Now it seems likely that on-line dp users and suppliers have a basis for complaining to the FCC about ISAL rates. Since the commission tends to be less mesmerized by Ma Bell's rhetoric than the state commissions, ISAL customers have a better chance of

winning their argument.

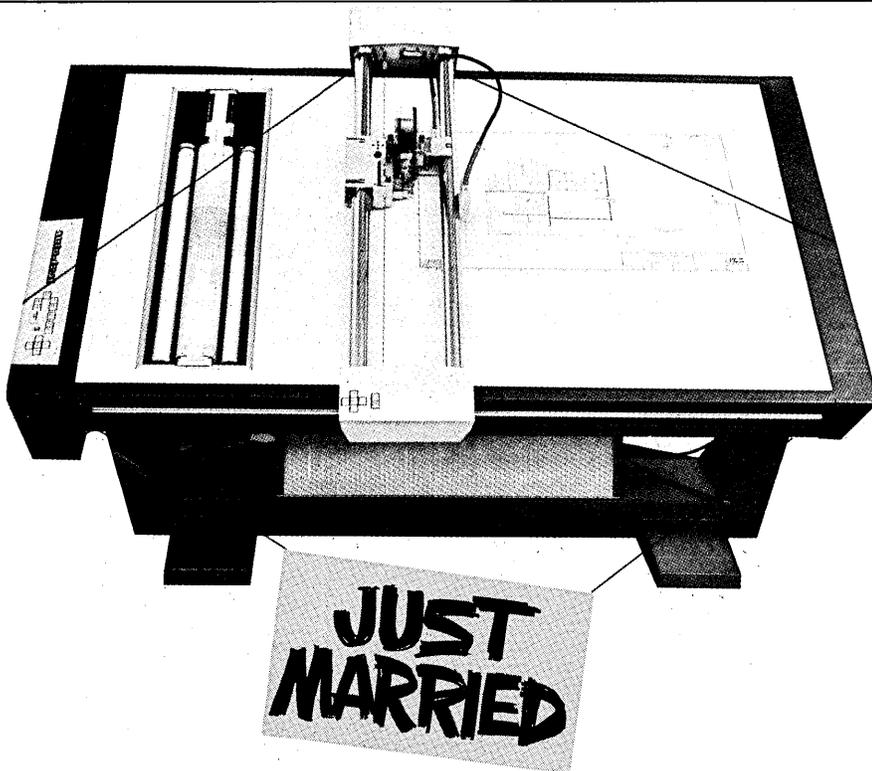
A few months ago, BEMA was reportedly on the verge of asking FCC to intervene in the ISAL fight, but in-house differences led to a stalemate. We were told that IBM opposed the move, while most other members favored it. In any event, the two recent FCC decisions probably will lead to a second attempt, by BEMA and/or the computer time-sharing section of ADAPSO.

ISAL rates are only part of the

story. As ADAPSO pointed out last year, during the Computer/Communications Inquiry, different state utility commissions often allow markedly different terminal options to be used within their jurisdictions. This situation creates trouble for interstate t-s firms because they can't offer the same service everywhere.

ADAPSO referred specifically to options available on the Mod 37 Teletype machine. "Unless all the various utility commissions are unanimous in their decision to accept or reject the (Mod 37) device and each of its particular options necessary for use with time-sharing systems, the time-sharing vendor will be unable to provide a uniform service across the country." Later, ADAPSO's brief talked about the difficulty of obtaining data access arrangements from various state telephone companies, and the problems encountered by t-s firms located in one phone company's territory getting remote terminal troubles corrected by another phone company.

Now that rates for interstate ISALs have to be filed with the FCC, the customers have a new and possibly more responsive forum for seeking terminal and service standardization.



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CIRCLE 118 ON READER CARD

NEWS BRIEFS

Bridging the Audit Gap

For the first time a major CPA firm and a leading software company are working together to eliminate the 5-10 year time lag (July 15, p. 13) said to exist between the auditing profession and computer developments. Informatics, Inc., Canoga Park, Calif., and S. D. Leidesdorf & Co., New York City, signed an agreement under which the CPA firm (No. 11 in the nation) will serve as a consultant in development of an auditing capability extension of Informatics' Mark IV file management system. The new capability is expected to be available in the first quarter of 1971.

In another branch-out, Informatics has begun offering a service it calls EDP '70 where it sends a task force into a company's installation to develop a set of customized standards for maximum return on investment, point out where these standards are not being met, and show how they could be.

DATAMATION

Travel Standards

In an effort to coordinate the travel reservation information that is becoming more internationally available but not necessarily more usable, because it still is not interchangeable, American Hotel & Motel Association has sought the assistance of ANSI (American National Standards Institute) by entering a joint agreement to work out criteria for information systems. The hope is that ANSI can arrive at a compatible solution that will satisfy all and not impair the networks already operating. Among the considerations: What information should be included in reservation requests and methods of transmitting it not only to hotels and motels, but to transportation and travel agencies.

A task force, sponsored by the association under ANSI supervision, will include representatives from domestic and international airlines, computer and business equipment manufacturers, communications, dp services, credit systems, banking, travel agencies — and government.

Hello Out There

Learning by computer apparently requires some psychological adjustment, according to reports from campuses of 10 colleges now accessing Iowa Univ.'s computer center in conjunction with their regular social science courses. Contrary to being a cut-and-dried procedure, having to question the computer gave one student "the insecure feeling I get when I have to think for myself."

Prof. G. R. Boynton, in charge of the computer-aided teaching with the help of a \$240K grant from the National Science Foundation, said that some students find themselves in a new give-and-take situation rather than the old passive lecture-listening, and a number of them feel somewhat overwhelmed by the additional information put at their disposal, and the responsibility of coordinating it. Some are just plain scared of the computer, although they are furnished with instructions that tell them how to communicate with the cpu through the remote terminals. All in all, though, Boynton determined from a questionnaire that most students regarded the computer as a welcome chance to

ask questions they would not otherwise have the opportunity to have answered in any comparable detail.

Academy-Standard

Academy Computing Corp., Oklahoma City, and Standard Computing Corp., Santa Ana, Calif., have signed an agreement under which Standard will provide hardware for a time-

shared data file management service using Academy's BELSTAR (Business Enriched Language for Storage and Retrieval) software at Academy's Oklahoma City data center. Initially, Standard will provide the center with a GE 265. This will be replaced in January with a Standard IC 7000. The agreement calls for both companies to share in profits from the center's use of the BELSTAR system.

(Continued on page 147)

"Brownout warnings spell gloom for DP installations"

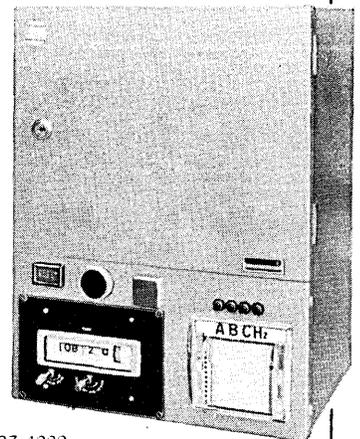
Once again, the trade press and daily newspapers are headlining warnings of critical power shortages. To try to avoid another "blackout", leading utility companies are causing "brownouts" and publicly admitting cutbacks in voltage which can take the power level out of the tolerance range of many computers. This out-of-tolerance condition can cause costly computer error, downtime, program reruns and even damaged equipment.

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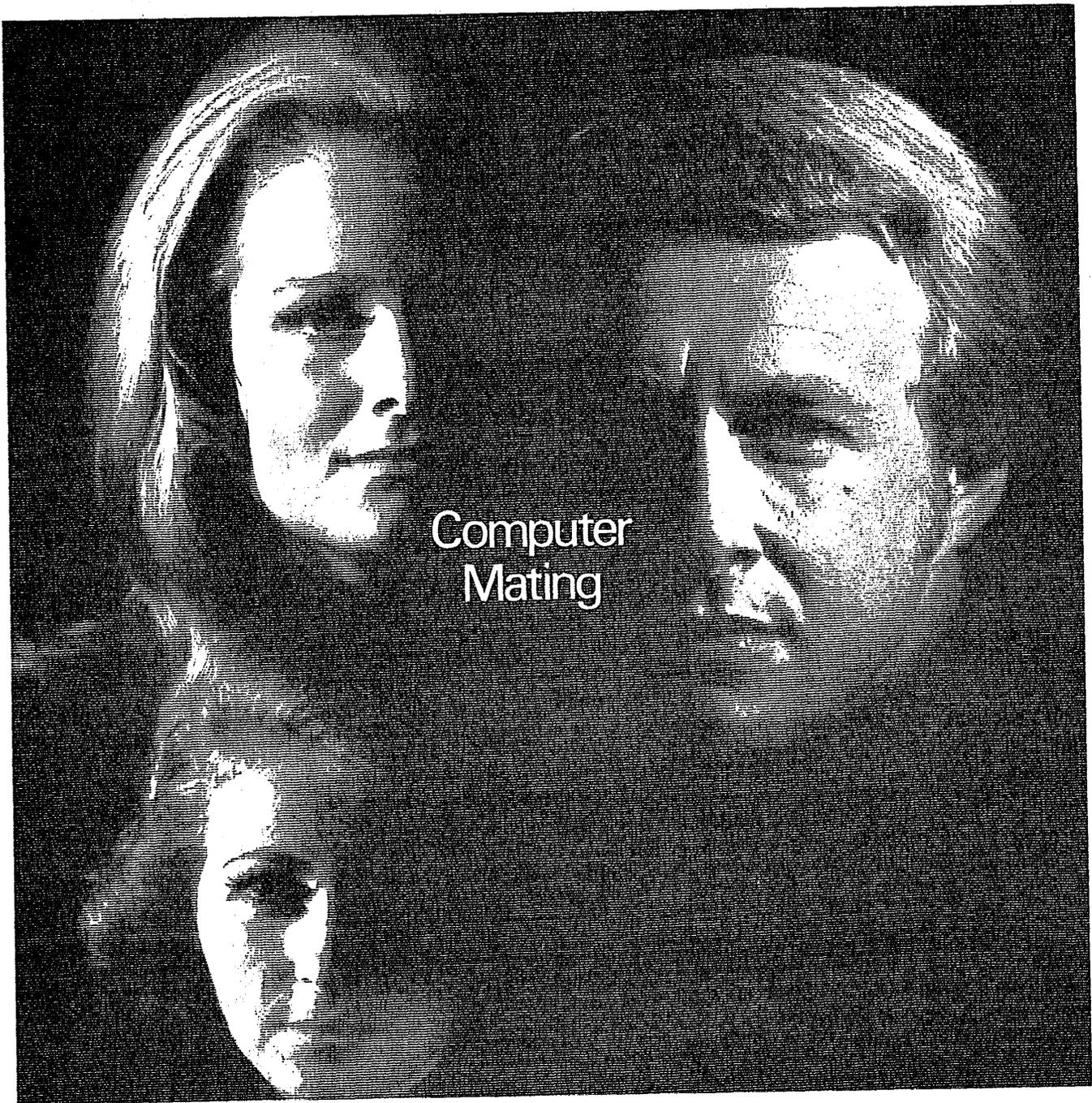
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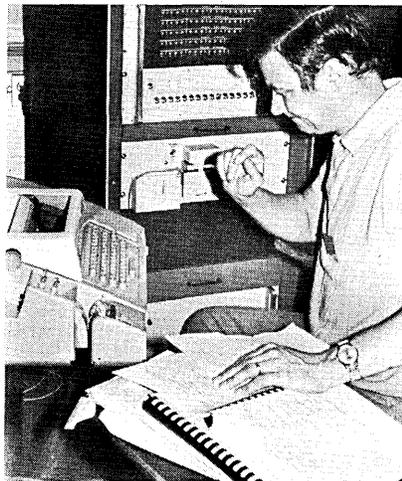
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'71 FJCC Adds a Day

Every Joint Computer Conference offers something new, and the 1971 Fall Joint in Las Vegas Nov. 15-18 will be no exception. It will be the first JCC to feature an exhibits program expanded to four days and to permit exhibits-only one-day registration on the final day (\$10 for members of AFIPS and \$20 for others). The technical program will continue in its present three-day format, running Monday through Wednesday, with the exhibits running Monday through Thursday.

MERGERS, ACQUISITIONS

Billing themselves as the "first nationwide APL service for business and industry," three time-sharing companies have banded together to offer their facilities and wares, including more than 1,500 programs, over a combined t-s network of cities: Boston, New York, Princeton, Philadelphia, Washington (D.C.), Richmond (Va.), Norfolk, Chicago, San Francisco, Palo Alto, Los Angeles, Santa Ana and San Diego. The companies involved: **Proprietary Computer Systems**, Van Nuys, Calif.;



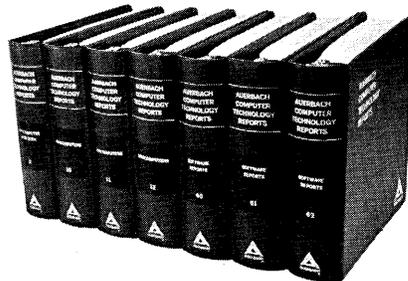
This is a chemist. And he's solving a chemical problem. He's a member of a three-week intensive course at Purdue Univ. for practicing chemists called "Digital Computers in Chemical Instrumentation." Half of the course centers on digital logic design as applied to analytical instrumentation. The second half is devoted to machine language programming. Six Hewlett-Packard minicomputers are used in the course.

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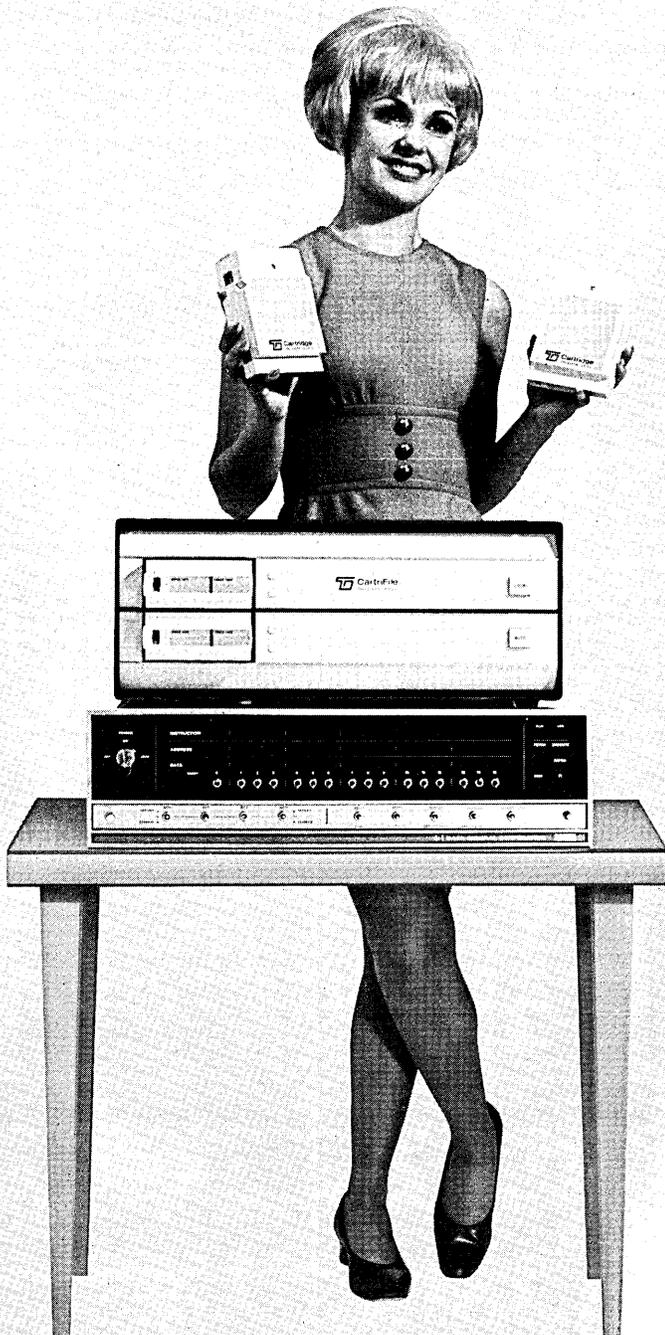
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CIRCLE 18 ON READER CARD

NEWS SCENE

Computer Innovations, Chicago; and **The Computer Company**, Richmond. They use Mod 360/50s. . . . One way to make a sale: **GAC Corp.** has agreed to loan **Boothe Computer Corp.** \$5 million so it can buy a subsidiary, **GAC Computer Leasing Corp.** All GAC wants to do is recover its investment, but this seems dubious, since it was said to involve more than \$50 million in IBM 360s that are leased out in the U.S. and Canada. Apparently another incentive to sell was the introduction of the 370/145. Boothe says it is well content with the prospect of becoming the largest independent lessor of 360s — it already has some \$180 million worth of computers on lease in the two countries and in Europe. . . . **Beta Instrument Corp.**, Boston, has ratified an agreement whereby **Recognition Equipment Inc.** is acquiring an interest in the company by agreeing to buy 100 COM systems from it by the end of 1971. REI also has a warrant to purchase 51% of Beta any time before that deadline. The agreement gives both companies a combined OCR-

COM capability that they already have started to sell to multiple-system users. . . . **Precision Magnetics, Inc.**, maker of *high-speed* plated wire memory systems, has agreed to acquire the **Tetra Corp.**, maker of *medium-speed* core memory systems and a peripheral display unit, both in Minneapolis. . . . **SDM Corp.**, electronics system manufacturer specializing in air traffic control and weather data, has absorbed **Computer Devices, Inc.**, which has moved from Cambridge, Mass., into SDM's new facility in Woburn. . . . Surprise! **Electronic Associates Inc.** called off its proposed merger (the fourth in three years), this time with **Computing Efficiency Inc.**, Hauppauge, N.Y.

NEW COMPANIES

The marketing problems of computer companies that want to cut down on rep and regional expenses have been taken on by an east-west coast com-

bine, **Courtney/Peters**. Joint efforts include a recent nationwide survey of representative firms qualified to sell various types of computer products, which in turn will be computer-processed to match producer with proper selling agent. The venture will determine for clients what type of representation is needed, assist in setting it up, technically train salesmen, and will act as a sales office itself for those needing an address. Larry Courtney Co. is the western end of the axis in the Greater Los Angeles area (Encino). Eastern end is David L. Peters Associates in the Even Greater New York area (Hohokus, N. J.). Both men were formerly vp's at Moxon Electronics who have kept in touch. . . . "Technologies expanding faster than people can keep up" is the reason for founding **Integrated Technology Corp.**, which actually is the outgrowth (although now the parent) of Integrated Circuit Engineering Corp. of Phoenix. ITC hopes to offer forward-looking services in the computer and information systems fields, among others, by pooling scientific, legal and

Here's what \$395 gets you.



The ForData® 1610 self-contained, automatic answering data modem.

Unmatched automatic answering versatility: DAA, Telephone Coupler, or Direct Line Adapter connection to the telephone system; EIA or TTY terminal interface; originate mode as well; handles data to 300 baud.

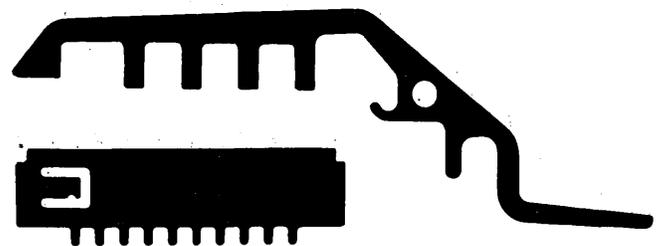
For "originate" only: ForData 1210 at \$295, equally versatile.

Quantity discounts, of course.

Communications is our business. Call or write:

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CIRCLE 119 ON READER CARD



MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohall) during the FJCC.

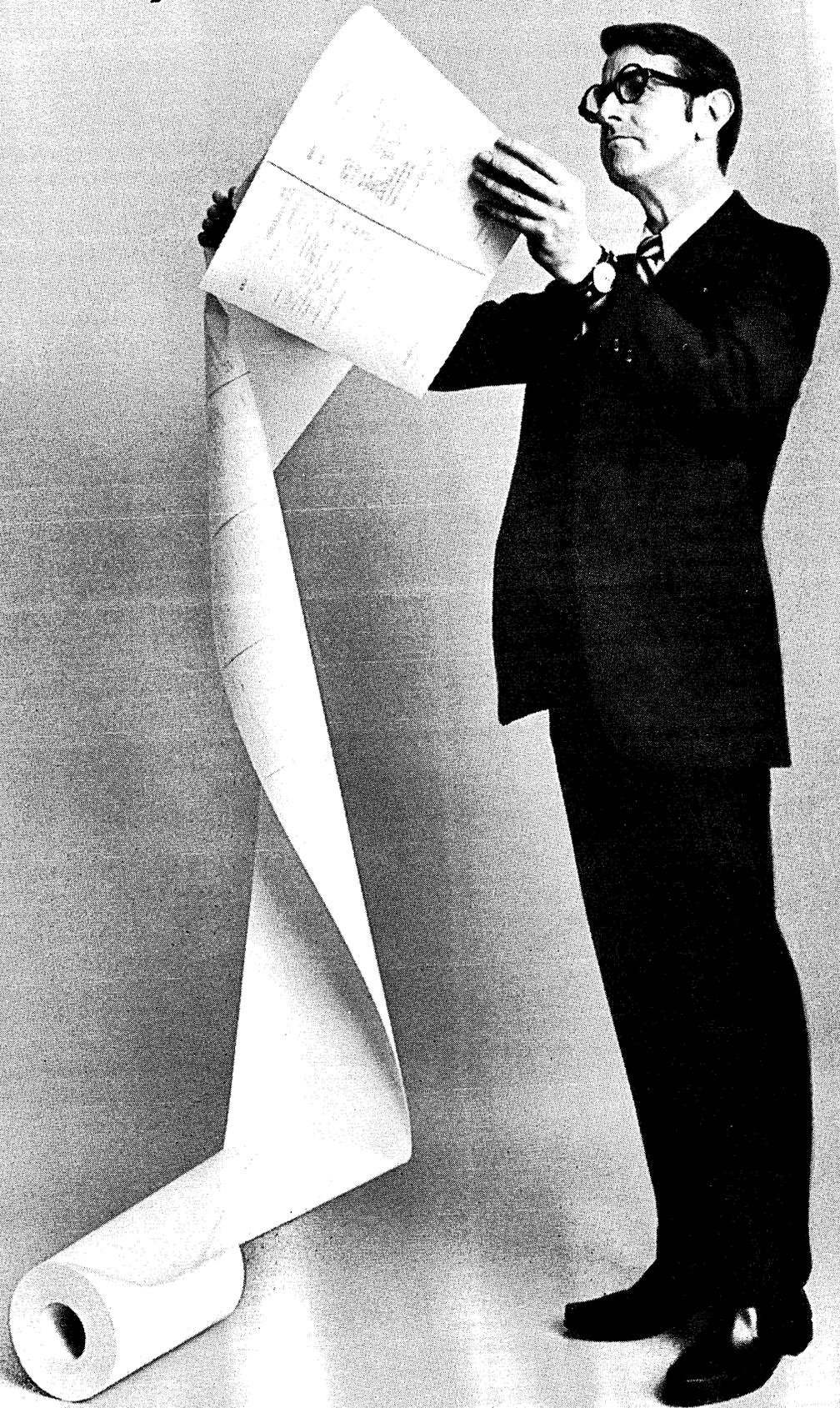
TRACOR DATA SYSTEMS



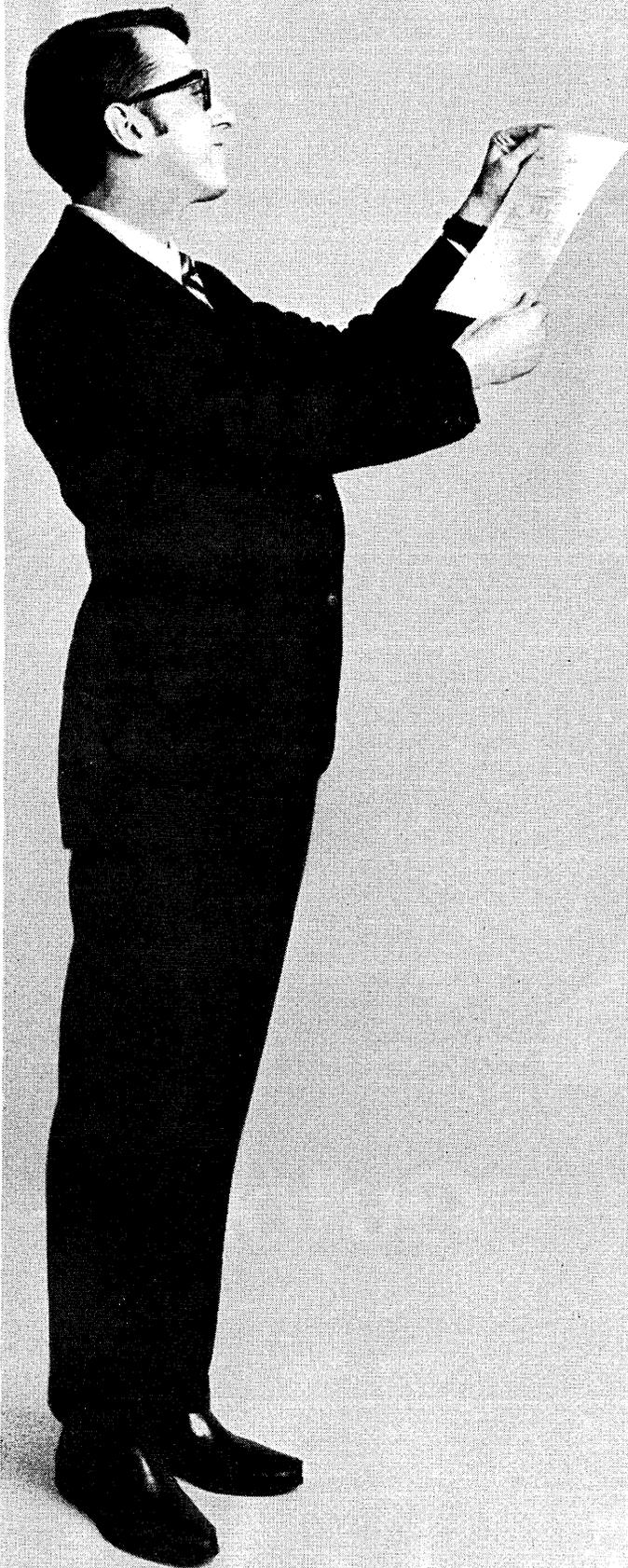
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CIRCLE 62 ON READER CARD

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



any way you look at it.



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

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

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

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

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

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

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

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

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

XEROX

... with the new Gulton 10/32 Terminal Control Unit. The only system of its type currently available, the Gulton 10/32 provides standard interface between virtually all ASCII encoded peripheral devices. The remote user can now interconnect different terminals to take advantage of their combined features... and still retain each as a separate terminal.

The Terminal Control Unit is basically a magnetic tape reader-recorder, with two serial interfaces and inter-channel switching provisions. This design permits two terminals and the G10/32 to be utilized in a number of unique applications...

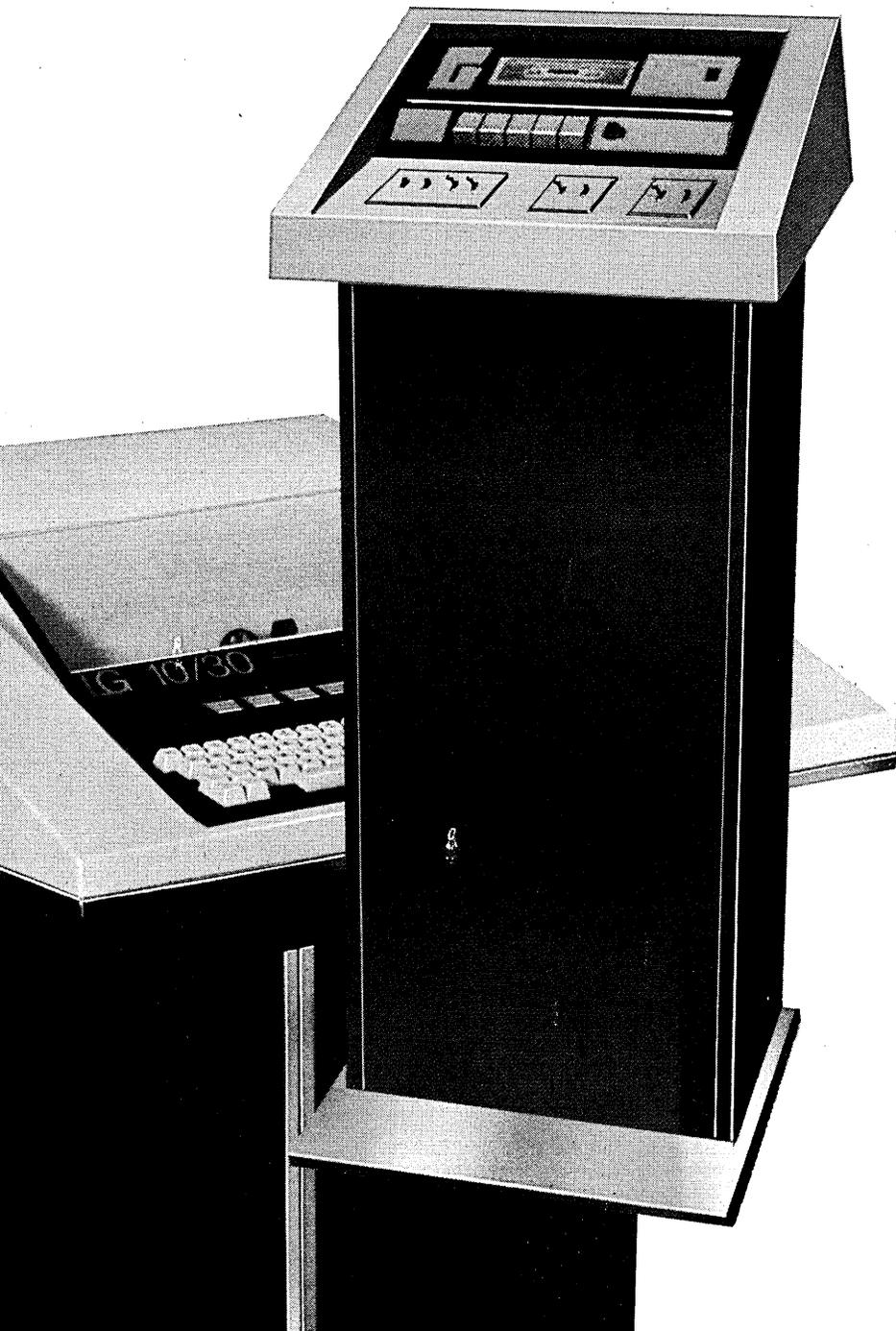
- * Two independent terminals sharing a common magnetic tape reader-recorder, with switch selectability.
- * One terminal on-line CPU, format controlled by the second terminal.
- * One terminal acting as a robot printer for a second terminal with greater editing capability.
- * One terminal on-line to CPU, with G10/32 monitoring another line for incoming TWX and inter-company data messages.
- * Interfacing devices with different connections — RS 232B to current loop.
- * Converting paper tape to magnetic tape at 10, 15 or 30 cps.

Application of this new Terminal Control Unit is really limited only by your own EDP requirements. A booklet has been prepared which diagrams these and other uses, which can double your terminal capability. It's yours for the asking. Write Gulton Industries Inc., Computer Systems Div., 13041 Cerise Ave., Hawthorne, Calif. 90250... or call (213) 679-0111.

Computer Systems Division

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NEWS SCENE

financial sources and resources, while subsidiary ICE will stick to more immediate goals in MOS system design and training. ITC has specifically designated itself a "high technology" company, and its funding is quite lofty — New York Life Insurance Co. . . . Bristol-Myers Co. has launched a subsidiary, **M/D Systems, Inc.**, L.A., to supply financial dp services to physicians, including I/O on insurance forms, daily accounts receivable, statement preparation and mailing. The program used can cope with all insurance forms used in California, is approved by the Health Insurance Council, Blue Cross and Blue Shield, and is acceptable to all government health agencies. Although a B-M company, M/D will contribute its services as an affiliate of other medical service companies owned by Mead Johnson & Co. . . . In hospital services, **McDonnell Automation Co.** has formed a separate division to further develop and market its hospital dp services, although it currently has 36 hospitals already operating under its system. . . . **Image Systems, Inc.**, originator of the CARD microfiche storage and retrieval display system, has decided it needs to link its operations more directly with the computer and has established a computer science division, with responsibilities comprising system design, hardware and software, with marketing.

SHORTLINES

Sylvania is getting out of the semiconductor business. In a statement bearing a whiff of sour grapes, it said the reason was because "there is no indication that within the foreseeable future stability will supplant the disorderly conditions that have characterized this branch of the electronics industry for many years." Microwave is not included in the phaseout. . . . Datafair '71, England's major computer gathering for next year (March), has announced that all its exhibition space has been sold and that 120 papers already are in the mill, the majority dealing with business dp. Datafair is sponsored by the British Computer Society. . . . Also in the U.K., the software industry has formed its own association of more than 30 members, complete with the "necessary funds."

Official name is Software Houses Association, Ltd., headquartered on Kingsway's arc in London. . . . "Little" Finland, where U.S. dp exports took over preeminent position in 1969, is expected to order \$21.6 million worth a year by 1974, compared to last year's \$9.3 million, particularly process controllers. There are presently 203 computers in use there; private service bureaus number 18, government-owned, nine. . . . Purchase, lease, and maintenance rates all have been reduced for Systems Engineer-

ing Labs' 810B computer (\$33.5K to \$31K) and 800 Series peripherals (up to 30%). SEL's 86/88 midcomputers also have had their lease and maintenance rates pared. . . . Hewlett-Packard is offering a trial plan for its t-s 2000 computer series that allows the tryer to back out after six months with payment of regular lease charges — no penalty — the catch being he must employ a systems analyst for at least one month. H-P will obligingly furnish a month's worth of analyst for \$2000. ■

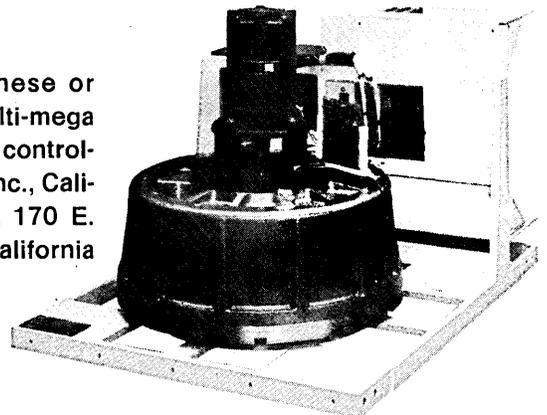
FOR \$855 FAST DATA STORAGE— IN 30 DAYS

Let your imagination run wild! Available today for tomorrow's projects — reliable data storage systems featuring fast, head-per-track, rotating memory systems at the best price per bit in the industry.

Capacities start at 50,000 bits and range to 5,000,000 bits. Performance? For \$855 we'll deliver you a basic 4K x 16 memory system with a bit transfer rate of 1 MHz. Access time — 8.3 milliseconds average!

Computer application? Try our RUGGEDIZED Model 388 on for size — 32K x 16 of 2 MHz fast core extension for \$2,500 — complete with electronics and rack mounting as shown.

For full information on these or larger memories with multi-mega bit capacities or associated controllers, write or call: DATUM, Inc., California Peripherals Division, 170 E. Liberty Avenue, Anaheim, California 92801. (714) 879-3070.



**DATUM —
the mini-peripheral people.**

Now! A 60 page report in 1 minute.

Make room for Statos® 21 — the new line of electrostatic printer/plotters featuring the quickest output in the EDP business. Statos 21. Zings out 8½x11 hardcopies at a page-a-second rate. Or 5,000 very readable lines a minute. On Z-fold or roll paper.

And *plots* at the same time, if you wish.

At that rate, Statos'll do the work of 2, 3, even 4 contemporary printers or plotters. Or eliminate a mag tape unit as a middle-man. All in a space of 4 square feet.

It'll give you plug-to-plug compatibility with computers ranging from the IBM/360 to the Varian 620/f. And something no other non-impact printer offers: forms control.

Designed from the floor up as a full-fledged computer peripheral, Statos 21 will handle full lines of alpha-numeric data, allowing efficient I/O programming at the data source.

With its 80-character line buffer the Statos 21 can handle card-image records, teletype-compatible listings plus a wide gamut of other business data formats. Statos 21.

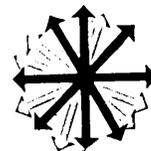
You can't beat it. For the whole persuasive story, with a surprise cost ending, contact us at 611 Hansen Way, Palo Alto, Calif. 94303. Call 415-326-4000.



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Statos 21





COM System

For several years the potential of microfilm supplanting paper as the primary document storage medium has gone unrealized. Perhaps it has been the unfamiliarity with the new techniques, or the added expense, or the necessity of handling chemicals, or, in some cases, constructing dark-room facilities, or all of these to varying degrees that have kept the many advantages of COM out of so many dp installations. After all, the alternatives are paper and printers, and they are familiar and proven.

But according to this vendor, the resistance has been mainly that "nobody wants to handle film." Perhaps Kodak found that out years ago—witness the success of the Instamatic. So the Quantor 1-2-3 system has been engineered with emphasis on reduc-

PRODUCT SPOTLIGHT

ing the number of steps and cutting film handling wherever possible. The first product line consists of the model 100 recorder, the model 200 copier, and the model 300 display terminal.

The 100 recorder reads 9-track, 800-bpi EBCDIC output tapes at 24 ips, transferring data at 19,200 cps. The font (similar to OCR B or the IBM "PX" train) is displayed in either Cine or Comic image orientation in the form of 7 x 10 dot matrices. The pages are made up in 64 lines of 132 characters and reduced 27.5:1. The image is photographed and transferred to a silver-halide master; the frame advance time of 35 msec is one of the quicker pulldown times seen to date.

A viewer allows checking the quality of the film as it is processed. An average page density range of 20-40% yields a processing rate of 420 to



250 pages/minute, respectively. An installation that fills every page will slow the recorder down to 150 pages/minute. The 16mm film (up to 400 feet of it) is developed and delivered dry, packaged in a cartridge, and ready for use. Chemicals for the recorder come prepackaged in sealed containers.

The control panel that leads the operator through the sequence of operations is controlled by inserting little preprogrammed job cards in a slot. These cards tell the 100 recorder the format of the input, how to set up the forms overlay, etc. The procedure appears to be no more difficult than operating a vending machine.

The master film is now ready to be displayed—but more likely it will first be duplicated on the model 200 copier. Thermal film is used, obviating a darkroom and chemicals. Film is processed approximately 40 feet/

minute, and loaded into a cartridge ready for handling.

Finally, the model 300 display unit automatically threads the finished cartridge and displays it on a 14-inch-square screen. Page numbers are displayed and readable while the information file is being scanned at speeds of more than 100 pages/second.

Either standard or COM-formatted tapes are acceptable, or the user has the option of a software package to optimize the printout. OS/360 or DOS system output is accommodated, as are PL/I and COBOL.

The model 100 recorder is priced at \$49,950; the model 200 copier is priced at \$6950; and each model 300 display unit is \$695. The equipment can also be leased. QUANTOR CORP., Cupertino, Calif. For information:

CIRCLE 367 ON READER CARD

Off-line Printing

Two 1,100-lpm IBM 1403 printers, a 64K byte minicomputer, and a tty are the basic ingredients of the Data-Print computer-controlled off-line printing system. Alternative configurations include the two printers, plus four tape units and/or four disc drives of either the 2311 or 2314 type.

The software is responsible for



driving the printers, as well as allowing different blocking factors and block sizes to be printed, and fixed

and variable record lengths to be accommodated.

Less the 1403 printers, a Data-Print tape system leases for approximately \$1165/month; a tape system capable of operating two printers leases for about \$1850. COMPUTER MACHINERY CORP., Los Angeles, Calif. For information:

CIRCLE 389 ON READER CARD

(Continued on page 157)

Family planning with the 16-bit PDP-11.

The PDP-11 family is a remarkably compatible one: PDP-11/15, PDP-11/20, with more to come. All 16-bit machines, all in the same software tradition, all compatible. Start with the PDP-11 that fits today's application and today's budget. Tomorrow is another day - but not another computer, because you simply add to or modify the configuration, the size, the power, the I/O devices, and the software that you need. Without leaving home, without even a family argument.

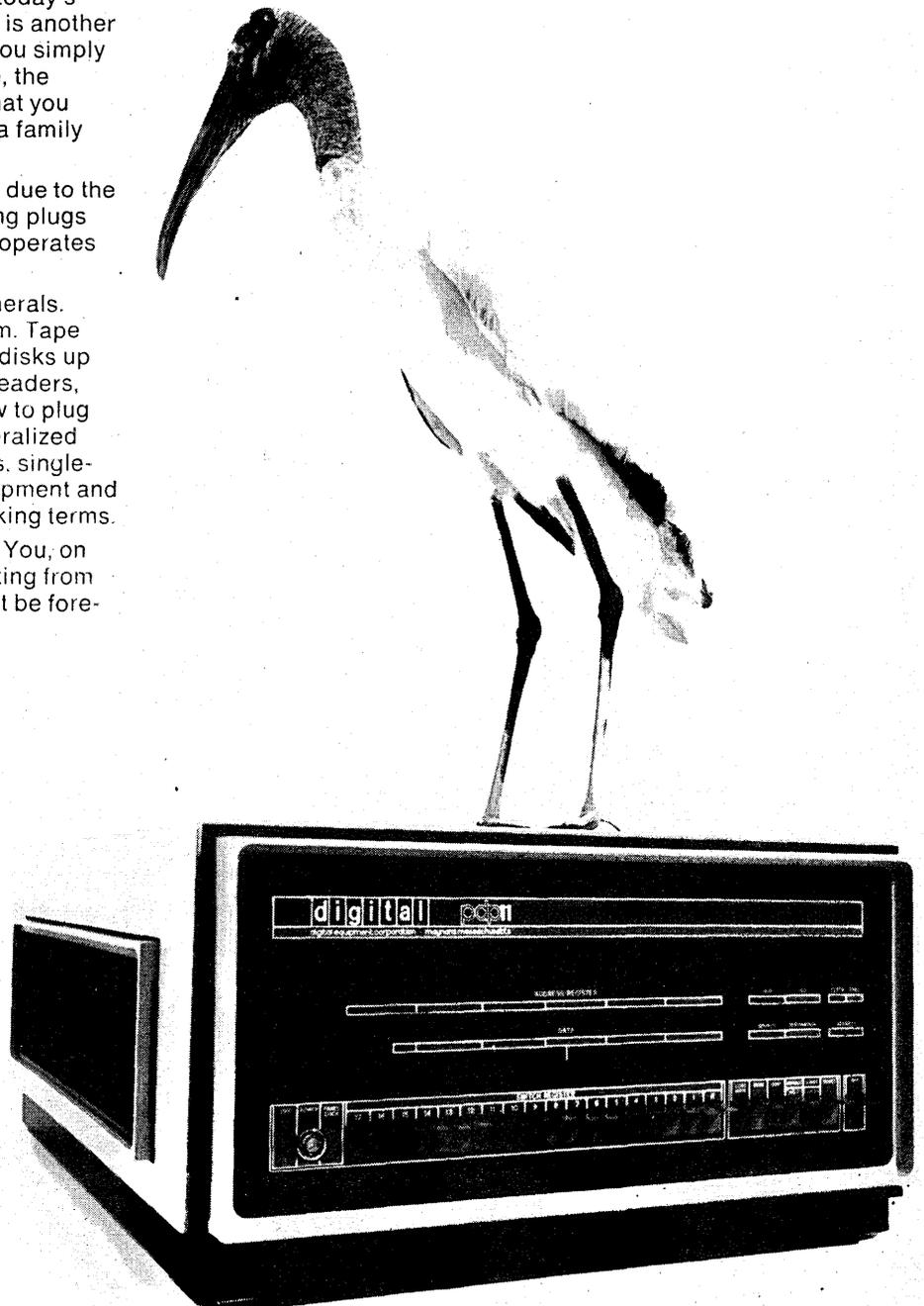
Such compatibility and expandability is all due to the remarkable UNIBUS™, into which everything plugs without modification, on which everything operates asynchronously and independently.

And that brings up the other kinfolk, peripherals. We've not only planned them, we *have* them. Tape readers and punches, magnetic DECtape, disks up to several megawords, line printers, card readers, A/D and D/A converters. They're ready now to plug in. So are scopes, read-only memory, generalized device interfaces, clocks, remote terminals, single-line and multiplexed communications equipment and lots of software to keep the family on speaking terms.

As you can see, we planned a large family. You, on the other hand, can be more modest - starting from \$6,200 with a 4K memory, discountable. But be forewarned, a PDP-11 grows on you.

digital

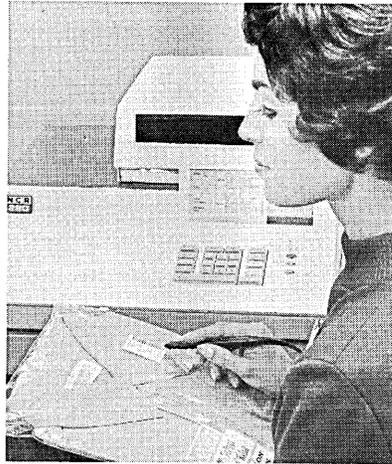
Digital Equipment Corporation
Maynard, Mass. 01754. (617) 897-5111



Off-line Point-of-Sale

This point-of-sale system for use in retail stores was apparently designed to provide maximum simplicity in operation and implementation. It is off-line, pooling information from up to 48 electronic cash register terminals onto a single reel of 9-track, 800 bpi tape. The cash register includes its own miniprocessor with 256-byte memory and uses an optical "wand"—resembling a penlight on a cord—for scanning of color-encoded labels, credit cards, ID cards, etc. The register also features a display which steps the operator through a transaction, something like displays found on certain key-to-tape systems.

The system should not be difficult to integrate into any store, since it can be used concurrently with older



equipment. Information encoded on the labels, such as product identification and price, may also be entered manually by the operator, just as on

an ordinary cash register. In addition to performing functions such as calculation of totals, taxes, and discounts, the register can also verify credit. And, of course, all of these details are recorded on tape for later processing.

The system is priced by components and is available for sale only: The cash register, designated 280, costs \$3470; the model 723 data collector (tape unit) is \$9,600-19,100 depending on how many registers it serves; the 785 wand is \$850; and the 747 tag printer, capable of encoding 175 tags/minute, is \$10,450. Lead time for delivery plus training of user personnel is about nine months. NCR, Dayton, Ohio. For information:

CIRCLE 369 ON READER CARD

Modem

Better performance on dial-up lines than is currently available on most leased lines is claimed by the developers of the MARQ-48 modem. Built-in error controls subtract about 300 baud from the unit's 5,100 design speed, leaving 4,800 baud for full- and half-duplex operation. A different technique than the Binary Synchronous Communication of IBM is used, and the vendor says the chance of undetected bit errors is 1/1000 that of the BSC method.

Compatible with the Bell 201A modem, the MARQ-48 is also EIA RS-232 B/C compatible. The single-unit

price is \$5950. PARADYNE CORP., Clearwater, Fla. For information:

CIRCLE 368 ON READER CARD

Teletype Interface

The Teletype Port Interface enables the attachment of the vendor's T4002 graphic terminal with a minicomputer using tty electronics. Data is transferred serially by the ASCII-compatible interface in full-duplex mode up to 125KB.

When operating the T4002 with the tty and either a DEC PDP-8/I, PDP-

8/L, Data General Nova or Supernova, or H-P 2114, 2115, or 2116 minis, standard computer/terminal procedures are followed while executing programs. To switch from T4002 to tty operation, a button is pressed that disconnects the graphic display and changes the baud rate to 110. This operation may be electronically controlled. A modem is optionally available to the interface unit, which is priced at \$750. TEKTRONIX, INC., Beaverton, Ore. For information:

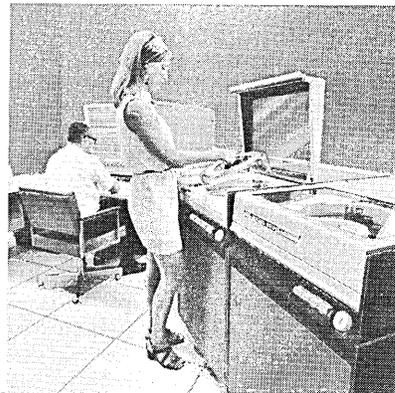
CIRCLE 371 ON READER CARD

Disc Storage

For years to come there will be computers that don't have block multiplexor channels required to run the IBM 3330 disc storage, and management may be unwilling to pay out the \$357K required to buy a 3330 even if it could be attached. So the 2314 disc storage unit might be with us for some time. Or, maybe it won't be if this vendor has its way, because the 23141 is plug compatible with the 2314, but offers 35 msec average access time compared to the 2314's 60 or 75 msec access time, and for less money.

From one to eight 29 megabyte model 23121 disc packs can be attached to the 23141 controller, plus one additional pack as an off-line spare. The data transfer rate of 312KB is the same as the 2314.

A three-year lease for the control-



ler and eight disc packs is \$4312 a month, or they can be purchased for \$187,500. A smaller configuration (four packs) on the same length contract will be \$2587/month, or \$113,500 on purchase. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 373 ON READER CARD

Fiche Reader

Up to 75,000 pages of microfiche data can be stored and accessed randomly on the Remkard. The tabletop display holds up to 750 6 x 4-inch microfiche, each in a binary coded clip. By pressing control keys, the operator can select any of the documents stored on the fiche for display at original size.

Remkard, due to its binary code control, can also be used on-line with a central processor as an inquiry terminal for display of static data.

The price of the microfiche terminal is \$4750. Remkard can also be leased for \$198/month. OFFICE SYSTEMS DIV. of REMINGTON RAND, Marietta, Ohio. For information:

CIRCLE 372 ON READER CARD

(Continued on page 161)





**Now there's
a better way.**

**Our new DOS brings
batch processing costs
down to
\$765 a month.**

If you've been hanging on to old-fashioned ways because you thought a computer was too expensive, think again. Our new Disc Operating System brings the cost of computation and general purpose processing right down to where your budget lives.

With our new DOS, you'll easily create, check out and run your own programs. Use it for scientific calculations, business-accounting functions, information retrieval, inventory control, school administration — in fact, problem-solving of all kinds.

Anyone who can poke a typewriter key or pencil-mark a card can use our DOS. Because the assembly (or compilation), loading and execution of your programs are under the control of a teleprinter keyboard or batch input device.

On the other hand, if you're already batch processing with another system, give this a thought. Our DOS can probably do everything you're doing now — for about half the cost.

Because both the software and the hardware are fully modular, our DOS accommodates the needs of many different applications. Lets you vary the number of input/output devices. Add more core memory. Use a card reader as well as teleprinter. Add a line printer, paper tape punch, photo reader and magnetic tape. Other advantages include software protection and program segmentation. Plus automatic program retention so your programs can be easily reused.

Our basic DOS includes an 8K computer with direct memory access, 2.4 million-character disc, one teleprinter and one high-speed paper tape reader. Price is just \$35,600. Or \$765 per month on a five-year lease. And it's upward expandable for your future needs.

Get the full story by calling your local HP computer specialist. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT  PACKARD

DIGITAL COMPUTERS

CIRCLE 126 ON READER CARD

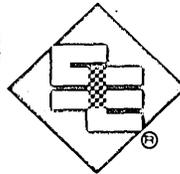
*Sorry, we can't tell you the trouble-free
life of a SLO-SYN® Photoelectric Tape Reader.
We started one at 9 a.m. on Feb. 6, 1968
... it's still going!*

No maintenance, no foolin'. We did wipe the dust off the lens and diodes several times, but at 125 characters a second, hour after hour, year in and year out, it never went to sleep. In fact, never a wink or a blink.

There are reasons for this reliability. Because there are only three moving parts — the precision stepping motors — there are no detents, ratchets, belts or gears to create sticky maintenance problems. Constant torque reels allow high speed spooling without risk of

damage to the tape. There are 5-volt DTL and TTL compatible models and 15-volt models with bidirectional, 2-channel pulse inputs. They read all opaque and translucent tapes that have a 40 percent maximum light transmission. Types with or without reels are offered.

For additional information and top performance, economy price, write, wire or phone The Superior Electric Company, Bristol, Connecticut 06010. Phone 203/582-9561.



SUPERIOR ELECTRIC



Display System

Display systems with combined raster and calligraphic capabilities have tended to be scientific curiosity pieces, existing in the main—if not solely—in research laboratories. This vendor, however, believes its CHS-1 may be the first display on the commercial market that has capabilities to display both line drawings and full video images.

Color and black-and-white images can be presented on the unit's video monitor. Seven gray levels are visible on its 1000 x 1000 addressable loca-

tions. Composite video output of 525 lines is generated.

The vendor says the device is ideal for time-shared applications where remote graphics are needed. The speed of the unit is as follows: settling, 8 usec maximum; writing, 2-11 usec; and erase, .3 seconds. Maximum storage time is five minutes.

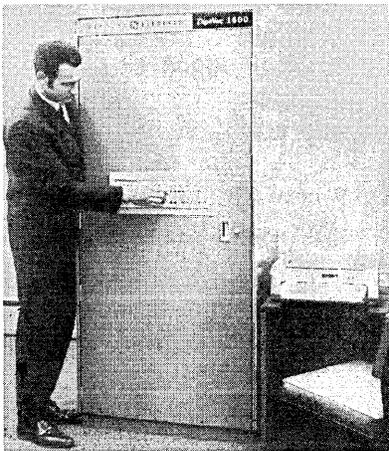
The unit, which is intended initially to see use in the medical field, is priced at \$6K. COMPUTER SYSTEMS FOR MEDICINE INC., Boston, Mass. For information:

CIRCLE 401 ON READER CARD

Quiet Teletypewriter

Six months ago this vendor was offering acoustic enclosures for tty's. Now they're busy installing them on ASR33s, with paper tape reader/punch and either a hard wire or acoustic coupler, and selling the package for \$1459. The terminals can also be rented for \$50/month on a 36-month contract. DATA TERMINALS CO., San Jose, Calif. For information:

CIRCLE 262 ON READER CARD



Commo Concentrator

The DigiNet 1600 stored program communications concentrator is built around processor logic and 4-32K of storage. Because of its programmability, the device is not only easily configured for any communication network, it is also readily adaptable as a communication preprocessor. Line maintenance overhead for the unit is said to be 5-6% of processor power, giving it time to handle such things as error detection, message recovery, and speed and code conversion.

DigiNet 1600 can handle up to 256 low-speed lines in any variety of

110, 134.5, 150, and 300 baud. High-speed lines can also be intermixed. Top channel speed for the concentrator is 9600 baud.

The basic DigiNet 1600 configuration provides processor and memory and sufficient rack space for 60 line endings with modems. Standard processor software is included, plus packages to facilitate use with GE computers and GE's Mark II time-share service.

Price of an average DigiNet 1600 is between \$30K and \$50K, or from \$800 to \$1500/line. GE, Lynchburg, Va. For information:

CIRCLE 377 ON READER CARD

Data Collection

The TU 100 series of data collection and inquiry devices can incorporate punched card, credit card, and badge reader capabilities with its standard 10-key numeric keyboard and 48-character, 15-cps printer. Due to the selection of input options and standard features, the manufacturer says the terminals will find on-line use in such applications as inventory control in factories and warehouses, product and personnel data collection in manufacturing and commercial establishments, and patient data collection in hospitals.

The terminals can be used singly



with direct lines to a CPU or in multi-station configurations. A controller/concentrator, the TU 920, is available for the multistation system. It has a

1200- or 1800-baud channel for CPU connection of up to 20 TU 100s, which operate at 150 baud. Buffer memory for the TU 920 can range from 512 to 2K characters.

The TU 100 terminals have lease prices ranging from \$55 to \$75 a month; the purchase price ranges from \$2400 to \$3000. The TU 920 monthly price is \$125 to \$170 and purchase price range is \$5200 to \$7300. Delivery of the units is expected to begin in April 1971. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 379 ON READER CARD

Terminal System

The Datamanager remote terminal system is a minicomputer repackaged by its manufacturer. The 4-8K business-oriented CPU has been combined with 360-compatible software, communications interfacing, up to 32K of memory, and a string of peripheral devices.

Software consists of an assembler that also operates on IBM 360s; utility routines for card reader, line printer, tape drives, disc drives, CRTs and consoles; and a report program generator. Communications programming includes an IBM 2780 emulator package, remote job entry and ILASP-compatible batch processing.

The manufacturer is pricing a

“medium capabilities” configuration of the system at \$50,100. This consists of the 2780 package, 8K of core, full instruction set, 400-cpm reader, 300-lpm chain printer, 25-ips 9-track tape unit, and maintenance contract. ATRON CORP., St. Paul, Minn. For information:

CIRCLE 383 ON READER CARD

(Continued on page 163)

the real
\$39 a month
CRT terminal
from
the real real-time people



Somebody promised you a \$39 computer terminal. Bunker-Ramo delivers — the 2210.

It breaks the \$\$\$ barrier for on-line terminals at bank teller stations, factory assembly points, hospital wards, credit departments, utilities, warehouses and countless other locations.

The 2210 has all the necessary features: tab, fixed format, skip, computer-call, variable lay-out, conversational mode, plus a special block keyboard

for easy operation by non-typists. Interfaces with present data processing systems without costly modifications.

Price includes maintenance by Bunker-Ramo's nationwide field service staff.

Before you install any — or buy more — CRT's, see the 2210 at the Fall Joint Computer Conference. Or write for information.

The real real-time people



THE BUNKER-RAMO CORPORATION

Business & Industry Division

445 Fairfield Avenue, Stamford, Connecticut 06904. Phone: (203) 348-4291

S/3 Card Equipment

The models 9601 and 9610 punch/verifiers differ only in that the 9610 interprets the card during either punching or verifying operations. The effective feed rate of the units is 250 cpm, and the standard punching rate is 60 cpm. Card duping is done at a 45-cpm rate. Both units have 600- and a 400-card capacity input stackers and two 400-card capacity output stackers. The 9601 will be available next month, with the 9610 expected to be ready next March. The 9601 is priced at

\$5900, and the 9610 is set for \$7400.

A numeric sorting rate of 1500 cpm is claimed for the model 9620 card sorter. Cards are sorted into eleven 1200-card capacity pockets. Available next March, the 9620 is priced at \$5600.

Compatibility with 80-col. card systems is a major feature of the model 9630 card reader. It is available in two versions: the -01 with interface electronics, power supply, controls and connectors compatible with the multiplexor channel of the 360/25 and up; and the -02, a table-top unit with basic controls and a

buffer memory for oem use.

Read rate of the 9630 is 1200 cpm, and multiple-sense-read checking is standard. It has a 2000-card input stacker and three 1200-card output stackers. Automatic overflow shifts output to the secondary stacker when the primary is filled so that operation can continue while cards are removed. The price of the 9630-01 is \$5800, and the oem model -02 is \$4500. These units are available now. **DECISION DATA CORP.**, Warminster, Pa. For information:

CIRCLE 378 ON READER CARD

Communications Interface

One almost has to feel sorry for IBM. Vendors keep duplicating various components and maybe even improving them. The latest frontal assault concerns the IBM 2701/2/3 data adapter/telecommunications controller, which this vendor feels can be very nicely removed and replaced by the IDS-64/360.

A MAC-16 mini is used to control from 1 to 256 synchronous or asyn-

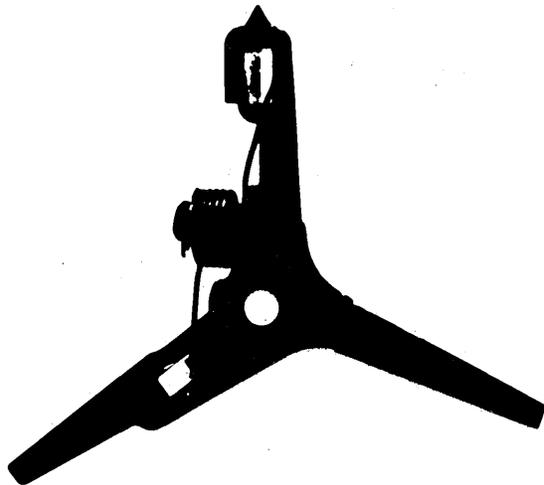
chronous lines. Synchronous communication from 2,000 to 50,000 baud is claimed, with asynchronous rates ranging from 45 to 2,000 baud. The unit is a plug-in replacement for the 2701/2/3. Local terminals attach through VCA interfaces while remote terminals attach through standard EIA RS-232 or rwx lines. Error recovery procedures are taken out of the 360's hands by the 64/360.

A dp installation that has outfitted its 360 with a 2702 (\$39K) or a

2703 (\$67K) might look into the possibilities of the 64/360 with its price of \$30K plus \$365 for every two asynchronous lines and/or \$500 for every two synchronous lines. Later models of the 64/360 will relieve the 360 system of BTAM and QTAM responsibilities. **INTERACTIVE DATA SYSTEMS**, Irvine, Calif. For information:

CIRCLE 370 ON READER CARD

(Continued on page 165)



MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohall) during the FJCC.

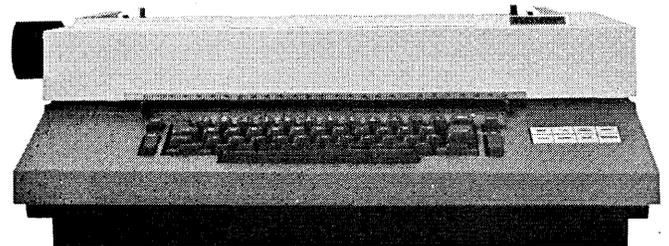
TRACOR DATA SYSTEMS



4201 Ed Bluestein Blvd., Austin, Texas 78721

CIRCLE 63 ON READER CARD

November 15, 1970



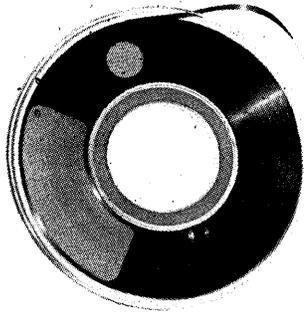
All Novar terminals can be equipped with built-in modems that offer the best signal-to-noise ratios available — reducing to a minimum errors introduced by noisy phone lines. One of many Novar features that assure data accuracy.

Novar Corporation • 2370 Charleston Road
Mountain View, Calif. 94040 • (415) 964-3900
Offices In All Principal Cities

NOVAR

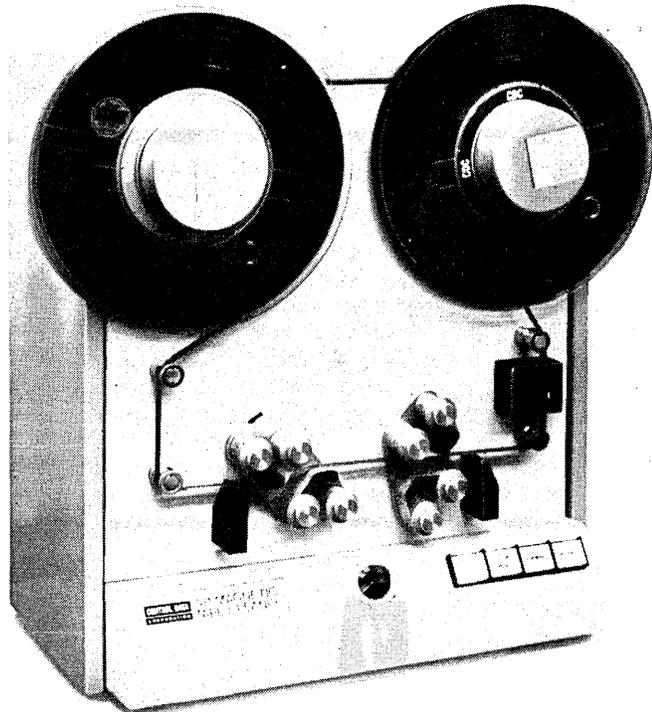
A Part of General Telephone and Electronics

CIRCLE 9 ON READER CARD



This tape will self-destruct.

This will keep it alive.



It's a fact of life. Tapes destroy themselves during normal computer operation.

Wear particles of oxide accumulate causing head to tape separation. Which causes 90% of all tape errors. Which means lost data. Missed deadlines.

Can tapes be saved? The mission is possible if you install a CDC® 781 Magnetic Tape Cleaner.

It removes the contaminating wear particles. Eliminates the static build-up which makes them adhere.

So your tape reads like it should. And you aren't faced with the cost of re-creating data, or the hidden cost of read-skips.

Also, the CDC 781 eliminates storage and handling problems. Because it rewinds with perfect stacking and tension.

Easy to operate, too. Just load and let it run. It stops when the tapes are clean. Automatically.

The CDC 781. It saves tapes. And you and your computer save time and money.

In 15 seconds, you can stop the self-destruction in your installation. Call collect on our Hot Line (612) 884-8195. Or circle the number below.

Business Products Operations
Dept. 351
Control Data Corporation
P.O. Box 1980
Minneapolis, Minnesota 55111

CONTROL DATA
CORPORATION

DATAMATION

Mini Voice Response Units

STAR (Sequential Talking Audio Response) is a single-line voice response system for the PDP-8 computer and the 403-E3 data set. The manufacturer will on request configure it for other minis.

Central to the system is a film drum with control electronics and a photo sensor for reading the words and phrases. The messages are recorded as analog pulses on reverse

negative film. A 3-inch, 32-word capacity drum is used for STAR.

The system is available 90 days ARO with interface and cabling, executive software, and vocabulary prepared to user specifications. The price of STAR is \$3995. COGNITRONICS CORP., Mt. Kisco, N.Y. For information:

CIRCLE 374 ON READER CARD

Data Collection

Here is an interesting little gadget—it translates Touch-Tone telephone signals into information that a key-to-tape unit can understand. The translator plugs into most key-to-tape systems currently available, and leases for \$65-75/month. GENERAL COMPUTER SERVICE, INC., El Paso, Texas. For information:

CIRCLE 382 ON READER CARD

Controlled Plotting

Connection to a Hewlett-Packard 2114 minicomputer provides the model 1223 plotter with stored program control and 70-step lookahead. The computer combination also makes the plotter applicable to space vehicle tracking, display of intelligence data, map making, statistical analysis, preparation of schematics, logic diagrams, and aircraft design.

Computer control is said to enhance reliability, simplify and speed operation, and ease alteration of the

system's basic capabilities. It allows use of parameter entry statements to control system functions and runs the plotter at optimum speeds through calculations based on the lookahead ability. Speed is also achieved through automatic linear and circular interpolation in absolute or incremental formats.

Model 1223 has a 34 x 44-inch aluminum drawing surface with vacuum hold-down. Standard velocity is 600 inches/minute. Accuracy is plus or minus .004 inch and repeatability is plus or minus .0025 inch resolu-

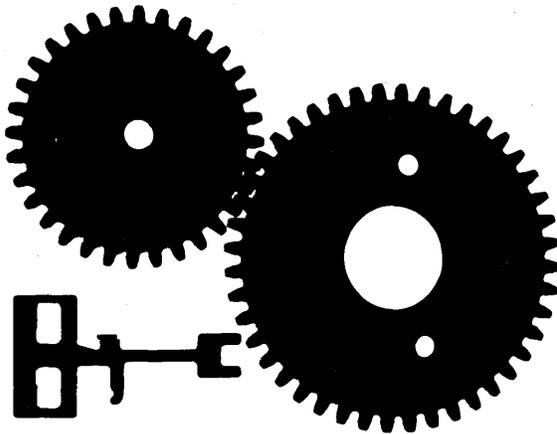
tion. A variety of heads are available.

Standard input for the plotter system is a 400 cps bidirectional punched-tape reader and teletypewriter. Magnetic tape input is optional.

The system—plotter, 8K computer with full software, and I/O devices—is available three to four months ARO for \$80,000. THE GERBER SCIENTIFIC INSTRUMENT CO., South Windsor, Conn. For information:

CIRCLE 381 ON READER CARD

(Continued on page 167)



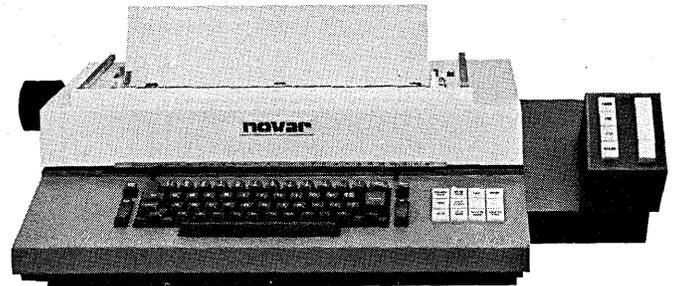
MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohalla) during the FJCC.

TRACOR DATA SYSTEMS
4201 Ed Bluestein Blvd., Austin, Texas 78721

CIRCLE 59 ON READER CARD

November 15, 1970



This one can reduce phone costs up to 94% since it can transmit a full day's typing from magnetic tape during a 3-minute phone call.

That's a lot of dollars saved in any telecommunication system. Ask about the 5-50 and 5-51.

Novar Corporation • 2370 Charleston Road
Mountain View, Calif. 94040 • (415) 964-3900
Offices In All Principal Cities

NOVAR
A Part of General Telephone and Electronics

CIRCLE 10 ON READER CARD

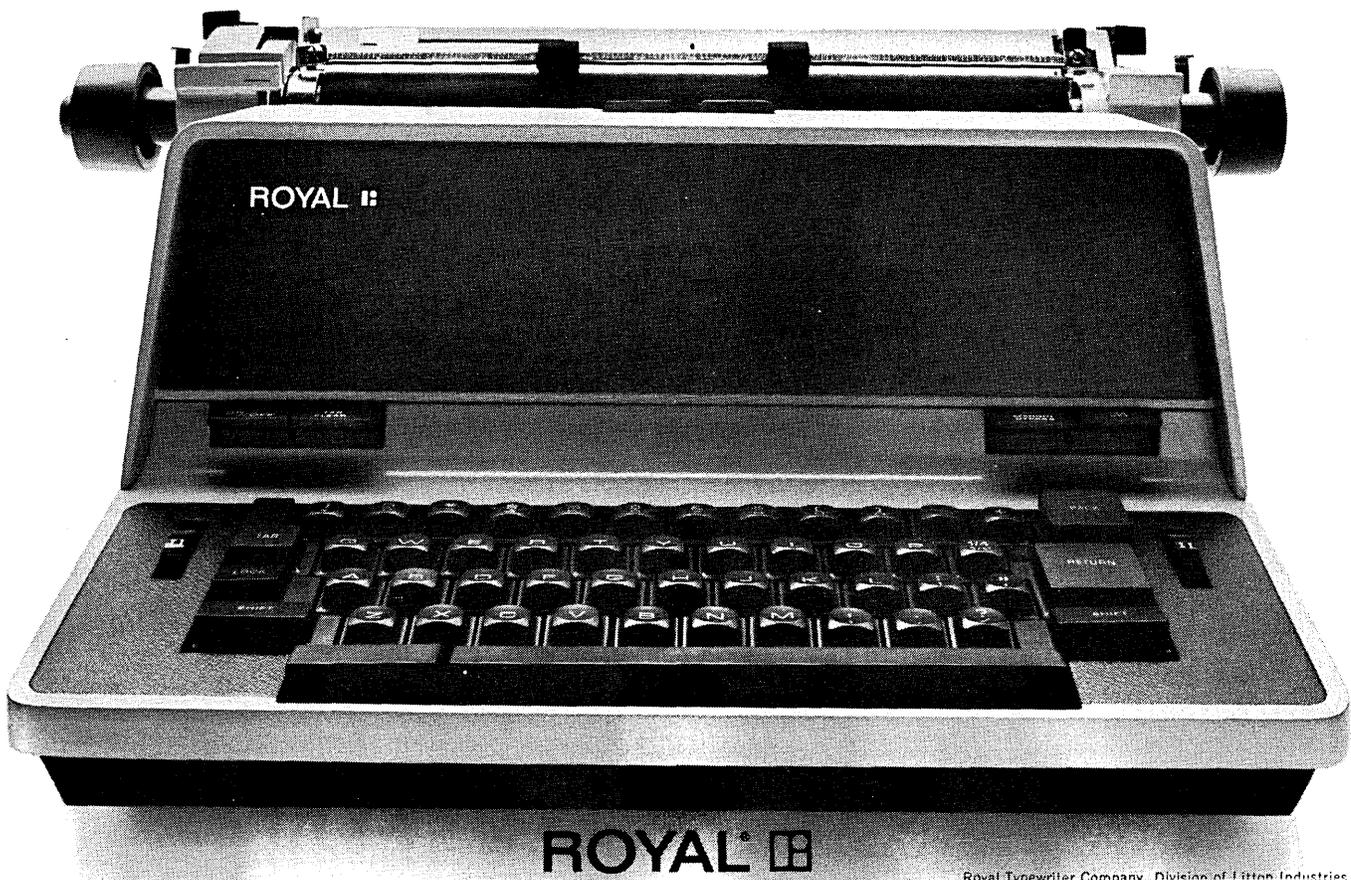
A Royal OCR typewriter cuts reader rejection two ways.

Way 1:

The machine. The Royal Model 568 offers unequalled consistency of impressions. It's been especially designed and heavily reinforced to maintain the precise alignment of characters critical to efficient OCR operation. While it costs more than other Royal typewriters, it still saves you money. First, because it permits a greater daily output without sacrificing Reader acceptability. As a result more data is produced by each operator, and Reader correction passes are eliminated. Second, because it is already equipped with the scannable lower case alphabet, there will be no future expense when lower case Readers are installed. Add to this the 568's rugged construction for trouble-free operation plus service from 1,000 factory-trained locations, and you'll understand the first way it cuts rejections.

Way 2:

The operator. The Royal 568 works like a conventional typewriter. There's no special training needed, so a typist can concentrate on OCR procedure. A special touch control allows typists to adjust the keyboard to suit their own preference. The result: increased accuracy, speed, and confidence. The 568's conventional carriage also facilitates quick, precise form alignment. And because the writing line is visible, there's no guesswork on the printing point. In addition, its precise type bar action eliminates the danger of erroneous characters that can go undetected—an experience you have with some other OCR typewriters. And because the Royal 568 has built-in capability for both OCR and correspondence, it is always ready for any task. Don't take our word for it. Let our consulting representative arrange for your typists to use the Royal 568 under actual working conditions. You'll find him listed in your local telephone directory.



Royal Typewriter Company, Division of Litton Industries

On-line Microfilmer

Designed expressly for on-line COM applications, the Micromation On-Line Microfilmer model 4200 unit can be called MOM for short. It can be attached to any IBM 360 model above the 20, and converts EBCDIC text directly to microfilm. It prints output data at a transfer rate of up to 30,000 lpm. Throughput is quoted as 13,000 lpm, and data is transferred at rates up to 60,000 cps using the vendor's patented shaped beam tube

process.

Included in the price of \$49K is the vendor's Universal camera, allowing output to be printed on roll film or microfiche at either 25X or 42X reduction ratios. At 42X, a 4 x 6-inch microfiche can contain up to 224 frames of data. Sixteen mm roll film can be coded with sequential retrieval marks and recorded "one-up" with a frame occupying most of the width of the film. Or, the camera can print images two-up by reducing the image size to 42X and moving

the recording lens across the width of the film.

The 4200 also has the capability of superimposing preprinted background forms over the displayed data, eliminating the need for pre-printed forms.

First deliveries will be in the second quarter of next year, and MOM can also be leased. STROMBERG DATAGRAPHIX, INC., San Diego, Calif. For information:

CIRCLE 260 ON READER CARD

Off-line Printout

The abundance of tasks for the computer and the desire for greater price/performance ratios appear to be forcing a proliferation of special systems for communication, data acquisition, store and forward—you name it, and some systems entrepreneur is trying to raise money to produce it.

Here is a system to relieve large computers of printing chores. Built around a small 16-bit cpu—MSI circuitry, 200 nsec ROM, modular 1.1

usec core (4-32K)—it is for off-line batch operation. The printer is a 132-column, 1100-2000 lpm unit. Input is from an IBM-formatted tape.

Options are card-to-tape input editing and processing, and a data communication adaptor for on-line operation.

The printer is designated the ASC 1100 System. It will become available in the first quarter of 1971. Deliveries are expected to be scheduled seven months ARO. The lease price of the system will be about \$200 a month. No purchase price has been

set. The maintenance contract will add about \$200 to the monthly rent, and the maintenance will come from Honeywell, who supplies the pc boards. APPLIED SYSTEMS CORP., Detroit, Mich. For information:

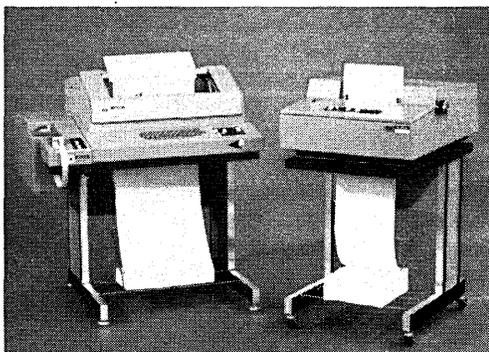
CIRCLE 261 ON READER CARD

For additional new products being introduced this month, please refer to the FJCC Product Preview section starting on page 80 of this issue. ■

We're very compatible

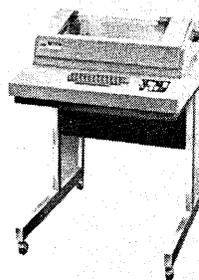
Whether your application is time-sharing, communications or special purpose . . . we will help you get the job done faster, easier and at lower cost. We know that's saying a lot . . . and we love to be asked to prove it!

See us at the FJCC Show . . . Booths 2403-5-7



ASR-300

ALPHA



BETA

The ASR-300 paper tape punch/reader provides: Automatic sending/receiving; data recording/play-back; and paper tape interpretation, duplication and editing.

The Alpha is a 300 line-per-minute printer which makes up to six copies and is priced almost \$1,000 lower than its nearest competitor.

The Beta interactive computer terminal is three times faster than conventional teleprinters and capable of making up to five carbon copies.



SYNER-DATA, INC.
133 Brimbal Avenue, Beverly, Ma. 01915
SYNER-DATA CANADA, LTD., 130 Rivalda Rd.
Weston, Ontario, Can.



SYNER-DATA SALES AND LEASING/OEM SALES: SYNER-DATA, INC., 133 Brimbal Ave., Beverly, Mass. 01915, (617)927-3222 • SYNER-DATA, INC., 1570 East Edinger Ave., Santa Ana, Calif. 92705, (714)836-1944 • SYNER-DATA CANADA, LTD., 130 Rivalda Rd., Weston, Ontario, Canada, (416)742-7804 • DATABASE, LTD., 22-25 Finsbury Sq., London EC2, England, 01-638-8774 • DISTRIBUTOR LEASING/SERVICE: NATIONAL DATA COMMUNICATIONS SYSTEMS, INC., 59 Union Sq., Somerville, Mass. 02143, (617)623-7800 • DATA AUTOMATION COMMUNICATIONS, INC., Plainville, N. Y., (516)433-1330 • Edina, Minn., (612)941-5880 • Birmingham, Mich., (313)399-4711/645-9394 • Niles, Ill., (312)647-0166 • Colorado Springs, Colo., (303)634-5479 • Dallas, Tex., (214)637-2403 • San Diego, Calif., (714)297-6821 • Los Altos, Calif., (415)957-9506

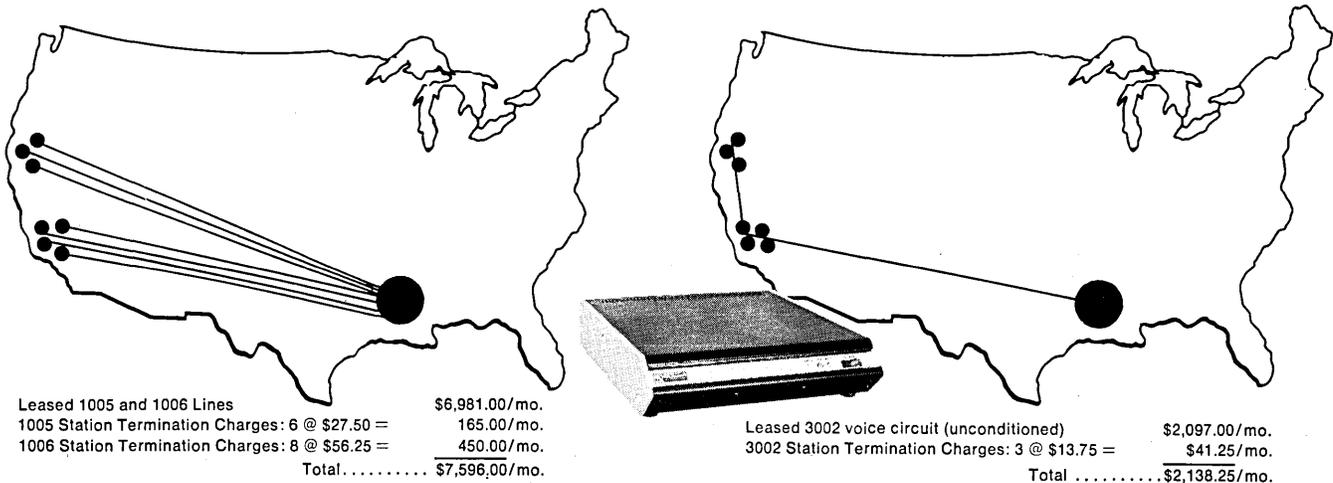
CIRCLE 133 ON READER CARD

How Data Products DataPak FDM Multiplex-Modem reduces data communications costs.

An \$8300 purchase saves one user \$65,493 a year.

(actual \$65,493 out-of-pocket savings)

Take this network we recently installed. The CPU interface is in Houston. There are 7 West Coast locations of 75, 110 and 150 baud terminals. The monthly data communications costs were over \$7500 a month. Our customer, with no system software or operational changes, converted his system to DataPak™. New monthly costs: less than \$2200. Capital expenditure just \$8300. Actual yearly savings: \$65,493. Here's documentation.



If you have a data network using 10, 15, 30 or 60 cps terminals let us analyze your system with our computerized DataPlan program. Your savings will probably be as great or even greater. Your comptroller will love you. ■ OEM TERMINAL MANUFACTURERS: Consider what DataPak's system cost reduction would mean to the saleability of your terminal. Then talk to us about our plug-in OEM DataPak Module for integration into your terminal. No other FDM Multiplex-Modem has DataPak range of transmission rates. Or flexible channel speed/bandwidth intermix. Operation can be synchronous or asynchronous. Speeds range from 75 to 1800 b/s, and DataPak is compatible with all types of terminal and line inter-

faces. That's about what you'd expect from a company that's been a supplier of data communications products to common carriers for 20 years. Data Products, of course, is a major supplier for the entire EDP industry. Peripherals, like the Satellite Printer. Memory systems like our Large Core Store. And data communications innovations like our DataPak and DataPlan. Let us show you how Data Products can give *your* communications the edge. Call Terry Edwards at: 203-325-4161



DATA PRODUCTS

telecommunications division 17 Amelia Place, Stamford, Connecticut 06904

.See us at booth 1701-1703 FJCC

TOTELCOM

NEW FROM COMPUTER COMMUNICATIONS . . . CC-335 — A TOTALLY TELETYPE-COMPATIBLE TELECOMMUNICATIONS DISPLAY

Compact dimensions and lightweight, solid-state construction mean TOTELCOM can go with you anywhere, anytime.

Switch-selectable transmission rates of 110, 150, 300, 600, 1200 baud.



Totally self-contained unit, including built-in coupler.

Switch-selectable display of 864 or 960 characters. Twelve lines of 72 or 80 characters.

Format capability for combining both fixed and variable data in the same display.

Full- or half-duplex operation under switch selection. Character mode for conversation and block mode for editing also provided.

Powerful editing capabilities include inserting and deleting characters and lines.



TOTELCOM 335 is the latest advance from CCI. TOTELCOM is all you need for on-line, real-time computer communication anywhere, anytime. TOTELCOM is completely compatible with existing Teletype programs, programming practices, and formats regardless of the computer you're using. But TOTELCOM is more than a Teletype replacement. You get ultra-quiet performance, high resolution, flicker-free display, extensive formatting and editing capabilities, including character and line in-

sertion and deletion, switchable transmission rates from 110 to 1200 baud, and much more, all at very low cost.

TOTELCOM is easy to use, even for hunt-and-peck typists. The self-contained unit includes keyboard, CRT, refresh memory, logic system, communication interface, built-in acoustic coupler and power supply, all in its own carrying case. TOTELCOM weighs just 25 pounds and fits anywhere, including under an airline seat.

See us at Booths 3108-3114



Computer Communications, Inc.

701 W. Manchester Blvd.
Inglewood, California 90301
Telephone (213) 674-5300

George wanted to build a 3,000 mile wide computer

That may sound crazy, but Dr. George Feeney's crazy like a fox. Because he got his way—that computer exists.

I'll never forget that day I walked into his office and he said: "I want a central file you can access from anywhere in the country—or Europe, or the whole world."

(Sure, George, who's going to lay a new transatlantic cable for us?)

"And" he continued, "I only want the customer to have to pay for a local call."

(That had to be a put-on, but he's the boss. Did he have any ideas on how we pull this off?)

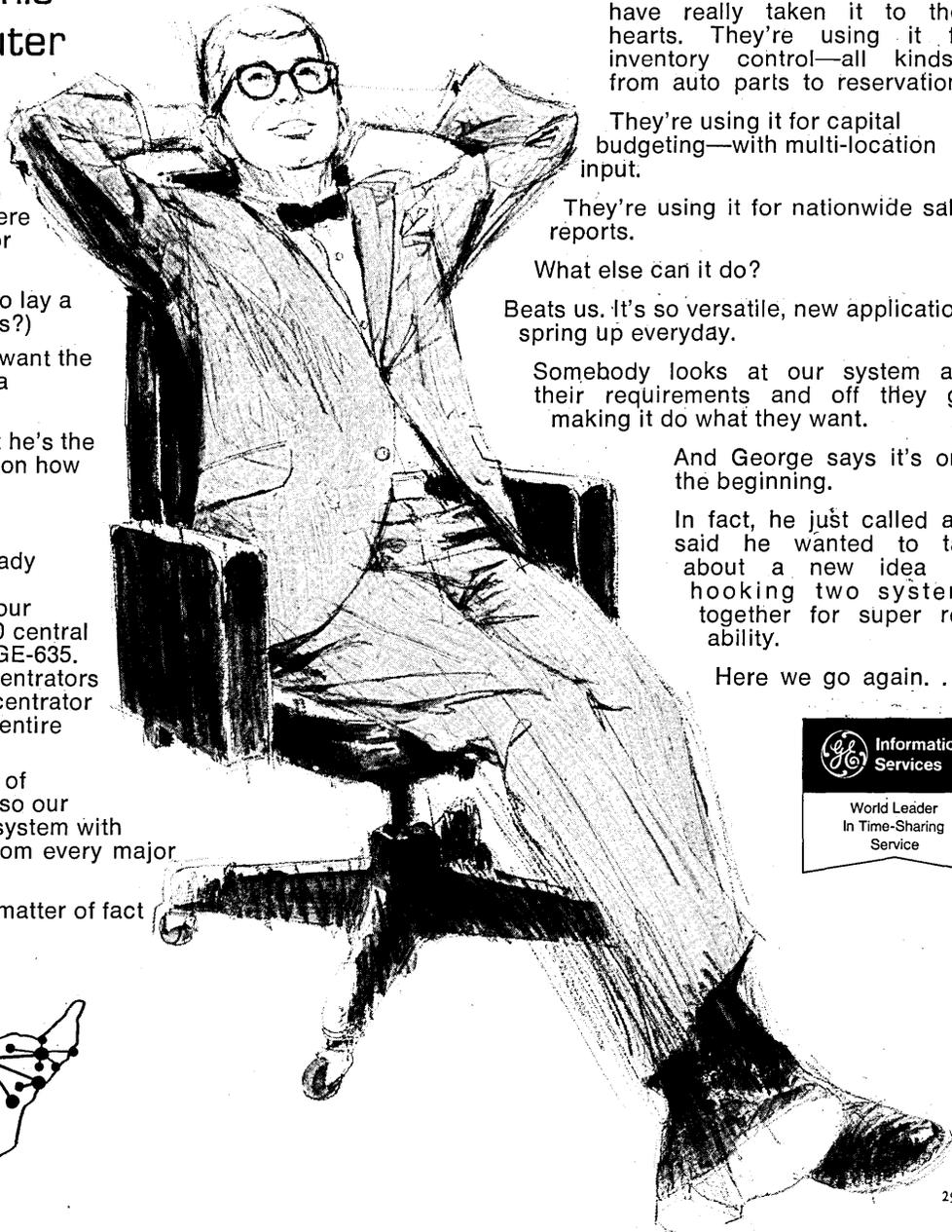
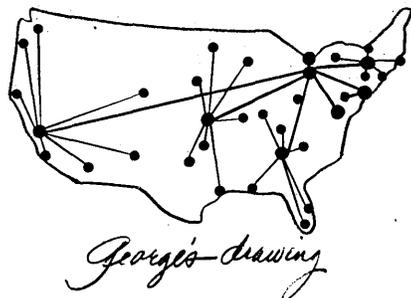
He did.

"Look," he said, "we've already developed the world's best communications system for our Mark II, using a GEPAC-4020 central concentrator hooked to the GE-635. Let's take the 8 remote concentrators that tie into that central concentrator and deploy them across the entire country.

Then, fan out a whole bunch of multiplexers from each one, so our customers can call a single system with a local telephone number from every major metropolitan area."

"You get it?", he said. As a matter of fact we didn't.

So he drew this diagram.



Then he said, "Do it. And use a satellite to get to Europe. It'll be the Time-sharing system that only EDP people can love."

We did. And they do.

Oh, yes — we call it General Electric Network Service.

And EDP men across the country have really taken it to their hearts. They're using it for inventory control—all kinds—from auto parts to reservations.

They're using it for capital budgeting—with multi-location input.

They're using it for nationwide sales reports.

What else can it do?

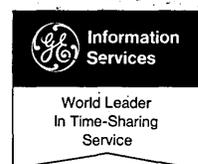
Beats us. It's so versatile, new applications spring up everyday.

Somebody looks at our system and their requirements and off they go, making it do what they want.

And George says it's only the beginning.

In fact, he just called and said he wanted to talk about a new idea for hooking two systems together for super reliability.

Here we go again. . . .



291-69

GENERAL  ELECTRIC

If our new alphanumeric digital printer didn't work, neither would thousands of Friden calculators.

But of course Friden* calculators do work. Including the thousands of electronic printing models we've sold for the past 4 years.

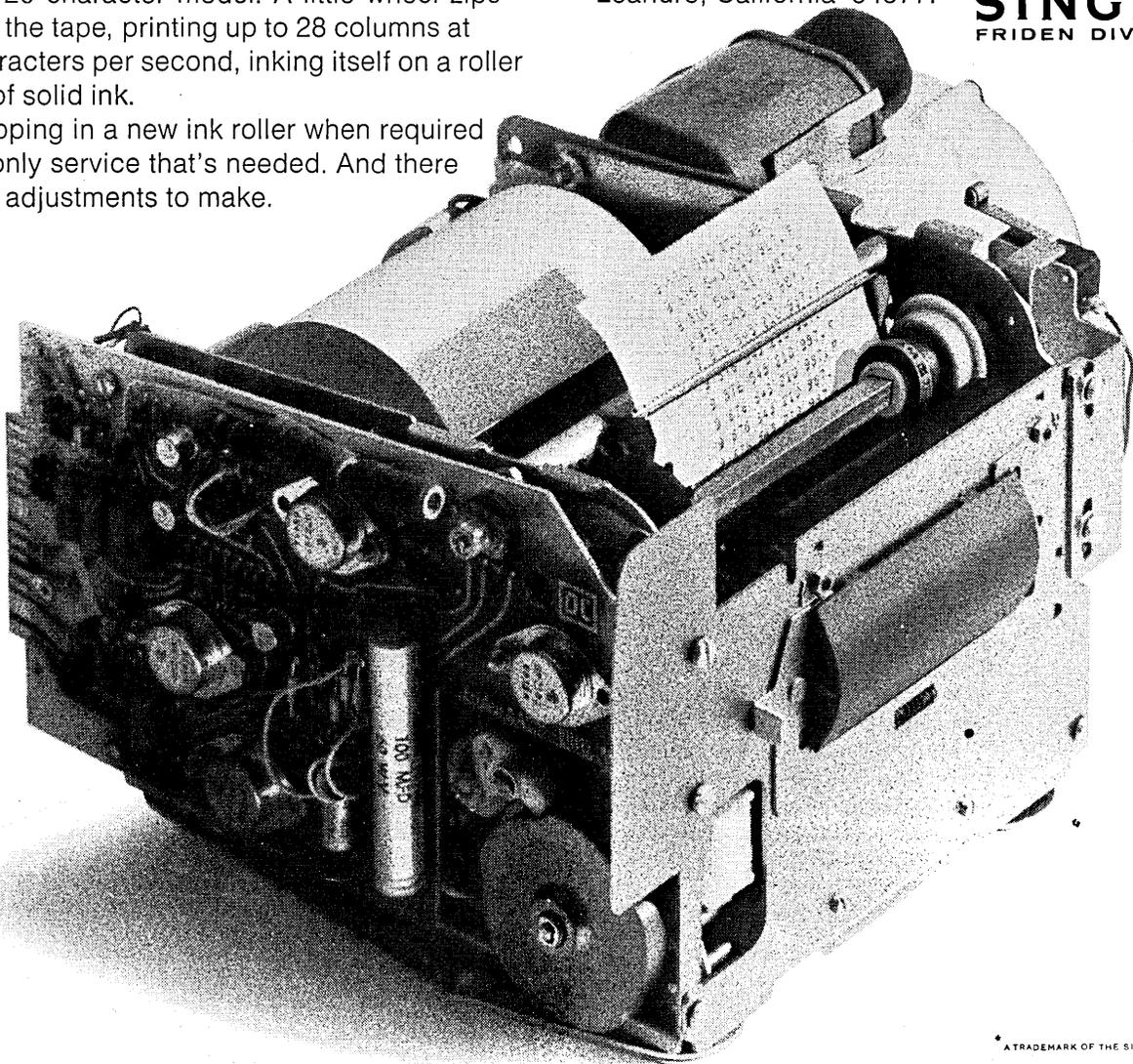
With this ad, we're introducing 30-character and 40-character alphanumeric printers, both of which work exactly the same as the standard Friden 20-character model. A little wheel zips across the tape, printing up to 28 columns at 46 characters per second, inking itself on a roller made of solid ink.

Popping in a new ink roller when required is the only service that's needed. And there are no adjustments to make.

It's a printer you can count on. Ask anybody who owns one of our calculators.

And if you'd like complete information on all three Friden digital printers, ask Mr. Gary Dotzler, Sales Manager, OEM Products, Friden Division, The Singer Company, San Leandro, California 94577.

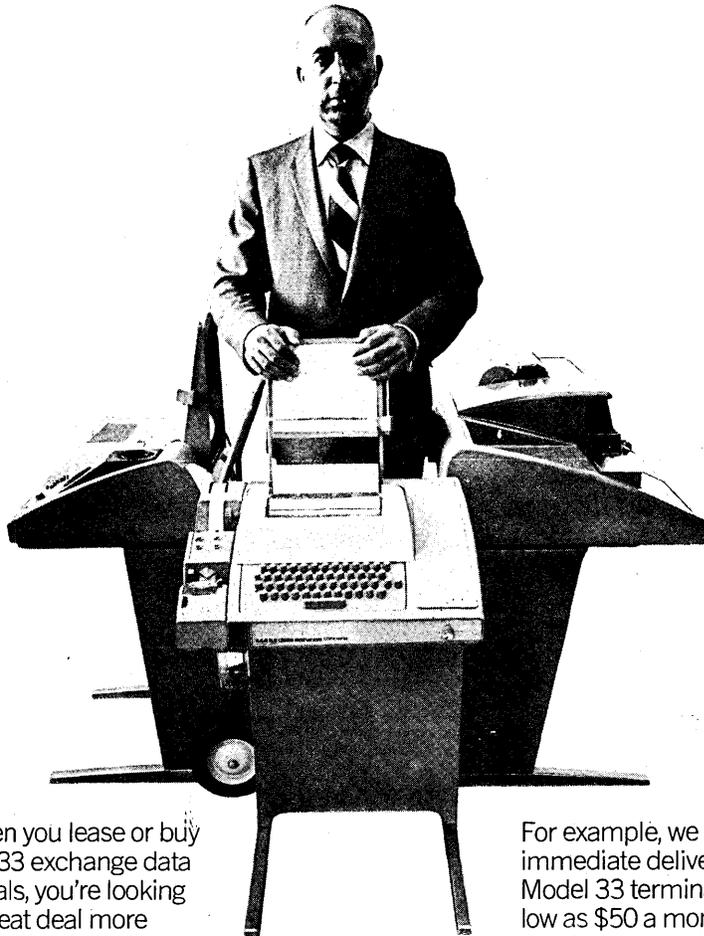
SINGER
FRIDEN DIVISION



* A TRADEMARK OF THE SINGER COMPANY

"Why we're offering you a new source for exchange data terminals."

Z.V. Zakarian, President, Western Union Data Services Company.



When you lease or buy Model 33 exchange data terminals, you're looking for a great deal more than hardware. But we both know you don't always get it.

That's why Western Union Data Services Company provides the nationwide servicing, applications engineering, training and support you need along with every data terminal we install.

As a new company that grew out of many years of communications systems experience, service is the heart of our business. Looking for more than hardware? We can help you.

For example, we can offer immediate delivery of Model 33 terminals for as low as \$50 a month, plus the

help you'll need in the months to come.

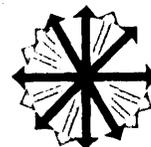
By the way, we can supply the Model 33 in three configurations permitting access to the telephone network via (1) Data-Phone (2) Data Access Arrangements or (3) Acoustic coupler to standard telephone.

Contact me at Western Union Data Services Company, 16 McKee Drive, Mahwah, New Jersey, 07430.
Phone: 201-529-4600.
Telex: 12-5077.



Western Union Data Services Company.

See us at FJCC, booth 1334.



Sigma 5/7 Debugging

Sigma 5/7 programmers can now go after assembly language bugs with TRACE. The Sigma assembly language package is used to produce printouts of program paths indicating and labeling errors. To achieve this, the programmer runs a test with a newly written program through TRACE. The package generates one line of printout per program instruction, listing 11 items including mnemonic operation codes, the register it uses, address field, condition code, effective address and its content, and affected address and its content.

TRACE uses 518 (32-bit) words and runs under BPM. It operates at printer

speed, around 600 lpm maximum. Developed by a consulting company to meet its own needs, TRACE can be purchased for \$1K. A card deck with user documentation is supplied. PENNSYLVANIA RESEARCH ASSOCIATES, INC., Philadelphia, Pa. For information:

CIRCLE 388 ON READER CARD

Mini Executive

This vendor, troubled that so many people were loading their mini-computers with paper tape input every time they wanted to do another function, wrote IDEX, which stands for Information Design. Executive. Six versions of IDEX range from ver-

sion 10, a very basic system requiring less than one hundred words on a PDP-8 (and priced at \$500) up through version 60 which has conditional statements, macro definitions, loops, index registers, and program storage on either disc or tape, etc. Version 60 with all the stops out is priced at \$6715 and requires approximately 3K on a PDP-8.

The customer can pick and choose those modules he needs, and the vendor then supplies IDEX in four to six weeks for "most" minis, and even some medium-scale computers. INFORMATION DESIGN INC., Lexington, Mass. For information:

CIRCLE 387 ON READER CARD

Commercial Fortran

The claims for COM/FORT are program writing and I/O in one-half the time it takes to do the same job with COBOL and one-third the time for PL/I, plus compile rates of one-tenth the time of COBOL and one-twentieth the time needed for PL/I.

COM/FORT is a modified FORTRAN IV library subroutine package that is aimed at 360 DOS and TOS installations using COBOL and PL/I for business programming applications. The package includes standard FORTRAN elements—i.e., syntax and calls—and EBCDIC conversion routines. In addition it reads and operates on column binary data and provides core-to-core formatting, character and bit manipulation and testing. It is disc-resident, requiring 25K of memory.

COM/FORT was developed by a company whose heavy involvement in processing market research statistics created a need for a combination of scientific and commercial computer languages. The firm is selling COM/FORT with installation assistance for \$2000. ADAPT, INC., Philadelphia, Pa. For information:

CIRCLE 363 ON READER CARD

Cobol Documentation

RECFLOW provides visual layouts of COBOL file records, working-storage areas, and, optionally, cross-reference listings. Source programs stored on tape, disc, or cards are used as input to RECFLOW, which itself is written in COBOL.

Size, class, usage, number of deci-

mals, relative record positions, and redefine indications are shown on the layout—no plotter is required since the layouts are constructed of alphanumeric characters. If an entire program is input, only the Data Division is utilized. Multiple programs may be submitted together, and the various record layouts will be drawn for each.

For 360 users, DOS or OS and a 46K partition is required, plus a disc to accommodate the cross-reference option. The package will also run on Honeywell 200 series equipment.

A minimum lease period of one year at \$25 per month is required, plus \$5 a month for the cross-reference option. THORNE DATA PROCESSING, INC., Alexandria, Va. For information:

CIRCLE 364 ON READER CARD

Plotting System

Written in FORTRAN, DISSPLA (Display Integrated Software System and Plotting Language) is a collection of subroutines for handling all plotting chores. A CALL statement is all that is needed for DISSPLA to summon two arrays and automatically scan the data to find suitable axis lengths and determine the step sizes for a standard page. This plot can then be modified by the user—for example, one could add a grid, frame the axes, add any number of data curves, place a legend in a blanked area on a dashed grid, interpolate the data points, write an underlined heading, or change the entire axis system to semi-log by adding a subordinate Log axis.

Spline, parametric spline, parametric 3rd or 5th order polynomial or step interpolation between data points is provided, as are a least squares technique for smoothing.

DISSPLA is supplied in object deck form, and depending on the efficiency of a machine's compiler, requires approximately 5K on systems like a CDC 3600.

Several different leasing plans are available from the developers, but one of the more interesting ones is an initial installation charge of \$2500, plus 5¢ times the square root of the number of points plotted. INTEGRATED SOFTWARE SYSTEMS CORP., San Diego, Calif. For information:

CIRCLE 365 ON READER CARD

Test Data Generator

Written for creating business dp oriented records on tape, disc, or card files, TESTDATA is written in COMPASS and runs on CDC 3300 and 3500 computers. Approximately 14K of core is required.

Restrictions placed on the user include: A minimum of six to a maximum of 20,000 characters for physical records; fields within records must have at least one character, or can contain 1,000; and field lengths cannot exceed 50 characters.

The price of \$750 includes documentation and a year of system support. BENGAL PRODUCTS, Beverly Hills, Calif. For information:

CIRCLE 384 ON READER CARD

(Continued on page 175)

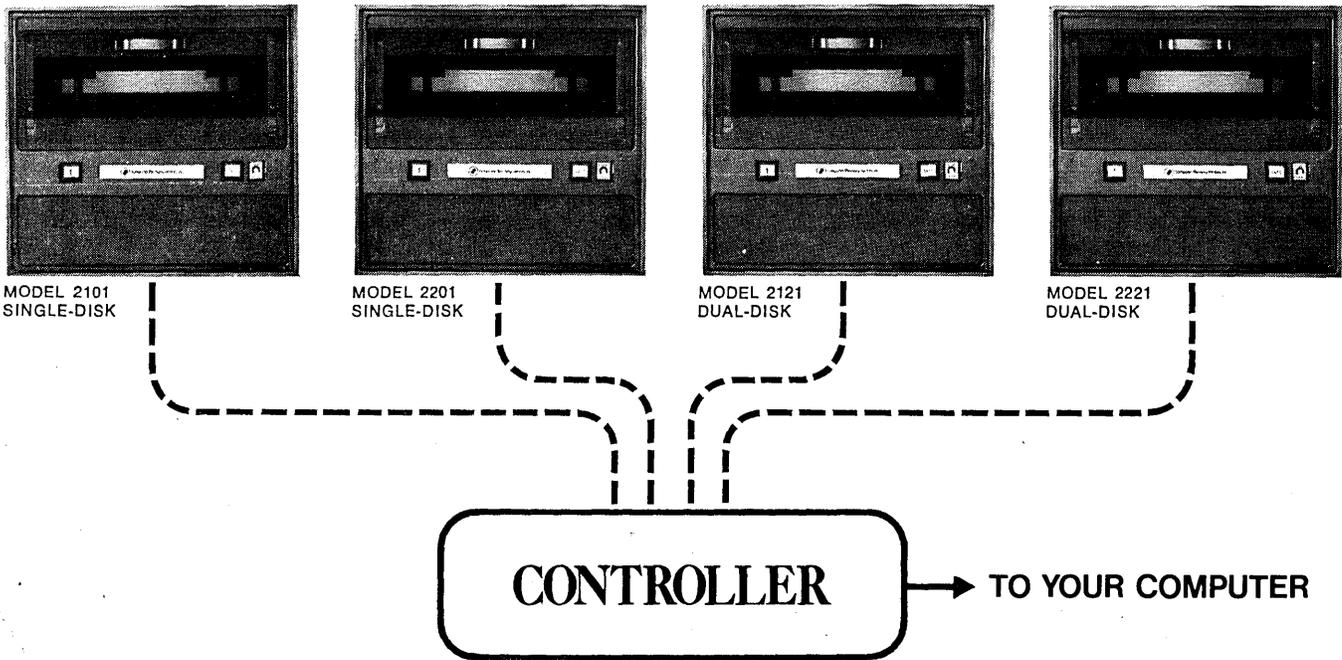
Computer Memory Devices Announces a \$9,950 Disk Sub-System ... for any computer

We proved that a good disk memory drive doesn't have to be expensive, with our MD-2101-2. Now, we're proving that a disk sub-system doesn't have to be expensive. Computer Memory Devices is offering a complete disk sub-system including our MD-2101 single disk drive, power supply and controller for any computer for \$9950... and that's just *one* of the systems available.

Because CMD offers a complete family of ultra-reliable disk drives using the IBM 2315-type disk cartridges with capacities ranging from 11.5 mega-

bits to 46.0 megabits; in single (removable) and dual (fixed and removable) disk configurations *you* can choose the sub-system which best fits your needs... at the lowest prices in the industry.

Your disk sub-system will be backed up and serviced by a nation wide field service organization. And most important, you get *proven* CMD quality and in-the-field reliability. For detailed information contact Tazz Pettebone at Computer Memory Devices, Inc., 5170 W. Bethany Home Road, Glendale, Arizona 85301, Phone (602) 939-9444, TWX 910-950-1244.



	MD-2101	MD-2201	MD-2121	MD-2221
Density (bpi)	1100	2200	1100	2200
Capacity (megabit)	11.5	23.0	23.0	46.0
Disk Sub System Single unit price*	\$9950.	\$10,995.	\$11,600.	\$12,200.

* OEM DISCOUNTS AVAILABLE

All models measure 19" wide, 17½" high, 28½" deep.
All fit standard 19" rack.



Computer Memory Devices, Inc.

5170 W. Bethany Home Rd., Glendale, Ariz. 85301 • (602) 939-9444 • TWX 910-950-1244

Precompiler/debugger

According to this vendor, the various debugging aids for COBOL on the market do not really approach the problem where it should be attacked—namely, before the job is compiled. The solution offered is JOBOL, which is constructed of three different program sections.

JOBOL-I allows the programmer to describe the proposed file in a free-form shorthand. JOBOL expands this into Data Division FD and record description entries, and a layout of the record showing the slack bytes that are generated. Using this part of JOBOL helps in file design selection,

showing the effect of different blocking factors for disc files.

Once the optimum file design has been decided upon, JOBOL-I is rerun to catalog the file and to generate the I/O coding required by the program to handle the file.

JOBOL-II is a precompiler using the coding generated in JOBOL-I and the programmer's logic to produce object decks and program listings. These listings show what the final reports will look like, which is in contrast to other precompiler layout sheets.

JOBOL-III allows modification of the files after they have been cataloged.

Control cards are used to gener-

ate Identification, Environment, and Data Division, as well as major portions of the Procedure Division, permitting the programmer to concentrate on debugging the program logic. Debugging is further aided by a COBOL source listing that cross-references each source statement to the appropriate JOBOL control card, shorthand statement, or file which generated it.

JOBOL requires 32K bytes running under DOS/360 and is priced at \$10K. An OS/360 version requires 22K bytes and is priced at \$15K. COMPUTER USAGE CO., Towson, Md. For information:

CIRCLE 385 ON READER CARD

Hospital Billing

The manufacturer of System/3 has added a package for patient and insurance company billing to its program product list. Called Hospital Patient Billing, it is compatible with the earlier Hospital Accounts Receivable program. It is an RPG-II card-oriented package and requires 8K of memory.

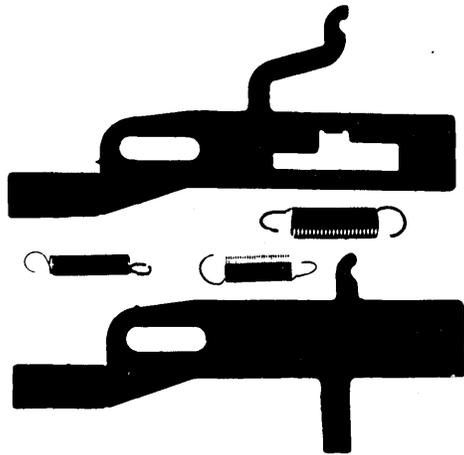
HPB enables the computer to record patient changes, update accounts daily, and produce a final bill. It also permits automatic prorating of charges to a patient and up to two insurance organizations.

The package will be available in the first quarter 1971 under a license agreement for \$65 a month. IBM CORP., White Plains, N.Y. For information:

CIRCLE 366 ON READER CARD

Correction

Somewhere along the way a 0 was lost on the price of Compata's Cross-Assembler (October 1, p. 93). The correct price is \$1000—just in case, that's one thousand dollars. ■



MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohall) during the FJCC.

TRACOR DATA SYSTEMS
4201 Ed Bluestein Blvd., Austin, Texas 78721

CIRCLE 60 ON READER CARD

November 15, 1970

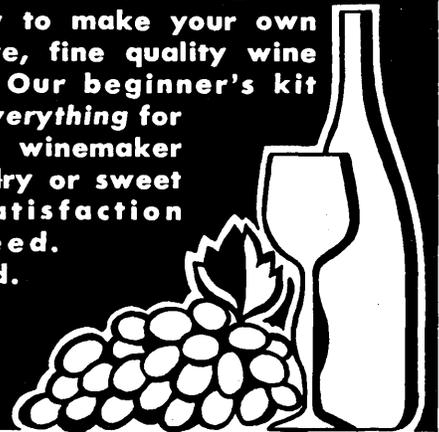
make wine

For 30¢ a bottle

Learn how to make your own inexpensive, fine quality wine at home. Our beginner's kit includes everything for the hobby winemaker to make dry or sweet wines. Satisfaction guaranteed.

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Name _____

Address _____

City _____ State _____ Zip _____

CIRCLE 67 ON READER CARD



keyed for success

Introducing MSI's Source 2002 Portable Alphanumeric Terminal. All eight pounds of it.

Designed for use at the source data entry location, the Source 2002 is low cost, lightweight, and self-powered. It simplifies and speeds recording and transmitting of alphanumeric data, relieves "in-put bottlenecks," and eliminates slow, costly intermediate data preparation steps--such as key-punching, key-taping, and transcribing. Computer files can thus be updated, and reports printed in minutes or hours, instead of days or weeks.

Smaller than an office typewriter, the 2002's simplified controls make it easier to use. Data is entered on the alphanumeric keyboard, recorded on a magnetic tape cassette, and transmitted at 40 or 60 characters per second over common voice-grade telephone lines direct to the receiver. Off-line transmission provides greater flexibility at less cost.

Completely portable, the 2002 operates on its own self-contained, re-chargeable batteries, or may be plugged

into any wall outlet. Options include attache case model; strip printer; two-way communications; separate ten-key adder keyboard; and on-line capability.

If your problem is fast, accurate, low cost alphanumeric data recording and transmission, MSI Data Corporation has an eight-pound solution.

Gentlemen: I am interested in learning more about MSI's Source 2002.

Name _____

Address _____

City _____

State _____ Zip _____

Company _____

MSI
DATA CORPORATION

Department D11
4751 Holt Avenue
Montclair, Calif. 91763
(714) 626-2451

See the Source 2002, in MSI's Booth at the FJCC

Sure, the Sycor 340 data communication system gives you clean source data capture.

Sycor 340. The one CRT terminal that does it all. Heart of the Sycor System. Trim. Tasteful. Yet figuratively bulging with the newest of proven, mass-produced modular microprocessor technology. All of it operator-oriented. So easy to learn and use that any regular office guy or gal takes to it quickly and can achieve high productivity without knowing a thing about data processing.

Entry by electronic keyboard onto magnetic tape cassettes permits data to be recorded about 30 per cent faster than it would be electromechanically. Sycor 340's unique automatic paging option handles even long or complicated forms by accepting them in small segments, or pages, easily scanned. Then, it automatically displays page after page of labels and field control characters, easy for the operator to follow. And (hallelujah!) no cards, no paper tape to mess with. Just compact cassettes that hold the equivalent of 1400 punch cards. Easy to load and to store. Thriftily re-usable.

You can interface the 340 with the Sycor printer and get all the versatility of high priced line printers. Use multipart, continuous, pre-printed forms for a host of applications.

Like order forms.
Remote invoicing.
Remote payroll checks.
Whatever.

Two 10-digit accumulators—a Sycor first, by the way—generate totals or subtotals for zero balancing, detecting keying errors in numeric data, without re-keying or verifying. Other error detection features include visual proof-reading from the CRT, programmed entry, format field and character checking, and check digit verification. Add and subtract operations give you automatic total and subtotal field computation and entry without re-keying on an adding machine. Result? Clean tape output—at the data source—that cuts delays and confusion, dramatically lowers mainframe processing costs.

But data capture is only a part of what you really want a terminal system to do for you, isn't it?

Sycor's modular system can be configured for batch communication, via the voice-grade public telephone network, for attended or lower-cost unattended operation. Sycor's binary synchronous procedures, with automatic retransmission that provides automatic error detection, and speeds of 1200, 2000 and 2400 baud, are compatible with S/360 hardware and software.

You can set up an off-line system that gives you the advantages, but none of the complexities, of teleprocessing, by using the Sycor 610 Communication Converter Station at your central office to record on, or transmit from, computer compatible magnetic tape.

That's another part, right?

Talk to Sycor.

100 Phoenix Drive, Ann Arbor, Michigan
313/971-0900

Si
SYCOR INC

"n" Key Rollover. It remembers your every touch.

Our new "n" key rollover solid state keyboard has a memory like an elephant.

Data bits from the first key depressed are stored in our MOS memory until a second key is activated . . . even though the first key is still depressed. So any number of keys can be depressed without interfering with the sequence of data entry.

Which makes operator error practically nil. Tests have indicated up to 30% fewer errors than with two-key rollover keyboards.

And no special training is needed to switch from an electric typewriter. In fact, most any secretary can sit down and start operating.

Our "n" key rollover is also more reliable. Because pulse output is part of the solid state chip within the key, rather than a pulse network of discrete components.

For even more things you'll want to remember for your next keyboard application, call or write your MICRO SWITCH Branch Office.

MICRO SWITCH

FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL



HONEYWELL INTERNATIONAL—Sales and Service offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, U.K. and U.S.A.

*The 833
Disc Storage
System*

*Plug-to-plug
Compatibility
with the 2314*

*Monolithic
Circuitry*

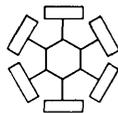
*More Inline
Diagnostics*

*Complete
Field Service*



*And far less
Expensive*

See it at FJCC: Booth 2003



Peripherals General, Inc.

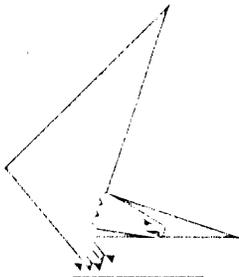
CHERRY HILL INDUSTRIAL PARK, CHERRY HILL, N.J. 08034 (609) 424-2010
CALIFORNIA FEDERAL BLDG., 5505 E. CARSON ST., LAKEWOOD, CALIF. 90713 (213) 421-3777
21360 CENTER RIDGE ROAD, CLEVELAND, OHIO 44116 (216) 228-3400

1

A lot of people know us as



2



US TAPE

U.S. MAGNETIC TAPE COMPANY HUNTLEY
A Subsidiary of Wabash Magnetics, Inc.
Telephone (312) 669-5181 Teletype 910-65

3

US TAPE

U.S. MAGNETIC TAPE COMPANY
A Subsidiary of Wabash Magnetics, Inc.
Telephone (312) 669-5181



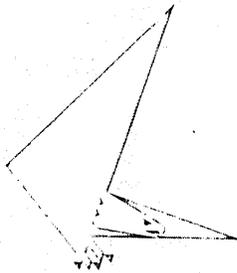
but our name confused them.

4

They liked our bird though.



5



6

So ... as part of Wabash Magnetics, we adopted the family name, and kept our eagle.



7

That's us. Wabash Tape.



8

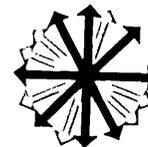
All Wabash digital tape is manufactured under the same conditions that produced the famous Type-1 digital tape, which conformed to government specifications. This insures a quality product and quality performance.

Wabash tape is interchangeable between different systems. Will function in adverse environmental conditions. Self-polishing prolongs tape life; reduces head wear. High resilience provides intimate head-to-tape contact and a good signal.



wabash

WABASH TAPE CORPORATION, HUNTLEY, ILLINOIS 60142
A Subsidiary of Wabash Magnetics, Inc.
312 669-5181 Teletype 910-651-1800



datamate 70 the Skinny Minis

Skinny Minis

A 20-page brochure from Big Spring, Texas, with big 70 on cover details Series 70 small computer systems. The 16-bitters range from small dedicated controllers with read-only and scratchpad memories to 32K cores and plenty of peripherals. System architecture is block-diagrammed, and a thorough instruction set explanation given, with summary. Programmed i/o and direct memory access channels also are graphed. Specs are exhaustively listed on back page, with chassis diagrams. DATAMATE COMPUTER SYSTEMS, INC., Big Spring, Texas. For copy:

CIRCLE 264 ON READER CARD

FORTRAN for All

Two-volume manual (366-page textbook with accompanying 205-page workbook) is a comprehensive course in FORTRAN programming. It begins with number systems and basics, goes through the characteristics of the language, and winds up with flow-charting and debugging. Plenty of examples are given, and the workbook includes answers to the exercises. Order Nos. N70-25287 and N70-25288. Price: \$6. U.S. DEPT. OF COMMERCE CLEARINGHOUSE, Springfield, Va. 22151.

Man to Computer

"Man-machine interfaces" are described in 16-page brochure, detailing custom and standard operator consoles, crt devices, and how to contend with special process requirements in power generation, batch sequencing and advanced programming. Applications are in process control, with visions of running an entire plant "from a single small console." Control tools include both hardware and software. The multimedia tandem approach using a variety of communication techniques is discussed. THE FOXBORO CO., Foxboro, Mass. For copy:

CIRCLE 359 ON READER CARD

THE FOXBORO COMPANY DIGITAL SYSTEMS DIVISION

"They laughed
When I SAT
Down at MY
KEYBOARD to
PLAY THE PROCESS"

Users List

All attendees of COMPSO, the regional computer software and peripherals shows held in New York, Chicago and Los Angeles, have been put in a computerized file, available regionally on different kinds of labels, on letterheads, and with window envelope insertion service, mailing optional. Information includes title, company, present or planned use of in-house computers, time-sharing and service bureaus. About 75% of attendees are said to be dp executives. PDA SYSTEMS, INC., New York, N.Y. For information:

CIRCLE 360 ON READER CARD

Used Computers

The first edition of a quarterly which aims to be the Bluebook of the secondhand market, *Price Guide for Used Computers*, contains current price listings for commonly used computers and peripherals, including those not necessarily handled by the broker-publisher. The resources of nationwide marketing facilities are used to keep track of the spectrum of asking prices, and new information will be issued every three months. Market tips and handy hints also are given. TIME BROKERS, INC., New York, N.Y. For copy:

CIRCLE 362 ON READER CARD

Printing COM

Two kinds of COM printers are described and specified in six-page foldout brochure that includes a catalog description of parts. One kind is

for centralized, volume printing, the other for decentralized, point-of-need selective printing. Both can be fed with 16 or 35mm microfilm. Images come out on continuous, ordinary unsensitized paper. The heavy-duty machine puts out 3,000 lines/minute, can be equipped with optional cutter that will trim to size. XEROX CORP., Rochester, N.Y. For copy:

CIRCLE 265 ON READER CARD

Job Shortener

This 58-page manual gives general description of production job scheduling for OS/MFT, MVT and multi-cpu installations. Design concepts in scheduling are explained in the introductory section, with the need for data files and reports, followed by a second section that goes into the various files and reports used, with updating methods. Another section

details schedule preparation and adding jobs, while the last section gives sample reports. TIME SHARING SERVICES, INC., New York, N.Y. For copy:

CIRCLE 266 ON READER CARD

Family Circuits

Seventeen new circuit modules are described, along with packaging accessories and companion power supplies, in a folderful of bulletin sheets, each with diagrammed illustrations. Electrical and mechanical descriptions are given for each plug-in module, making up a family of monolithic 930 DTL integrated logic circuits. They feature compact size, high noise immunity, and low power requirements. Delivery and warranty schedules are furnished. COMPUTER PRODUCTS, Ft. Lauderdale, Fla. For copy:

CIRCLE 267 ON READER CARD

(Continued on page 183)

TECHNICAL



7 sound reasons why you should call us about the Remcom 2780

1. It's the remote batch terminal that is truly compatible with OS/360 and DOS/360 and all IBM 2780 software.
2. *New 18-month rental period*, including maintenance, as low as \$850 per month.
3. 60-day delivery.
4. 300 or 600 CPM card reader, 400 or 600 LPM printer, control electronics and line interface all in one cabinet.
5. Up to 80% increase in send-receive rate with *Remcom's advanced data compression/decompression. (Optional)*
6. Double buffering to 1200 bytes. (Optional)
7. We'll pay for the call. Call collect to one of our Sales Managers:
Eastern Region — (703) 820-7802
North Central Region — (312) 298-5090
South Central — (214) 328-9991
Western Region — (415) 433-7673

■ See the
Remcom 2780 during
the FJCC at
Tracor Booth 2003
and
SDL Booth 2009

2705 National Drive / Garland, Texas 75040 / 214-328-9991
A part of Tracor Data Systems, Inc.



CIRCLE 6 ON READER CARD

Micro Directory

A tail-wagging-the-dog supplement to the *Guide to Microreproduction Equipment* since it was last published in 1968 shows an increase in manufacturers and distributors from 88 to 128. There are 137 new items and changes in 120 entries. NATIONAL MICROFILM ASSOCIATION, Silver Spring, Md. For information:

CIRCLE 361 ON READER CARD

Debugging the Operators

What is modestly called "the ultimate data entry system" is described in loud-and-clear eight-page brochure with labelled illustration of the terminal used, incorporating a display that helps the operator visually check the information entered, and also is an easy-to-follow formatting aid. A Help! button on the keyboard also triggers bail-out instructions when punched by an operator who

has forgotten procedure. Mistakes can be corrected by simply backspacing and striking over. The operator is even helped to maintain typing cadence by "a soft clicking sound." Up to 64 terminals can be handled by the system's cpu with intermediate storage and mag tape drive. ENTREX, INC., Lexington, Mass. For copy:

CIRCLE 268 ON READER CARD

Accessories for the 70s

A 56-page catalog itemizes dp accessories, including those for storage, keypunch, i/o, System/3, and cards, tape, et al. Several innovative products also are introduced—the "swinger," a cabinet-free disc pack storage device, a one-piece canister for tape handling, and a "maxi-tray" for use with System/3 computers. Basic information also is furnished on handling, installation, and applications, with specs on each item. ENGINEERED DATA PRODUCTS, INC., Ferndale, Mich. For copy:

CIRCLE 269 ON READER CARD

Cores and Stacks

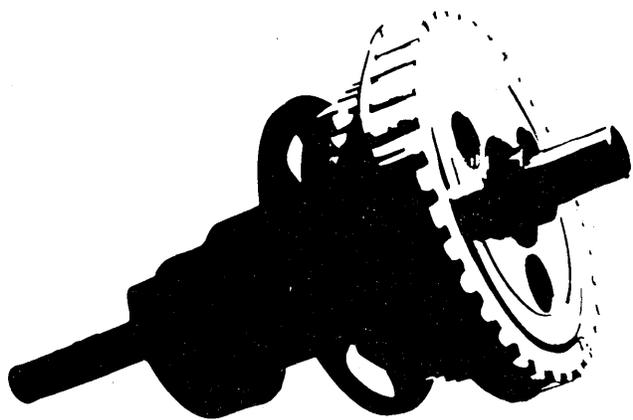
Major memory manufacturer offers 16-page product summary catalog briefly describing the ferrite cores, commercial and military stacks, and systems it produces. More than 75 standard products are itemized, with specs. ELECTRONIC MEMORIES & MAGNETICS CORP., Hawthorne, Calif. For copy:

CIRCLE 270 ON READER CARD

Mag Tape Monitor

Twelve-page brochure explains a monitor system for a magnetic tape library that pinpoints tape availability, retention and projected use. The monitor also finds tapes that need to be cleaned or recertified. The system can furnish report lists by reel and job number, weekly and daily; and on tape retention, release—and problems. The system can be operated under dos or os machines. MNEMOTECH COMPUTER SYSTEMS, INC. New York N.Y. For copy:

CIRCLE 271 ON READER CARD



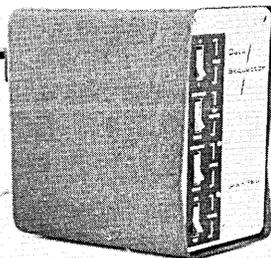
MISSING

From the TDS 1601 impact printer.
Find out why at Tracor booth 2003
(center of Astrohall) during the FJCC.

TRACOR DATA SYSTEMS 
4201 Ed Bluestein Blvd., Austin, Texas 78721

CIRCLE 61 ON READER CARD

SCRAMBLE YOUR DATA TRANSMISSIONS WITH THE Data / Sequestor[®]



MODEL JJC-3

- ON-LINE OR OFF-LINE OPERATION
- DATA RATES TO 1 MEGABIT
- 8,000,000 CODES AVAILABLE
- ASCII, BAUDOT, OR SPECIAL CODES
- RS-232C OR TTL INTERFACE

AVAILABLE NOW FROM STOCK

Ground/data CORPORATION

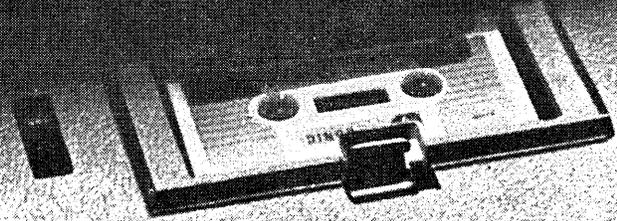
4014 N.E. 5th TERRACE
FORT LAUDERDALE, FLA. 33308
(305) 563-2527

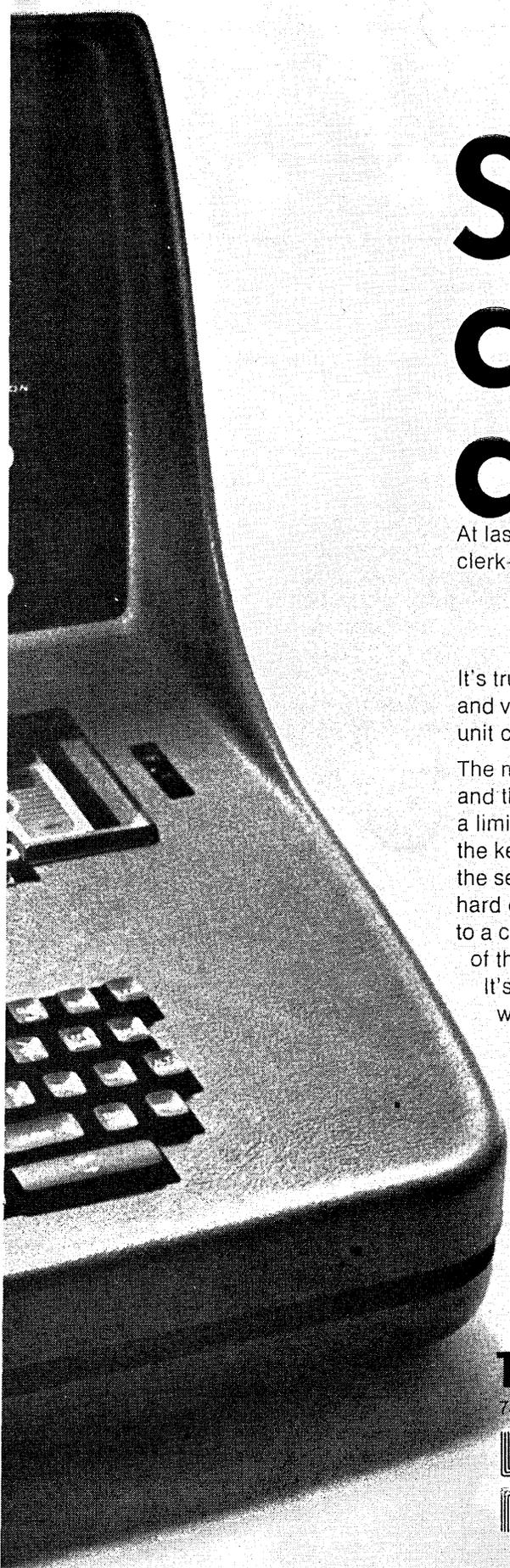
CIRCLE 37 ON READER CARD

DICK
SEE JANE
SEE JANE AT THE OTU-1
SEE JANE ENTER DATA
SEE JANE SEE THE DATA
SEE JANE SMILE
SEE THE BOSS
SEE JANE SAVE BOSS A TON
SEE THE BOSS SMILE
SEE THE BOSS CHAIN JANE
TO THE OTU-1
GOOD BYE, DICK


HYPERTECH

POWER SHIFT PROGRAM FORMAT MODE
ON CLR
MESSAGE PERIOD
SEARCH NORMAL
DISPLAY VARIABLE MASTER OUTPUT/PROGRAM
1/2 1/2
1/2
CLEAR SYSTEM MASTER OUTPUT PROGRAM AUTO CLEAR
1/2





Simplicity comes to data entry.

At last . . . a truly wise machine that can be run by a clerk-typist. Accurately and happily.

It's true. With two days of instruction, a mere clerk-typist can enter and verify data using our GTU-1. This means, of course, that the unit can pay for itself in payroll savings alone in very short order.

The machine uses easy-to-handle cassettes, one for programming and the other for recording output data, and its small brain contains a limited but capable memory system. Data can be fed in through the keyboard, the cassette, or telephone lines and output goes to the second cassette, the video display screen, or a typewriter for hard copy printout. The terminal will also spill everything it knows to a computer, either over the phone or through our translator. One of the major virtues of the GTU-1 is that it is engineered for people.

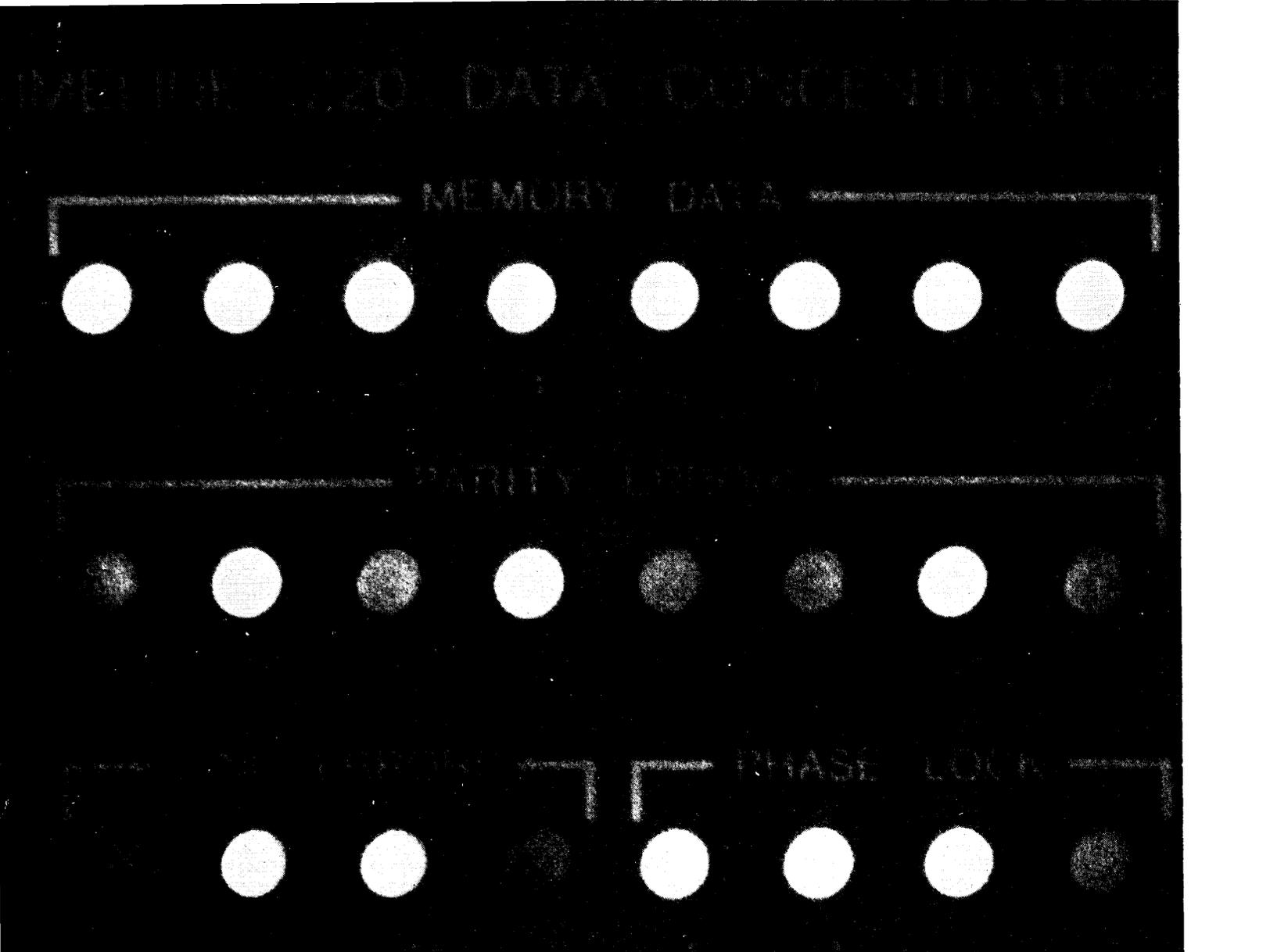
It's compact, comfortable, dead silent, and can work within a whisper of its information source. All entries are immediately visible for spot checking, and the machine can be programmed so that it's just a matter of filling in the blanks on the screen.

Verification is either visual or by simple re-entry, and the unit will light up, lock up, and say "ding" at any errors. Our terminal holds no touchy, untried electronics. It's tough, fast, accurate, and as foolproof as we could make it. And it contains the most useful and logical set of functions we could devise in a solid two years of designing, building, and testing. It is now being delivered. For details, drop us a line, or give us a call at (312) 867-4200.

The Hypertech Corporation

7343 West Wilson Avenue, Harwood Heights, Illinois 60656





Our New Time Division Multiplexer Is a Bit of a Character.

A bit of a character because it can do what no other time division multiplexer can. Our Timeline 220 can either bit multiplex (for echo-back operation) or character multiplex (for maximum channel capacity). Or both, *simultaneously*. The others can only bit or character multiplex. They can't do both.

If you're looking to cut your communications costs, here's another surprise. Infotron Systems' Timeline 220 multiplexer gives you the greatest possible number of simultaneously operating speedmixed channels. For example, with the high speed line operating at 2400 baud, the Timeline 220 can provide simultaneously 12 110 baud channels (TTY 33,35), 5 134.5 baud channels (IBM 2741), and 2 300 baud channels (GE TermiNet 300).

Most multiplexers have a diagnostic capability that isolates problems within the multiplexer equipment. But that's where it stops. If you're really worried about down time problems—forget it with the 220. Our system features a built-in diagnostic panel that locates trouble spots, not only in the multiplexer itself, but also in your data sets and telephone lines.

Right now our 220 multiplexers are installed throughout the United States and Canada, operating on-line for businesses whose success depends upon reliable communications every minute of the working day. You might also like to know that our operating history is so successful that we're able to offer our customers a two-year warranty, including on-site service.

Quite a bit of a character that Timeline 220.



Infotron Systems

7300 North Crescent Boulevard, Pennsauken, N.J. 08110 (609) 665-3864

CIRCLE 8 ON READER CARD

A PERFECT MARRIAGE!



the MODEM and the TELETYPE

When Penril married its modem to a Teletype, there were no halfway measures. The Penril TTY-300 Teletype Modem provides *full* capability including; *originate and answer, automatic answer, automatic answer back; one card construction; snap-in installation; better than 70 dB channel separation; direct replacement for the Western Electric 101C, end-to-end compatible with the Western Electric 103A2 and 103E.*

It sounds expensive doesn't it? Estimate what you think it should cost, then contact our Marketing Department to see if you were right. Anyone estimating within 5% is invited to our next wedding. (Hint: It doesn't cost as much as some modems that do a whole lot less.)

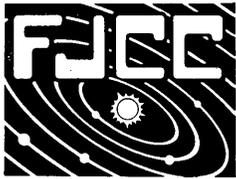
"... it had to happen"

PDC Penril Data Communications, Inc.

960 THOMPSON AVE.

ROCKVILLE, MARYLAND 20852

301/881-8151



**You'll find it easier
than ever before
to attend FJCC...**

PRE -

**"Convenience" Key to Houston FJCC
"Systems and Society" Conference
Nov. 17 to 19.**

This year the world's largest computer conference and exhibition will also be the most convenient. Houston's famous Astrohall will house an extensive technical program plus computer hardware, software, and services valued at over \$200-million.

Air conditioned busses will add to the convenience by shuttling you between your hotel or motel and the Astrohall. Special tours of NASA's computer complex have been planned with transportation provided. The conference committee has done everything possible to make your FJCC attendance pleasant and convenient — but there's one thing they can't do for you — PRE-REGISTER. These Advance Registration and Housing forms will allow you to avoid on-site registration. A confirmation card will be mailed to you as soon as your completed forms are received. (Hotel rooms will be assigned on a first-come basis.)

'70 FJCC Broadens Program Appeal

A unique feature of the FJCC technical program will be a *Special Survey Session* which explores new developments and industry trends and provides a broad, general view of where the industry stands and where it's headed. This *Special Survey Session* will allow specialists to keep abreast of developments in other fields and will give generalists a full industry overview.

In addition numerous technical sessions will cover the latest developments in hardware, software, systems and applications of major importance to the computer field and users of EDP systems.



Site of all FJCC exhibits and educational sessions is Houston's Astrohall, the world's largest single convention facility.

NASA TOUR HIGHLIGHTS FJCC ATTRACTIONS

The role of the computer in the successful Apollo moon flights and the dramatic rescue of Apollo 13 is a source of pride to the industry. Tours of NASA's Manned Space Flight Center have been scheduled which will take you into areas not usually open to the public, especially the Simulator Lab where space flights are "rehearsed" prior to launch. Such critical simulations made possible the safe return of Apollo 13.

Government Control and the Computer Industry — A panel will discuss existing and pending legislation which affects the computer industry. Congressman Jack B. Brooks, Dr. Herbert R. J. Grosch of the National Bureau of Standards, and representatives of computing equipment firms and user groups will participate.

Interfacing Computers and Education — A special session will explore the implications of bringing the computer into the educational process, with special emphasis on the reaction of students to computer aided instruction, training system users and integrating programming skills with competence in subject matter.

Ross Perot to Keynote Conference — An internationally recognized computer leader, Ross Perot, will keynote the conference, addressing the theme . . . "Systems and Society".

Art, Vice and Games — An intriguing session will take a fresh look at the possibilities and limitations of computers by reporting on their unorthodox use in art, games and vice.

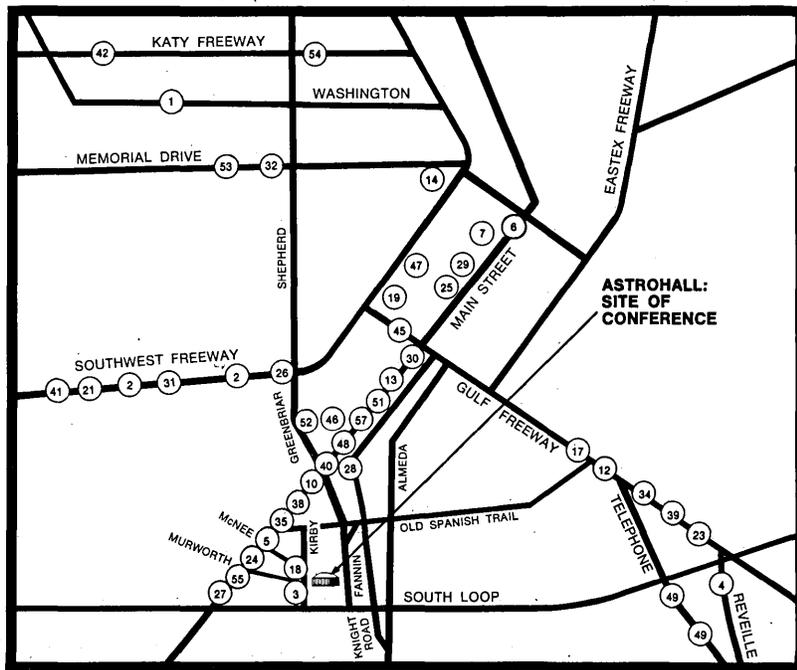
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32. RAMADA INN — ALLEN PARKWAY	10-11	13	19	2-2 rm., 30
33. RAMADA INN — EAST	13	15.50-	15.50-	10 Jr., 1-2 rm.
34. RAMADA INN — GULF FREEWAY	18.50	18.50	18.50	2-Pool, 19.50-up
35. RAMADA INN — MAIN	14.50	16.50	19.50	
36. RAMADA INN — S.W.	14	18	22	
37. RICE HOTEL	12.50-15	17-20	17.50-20	2-Jr., 6-2 rm., 2-3 rm., 30-up
38. ROADRUNNER INN	10.50-20	16.50-22.50	17.50-28	39-2 rm., 42-up
39. RODEWAY INN — GULF FREEWAY	9.50	9.50		
40. RODEWAY INN — MAIN	10	12	15	
41. RODEWAY INN — S.W.	9.50	12	15	
42. RODEWAY INN — KATY	11-13		15	2-Fam. rm., 25 2-2 rm., 16
43. ROYAL COACH INN	18	25-26	25	25-up
44. SAM HOUSTON HOTEL	7-8	9-10	12-14	28-Par., 40 9-Tun. suites, 40 5-Bi-level, 55
45. SAVOY FIELD INN	16-19	20-23	22-23	6-1 rm., 20-28 6-2 rm., 35-up
46. SHAMROCK HILTON HOTEL	14-30	20-36	20-36	2 rm., 45-up 3 rm., 80-up
47. SHERATON LINCOLN HOTEL	16-22	23-27	21-27	10-2 rm., 40-80
48. SHERATON OAKS MOTEL	12	14	18	30-up
49. SKYLANE INN	12-16	14-18	14-18	5-2 rm., 22.50-25
50. TEXAS STATE HOTEL	10	14	15	
51. TIDELANDS MOTOR INN	16-18.50	18.50-20.50	22.50-24.50	
52. TOWERS HOTEL	12-18	16-20	16-24	
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55. TWENTY NINE PALMS MOTOR INN				
56. VAGABOND MOTOR HOTEL	9-10	12	14	
57. WARWICK HOTEL	18-30	28-30	28-30	2-2 rm., 64-240 3-3 rm., 90-275
58. WHITE HOUSE MOTOR HOTEL	16-20	20-22	25-30	
59. WILLIAM PENN HOTEL	8.50	9.50	11	
60. HOLIDAY INN — NASA	12.25-14.25	16.25-20.25	18.25-20.25	2-Jr., 2-2 rm., 1-3 rm., 32.50-up
61. NASSAU BAY HOTEL	15	20	24-28	
62. RAMADA INN — NASA	12	14	16.50	Jr., \$20 2 rm., \$35 3 rm., \$50
63. SHERATON KING'S INN	20	20	20	3-3 rm., 60-up

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2. ALBERT PICK MOTOR INN	15-16	19-20	19-20	2 rm., 38-up 3 rm., 75-up
3. ASTROWORLD HOTELS	14-26	16-30	16-30	40-up
4. CARROUSEL MOTOR HOTEL	12-16	15-18	16-18	4-Jr. 2-2 rm., 30-up
5. CHIEF MOTEL	16	22	25	
6. CONTINENTAL HOUSTON MOTOR HOTEL	13-15	17-19	17-21	
7. DOWNTOWNER MOTOR INN	12-13	15-16	18-19	
8. FIELD INN — KATY	14-17	18-21	20	3-2 rm., 33-up
9. FIELD INN — NORTH	17-19	21-24	21-24	12-3 rm., 24-28
10. GRANT MOTEL	10	12	14	
11. GOLDEN KEY INN	13-17	15-19	15-19	35-up
12. HELENA MOTEL	12	15	17	1-3 rm., 35
13. HOLIDAY INN — CENTRAL	11-15	15-17	15-17	
14. HOLIDAY INN — CIVIC CENTER	13	19	19	38-up
15. HOLIDAY INN — EAST	15	15-17	15-17	
16. HOLIDAY INN — KATY	12-16	16-19	16-19	

HOTELS/HOUSTON	SINGLE	DOUBLE	TWIN	SUITE
17. HOLIDAY INN — MIDTOWN	11.50-16	16-18	18	
18. HOLIDAY INN — S.W. 610	13-15	16	17	
19. HOTEL SONESTA	16-24	20-24	23	10-2 rm., 65-110
20. HOUSTON AIRPORT INN	12	15	15	
21. HOUSTONAIRE MOTOR INN	14	17	18-26	32
22. HOWARD JOHNSON MOTOR LODGE — KATY	14	17	20	
23. HOWARD JOHNSON MOTOR LODGE — GULF	13-16	16-20		
24. KING MOTOR LODGE	14	20	20	
25. LAMAR HOTEL	13.50-24	17.50-24	20-25	11-Jr., 25-45 6-2 rm., 30-60 4-3 rm., 60-90 5-Exec., 45-50 5-2 rm., 20
26. LA QUINTA MOTOR INN	12-13	15-16	16	1-2 rm., 65 1-3 rm., 85
27. LAS VEGAS MOTOR HOTEL	12-13	15-16	17.50-23.50	35-up
28. MARRIOTT MOTOR HOTEL	16-21	21-26	21-26	
29. MCKINNEY HOTEL	10-13.50	12-14.50	16.50	
30. MITCHELL INN	11	14	18	

HOTELS/GALVESTON	SINGLE	DOUBLE	TWIN	SUITE
1. FLAGSHIP HOTEL	18.75	21.75	21.75	
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3. GAIDOS MOTEL	20.00	24	26	
4. HOLIDAY INN	13-18	17-22	17-22	
5. JACK TAR MOTEL	16	18	20	
6. COMMODORE HOTEL				22
7. DRIFTWOOD HOTEL	11	14	16	
8. SEAWALL HOTEL	14	16	16-18	22
9. TREASURE ISLE HOTEL	12	16-20	16-20	

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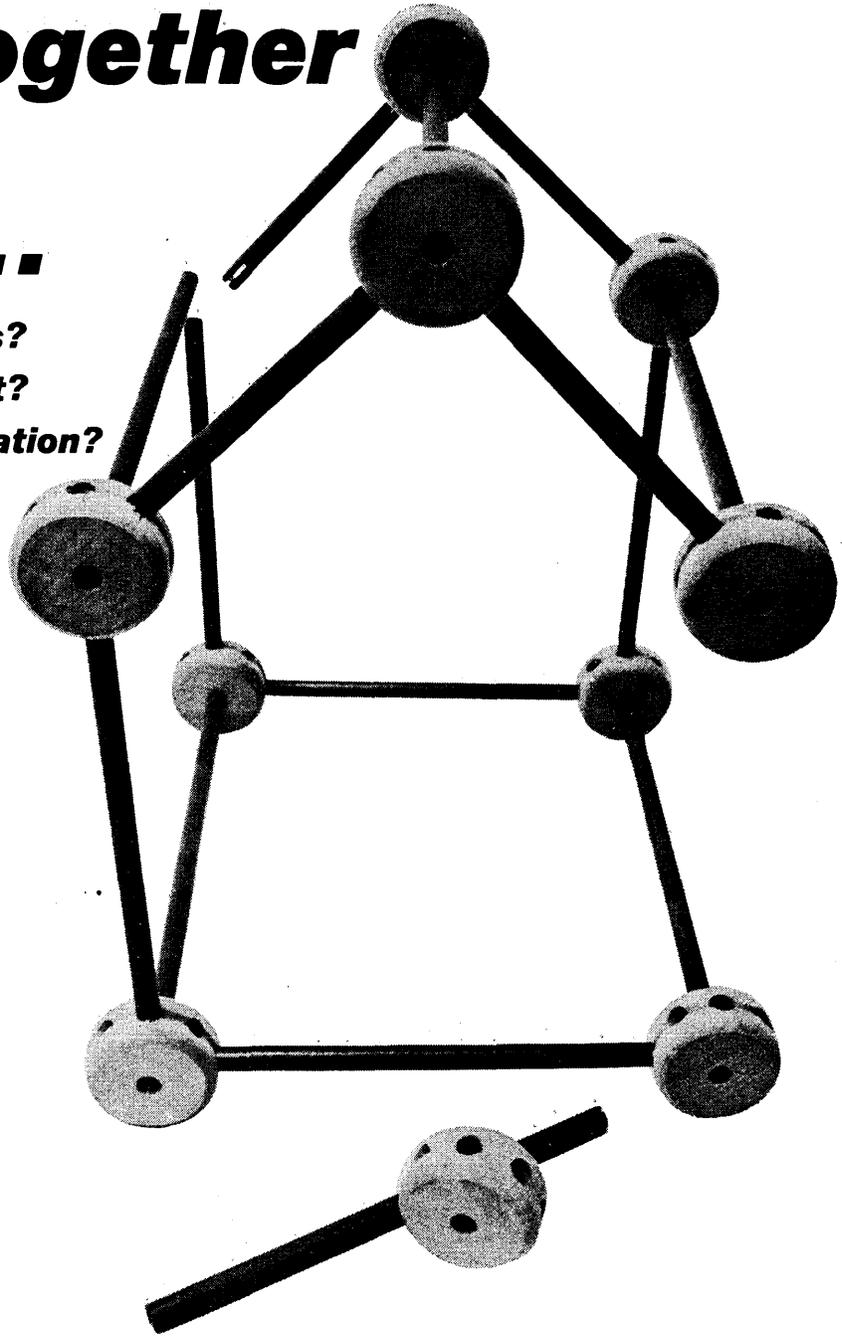
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HOUSE PUSHES DOD ADPE COMPATIBILITY

The House GovOps Committee will push for better long-term planning and increased compatibility of adp systems in Pentagon logistics operations. A committee report placed a major part of the blame for poor Vietnam logistics on failure to adequately utilize adp. "It is obvious," it noted, "that had the dimensions of data processing been analyzed and necessary actions taken, it would have been possible to integrate this capability into supply systems with much less cost and much more effect." The committee concluded that further adp standardization was vital and said the variety of adpe in Pentagon logistics made it difficult to communicate and required costly conversion processes. It also recommended improved quality in communications circuits, more use of satellites, and upgrading of terminals.

JUSTICE SCORES AT&T ON MICROWAVE SERVICES

The Justice Dept. has joined the ranks of AT&T and Western Union critics on the microwave transmission issue. In a brief to the FCC, Justice said the two giant had not been "responsive to modern needs for specialized communications services, particularly for transmission of data." The department rejected AT&T's charge that new carriers would "skim the cream" off better markets, said it's "entirely rational" for new competitors to develop selected, favorable markets, "much as AT&T has done with devices such as its Picturephone." In fact, AT&T has "strayed considerably from uniform or average-cost pricing in its own marketing of data transmission services," Justice said, referring to favorable rates for Telpak to large users. Justice agreed with the FCC staff report that AT&T would grow anyway in the data market, since demand is rising rapidly and because many new entrants would hire AT&T facilities for local distribution. Justice said there is a danger AT&T would overreact to competition by lowering rates unreasonably, "subsidized out of public message telephone revenues." Closer FCC monitoring of Bell System costs will be necessary. Justice also agreed with FCC staff that tariff challenge procedures would have to be swift, since delays unfairly help the established carriers. Both sides would have to accommodate one another, it said, which may mean new entrants would have to pay AT&T compensation for relocating routes.

DAVIS FOR GROSCH AT NBS

Appointment of Dr. Ruth Davis as Director of the Center for Computer Sciences and Technology at NBS was about to be announced publicly as we went to press. Dr. Davis, who now heads the Lister Hill National Center for Biomedical Communications at NIH, will succeed Dr. Herb Grosch. Bill Andrus, former chief of standards at IBM, will be appointed associate director for standards and performance measurement, a new position. Dr. Davis requested creation of this post, and nominated Andrus to fill it.

(Continued on page 197)

Mars is talking, but nobody's listening.

The Jet Propulsion Laboratory's computers were standing ready to analyze the impulses from Mariner 7 as it passed close to Mars.

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CIRCLE 111 ON READER CARD

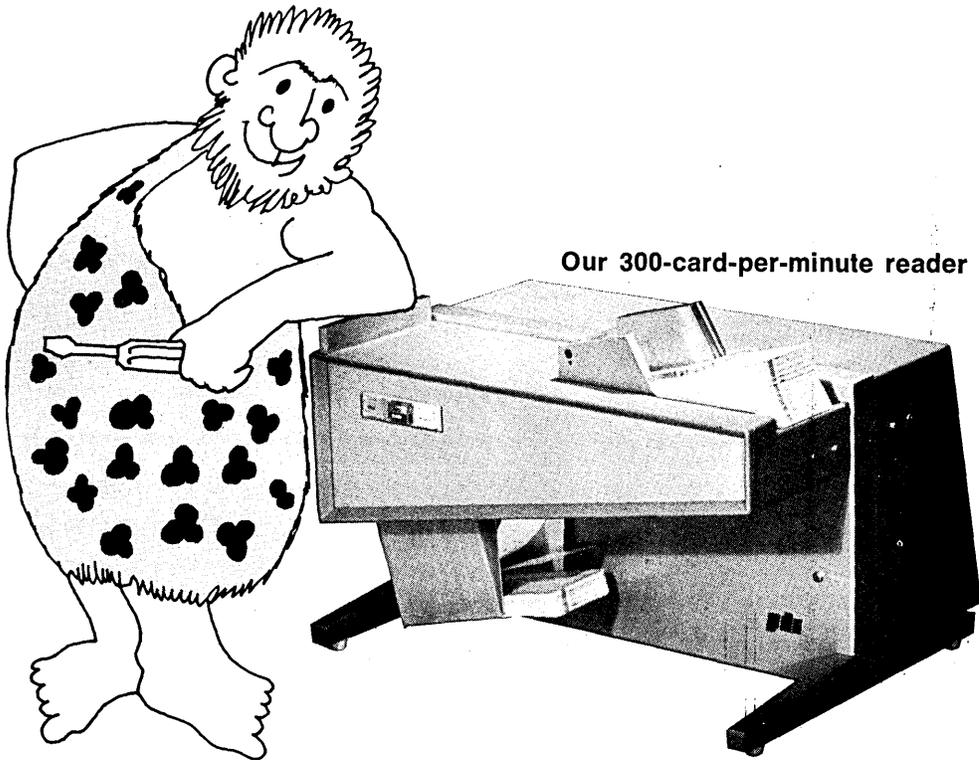
WASHINGTON REPORT

CONGRESS PASSES TWO CREDIT CONTROL BILLS

Congress has finally enacted two credit control bills. The first prohibits mailing of any unsolicited credit cards, including those issued by banks, retailers, oil companies, and airlines. It limits a consumer's liability for lost or stolen cards to \$50. But if he has notified the issuer before any unauthorized purchases, he faces no liability at all. The second bill establishes consumers' rights in commercial reporting practices involving credit, insurance and employment. It requires that consumers be informed if a credit report was partly responsible for their being turned down and that they be given the name and address of the reporting agency involved. Consumers receive the right to learn the substance of their credit files and to be informed as to who has received reports. Inaccurate and unverifiable information must be deleted and the files must be reinvestigated where disputed. Adverse information must be deleted after seven years, or after 14 years in cases of bankruptcies.

CAPITOL BRIEFS

An ASCII keyboard standard has been approved by ANSI's X4 committee and sent to the Board of Standards Review for a virtually certain final OK. The official standard should be out in about three months ...A bill authorizing the Library of Congress to coordinate technical development of all adp activities in both Houses, under direction of the Joint Committee on the Library, may reach the House floor before the end of this year. The sponsor: Jack Brooks...India's huge Tata Organisation is expected to receive a 360/50 shortly — first step in a plan to develop science-oriented software for marketing abroad, including the U.S. ...Tata, in exchange for Indian Government financing, is obligated to sell enough software during the first two years the 50 is operating to pay back twice its costs...Air Force officials are confident they'll get money for the Advanced Logistics System next year, despite a possibly unfavorable GAO report to be completed shortly, and despite criticism of the project in a recent House Appropriations Committee report. The committee's blast is the result of a "misunderstanding." ALS bids are due next April; award announcement is scheduled for August, and the first delivery is programmed for March '72...Datran's satellite plans (Oct. 1, p. 59) have been shelved because the company "doesn't want to dilute" its effort to become a terrestrial common carrier... Lee Johnson has resigned as president of Comcet "for reasons of personal health," but remains a director ...Information Systems Corp. has signed an agreement with the Black Economic Union authorizing BEU to market its computerized college selection service in the Washington metropolitan area. BEU supports black enterprises in major cities...A Tariff Commission study has confirmed edp manufacturers' contention that offshore assembly of components is now part of a well established integrated worldwide production system, that repeal of special tariff statutes encouraging these operations would only encourage more manufacturing abroad without U.S. components.



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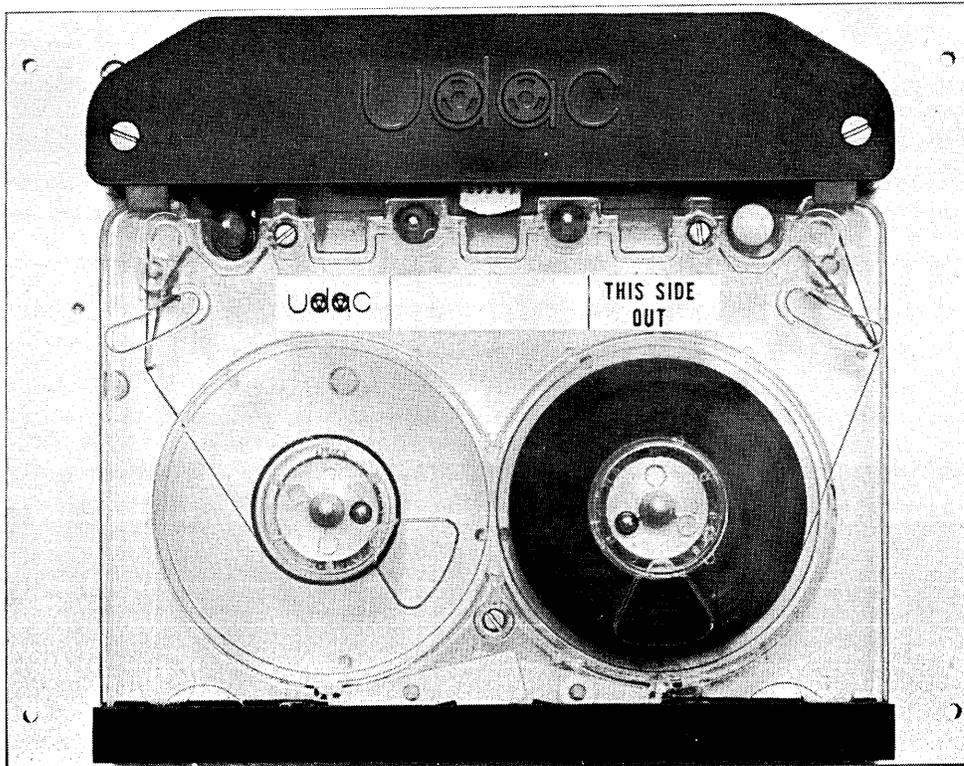
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WORLD ROUNDUP

U.K. GOV'T. FAVORS END TO AID TO COMPUTER FIRMS

There are important implications for the computer industry in the changes of Government machinery disclosed Oct. 15 by the new Conservative administration in Britain. The attitude toward industry in general is one of disengaging from a number of projects in which the Labour administration had intervened to prop up sick companies. So far, the changes amount to merging of several departments that should lead to big savings in public expenditure. Just what this will mean in terms of hard cash will not be apparent until a whole series of reviews of various sectors are complete. The Labour Government mounted several rescue operations in the electronics and computer industry through the Ministry of Technology, which was a department created by them. It had an expenditure of \$6 billion-plus a year. About \$1.4 billion of this went into civil research and as development grants to companies such as International Computers Ltd.

The Ministry of Technology has now been split down the middle. Some has been moved to the Ministry of Defence (procurement of electronic equipment for the military); a Ministry of Aviation has been created to overlord support for civil aircraft development (MinTech had responsibility for the Anglo-French supersonic Concorde); and the industrial research and development (including electronics, computers, machine tools and atomic energy) have been placed under a new department of Trade and Industry. The policy of this new department can be assessed to some extent by the attitude of the man who has taken charge. He is John Davies, 52, and his title is Secretary of State for Trade and Industry.

By any standard, his political career has been meteoric. Davies, a highly successful industrial executive who won his first attempt for public office at the June 8 election, made it clear at his first press conference after the changes that he favors disengagement. He said the degree to which Government should be involved in industrial research or in promoting development of an industry was under review.

One of the organisations with which the Government is closely tied is International Computers Ltd. The old Ministry of Technology acquired an \$8.5 million equity and provided a \$35 million development loan at very low interest when the company was formed in a series of mergers three years ago. It has been taken as almost certain that a Conservative Government would want to place their equity holdings back onto the stock market.

When asked if the new department of Trade and Industry would continue with large research and development loans to ICL, Davies said the Government might take a hand if it could be convinced there was no other party to provide support, and if it could be convinced that it was not merely providing a subsidy that was a crutch to an organisation that could not operate without it. He believes Government should only become involved in industrial research if industry asked for special help, and if they were prepared to pay for this service.

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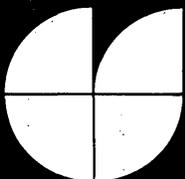
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Letters . . .

ing APL for some time you will on numerous occasions be pleasantly surprised by the ease and speed with which some new task is accomplished. Isn't that the way programming should be?

DANIEL DYER
Washington, D.C.

Mod squawk

Sir:

I applaud Peter Vaughn's call for modular programming in business systems ("Can COBOL Cope?" Sept. 1, p. 42) but his indictment of COBOL is amazing! COBOL is not suited to modular programming because he says so? Very little else is offered in the way of arguments.

My complaint is that Mr. Vaughn confused modular programming techniques with something else that is language dependent. Modular programming, as a technique, is both machine and language independent.

Modular programming can be of two levels:

1. Modules are physically separated (compiled separately) but linked together via program CALL statements.
2. Within a given physical module, routines are logically blocked out and invoked by a main section of code (PERFORM statement in COBOL).

Having used both levels of modular programming (in COBOL, PL/I, ALGOL, FORTRAN and Assembly languages), I submit that proper planning and construction of programs is the crucial problem.

I will yield on one point—languages offer some problems (especially linkage problems) when they are mixed together as modules of a single system. Imagination has proven to be the key to solving these problems with little or no expense to modular programming.

J. A. HILL
Washington State University
Pullman, Washington

Sans Anbar

Sir:

I am surprised that Alan Pritchard omitted ANBAR: *the Documentation Service for Management* from his list of abstracting journals covering computer literature, published on page 41 of the June issue. I trust that this omission is not repeated in the research project to which he refers.

ANBAR, which is now in its tenth year of publication, abstracts ap-

proximately 2,400 articles per annum on management topics. Approximately 500 of these appear in a section entitled "Computer Views," dealing with the management aspects of computers. With this section there is a regular feature entitled "Hardware & Software," devoted to new data processing equipment.

A large number of the 187 journals currently abstracted by ANBAR deal specifically with computers and data processing. They include *Computer Bulletin*, *Computer Management*, *Computer Education*, *Computer Journal*, *Computer Weekly*, *Computer Weekly International*, *Data Management*, *Data Processing*, *Datascene*, *Data Systems*, *Program*, *Data Processing Magazine*, and *DATAMATION*.
K. G. B. BAKWELL
Wembley, England

Touch downer

Sir:

I noticed in a recent issue of *DATAMATION* (Sept. 1, p. 9) a reader's letter concerning a more efficient data-input keyboard; in this case the Dvorak

(Dvorak-Dealey).

Data processing equipment keyboards are derived from the standard typewriter keyboard, whose left-hand oriented letter arrangement is the child of inventor Christopher Latham Sholes and is about to celebrate its first centennial (1872).

Better keyboards have been engineered, including the Minimotion, by R. T. Griffith, but all good efforts have been frustrated by the problem of retaining thousands of touch-typists trained in the traditional system.

It would take a unified, concerted effort by the big names in data processing to make a swingover to a new system. Like conversion to the metric system, such a move would not only be desirable, but ultimately necessary. Who knows but that a data processing industry switch to a more efficient keyboard might pull the entire typewriter manufacturing world along with it!

The above information was taken from pages 740-43 of "The Codebreakers" by David Kahn (Macmillan Co., N.Y., 1967).

F. W. CHESSON
Waterbury, Connecticut

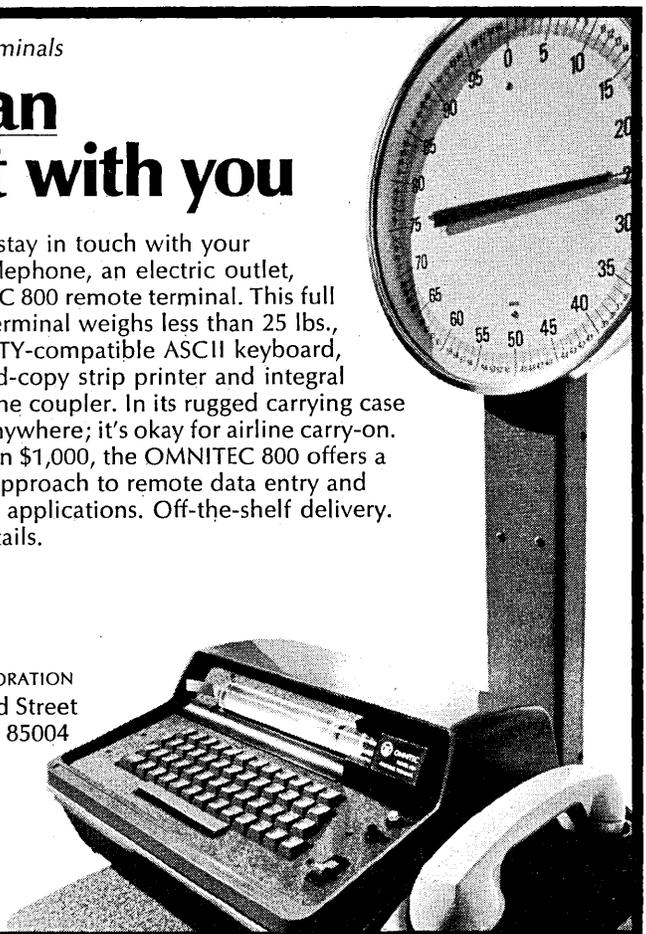
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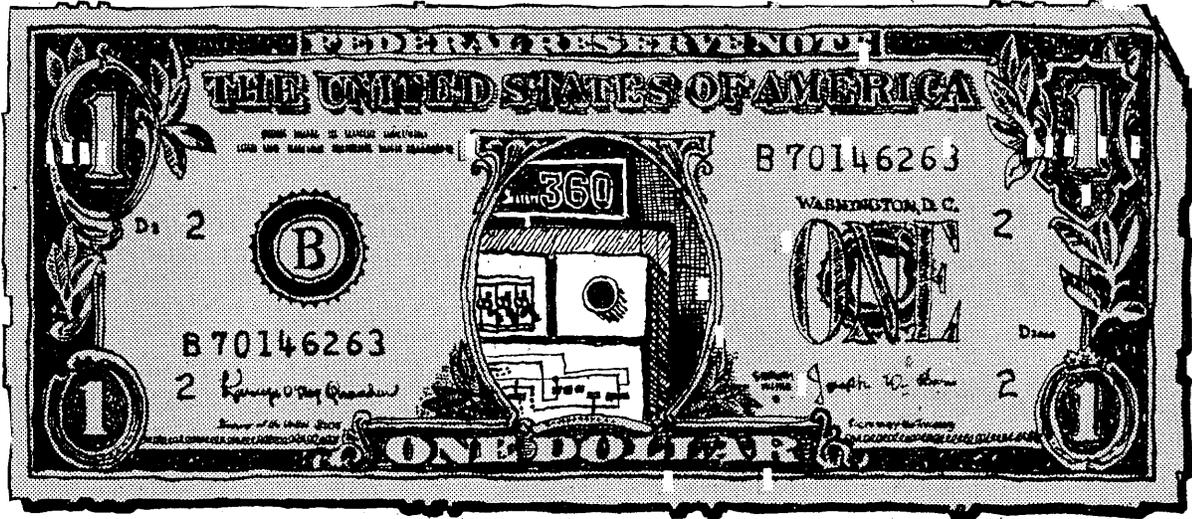


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PEOPLE

Executive creaking and hauling, called "realignment" in the official releases, continues at companies trying to keep themselves on an even keel through the present blow. At Datatab, Inc., NYC-based data center operator also in L.A. and Chicago, **Alvin L. Steinhart** has relinquished his position as board chairman and chief executive officer to treasurer (who will remain so) **Gerald Yass**. Steinhart has assumed the presidency, succeeding **Salvatore Parisi**, who has resigned, no comment. **Richard R. Scotson** has moved from vp of operations to the presidency of the New York center, succeeding **Sidney Shapiro**, who has resigned, no comment. And the NYC data center vp, **Stanley J. Schiffman**, was formerly vp of planning, the post apparently unreplaced. The rather downward shift was described as "a prudent measure" to continue Datatab's profit record. . . . **Dr. James R. Guard** has resigned his president's post at Princeton's Applied Logic Corp. to **Martin T. Mobach**, hitherto exec vp/gm and a former IBM managerial type. Guard, founder of the company, will continue as vp in his forte, advanced software systems. . . . **Dudley P. Spofford** resigned as president of Microform Data Systems, Inc., after the company reported a fiscal year loss of \$2.75 million. His office is not yet filled, but **Dean T. Mack** has been promoted to exec vp/gm at the Menlo Park, Calif., firm. . . . Back at RCA, **Andrew F. Inglis** is vp/gm of the communications systems division of newly combined Government and Commercial Systems; **Bruce G. Curry** has become staff vp of management information systems programs, servic-

ing dp for all divisions and subsidiaries. . . . At TRW Data Systems, **James W. Power** has shifted from financial vp to exec vp/gm of the entire operation, a newly created position. . . . At GE, **Dr. Thomas A. Vanderslice**, formerly deputy division general manager of the information systems programs division in Phoenix, has been appointed gm of the electric components division in Syracuse, succeeding **Dr. Leonard C. Maier, Jr.**, who has gone on to be corporate head of consulting services. . . . The message from Western Union can be read through its advancing executives—**Russell McFall** passed the presidential title of the telegraph company to **Earl D. Hilburn**, whom he gave credit for being "responsible for implementing the decisions that have permitted wu to adapt computer technology to the development of its integrated electronic communications service." He has been with the company four years since coming from NASA. McFall will remain chairman and president of the parent corporations, assisted by **Burton G. Mendelson**, elected vp of corporate development, whose special commission is to promote mergers and joint ventures "involving companies in the communications and information-service industries." He was a Motorola man before joining wu, also four years ago. . . . Appointed director of the Automatic DP Equipment Selection Directorate which is responsible for evaluating computer contractor proposals for Air Force installations worldwide, **Col. Robert F. Jensen** succeeds **Col. Robert L. Jones**, who has gone to the Pentagon as deputy director of data automation. Jensen



Bruce G. Curry



James W. Power



Dr. T. A. Vanderslice



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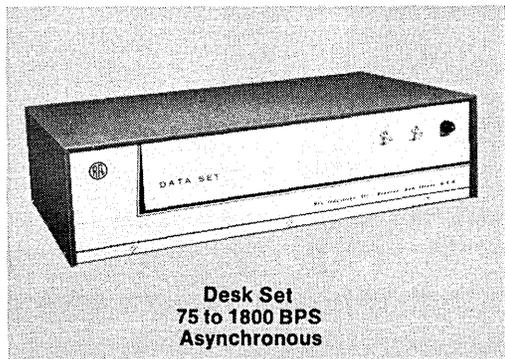


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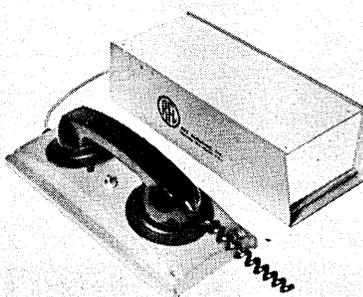
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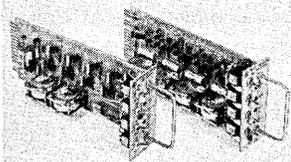
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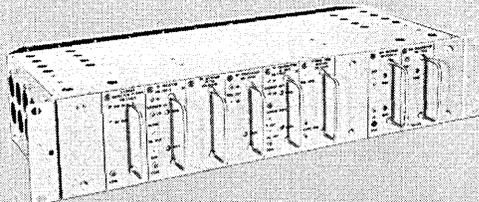
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will be stationed at AF Electronic Systems division hq, Hanscom Field, Mass. He spent the last two years at SHAPE hq in Belgium. Also at Hanscom, new deputy for command and management systems is **Col. Gonzalo Fernandez**, responsible for design, development and acquisition of computer-based command systems, integrated command-management systems, and selection and acquisition of dp equipment. . . . Two ex-Honeywellians have become presidents on their own: **Arthur Carr**, who also is chief executive officer at Codex Corp., Watertown, Mass., maker of data communications modems, where he came in 1968 as marketing vp; and **Neil D. Morrison**, who has taken over at Spiras Systems, Inc., a Boston subsidiary of USM Corp. producing minicomputers and peripherals, after coming directly from being vp of operations at Honeywell's Computer Control Division. He also directed Honeywell's European operations for four years from Scotland. . . . One of the founders of Penta Computer Associates (which recently agreed to merge with Redcor), **Richard E. Ketover**, is now chief exec and operating officer of an NYC data center, Dataplan, Inc., majority-owned by Informatics. His operating experience includes centers affiliated with Computer Usage and DPF&G. . . . **David R. Buchanan** had the dubious distinction of resigning three posts, as vp of both Wabash Computer Corp. and Wabash Magnetics, Inc., and as president of subsidiary Peripherals, Inc., in Phoenix, "for personal reasons." . . . **John F. Ready** resigned as exec vp of Tenet, Inc., cpu manufacturer of Sunnyvale, Calif., because his "job was finished." . . . **F. A. Ryder** has come over from a vice presidency of Stewart-Warner Corp. to take active control as president of I/O Com, Inc., Sunnyvale, where he previously served as board chairman. I/O makes monitoring equipment for tv commercials. . . . **J. W. McMurry III** has been appointed vp and planning director at Computer Dimensions, Inc., the Dallas-based service bureau firm. Prior experience includes seven years with the Service Bureau Corp. There is also a new financial vp, **Thomas A. Knapik**. . . . The man responsible for organizing the development of an advanced electronic point-of-sale system for the Sweda division of Litton Industries, senior vp **John H. Rubel**, has been put in charge of industrial systems and equipment. ■

A vs. B . . .

ting used to things we tend to make them sacred. And of course some people develop vested interests.

Believe it or not, what may be thought of as "standard," proper, type fonts aren't traditional. New books often have a printer's note expressing pride in having used a newly "designed" (!) font. And thank God, for we no longer have to contend with the "f" and "s" problem found in old books.

Hardware people have their hang-ups, too. Small character sets and graceless, illegible symbols were sanctified years ago as part of this coldly "efficient" industry. Anyone who complains is treated as an ignorant outsider.

The point of ocr fonts, one would think—unless I really *am* an ignorant outsider—is that an ocr font is usefully readable by *both* machines and humans. As for aesthetics, there's also something beautiful in getting things done. To this end, how about some rationality? We need some evidence:

1. What are the error rates, reading speeds, costs, etc., when the various fonts—OCR-A, -B, or whatever—are read by machines designed to read the font in question?

2. Ditto, for humans who are accustomed to the font under test.

3. In connection with (2), what evidence is there on the effects of dropping lower case alphas? I've been told that with the use of upper case only, human effort must be increased and that efficiency falls. And I notice that substantially every page of DATAMATION's June issue is printed in both upper and lower case; apparently you have found that information processing from your pages into reader's brains requires this characteristic. Even Viatron's ad for ocr equipment, which shows a new font minus lower case, uses lower case in its selling message.

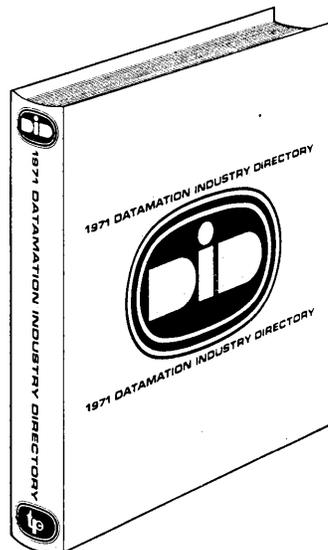
The benefits of standardization are obvious, but until questions like the above are thoroughly and publicly kicked around, the benefits can't really materialize. I have the impression that attitudes in NBS, ANSI and the OEM industry diverge, but nowhere do I hear of constructive and publicized discussion/experimentation. Or am I just plain uninformed?

FRANK M. BREWSTER
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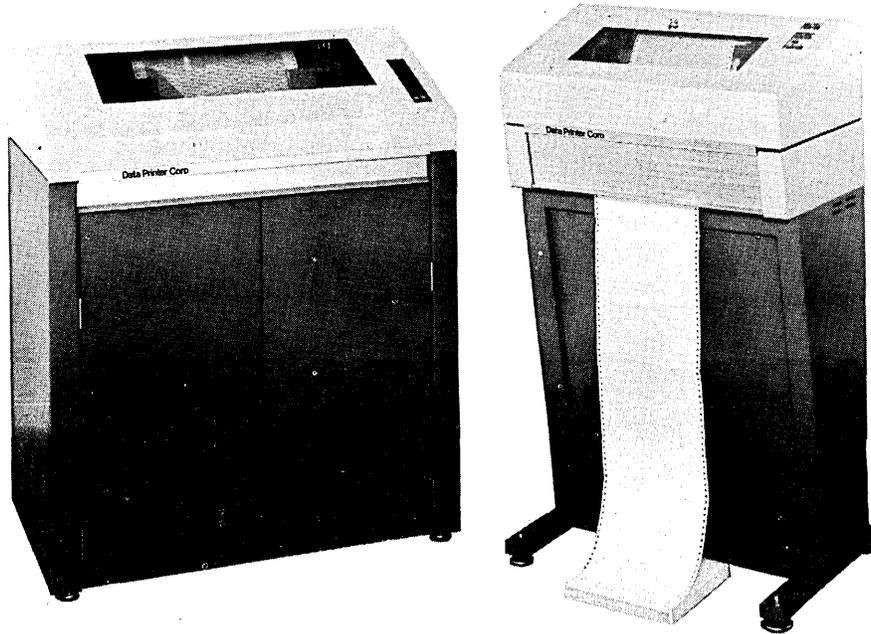
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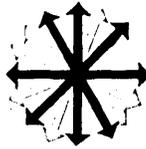
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BOOKS



Concepts and Models in Biomathematics, Vol. I, edited by F. Heinmetz, Marcel Dekker, Inc., New York, 1969, 287 pp.

To put second things first, this is a beautiful book. Marcel Dekker obviously cares. There may be a printing error someplace, but I did not find it, and that is saying a lot about printing a book with material as difficult as this one. However, although beautifully set and bound, the authors or publishers need to learn about photocopying flowcharts and computer printout—some of the flowcharts and most of the reproduced programs are all but unreadable. Perhaps computer-driven typesetting could correct this.

This volume is number one in a projected series entitled *Biomathematics* which will be edited jointly by F. Heinmetz and Lee D. Cady, Jr. The objectives of the series are not entirely clear, but if we are to judge by the first volume it will, at the very least, be a superlative collection of computer-based experiments in biomathematics. The flyleaf notes that the book would be suitable as a text for quantitative biology courses, which I doubt, unless by "quantitative biology" they mean precisely biomathematical models. Then, by all means, the next best thing to doing one's own homework is to study the masters.

The editor must have insisted on a certain form since all of the articles not only show actual programs, data, and output, but also use this data to accomplish something useful by showing how it was done and where the future lies. Most of the material is new. Although some are summaries of past work, most of the papers appear to be designed for this publication. D. Garfinkle occupies one-fourth of the book by himself; the remaining articles average 30 pages. The eight articles come under the following classifications:

1. *Specific biological reactions:* Garfinkle on Glycolytic Systems and Pring on electron transport;

2. *Compartmental analysis:* Pizer, Ashare, Callahan, and Brownell on analysis of tracer data;

3. *Physiological phenomena:* Ackerman, Gatewood, Rosevear, and Molnar on glucose regulation;

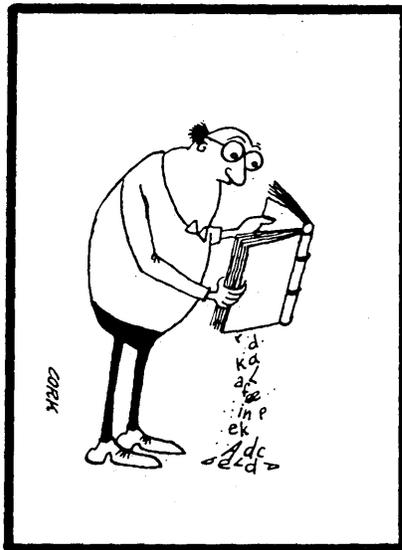
4. *Growth process and regulation:*

Heinmetz on cellular growth and Li and Urquhart on adrenocortical dynamics;

5. *Ecological systems:* Goodall on the grazing situations and Levin on species competition.

D. Garfinkle is by now the master of complex enzyme systems and his article spares the reader no detail in how these models are designed. The interplay between laboratory data and the computer model is especially evident in this modeling activity. Every step to an acceptable model must be argued in theory, supported by wet laboratory data where possible, or data must be approximated using the model itself. It is very educational to watch Garfinkle wend his way through this maze.

The central problem has two aspects, to arrive at a set of rate constants for a given set of kinetic chemical equations, or to postulate systems of enzymatic equations to satisfy lab-



oratory data. In engineering terms these two tasks are: (1) to fit the parameters of a given model, and (2) to identify the system by postulating a model. The parameter identification problem is the usual one of curve fitting except that here one may have 100 or more parameters for the 100 or more reactions. As many as possible are tied down by reference to work in the literature, because, as Garfinkle states: "In view of the length and complexity of the calculations, automatic methods of parameter fitting, etc., common in

simulation work, are simply inapplicable."

The system identification problem is, in a sense, easier here than in engineering systems because, paradoxically, the whole system is so complex. One may postulate an enzyme structure wherever it is needed as one might a solution to a puzzle that is only partially determined.

Finally, he discusses the problems of integrating the consequent large systems of differential equations on different machines, problems which will become more common as other biological simulations become equally complex.

M. Pring, writing on electron transport kinetics, gives a very lucid account of the problem, the questions to be investigated, the methods, the mathematics, the computer, and the results. He shows the arguments for each step of the simulation and for this reason it might have been well to have this paper precede the first. It is a simpler kinetic enzyme system and introduces the reader to the general concepts involved. True, he skips some points, as when he avoids the mathematical meat of the discussion under "curve-fitting strategy," but for the most part he shows where the problems are.

It is important to note that these simulations are now at a sufficiently complex level of detail to contribute original knowledge to the subject under study. As Garfinkle notes, "it thus appears that the work which has been done in this field so far is producing a technique of biochemical as well as of mathematical importance . . ." This has been a rather long-awaited day but, in my opinion, we will now begin to see simulation studies playing as important a role in biology as they have in engineering.

S. Pizer, et al., have a particular problem of wide applicability to solve, namely, the exponential fitting of tracer data. The method, inverting a fourier integral equation, is powerful and they add three procedures for improving the precision of the method. They thus automate a nontrivial and useful activity for the laboratory. Applicability is limited, however, by the accuracy and amount of data. In general, for biological data they show that the method has certain advantages (e.g., using all of the data and its dispersion), but that it may not be more discriminatory than previous methods. One should note, however, that it is a packaged program and

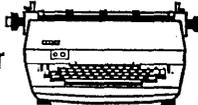


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Books . . .

evidently requires very little effort to use, and probably is as discriminatory as hand procedures.

E. Ackerman, et al., propose a model for glucose regulation in diabetes, a problem I am sure is important, complicated, and much harder than they say. Much more work has been done on this problem than indicated by their references.

F. Heinmetz, the editor, flexes his muscle on a fairly complex model of cellular growth processes. Now, here is a problem worthy of some muscle. Unfortunately, very little data is available for validity testing. A system of 30 kinetic equations is evolved from first principles. These are converted to differential equations and, with initial conditions, are solved on an analog.

The lack of experimental data severely limits the utility of this model. It very badly needs some growth data to tie down some of the parameters. Nevertheless, this functional model appears fascinating and educational. The author discusses several complex situations and, with the aid of the computer, elucidates the formal behavior of a system with his postulates. Altogether, it is a compelling argument for instituting a deliberate program for gathering more laboratory and literature data.

C. C. Li and J. Urquhart have again done the significant and comprehensive kind of job for which their work is known. In an extension of the mathematical models of the adrenal-secretory dynamics, they show in detail the development of the theory, the development of the plausible model, and a competent analysis of the model on an analog computer using both engineering dynamic response techniques and validation in the laboratory.

The final two chapters by D. Goodall on the grazing situation and by B. Levin on ecological-species competition are interesting for different reasons. The first because it provides no references whatsoever, a remarkable commentary on the newness of the science of "systems ecology." The second is remarkable because it seems completely immune to the injection of real data, a commentary on the inordinate difficulties of performing ecological experiments. Both, however, illustrate how valuable models of natural ecosystems might become. It is likely that ecosystems are at least as complicated as subsystems of an organism, but that

neither are as complex as human social systems. On this scale, it is hoped that ecosystem models of sufficient complexity to be interesting and simultaneously mathematically tractable can be constructed. The two models of these last chapters are challenging enough to whet the appetite for more.

In sum, Volume 1 of the series has come off very eruditely. Let us hope that subsequent volumes do as well. A final comment is that each of the mathematical models is implemented on a computer, the converse of which is that the computer has profoundly revolutionized not only our ability to analyze our universe, but also the discipline of applied mathematics itself. One consequence is that we can now write books on biomathematics.

—Edward C. DeLand

BOOK BRIEFS...

Automatic Data Processing and Management, by Nathan Berkowitz and Robertson Munro, Jr. Dickenson Publishing Co., Inc., Belmont, Cal., 1969. 348 pp.

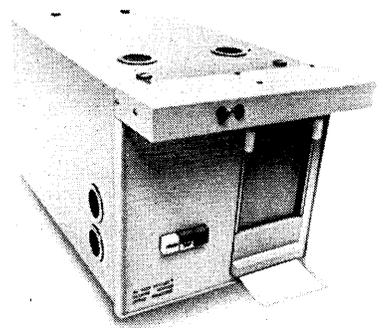
The authors originally wrote this book in 1965 as a text for their classes at Fairleigh Dickinson University. This new edition includes changes shown to be desirable by classroom experience and contains discussions of new concepts in computer systems.

The book gives a broad overview to the entire subject of automatic data processing and management. It has been written on the building-block principle, i.e., the equipment area begins with the punched-card and unit record equipment, proceeds to computers, and ultimately to on-line, real-time systems; the systems area discusses systems and programming from the initial stages through implementation; and the management area correlates the equipment and the systems with management's needs.

Only one instrument, the sales invoice, is used as an example throughout the book. Its consistent use enables the reader to relate each area discussed back to the same source document and to measure the effect of each innovation on the same basic source data.

The book contains a glossary, a bibliography and an index. ■

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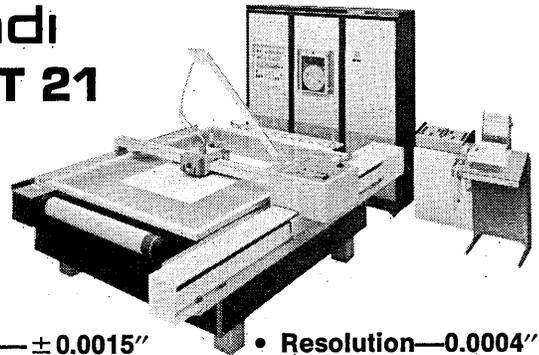
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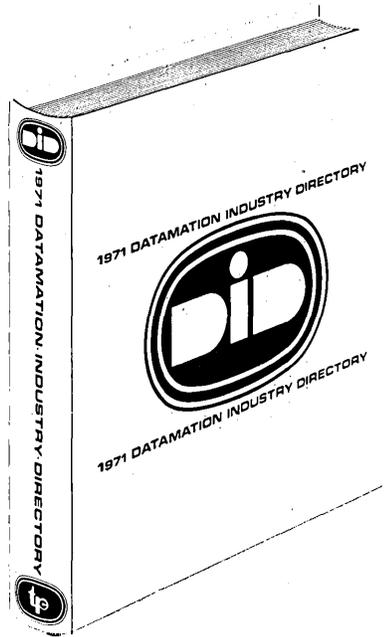
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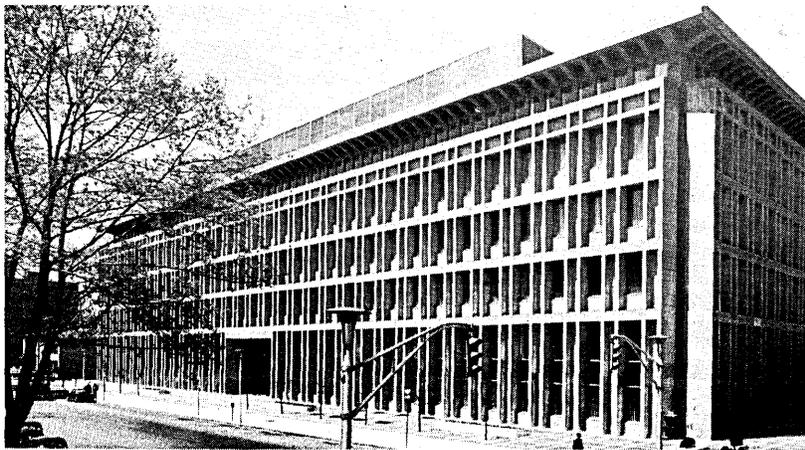
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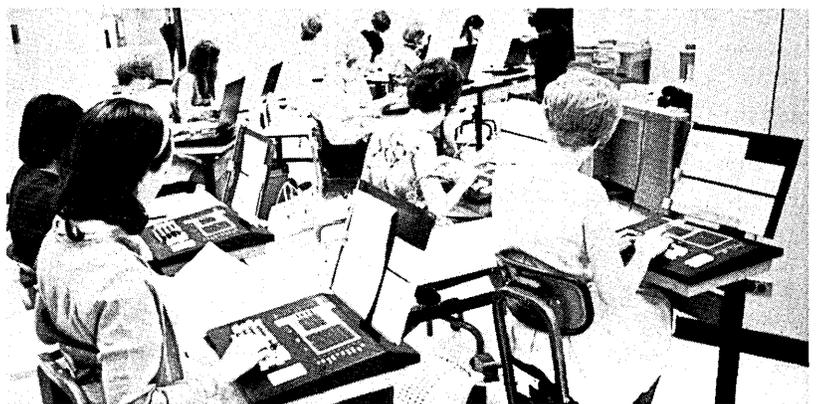


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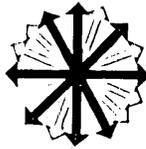
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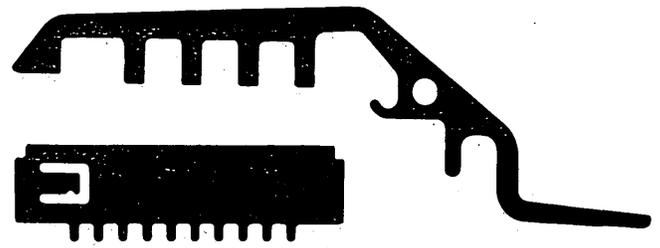
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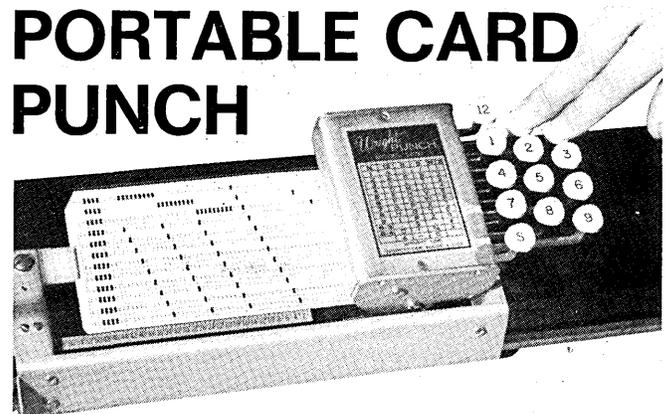
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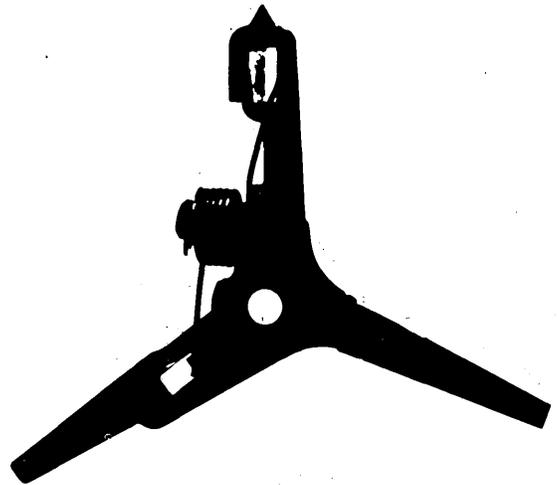
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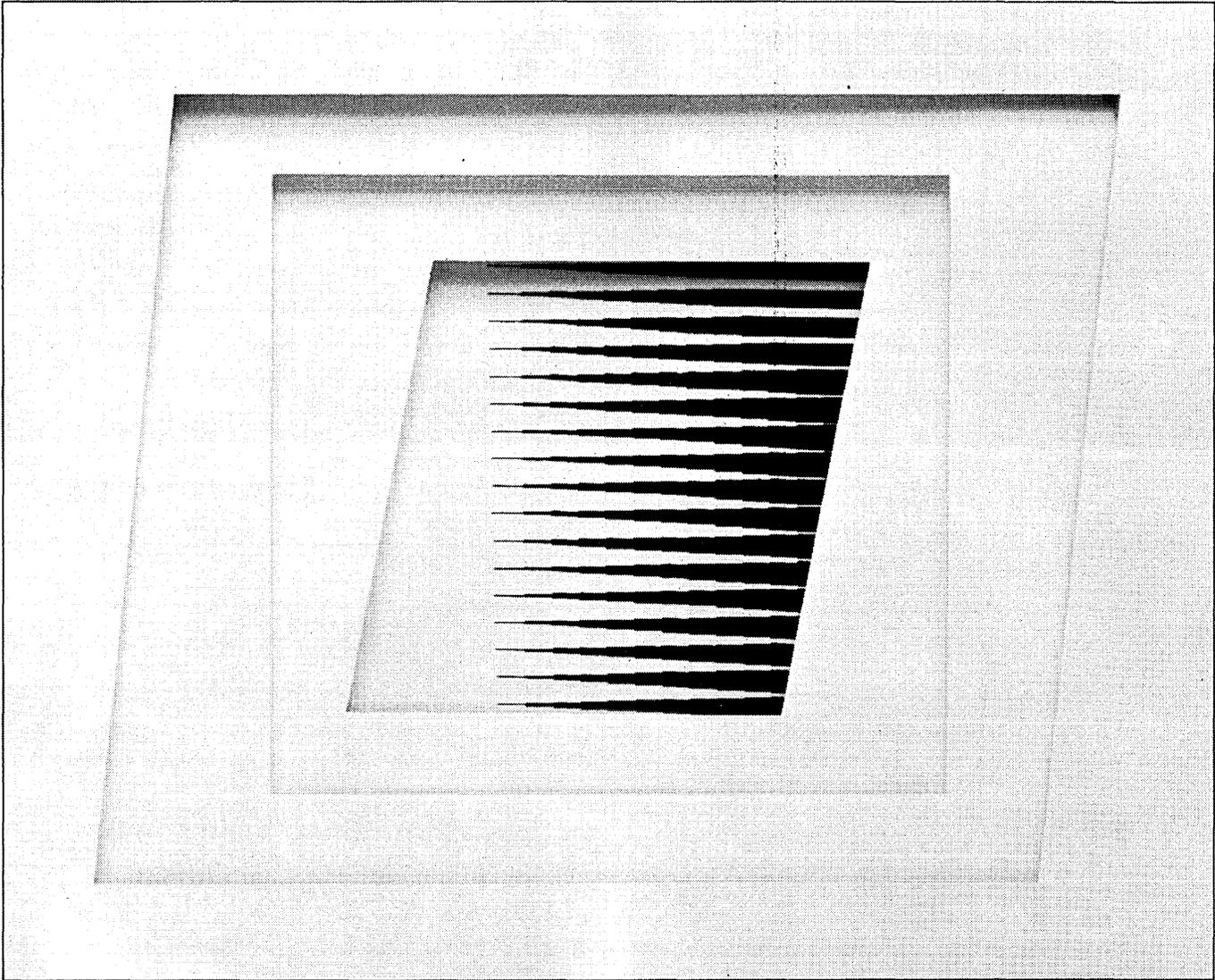
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The "Instant" Programmer

C The majority of present day data processing installations are running at a controlled state of chaos and are months behind schedule. Why does company after company suffer inefficiency in its data processing department? The data processing department is one department that should display complete confidence and tight control since it revolves around the computer, the most exacting and precise of machines.

Programming is the backbone of data processing and good programmers should be fairly easy to find and train. Yet companies search endlessly for young men and women who possess a strong background in program design and code development. These people are difficult to find not because they are in such demand and are all employed with top notch companies, but because an adequate number of well-trained programmers just does not exist. They are not there because the training programs, both inside the industry and in a majority of the educational institutions, are producing coders instead of well-qualified programmers.

Programming has been and is still being taught as a trade and not as an applied science. The average trainee enters a firm and is assigned to an experienced programmer. The programmer shows the trainee a few program examples and briefly explains to him the basic code structure and a few coding rules. Armed with a few manuals to study, the trainee

now becomes another "instant" programmer to further clog up the programming machinery.

Many programmers will vividly remember their first lesson in job control language. Another programmer gives him a deck of cards, shows him where to punch his name, the sequence in which the various cards go, and that is all. The trainee wonders—what is it all about? Often it takes a programmer weeks before he is even able to remember the sequence in which the various cards go and months before the mystery of job control begins to unfold, if at all.

The same "slap jack" approach is used in most classrooms with no better results. Teachers usually show the students a program (in the given language) and then build on and around the code from there. This is the old *canned* program approach. The programmers resulting from this grossly inefficient and antiquated method of training are glutting the data processing field. Such people, due to their ignorance and incompetence, contribute to the continuing chaos and weakening of data processing departments.

The only justification, if it can be so termed, for this method of training is that it requires the least amount of imagination, planning and knowledge on the part of the course designers, textbook writers, and instructors.

Programming is a highly technical job and demands a high degree of intelligence. It should be taught, learned, and practiced in the same mode as other highly technical pro-

fessions. Learning to program can be broken into the following steps:

1. Basic familiarity with the computer hardware and general architectural aspects of the machine.
2. Learning the general and overall programming logic.
3. Learning the structure, logic, usage, and coding of the programming language.

Unfortunately, the sequence of these learning steps is usually reversed and the first and only thing a programmer is taught is the code and code writing.

A programmer should familiarize himself with the specific physical and functional characteristics of the computer system he is going to work with. Often, programmers shy away from having to learn the basic architectural concepts of the computer system. This especially holds true of business application oriented programmers using COBOL. The notion, or should we say "misnotion," here being that high level business oriented languages do not necessitate learning of the physical aspects of the computer system. This practice of not familiarizing oneself with computer hardware leads to inefficient code development and low level utilization of the facilities offered by the complicated and highly efficient modern day computers.

A majority of programming managers and a great number of programming instructors believe that unless a programmer is writing assembly and compiler level codes he need not familiarize himself with a computer's basic architectural concepts. There is

nothing farther from the truth. Ignorance in this department of programming knowledge leads to a poor programmer writing bankrupt programs.

Programmers must be taught the basic and general programming logic techniques, as they do not vary to any great degree from one application to another—especially in business applications. He should develop a thorough understanding of different types of file organization techniques, data manipulation and data management techniques. General data editing and data validation methods, file updating methods and other basic programming concepts should be explored in depth. Due to inadequate knowledge of these points, programmers often end up designing files which have to be sorted an excessive number of times and require extensive data manipulation before the data can be retrieved and used.

While learning a programming language, a programmer must try to understand and grasp the logic and the structure of the language. He should not concentrate on learning the basic code and its usage without trying to understand the over-all language logic and structure. One of the greatest flaws in teaching programming languages is that often the teacher emphasizes only the technique of writing code in the given language. For example, in the case of COBOL, very few beginning students and even experienced programmers understand the logic behind the usage of level numbers in the Data Division of COBOL programs. As such, data organization and manipulation techniques of most programmers leave a lot to be desired and usually result in an extremely inefficient code structure.

Discussions with a number of students learning COBOL have revealed that a majority of them were deeply confused and mystified with the various optional entries provided in the COBOL language. Very few knew enough about the language to be able to utilize the optional entries towards producing an efficient and logically tight program. Often due to the lack of deep understanding of the language structure, teachers end up imparting substandard instruction and together with their misguided

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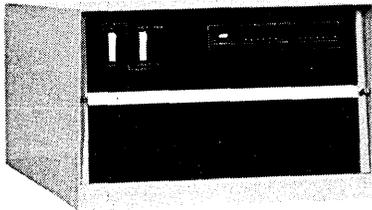
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students they have come up with such cliches as "COBOL is a self-documenting language." As a result, the majority of programs written by such programmers are a hodge-podge of haphazard code.

At times, even the author of such programs is unable to decipher the code and is seldom able to make any sense out of it. Whose fault is it? Certainly not that of the people who designed the language or the computer system. The blame goes to the people who teach and use the language in an extremely superficial and inefficient way.

Programming, one of the applied sciences, must be taught, learned, and practiced as an applied science. Very seldom, if at all, does one run into a civil engineer who learned the theory of beam design before learning the theory of structures and the property of materials. A programmer should be taught, along with the language, theory of file structure, file organization, file update logic, problem solving techniques and similar programming fundamentals. Some programmers take years to learn the various file organization techniques supported by the third-generation hardware and software and in the meantime continue organizing data as it was done for unit record equipment.

Some will say that it is not possible to teach a person the logic of problem processing in a relatively short span of a few months. It is true that problem processing logic has to be learned through consistent practice and varied experience. Nonetheless, principles of computer hardware and its architectural concepts and the basic principles of problem logic development can be and must be introduced at the initial learning stages.

If the demand for competent programmers is going to be met even partially, drastic changes must be made in the existing training methods in educational institutions and especially in the industry. The "rob Peter to pay Paul" method of companies luring programmers from each other is a great disgrace to the entire profession of data processing. Necessary changes, as outlined here, must be made to raise the training standards of prospective programmers.

—Gopal Kapur

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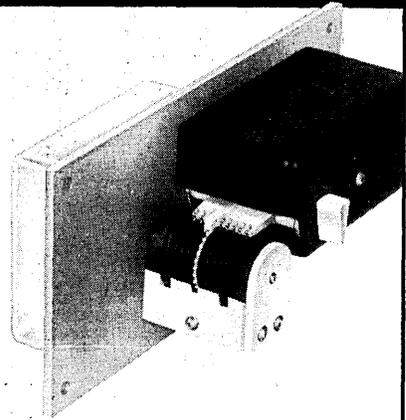
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