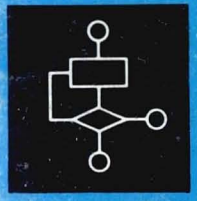
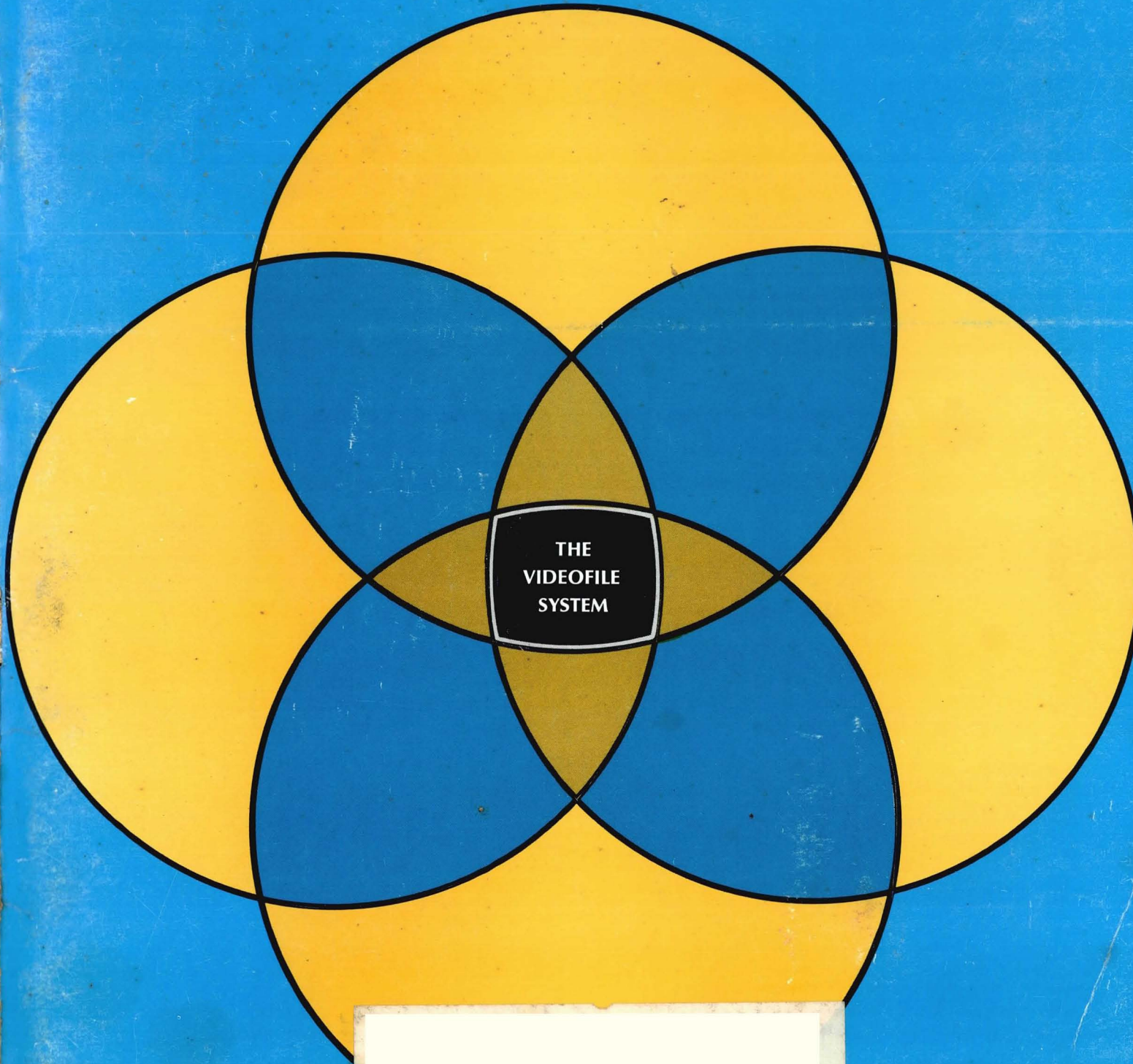


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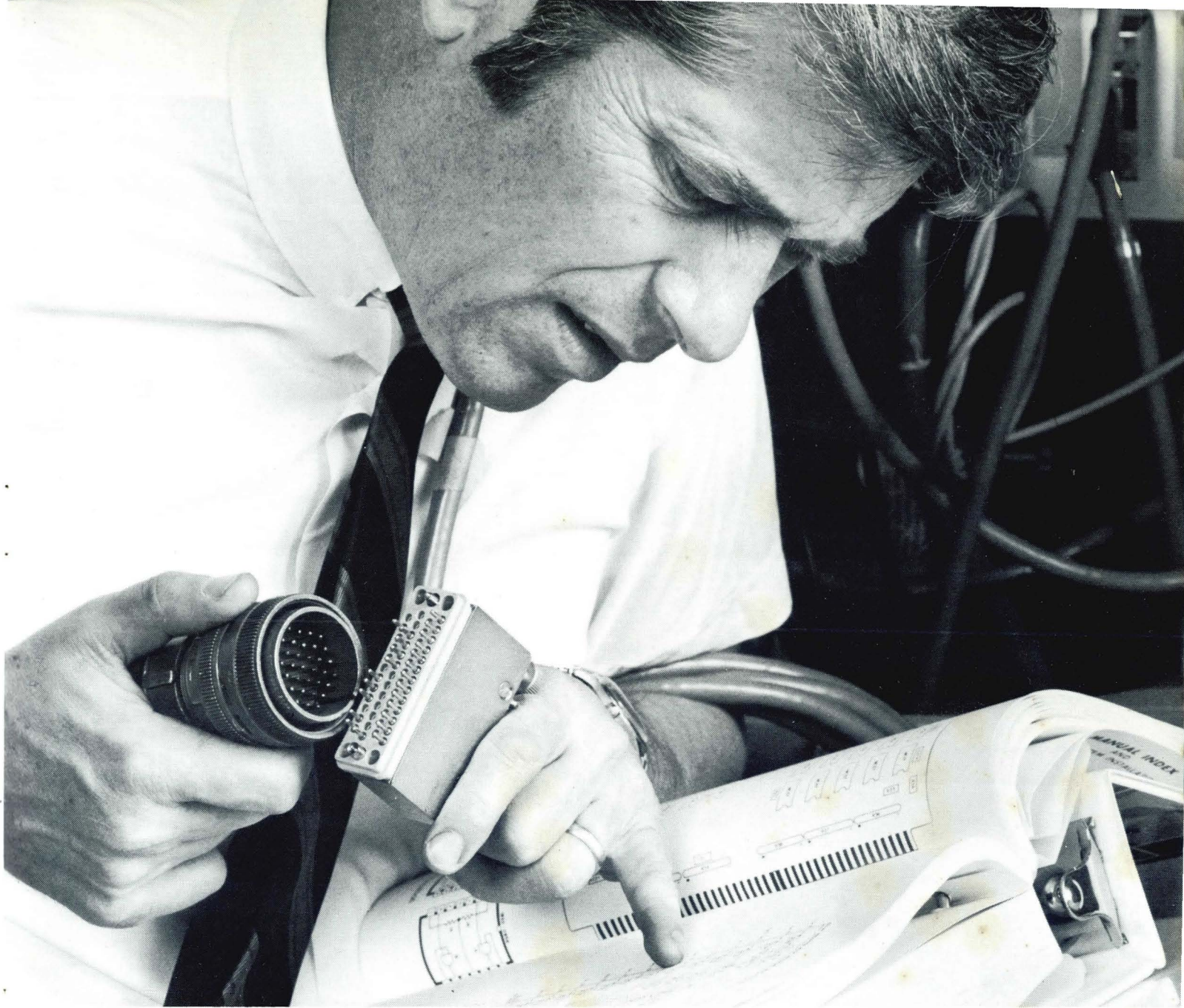
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COVER BY WILLIAM KWIATKOWSKI

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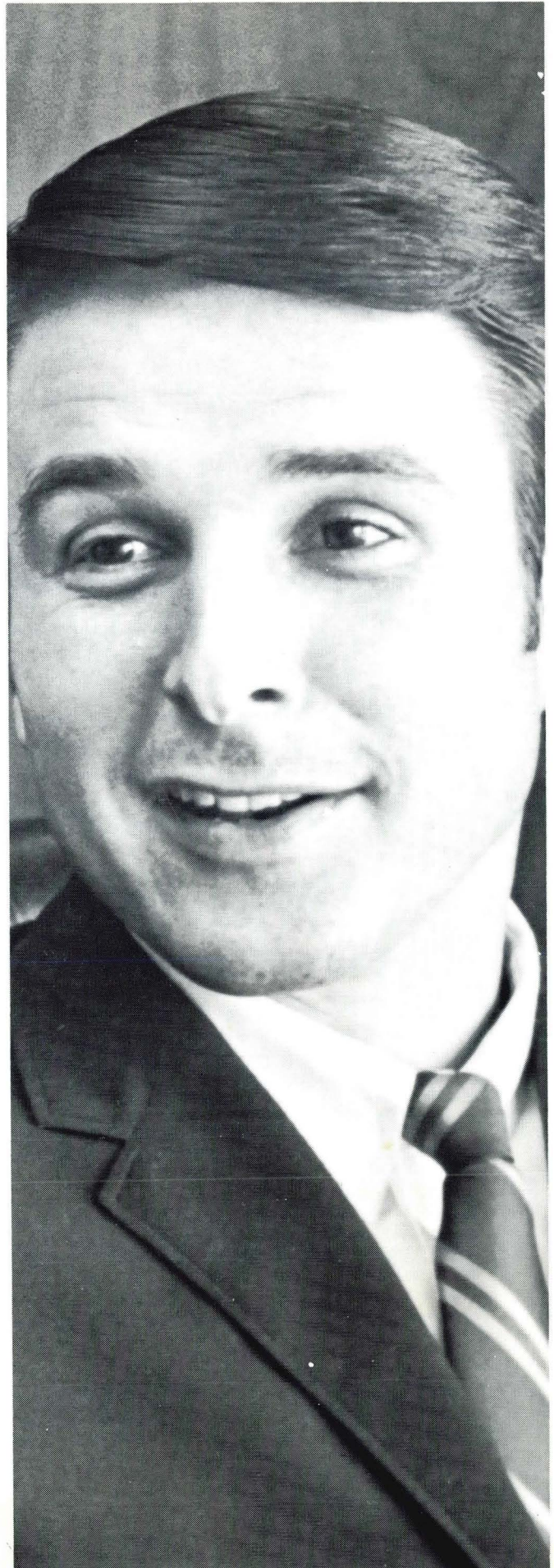
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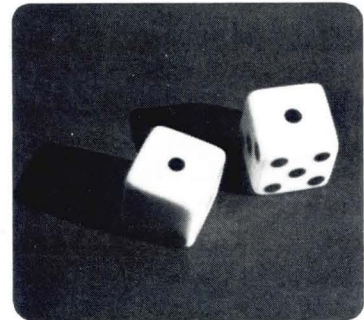
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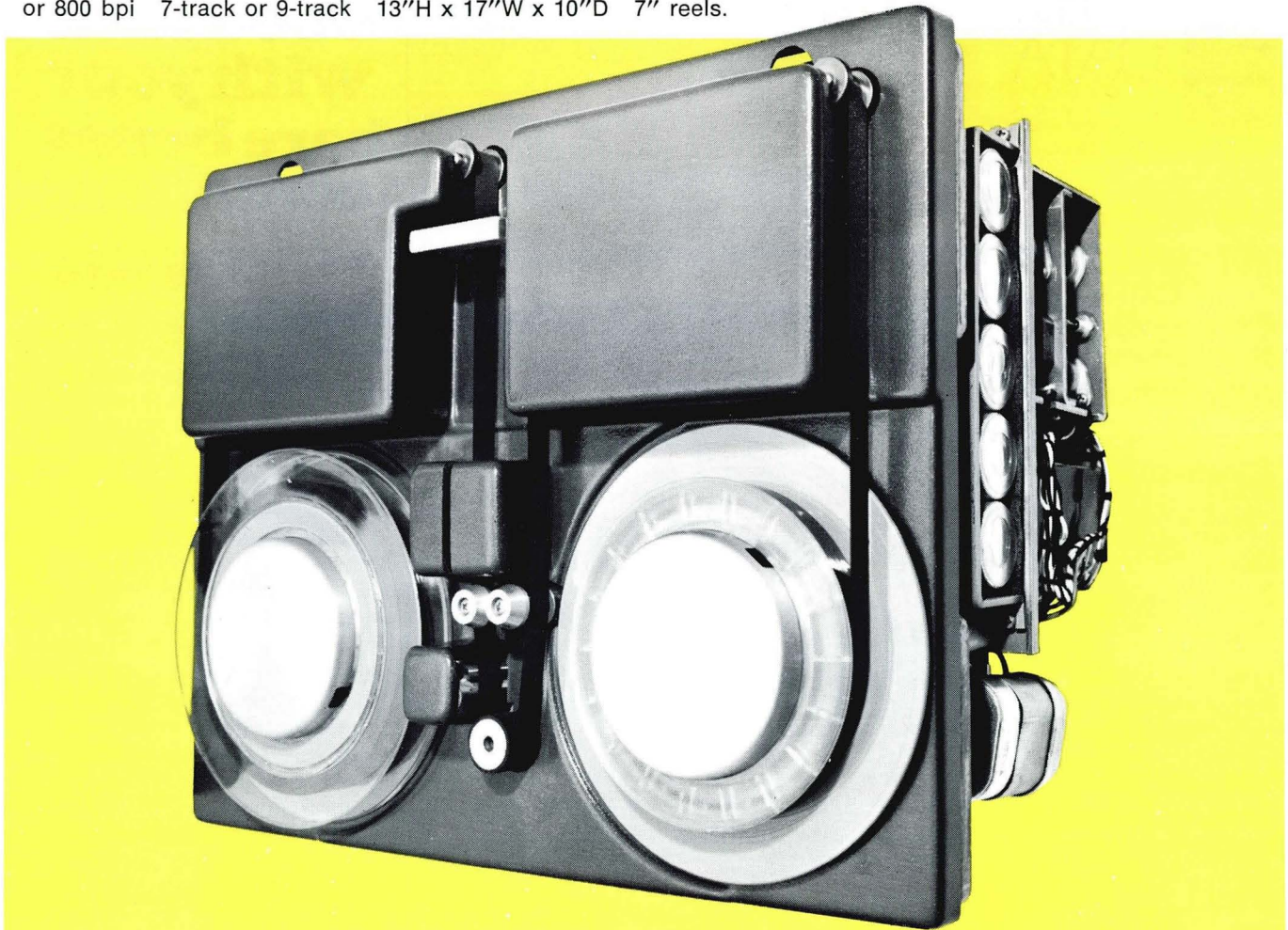
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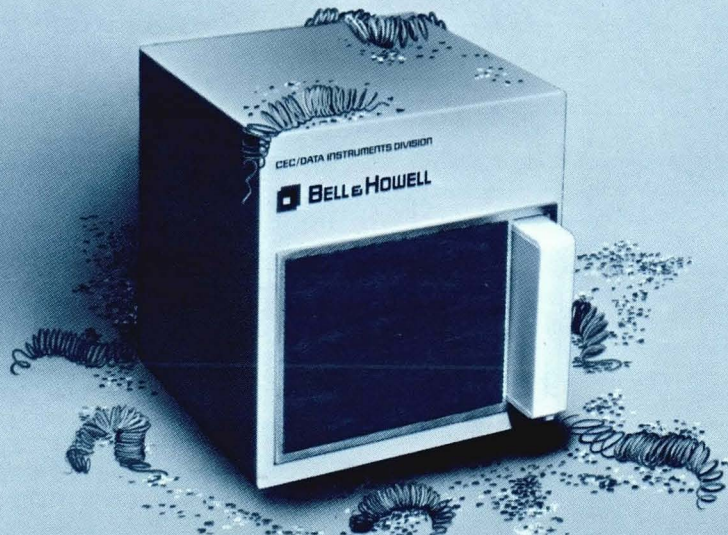
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LETTERS TO THE EDITOR

To the Editor:

It does not surprise me that Ethan I. Shedley chooses to remain anonymous. His comparison of the 7600 and 360/195 is a classic example of ignorance in action. To illustrate with only two examples: even a NOP on the 7600 requires a minimum of two of those 27.5 nsec cycles, and there are no move instructions required to "get back and forth between large and small core" of the 360/195 because it is implemented in the hardware.

The professional integrity of your publication requires confirmation of articles representing themselves as factual.

G. L. Miller,
McLean, Va.

To the Editor:

Your article, "IBM 'Socks It To 'Em'" from the October, 1969 issue, contains substantial numbers of factual errors, misleading remarks, and baseless conjectures:

1. A few hours of 195 time has been

available to *bona fide* prospects for the 195 since October. My firm, in fact, had benchmarks run on the 195 in September, 1969.

2. The 195 will run OS/MVT (or did with our benchmarks) unchanged: there is no "conversion problem" for 360 users.

3. To suggest that the 7600 compensates for the vast 195 instructions repertoire by using 3-address instructions (as compared with the predominantly two-address scheme of the 360 series) is an "applies-to-oranges" comparison.

4. The relationship between fast and slow memories on the two machines is quite different. The 195 does not do swapping in the sense of taking positive action to change the contents of its fast (buffer) memory. The 7600 does.

5. To say that the 7600 compiler/operating system software set is "tried and true" while that of the 360/195 is "as yet unknown" reverses exactly the facts of life. As I pointed out in paragraph 2, OS/MVT is a system of some

repute: it has been around in some form for years. Similarly, FORTRAN G and H are long-standing compilers. My firm's benchmark set was run with this software. In comparison, the 7600 operating system is nowhere near release date.

6. The cards are down (so far as we are concerned) and the 195 out-computes the 7600 on our benchmark set (primarily number crunching) by about 5-10%. The CDC (7638) disks are more capacious and have better transfer rates than the IBM (2314) disks. (The requirement for super-capacity and ultra-high transfer rates are what led us to select the 7600.)

Concluding, it is my considered opinion that your magazine might do well to be more careful of the material it prints and your author should have stuck to unique name-finding.

James Brooking,
Specialist,
Computer Planning and Special Proj.
General Electric Co.,
Schenectady, N.Y.

The author's reply: *I would like to thank reader Brooking for confirming much of what I had to say in my article. With regard to the "move instructions required to get back and forth between large and small core," as pointed out by Messrs. Brooking and Miller, I have some further comments below.*

1. We undertook to make the comparison between the CDC/7600 and the IBM/195 on the behalf of MODERN DATA's editor who felt that such a comparison might be of interest to its

readers. MODERN DATA is not a bona fide prospect for an IBM/195. In looking over the copy of the article, I was not aware of having said that the 195 was not available for benchmarks, but that it was not available to me, or scheduled for delivery for some 15 to 18 months. It is, I understand, alive, well, and running at IBM.

2. We are gratified for the verification by GE that the change from one 360 system "will not engender a major conversion problem." IBM, however, notes conditions under which existing

360 programs may not operate properly on the 195, devoting several pages of the functional characteristics manual to the problems and methods for the solution thereof. FORTRAN and COBOL programs should not have difficulty; however, BAL programs may occasionally be embarrassed.

3. Perhaps I should have said "partially compensates by effectively having three-address instructions to the 195's predominantly 2-address instructions." I did not wish to imply that

4. Granting the differences between the relation of the small and large memories of the two machines, and granting Messrs. Miller's and Brookings's correction that explicit move instructions are not normally required for swapping in the 195, the operation of the 195 small memory will require the execution of swapping cycles under the following circumstances:

a. If a console or channel input has been made to a block of main memory which is presently the current block of the buffer store, the block will be invalidated and must be retransmitted to the buffer store. The fact that explicit instructions are not required on the part of the programmer does not change the fact that buffer and main storage cycles will be used to make the transfer.

b. Main store is not accessed on a fetch from buffer store. However, the implication in the IBM literature is that if a store is made to a buffer store location, it will also be made to main store. Therefore, it is reasonable to assume that stores will go at main store speed. A succession of stores, then, might be limited to main store speed, foregoing the advantages offered by the buffer store.

CDC's swapping is explicit. IBM's is implicit. One way or the other, we expect that IBM will spend more cycles moving back and forth than will CDC.

5. Our comments on the operating system were made within the context of the effective use of simultaneous processing units and stacks. CDC, having lived through the trials and tribulations of CHIPPEWA, and the better-forgotten tales of SIPROS, on the CDC/6600, has among other things learned how to make operating systems and compilers that can make effective use of stacks and parallel computation units. IBM has had no such commercial experience. Existing IBM operating systems and compilers, good as they are purported to be, have little bearing on the fielding of an operating system and compilers that optimize the use of stacks and parallel computation units.

6. We again thank reader Brookings for substantiating our "misleading remarks" including the ones about the 195 floating point operations being a hair faster; the 7600 transfer capacity being higher than that of the 195; (see the last paragraph on page 141); and the 7600 being over-all faster than the 195.

As for reader Miller's comments on the execution time of a no-op instruction, I was not aware of the statistical

significance of no-ops in running programs; however, the 7600 has a no-op instruction (15-bit length) that is used to pad a word that might contain a 30-bit and another 15-bit instruction. It does indeed take 2 cycles to execute. That would put it at 55 nanoseconds. Assuming that the equivalent 360 no-op instruction "47 (BC 0)" is a one-cycle instruction (a fact not stated in the IBM literature on the 195), its execution time would be 54 nanoseconds. We did say that the timings of the CPU's were remarkably close — they

are. However, a one megabyte 360-195 (Unit Model J) has only an 8-way interlace, giving it an effective 94.5 nanosecond cycle and making it significantly slower than the 7600.

In retrospect, I should perhaps take umbrage with the kindly editor for not having devoted the entire issue, as well as the next three issues to the substantive, complete, and totally unimpeachable comparison of these two machines that I had originally intended.

Ethan I. Shedley

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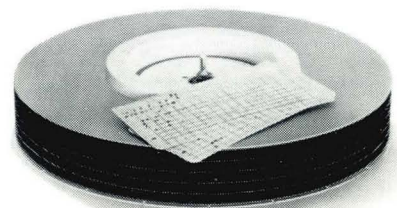
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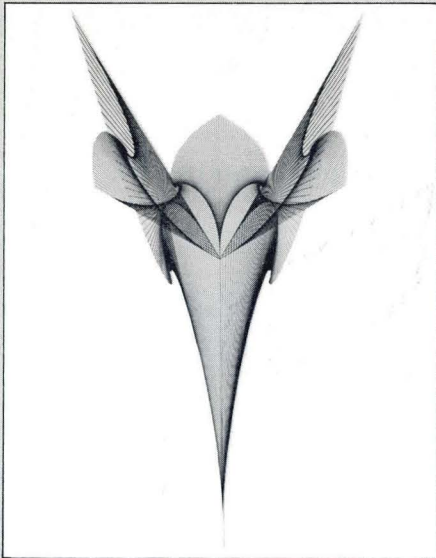
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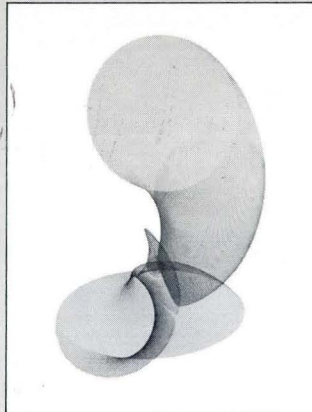
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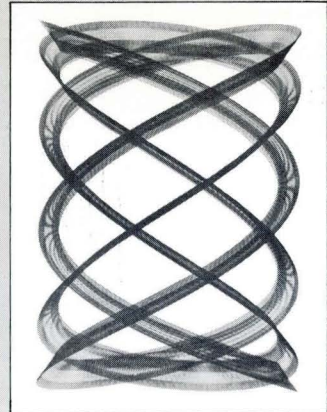
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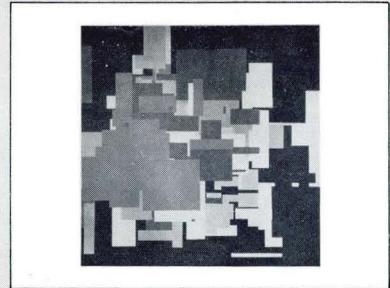
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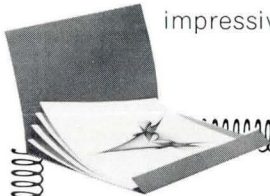


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We've taken the OEM experience we've gained from putting almost 4000 digital tape systems in the field. Added what you've told us you'd like to see in a low-cost tape drive for small computers and off-line applications. And produced the HP 7970.

It has all the features you're looking for in a digital transport: IBM and ASCII compatibility, 25 ips speed without program restrictions, DTL/TTL compatible interface. Seven or nine track capability with simple field conversion. Standard 10 $\frac{1}{2}$ inch reels. Plus handsome appearance, fingertip push-

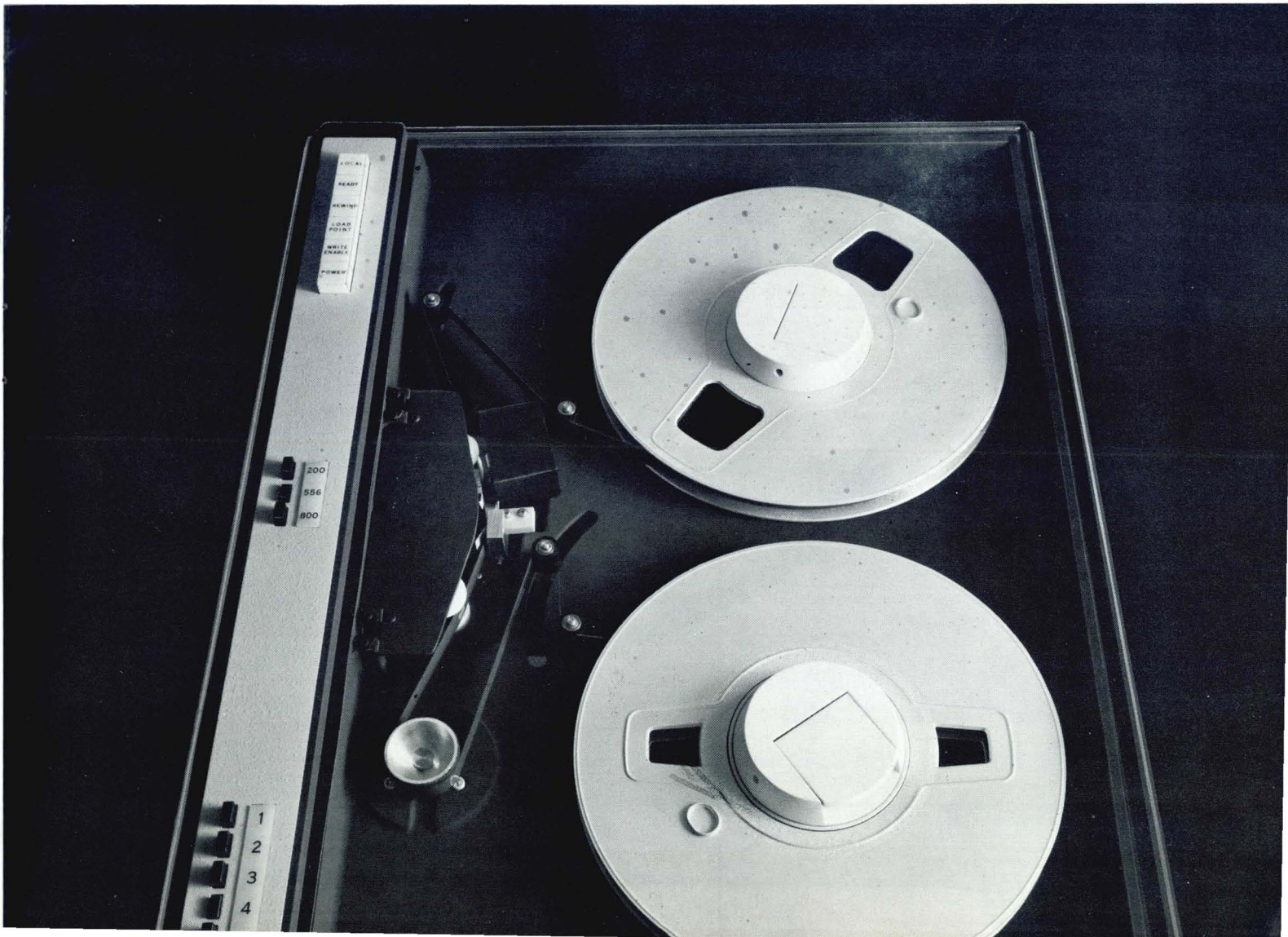
button controls, backlit indicators for quick operational status checks, dual gap head for read-after-write error checking capability.

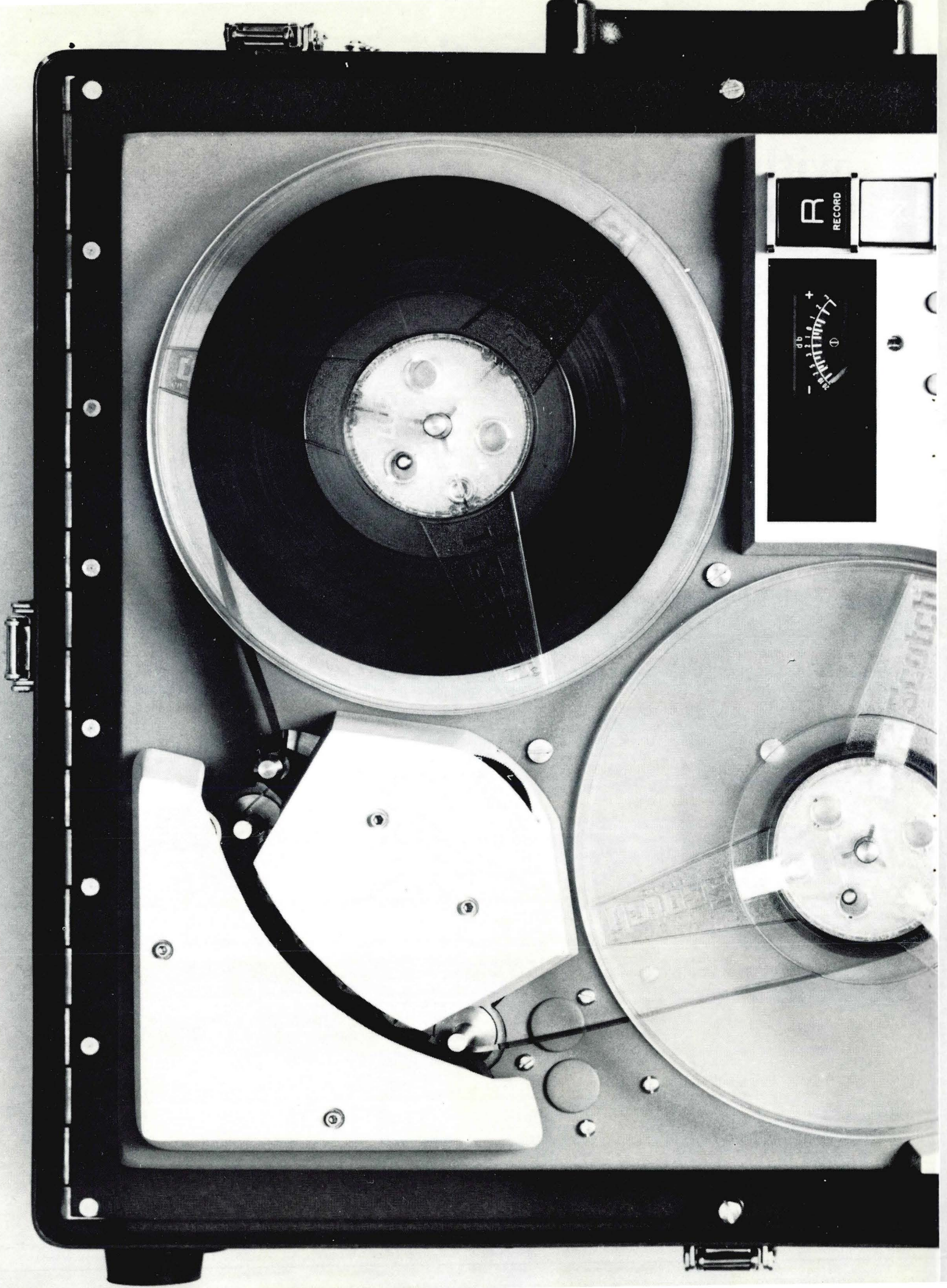
It also has HP's exclusive trouble-free design and rugged construction, with cast aluminum frame, automatically milled to precise reference planes. The tape transport components are mounted to this frame on precisely indexed bosses to assure that tape path tolerances are routine. The HP 7970 also has electronic deskewing, direct drive motors, single capstan, and dynamic braking that eliminates mechanical adjustments. Plus

the back-up capability of 141 Hewlett-Packard sales and service offices around the world.

So if you want a low cost digital tape drive with HP quality, call your Hewlett-Packard field engineer for more information on our new 7970. Or write Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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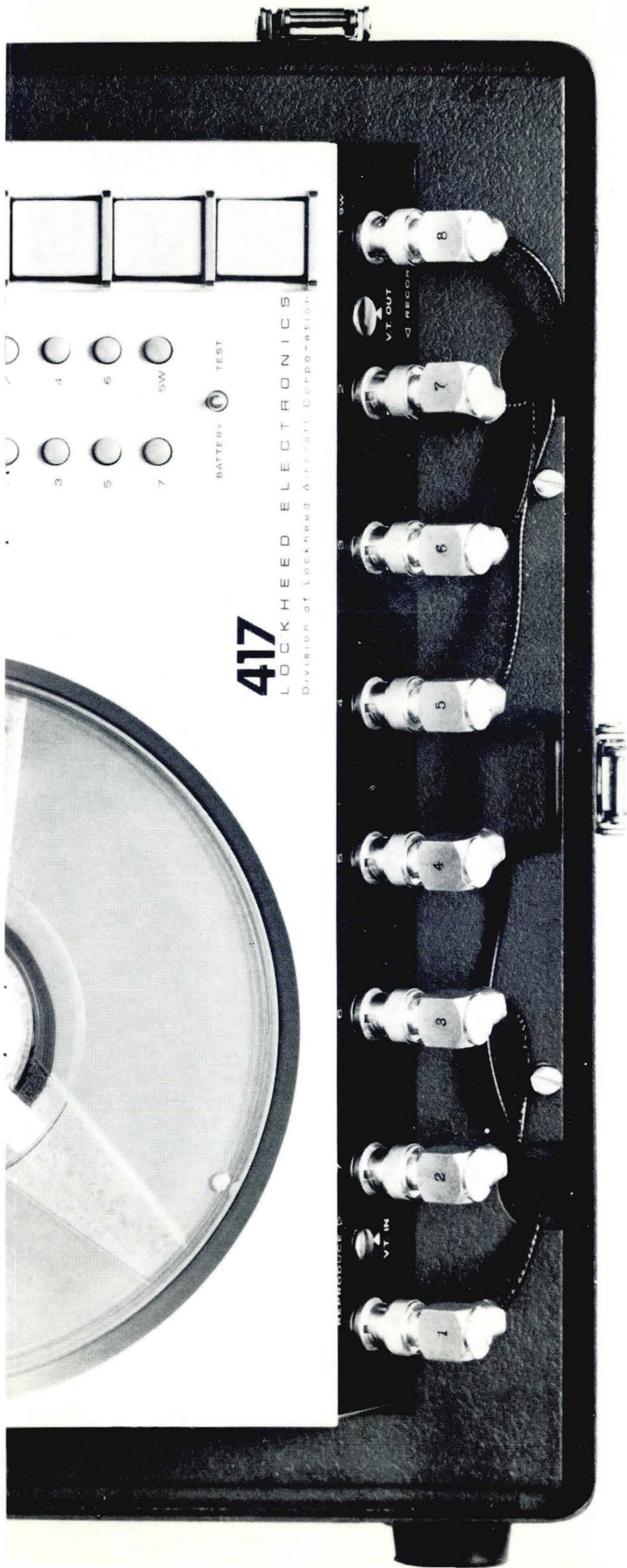


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The 417 is twice this size. And 28 lbs. heavier.

Data recording in the field is light work with the 417. For you. As for it: shake it, bounce it, bump it, stand it on end. It still records as accurately as if you'd lugged a large rack machine along. On seven channels, IRIG compatible.

Inside its standard case (15" x 14" x 6") or the rugged environmental case shown (17" x 15" x 7"), beats a heart with 200 Hz to 100 KHz direct frequency response. (FM frequency response is DC to 10 KHz.) In either case, it fits under an airliner seat.

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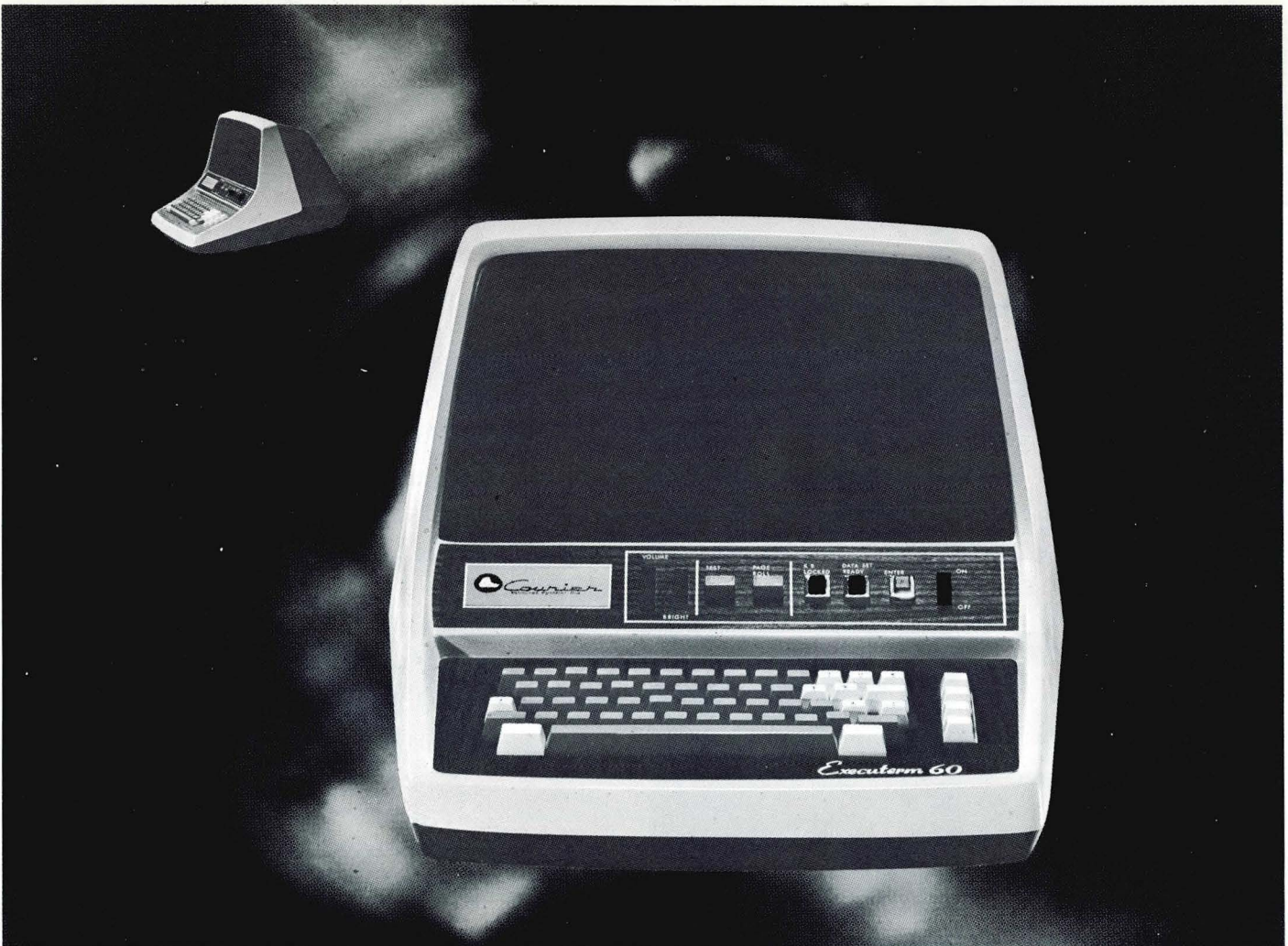
So don't bring the data to the recorder. Bring the 417 to the data. (And if there's ever a problem, bring it to any of our 35 offices in the U.S.) The portable 417. You can get away with it for as little as \$7,000.

For more specs, write: Frank Pike, Dept. 413-10, Lockheed Electronics Company, Plainfield, New Jersey 07061. Or call him at (201) 757-1600.

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Executerm 60 is available with 240 characters (6 rows of 40 characters) or 480 characters (12 rows of 40 characters), utilizing a 7 x 8 Dot Matrix. Executerm 60 does not require a separate controller* or additional software.

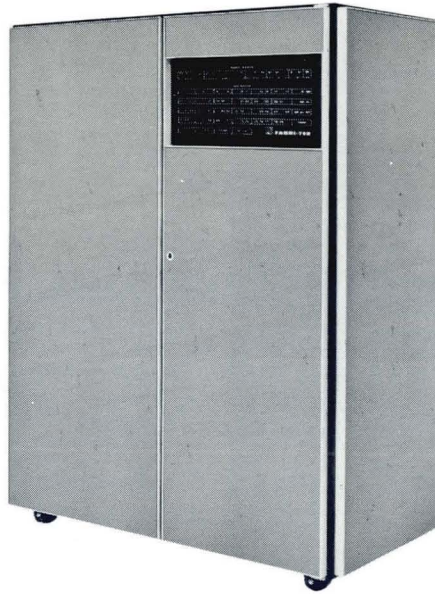
Courier also produces the Executerm I for the time sharing computer user. For further details on the operation, applications, and installation plans of the Executerm 60 and the Executerm I, write or call our Marketing Department.

*for single terminal applications




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Both models can be leased or purchased. Either way, Fabri-Tek can provide servicing on a nation-wide basis.

Call or write our local office. Our experienced application engineers are ready to help you find the solutions to your problems in the following areas: Main Memories ■ Buffer Memories ■ Scratch Pad Memories ■ CTR Refresher Memories ■ Peripheral Mass Memories ■ Mil-Spec Memories ■ Extension of Main Memory ■ Numerical Control.

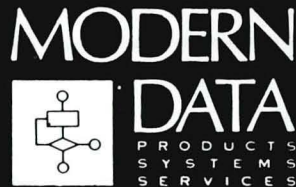


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"KEYPUNCH REPLACEMENT EQUIPMENT"

A
STATE-OF-THE-ART
REPORT FROM



SHOULD YOU SWITCH FROM KEYPUNCH EQUIPMENT TO KEY-TO-TAPE?

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The first definitive report on "Keypunch Replacement Equipment" written specially for the potential user!

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Key-to-Tape Systems available from over 30 manufacturers are described. Charts summarizing the major performance characteristics of available manufacturers' models are included in the report.

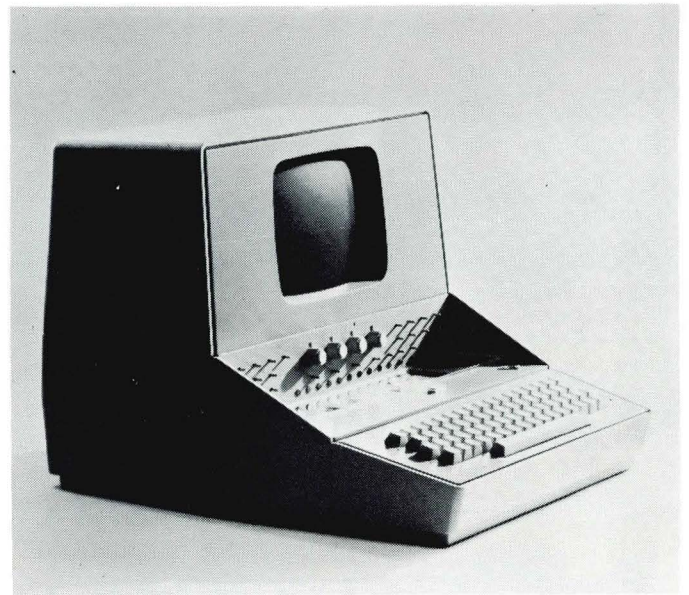


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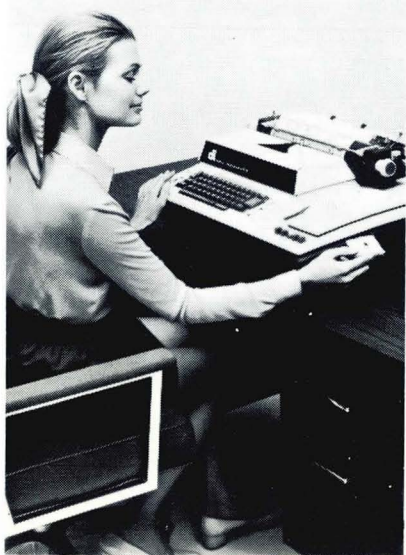
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 Equipment available from 10 manufacturers is described and tabulated in this section.



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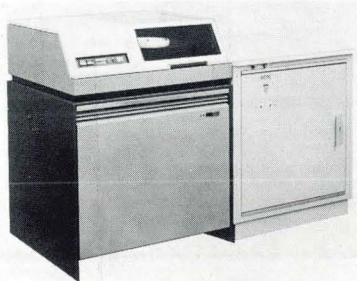
First we assembled an industrious, intelligent, conscientious determined group of computer engineers...



Then We Solved Everyone's Disk Drive Control Problems.

2311 or 2314, Buffered or Unbuffered. Minimum Cost or Maximum Efficiency. BC-DC now offers four Control Units to enable the users of non-IBM computers to take advantage of 2311 or 2314 Disk Storage Units. The minimum-cost D068 and D085 use direct-memory-access and the computer memory to provide the least

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BC-DC provides these IBM-compatible controllers, and our expert staff stands ready to help on your non-compatible storage problems as well. We also provide total systems engineering for custom applications and special problems, and dabble in the information retrieval business with our DIMBO-10 free-standing electronic file. Bring us your problems. The fish aren't biting anyhow.

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Uses software and the direct-memory-access feature of the host computer to eliminate buffers and much of the control unit logic. Under \$10,000.

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D082

Fully buffered, contains all checking and searching logic plus full-record buffer. Attach to any computer I/O facility. Under \$20,000.

For 2314's

D085

Takes the minimum-hardware approach of the D068 to control of the disk file of the future, the 2314. A steal for under \$15,000.

D086

Fully contained controller for the large disk file provides the ultimate in storage and efficiency. Go first class for under \$25,000.

Prices may be somewhat higher for quantities under 5 on certain computers.



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The second revolution in computer time sharing continues.

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■ **The AL/COM interactive time sharing network will electrify every sophisticated computer user in the United States.**

AL/COM now gives you more interactive computing power with faster response time, than any other time-sharing system . . . 32,000 36-bit words per user. Cycle time one microsecond. Your access to this increased computer power is instantaneous and direct. Through your telephone. Privately. It's a "tough-job" system and it has the best price/performance ratio there is.

■ **AL/COM has a policy about insoluble time sharing problems. We solve them.**

We're after the tough jobs, the big ones. We're talking about price/performance . . . good response time . . . and freedoms that time-sharing hasn't granted you before. Things like:

Core Capacity — AL/COM gives you 160,000 characters (32,000 words) in active core per user.

On-Line Storage — AL/COM has a billion characters of disc storage.

Large Files — AL/COM gives you 1,250,000 characters per file.

Fast Access — AL/COM can search a 2.5 million character bank in seconds.

■ **The things you can do with AL/COM time sharing are limited only by your imagination.**

AL/COM has the bugs worked out. We've been up for 3 years. We can connect you with teletypes, line printers, CRT's and multiplexers. We speak eight languages . . . BASIC, FORTRAN IV, COBOL, etc. We're adding others. AL/

COM solves problems in science, engineering, and banking. It's for operations research, marketing and statistical analysis, and bridge building . . . for management information, investments, and manufacturing. We even do little problems well.

■ **When comparing time sharing services, you can't include AL/COM with the others.**

AL/COM service stands out because we've interlaced a string of multi-processing AL-10 systems, with one computer backing up another in each system, and a second dual system backing up the first . . . and we'll soon have ten. They're all side by side, but as close as your local phone. Think about that . . . central files . . . back-up . . . speed . . . reliability . . . distributed nationwide by the AL/COM Time-Sharing Network.

■ **When you select AL/COM you get a nationwide network of computer software professionals.**

We bring AL/COM to you through a nationwide network of professional software organizations. We're more than reps, dealers or branch offices. We're AL/COM Associates; local, independent firms, among the best in the industry. Systems and applications expertise is an integral part of the AL/COM network. This means you have the largest group of independent computer software experts to help you solve problems more efficiently, right at your elbow . . . through AL/COM.

■ **In just 30 seconds, you can arrange for a demonstration of the world's best price/performance computer time sharing service.**

Experiencing AL/COM is believing. We'll benchmark AL/COM against your present system. Compare the response, the speed, the cost. Do you have a problem you can't solve on your present system? Try us. We're after the tough ones.

■ **It takes guts to start a revolution.**

Revolutions are started by people dissatisfied with the way things are. Success depends on a change for the better. That's what AL/COM is all about . . . and it's revolutionary.

Contact us for information or demonstration

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Call me Send data

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Sanders can throughput more input...

Mistake? It probably hit you right where you live. Error-free input is the life blood of any EDP man.

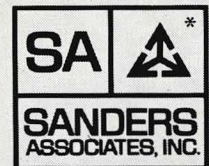
That's why Sanders designed a system that gets input moving, yet keeps it error free. The Sanders System 6000* Display Data Recorder.

The operator taps a key. Instantly, a replica of the source document—we call it a format—appears on the screen. Then the operator simply types information into the blanks. Logically. In the same

order and position as on the original. Notice how the System 6000 displays data in two intensities. It makes it easy to verify. Errors are corrected by simply overtyping. Text automatically adjusts for insertions and deletions.

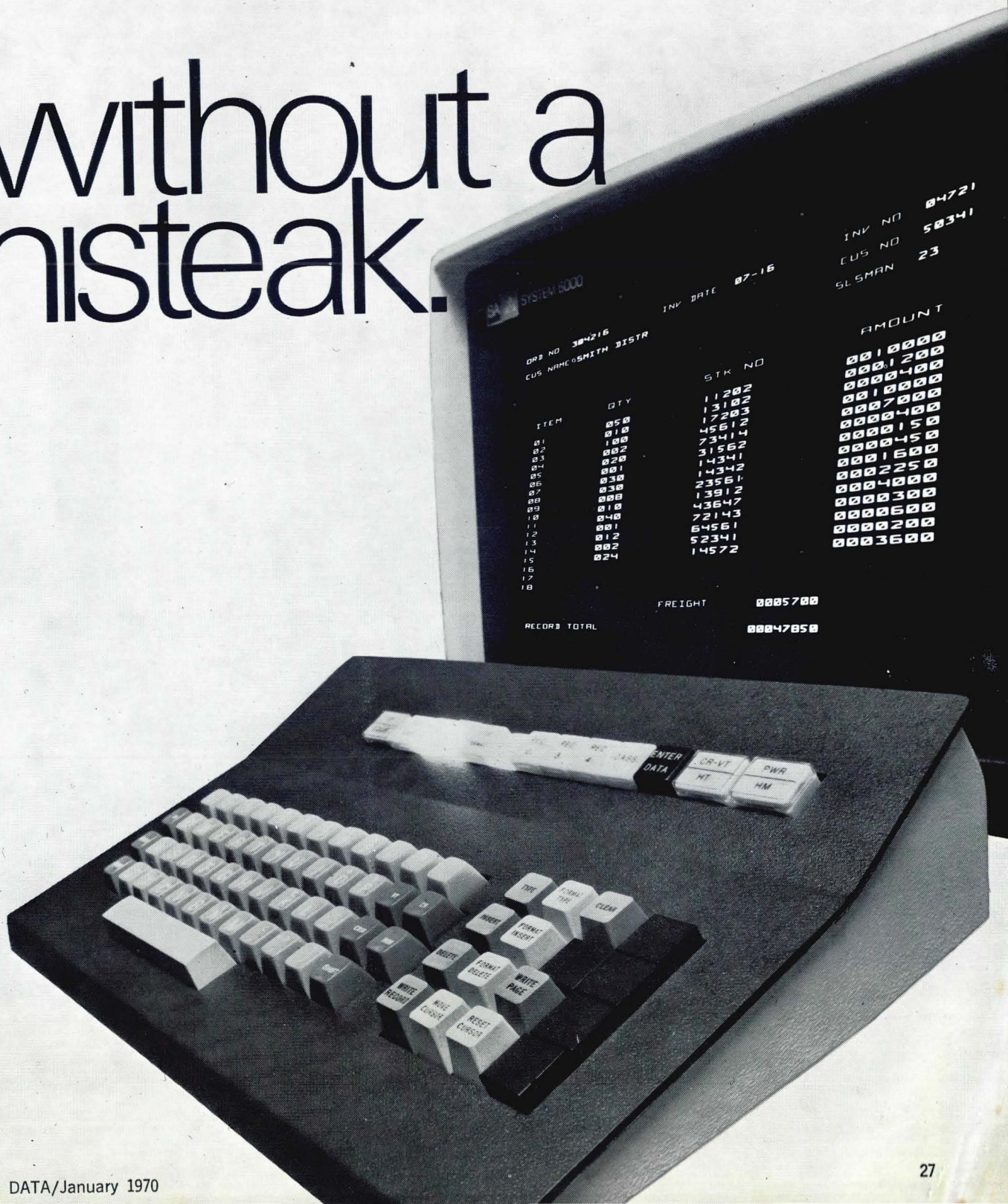
Once all the data is correct—and only then—the operator enters it on computer-compatible tape. Up to twelve units can share the same reel, so tape pooling is eliminated. And the operator can select many formats from a changeable tape cartridge.

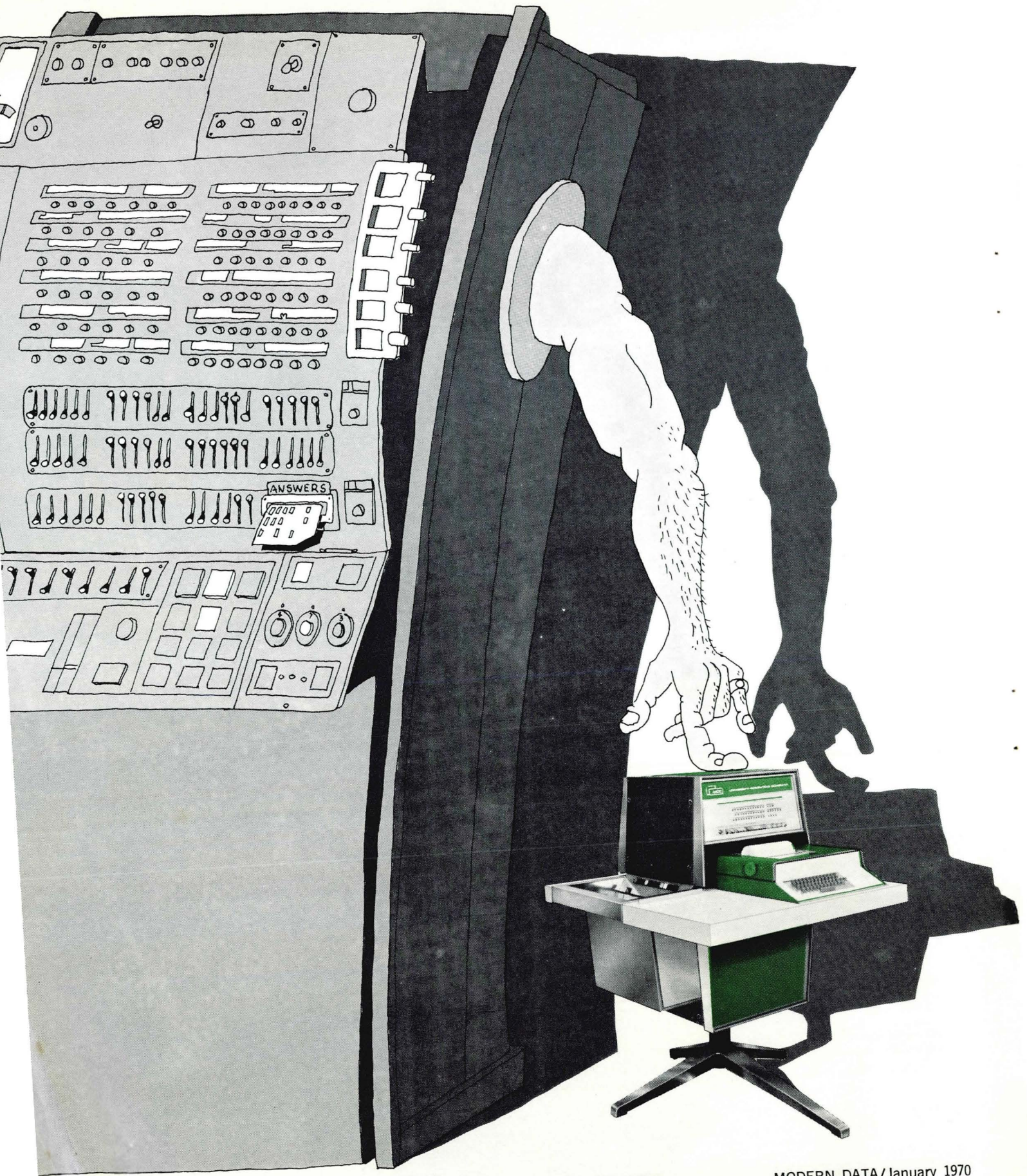
If you don't look at the system that can throughput more error-free input, you're making a mistake. Any way you spell it. Call your nearest Sanders sales office, or contact Marketing Manager, Data Systems Division, Sanders Associates, Inc., Daniel Webster Highway S., Nashua, New Hampshire 03060. Or call (603) 885-4220.



*TM Sanders Associates, Inc.

without a mistake.





360, 1108, 6000 users...

Your big computer needs a friend to lean on...

Go COPE!

You've got a super computer? Fine. But why overload it with communications and peripheral tasks? Free it to do what it does best — compute!

How? By giving your big system a COPE to help take the weight off. With COPE (from Communications Oriented Processing Equipment) systems, you can reduce the use of systems resources, core storage and data channels and still expand the number of readers, printers and remote terminals. The complete communications subsystem provides extensive software and hardware advantages. For example, one COPE Communication Controller can handle up to 30 peripherals and/or COPE remote terminals as well as multiple central processors.

The UCC COPE family of programmable remote terminals offers industry's best cost/benefit ratio. This family includes seven members, allowing you to select the reading/printing

combination best suited to your requirements.

You can grow with COPE as your data communication requirements grow. The COPE family can be field upgraded from the low cost COPE .30 series to COPE .41 status (1250 LPM, 600 CPM). And the top of the COPE line, the .45 (1250 LPM, 1500 CPM), is software compatible with all other COPEs.

COPE terminals feature dial-up flexibility, allowing them to access most large-scale computers in the United States through the standard telephone network by simulating the IBM 2780 and Univac 1004 terminals. COPEs also operate in the full-duplex (concurrent reading and printing) mode over voice-grade telephone lines utilizing 4800 or 9600 bps modems.

Speed, compatibility, flexibility, adaptability — these four words best describe the COPE product line. Need

further convincing? Then contact: Marketing Coordinator, Data Communication Systems Division, 2659 Nova Drive, Dallas, Texas 75229, (214) 241-3501.

Terminal Type	Communications Mode		Input/Output Device Speeds (Maximum)	
	Half Duplex	Full Duplex COPE	Reader C.P.M.	Printer L.P.M.
C.30	ATT 201A/B	No	200	240
C.32	No	Yes	200	360
C.34	Option	Yes	300	360
C.36	Option	Yes	300	480
C.38	Option	Yes	600	480
C.41	Option	Yes	600	1,250
C.45	No	Yes	1,500	1,250



UNIVERSITY COMPUTING COMPANY

DATA COMMUNICATION SYSTEMS DIVISION

2659 Nova Drive • Dallas, Texas 75229



NEWS ROUNDUP

INSTRUMENTATION FAIR

Approximately 50 manufacturers of minis, data acquisition systems, peripherals, comm. equipment, and software were exhibited at last year's Instrumentation Fair in Washington, D.C. For information regarding this year's I.F., to be held Feb. 18-19 at the International Hotel in L.A. and Feb. 25-26 at the Fairgrounds in San Mateo, contact Art Wrobel, Larry Courtney Co., 16400 Ventura Blvd., Encino, Cal. 91316.

TRILINGUAL COMPUTER PRINTER

First deliveries of a new type of computer printer which prints Arabic or Japanese along with the Standard Latin alphabet will soon be made by the National Cash Register Co. The Japanese version of the unit, designated the 640-300, combines numeric, Japanese katakana, and Latin characters on a single type-drum. Katakana is a simplified script based upon standard Japanese calligraphy and is generally used by businessmen. The Middle East version of the type-drum is trilingual. In addition to numerics, it bears characters for English, Arabic, and Farsi, the language used in Iran. The latter differs from Arabic in a dozen characters.

2,500/50/5: FORMULA FOR COMPUTER TRAINING

A nationwide effort by computer professionals to train and secure jobs for large numbers of educationally-deprived persons has been sponsored by the Association for Computing Machinery (ACM). Goal of the project is to train up to 2,500 disadvantaged persons in 50 cities within the next five years and place them in productive computing jobs. According to David B. Mayer, chairman of the ACM Committee on Computing and the Disadvantaged, motivated computing professionals, psychologists, and education experts are joining together through local ACM chapters to move the project forward. Sounding a note of caution to computing people who want to become involved in such training efforts, Mr. Mayer said it was imperative to "plan and execute your placement process first." Potential employers must be involved at all stages, he suggested, to generate interest in the students and to obtain job commitments for them as graduates. "It is almost axiomatic," Mr. Mayer said, "that failure to place a disadvantaged trainee within a few weeks of graduation often means a permanent human loss as well as a training investment come to naught."

GE TOP-OF-THE-LINE

General Electric launched a bid for the top half of the large-scale computer market by announcing its fastest, most powerful system, the GE-655. Announcement of the new computer was beamed simultaneously into 16 major cities across the nation via closed-circuit color TV. The GE-655 employs a 500 nsec processor with up to four 65K interlaced memory modules for a total of 262,144 36-bit (plus parity) directly-addressable words of core. Together with its new operating system, GECOS III, the 655 will be sold as the first computer to utilize GE's "United Systems" concept of providing upwards-compatibility with a common data base and total communications capabilities. Minimum configurations of the GE-655 will lease for approximately \$80,000 a month and sell for \$3.2 million.

TELEPHONE COMMUNICATIONS

Speakers at the recent Fourth Annual Digitronics Users Association Conference in NYC were generally pessimistic regarding the immediate prospects for improved domestic telephone service. The consensus was that domestic telephone service, which is subject to bitter criticism in many parts of the country, will become worse before it becomes better. Conversely, many of the same speakers were of the opinion that international telephone service and other international communications will not only improve rapidly, but will become far less costly due to the increased use of satellites.

NOMEN ES APUD NOS, NON NUMERUS

Trust the Cambridge Trust Co. in Harvard Square to post billboards informing their customers (in Latin, of course) that, notwithstanding computers, "With us you are a name, not a number."

WHO?

PULSE, a publication of The Naval Command Systems Support Activity, gleefully reported that an Army computer at Ft. Campbell, Ky. was thoroughly confounded by the simple task of entering a man's name onto a punched card. The card field was defined for a maximum of 18 characters. According to the Navy, the man who beat the machine was Pvt. Alenizo Roosevelt Abuelwhippingstraw.



IS HIS MINI COMPUTER ALL THAT GOOD? OR IS IT HIS SALESMANSHIP?

Every knock on the door these days is another mini computer salesman.

Most of the companies you can rule out without even talking with them. But there are three or four of us you really have to talk to.

And four is a lot of mini computer pitches to have to evaluate.

So this is what Data General's going to do.

We're going to send you not just another mini computer salesman. Not just another guy with a shoeshine and a smile who knows only enough about mini computers to tell you just what his company told him to tell you.

We're going to send you a Data General applications engineer who probably knows a lot more about mini computers than anyone in your company. A man who has specific instructions from us to tell you to forget about Data General if our computers aren't right for you.

We'll also tell you enough about our two mini computers right now so you'll know whether we're in your ballpark or not on the basis of this ad alone.

Both our Nova and Supernova have multi-accumulator organizations, 16-bit word length and a simple package design. They're 5¼" high. Their read-only memories are interchangeable with their core memories.

Nova in a basic 4K configuration with Teletype interface goes for \$7950.

Supernova has an add time of 800 nanoseconds from core memory, 300 nanoseconds from read-only. In its basic 4K configuration, Supernova goes for \$11,700.

If neither of these Data General mini computers sounds like what you're looking for, so long.

It's been nice talking to you.

DATA GENERAL

Makers of Nova and Supernova mini computers.

A DOG'S BEST FRIEND

The theft of his dog prompted Sal LaManna of Gillete, N.J. to contract time on a Univac 9200-II at nearby Capitol Data Processing Center in Montclair for the purpose of tracing lost dogs and identifying dognappers. Since 1968, his National Pet Registration Center has tattooed and registered about 10,000 dogs.

QUANTITY vs. QUALITY

A small, pilot study of the annual number of students graduated from private U.S. EDP schools indicates the need for a major, national survey of the contribution of these schools to the manpower pool of the computer and information processing field. The pilot study, carried out by The American Federation of Information Processing Societies (AFIPS) as part of its general Statistical Research Program, indicates that although U.S. EDP schools may produce over 80,000 graduates per year, more than enough in numbers, "the question which has yet to be answered is whether or not these people have the right level of training to match industry's requirements." Copies of the AFIPS' study are available from the organization's hqtrs. at 210 Summit Ave., Montvale, N.J. 07645 for \$3.00 per copy.

Cambridge Memories, Inc. says it has developed a magnetic domain memory technique which could replace disk storage devices for computers in the early 1970s. Although immediate uses for the new technology will be in shift registers, a mass memory storing up to 16 million bits of data should be available by 1972, according to Joseph F. Kruey, CMI president. The CMI memory technology, called DOT (for Domain Tip), stores data in tiny magnetic spots (domains) which move through channels etched on an aluminum film. "The technique is similar in many respects to Bell Laboratories' 'bubble' memory technique," Kruey said, "except that it uses common ferro-magnetic materials rather than the rare earth materials which Bell plans to develop." As a result of eliminating research into special materials, CMI expects to offer magnetic domain shift registers early this year.

\$2 BILLION OCR MARKET BY MID-1970s

Alan I. Frank, president of Scan-Data Corp., predicts that the optical character recognition market will reach \$2 billion by the mid-1970s as a result of both general EDP industry growth and the rapid displacement of conventional keypunch input systems. Mr. Frank believes that by the mid-1970s more than 25% of the current keypunch market will be converted to OCR equipment. "This involves displacing about 200,000 of the present 800,000 keypunch machines now in use," he said.

 **WHAT HATH BABBAGE WROUGHT DEPT.**

The following letter is typical of many we have received from our readers describing the "helpful instructions" on their charge-card statements.

This month I received my bank charge-card statement for November. The computer-prepared billing form politely informed me that since I have a "clean" account and haven't incurred any new purchases, I owe them a zero balance. But my payment of zero will be past due after the 22nd of the month!

To add further amusement to the situation, my attention was directed to an enclosure for important information. An insert in the envelope proceeded to inform me that now, as a further courtesy to me as a charge-card customer, I could take longer to pay. That is, I could pay as little as 1/20th of my zero balance. One twentieth of \$0.00 isn't much, but I must make a minimum payment of \$5.00. Woe is me!

Submitted by: David H. Alman, Sr. Sys. Engineer, F & M Systems Co., Dallas, Texas.

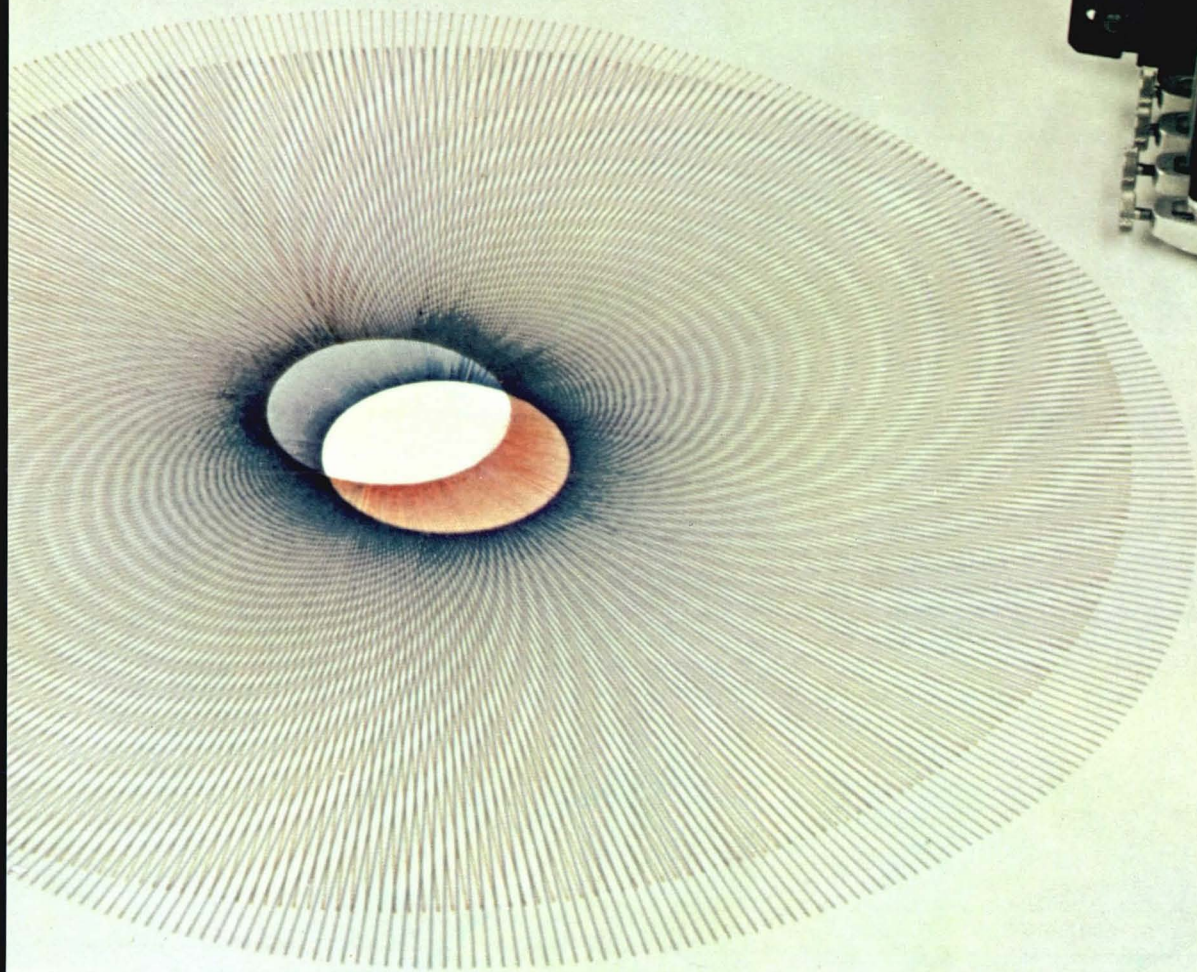
MODERN DATA will pay \$10.00 for any computer- or EDP-related item worthy of publishing in our "WHAT HATH BABBAGE WROUGHT DEPT." Humorous "information" for consideration may include weird memos or operating instructions, unusually solecistic (look it up!) documentation, and offbeat items of a general nature

(for review by our offbeat editors). Send all submissions to: WHBW Dept.

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3 Lockland Ave.
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It's computer-graphics state-of-the-art.



That completely unretouched photo of a double starburst is right off the revolutionary new EAI 430 DATAPLOTTER. It isn't there just to look pretty. It's there to demonstrate a couple of important things.

We deliberately offset the centers of the two starbursts. That produced the moiré effect.

The perfect symmetry of the moiré shows the 430's ability to plot smooth straight lines at any angle. Precisely positioned. And it plots these lines with resolution of 0.001 inches. Smooth-line resolution. With no sawtooth effect.

Moreover, the symmetrical moiré pattern underscores the 430's repeatability of 0.003 inches in each axis.

How come such performance?

It's because the 430 is a new concept in plotters. It's a hybrid plotter.

It combines an analog plotter's speed and smooth-line quality with a digital plotter's reliability and stability.

Did we mention speed?

Take a slew speed of up to 30 inches/second for openers. Line drawing up to 20 inches/second. Curve drawing up to 16 inches/second. Point and symbol plotting up to 300 characters/second.

The 430 gets its speed from another entirely new concept in plotter technology. A unique "look-ahead" capability. It lets the plotter optimize its speed to conditions coming up. Saves extensive computer time. Reams of tape. Only EAI has it.

The EAI 430 has six-mode operating capability. A four-pen assembly. An optional 48-character symbol printer. Complete EAI software and systems support.

Now. What's the prettiest picture you can think of?

If it's an EAI 430 reducing your masses of digital data into graphic form better, faster and less expensively than anything around, we're waiting to hear from you.

Electronic Associates, Inc., Long Branch, New Jersey 07740.

EAI.



ORDERS AND INSTALLATIONS

Comcet, Inc. has received contracts from Trans World Airlines and Optimum Systems Incorporated for three Comcet 60 Systems, the Comcet 10, and a variety of peripheral subsystems in excess of \$1,200,000. The TWA lease is for two Comcet 60 computer communications systems which will handle the entire communications processing for an IBM 360/50, IBM 360/40, and two IBM 360/65s. The major application is TWA's AIDS (Aircraft Integrated Data Systems) installation in Kansas City.

NASA has awarded a \$150,000 one-year contract to Cambridge Computer Associates, Inc. for the design, development, and implementation of a multi-processor, multi-access, Graphically Oriented Time-Sharing System (GOTSS). The system will be used by researchers, at the NASA Electronics Research Center in Cambridge, Mass., investigating the mechanisms and techniques of man-machine communications.

Computer Applications Associates, Inc. of Houston has installed the largest single configuration of Digital Equipment Corp.'s new, small time-sharing computer system, the TSS-8. The CAA system can handle 22 users simultaneously, and includes 32,768 words of core memory, DECTape, and two memory disks.

A contract award of over \$700,000 for two automatic drafting/digitizing systems and accessories has been received by The Gerber Scientific Instrument Co. from Fiat, of Turin, Italy.

The Voice of Prophecy, an international radio broadcasting organization of the Seventh Day Adventist Church operating from Glendale, Cal., contracted for a Univac 9200 II computer to be used for contribution accounting, preparation of mailing lists, and in-house general accounting.

Iomec Inc. announced the signing of a \$2.5 million contract with Hewlett-Packard for multiple units of IODISC Series 1000 data storage systems which will be integrated as a standard peripheral addition to H-P's 2000 Series general-purpose computers.

Leasco Systems & Research Corp. has been awarded a \$434,859 contract to operate the Processing and Reference Facility of the U.S. Office of Education's Educational Resources Information Center (ERIC).

The receipt of an initial \$13,620 contract with the Urban Institute was announced today by The Hendrickson Corp., a Washington-based computer software and systems consulting organization. The contract, to be implemented over a four-month period, calls for cost studies of various family assistance and income maintenance programs under development by the Administration.

National Data Control Inc., a Dallas systems company, has placed a \$1,200,000 order for 51 Model 816 and 216 mini-computers with Computer Automation, Inc. of Newport Beach, Cal. NDC will use the 816 and 216 computers in real-time data acquisition and telemetry systems.

The Air Force has awarded Control Data Corp. a contract for two 6000 Series computer systems to be installed at Wright-Patterson Air Force Base. The contract will total \$13.8 million over the next five years. The CDC 6600 and 6500 computer systems will be used by the Aeronautical Systems Division of the Air Force Systems Command.

National Data Communications, Inc. of Dallas announced it has signed contracts totaling \$56,333,607 with Honeywell, Inc. and Raytheon Co. to equip its computer-controlled hospital communications systems. The first of NDC's REACH Systems is currently in the final phases of operational testing in the Baptist Hospital of Southeast Texas in Beaumont.

International Communications Corp. of Miami Fla., announced the receipt of a \$200,000 data communications order from Alitalia Airlines, Rome. The Alitalia high-speed communications system, which will handle all reservations in North America, will use ICC's Modem 2200 and Modem 4400 data sets to link Alitalia's central computer site in Rome with reservations terminals across the U.S. and Canada. Domestic land lines, microwave circuits, and transatlantic facilities of Italcable and ITT World Communications will carry reservation data at the rate of 2400 bps over more than 7,000 miles.

The first ICL computer ordered for installation in the United States, a 1902A, will service the New York offices of Barclays Bank DCO. International Computers Ltd. will use the facility as a showpiece for further sales efforts in North America.

TRW Inc. will study the automobile's contribution to air pollution under a pair of research contracts totaling \$700,000 from the Coordinating Research Council, a non-profit organization funded by the auto and oil industries, and the U.S. Dept. of Health, Education and Welfare. The project will determine the effectiveness of automobile pollution control systems.

Ampex Corp. has received a \$1.8 million order to supply magnetic tape transports to Western Electric Co. for use in automatic electronic switching system centers being installed for the Bell Telephone System in the U.S. Ampex has supplied tape transports for the system since 1965.

Comtel Corp. has agreed to purchase up to \$1-million worth of disk drive systems from Computer Memory Devices over the next fifteen months.

Attention mini computers.

No mini computer has ever enjoyed choosing a printer.

Mainly because there have never been any appropriate printers to choose *from*.

On the one hand, there were little typewriter-type printers that were much too slow for high-speed mini computers.

And on the other hand, there were big superspeed printers that were designed for big superspeed computers. And they were much too expensive for mini computers.

Those were the choices.

And if the mini computer didn't like it, it was "Sorry, pal, take it or leave it."

Not much fun.

So if you're a mini computer, you'll be glad to know there is now a printer that was designed specifically for you.

It's not too slow. It's not too expensive. It's exactly right.

So rejoice, mini computers.

Rejoice.

Nortec's mini line printer.



Nortec 200 is 132 columns, prints at 200 lines per minute, produces crisp type on up to 6 copies. The entire unit, with all electronics including buffer controller, ready for direct hookup to computer, is as little as \$6000 in OEM quantities. It's just a little larger than an electric typewriter. The \$6000 price includes these standard features: IBM-compatible vertical format unit, front-opening yoke assembly for easier forms loading and ribbon changing, self-test feature for testing electronics and mechanism. Nortec Computer Devices Inc., a Computer + Technical Company, Ashland, Mass. 01721, (617) 881-2000.



ICL's Problems — British nationalization of the computer industry thus far has met only moderate success. International Computers, Ltd. (ICL) was chosen by the government as its instrument. Using the corporate framework of International Computers and Tabulators, Ltd., a former Ferranti subsidiary, the International Reorganization Corp. and the Ministry of Technology combined the business computer interest of English-Electric-Marconi, Elliott Automation, and Plessey, Ltd. The Ministry of Technology has retained a 10% holding in the end result. ICL has been saddled with three differing computer technologies, the job of maintaining spare parts inventories for its component companies, and the need to continue developing its own line of products. Since the company is concentrating on the business computer market, it seems highly possible there will be a conflict of interest between ICL and its component companies regarding how that market should be defined.

EDP Ethics — Standards of ethics for computer professionals concern the British as well as the Americans. The London Times reported that the subject was debated following a recent general meeting of the British Computer Society. Some members questioned the need for any professional code at all, while others recommended developing a scale of charges for use in determining appropriate fees for consultants. Invasion of privacy was another major issue. No long-term solutions were resolved formally, but the Society sent a draft proposal to members which calls upon them to exercise their skill impartially, not disclose confidential information concerning employers or clients, and not accept any position in which their interests may conflict with their duties.

There is some talk in Budapest of the need for an Eastern Bloc computer to oppose the West's superiority in this prestigious field, according to the *Journal of Commerce*. Experts, the paper says, believe it will be very difficult to develop it in time to meet East European needs. Hungary, however, is more vocal than most Iron Curtain countries in trying to promote joint development of Communist computer technology.

A computer system recently performed the navigation on an Amsterdam to New York jet flight of Finnish Airlines. It worked fine until the plane got stacked up over Long Island because of the heavy traffic, delaying the schedule beyond the time the system was programmed for. According to the airline, it was the first scheduled commercial trans-Atlantic crossing without a human navigator aboard.

Japan's program for the large-scale development of ultra-high-performance electronic computers may succeed to the degree that Japan will require them to be used for domestic time-sharing operations, concludes a recent study made by the Electronic Industry Association. EIA is concerned that this would result in excluding free competition. Japan's long-range plan of developing a strong domestic computer industry is proceeding on schedule, and the Japanese Government has appropriated \$28 million for research in 1970. Industry is expected to add another \$5.3 million to this figure. About half the Government budget is allocated for software research, indicating, EIA says, that this segment of the industry will be heavily government-controlled.

German computer production is lagging, according to a recent study done by the U.S. Dept. of Commerce. In 1968 business machine production amounted to \$663 million — an increase of only 5 percent over 1967. In the same period, overall German industrial production increased by 12 percent. Commerce believes that much of this apparent stagnation was "because development of more advanced computers has entered a decisive phase requiring extensive organizational changes and retooling in production lines." At the end of this process, Commerce said, "the lively expansion of the computer business is expected to resume."

RCA is building its first electronics manufacturing plant in Europe, a \$10.7 million semiconductor operation in the Province of Liege, Belgium. The 80,000 sq. ft. plant will supply components for data processing and other equipment. The European market for semiconductor devices is expected by RCA Vice Pres. C. E. Burnett to approach \$700 million by 1972, of which solid-state components will account for \$120 million. The plant is expected to be finished by the mid of 1970.

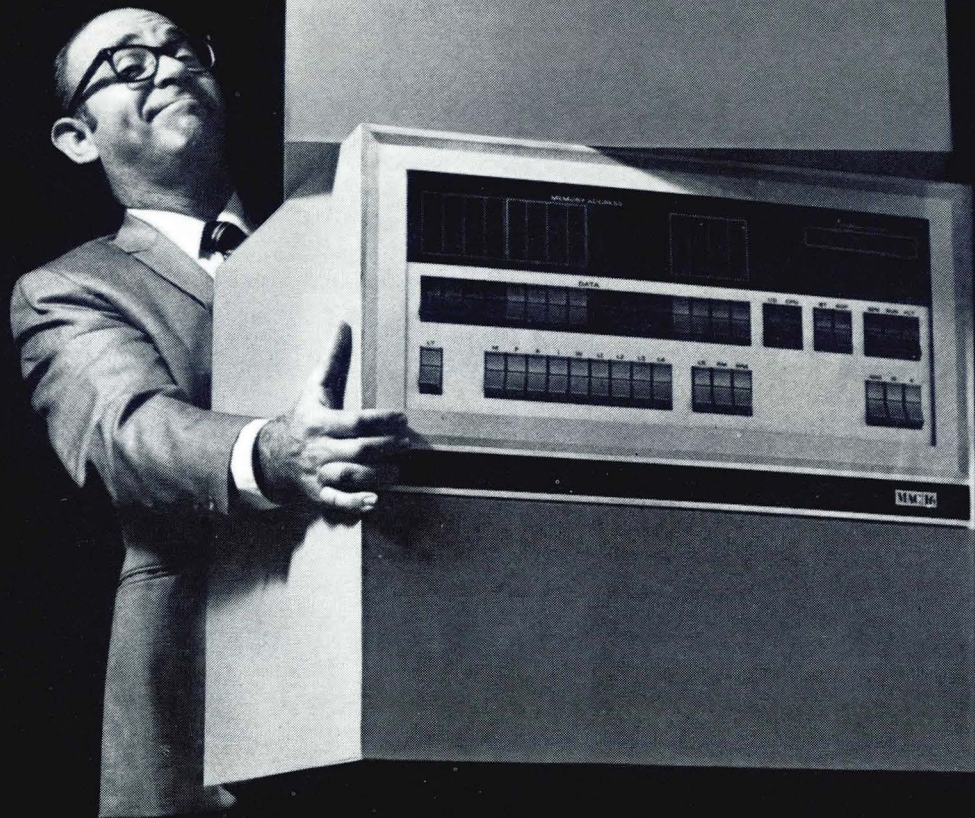
QUICKLY AROUND THE WORLD

Chinese-made computers were among the items shown at the recent export fair in South China City, reports Reuters. The fair is the chief exhibition for showing China's commercial products to the outside world.

Viatron Computer Systems Corp., Bedford, Mass., has set up a subsidiary in Belgium with initial capitalization of \$20,000.

Applied Data Research, Princeton, N.J., has acquired Systematik AB, a Stockholm-based software and service firm. Current plans call for expansion to West Germany.

If you insist on spending \$30,000 for a small computer, buy 2½ MACs.



Ridiculous? Sure. But so is paying 30 grand to get the features that MAC gives you for only \$11,950.

First, you get a 16-bit parallel word computer with a repertoire of 72 hardware instructions. A basic 4K memory. A programmed data channel, handling up to 255 devices. And MAC's four priority interrupts in hardware—with automatic store/restore.

Another big MAC feature is its raft of options. Like up to 64 interrupt levels. Memory expansion to 64K. Multiply/divide hardware. Memory parity. Power fail and restart. Remote control panel. Automatic bootstrap loader. Multiplexed or direct memory access data channels. Plus a com-

plete array of peripheral equipment.

So get the features you need and still save money with MAC. Buy one now and we'll give you an option on the other 1½.

Write to MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

LOCKHEED ELECTRONICS

A Division of Lockheed Aircraft Corporation



CORPORATE AND FINANCIAL NEWS

Data Transmission Co. (DATRAN) has filed an application with the Federal Communications Commission for authority to construct and operate a common carrier system for transmitting data to 35 major metropolitan areas. DATRAN is a wholly-owned subsidiary of University Computing. The nationwide system, estimated to cost approximately \$375 million, is designed solely to provide door-to-door communications service in digital form. DATRAN told the Commission that the new system would eliminate the necessity of translating to and from analog (voice-type) circuits that are already congested. The application asks permission to construct and operate 244 microwave repeater stations, 10 district offices for computerized switching, and the necessary circuits to handle the needs of 160,000 prospective customers.

EDAPCO, Inc., a black-owned computer service bureau with headquarters in Newark's racially-troubled Central Ward, has been authorized by the State of New Jersey to process local property tax rolls for cities and towns. EDAPCO was opened in September by Leonard Prather, Jr. with a loan backed by the Small Business Administration. Information from the Inter-racial Council for Business Opportunity and ADAPSO indicates that there are only four other black-owned computer service bureaus in the U.S.

Xerox Data Systems announced that it has reduced the price of its Model CF16 mini-computer by 38%, from \$12,890 to \$7,990.

Thomas T. Fleming, President, Scientific Resources Corp., told a luncheon meeting of the New York Society of Security Analysts that SRC plans to double its revenues from the computer industry in 1970 to \$20-\$25 million, up from the approximate \$12 million computer-service and computer-related finance revenues expected in 1969.

The crash of a light plane into its corporate headquarters seems to have caused Applied Data Research Inc. less damage than was rumored in mid-November. President Richard C. Jones stated that no ADR personnel were injured and there was no loss of important master tapes, documentation, or business records. The two Princeton computers — an IBM 360/50 and a PDP/10 — are being thoroughly checked-out to determine if they received water damage. Both computers were fully insured.

RECENT ENTRIES IN THE COMPUTER FIELD: *Computer Management Systems*, a new operating division of Universal By-Products, Inc., will provide special electronic data processing services for firms in the solid waste management industry, and general EDP services for other industries . . . *Computer System Architects Inc.* has been founded in Cambridge, Mass. to satisfy system-architectural needs of companies developing computer-based products . . . *The CORSTAR Business Computing Co.* will provide assistance and consultations in the area of management information systems. The company is located in White Plains, N.Y. . . . *Data Bank Corp.*, headquartered in N.Y.C., is entering the information (digital, textual, audio, pictorial, and analog) storage and retrieval business utilizing a new photo-optical random-access mass memory . . . A new management consulting firm, *Decision Sciences Corp.*, has been formed in Jenkintown, Pa. to specialize in decision support systems used to aid management decision-making . . . *DPA Management Systems, Inc.*, a company specializing in computer facilities management, has been formed by DPA, Inc., a diversified Dallas-based company . . . *Electronic Computer Graphics*, a new high-technology micro-photographic and chrome mask company, has been formed in Santa Ana, Cal. . . . *The Macrodata Co.*, Chatsworth, Cal., will produce sophisticated electronic equipment utilizing microminiature (LSI) cir-

uits. First to be announced is a family of computer-controlled, fully-automatic, diagnostic test equipment . . . *Medical Information Technology, Inc.* (MEDITECH) of Cambridge, Mass. will rent, lease, sell, and service medical information systems, including hardware, to hospitals, clinics, and medical data collection centers . . . *Micro-Image Corp.* of San Diego will market a microfiche reader, the MICRA 210 . . . *Quadra Data, Inc.*, located in Mountain View, Cal., claims to be one of the few service centers capable of offering expertise in computer commercial problem-solving . . . *Redmar Associates* has been formed in Needham, Mass., to act as sales representatives for companies manufacturing computer peripheral equipment, data communications, and computer memory devices. The company will serve the six New England States. Founders of the company are veteran salesmen and Honeywell CCD alumnae Martin J. Fitzgerald and Joseph T. Reddington . . . *Space Applications Corp.*, organized in L.A., will specialize in aerospace engineering, analysis, and software . . . *Technology Inc.*, Dayton, Ohio, has formed a new Dayton-area subsidiary, *Technology/Scientific Services, Inc.*, to perform on-site contract engineering and technical support services for government and industry . . . *Teknatronic Applications, Inc.* has been formed in N.Y.C. to provide business management with analytical, scientific, and professional services . . . *Unicom Inc.*, headquartered in Fairfield, N.J., will design, manufacture, and market a desk-top office data processing system.

MERGERS & ACQUISITIONS: *Aideo, Inc.*, Verona, Pa., has become associated with *Compunetics, Inc.*, Monroeville, Pa., through a sale of capital stock. Aideo assembles electronic parts. Compunetics develops both software and hardware for information processing and optical systems . . . A tentative agreement between *Aydin Corp.* and *Century Geophysical Corp.* calls for a merger under which Century would be a wholly-owned subsidiary of Aydin . . . *Bolt, Beranek & Newman, Inc.*, the Telcomp firm, and *Graphic Controls Corp.* have reached an agreement in principle to combine the

two corporations into a new enterprise called BBN-Graphic Corp. Graphic Controls, said to be the world's largest chart maker, has been marketing time-sharing services through its Computer Systems Division since mid-1967 . . . *Calculator-Computer Leasing Corp.*, of Pittsburgh has acquired *Management Information Center, Inc.*, a computer service center in San Juan, Puerto Rico . . . The *Computer Exchange, Inc.*, announced that talks are in progress which may lead to CEP's acquisition of *Capital Corporate Resources, Inc.*, a holding company headquartered in Philadelphia . . . *Computer Complex, Inc.*, Houston, and *Com-Share, Inc.*, Ann Arbor, disclosed that an agreement in principle has been reached to merge the two companies . . . *Control Data Corp.* has acquired all of the outstanding stock of the *Precision Data Company, Ltd.*, of Toronto, Canada . . . *Cybermatics Inc.*, and *Carci Computab Systems Inc.*, a computer business

forms company, announced an agreement in principle for the merger of Carci Computab into Cybermatics . . . *Cybernetics International Corp.*, a New York computer service organization, has acquired *Realtronics, Inc.*, also of New York. Realtronics produces a series of computerized data entry systems . . . *Datatron Inc.* of Santa Ana announced an agreement in principle to acquire two printed-circuit firms, *Orange County Electronics Corp.* and *Nova Circuits*, for an undisclosed amount of common stock. Datatron also plans to acquire *Shelly Associates, Inc.*, of El Segundo, a manufacturer of visual display components for computer peripheral equipment . . . *Economics Research Associates* has been merged into *Planning Research Corp.* . . . *Foto-Mem, Inc.* has completed its acquisition of *Wilkinson Computer Sciences, Inc.* The cost was 10,000 shares of Foto-Mem common stock, \$200,000 in cash, and the assumption of some limited

liabilities . . . *Information and Communications Applications, Inc.*, of Silver Spring, Md. has purchased the assets and facilities of *Data Power* of New Orleans. Data Power, a keypunching and EDP operation, was a division of Manpower, Inc. of Houston, Texas . . . *Photo Magnetic Systems, Inc.* has acquired *The Multiple Science Corp.* of Asbury Park, N.J. and its wholly-owned subsidiaries: Universal Programming & Systems, Inc. of Bethesda, Md., and Commercial Computer & Mailing Services, Inc., a District of Columbia corporation . . . *Raytheon Co.* and *Visual Electronics Corp.* have announced an agreement in principle on the purchase of Raytheon's electronic learning systems business by Visual Electronics . . . *Systems Engineering Laboratories, Inc.* and *Spectral Dynamics Corp.* of San Diego jointly announced an agreement in principle under which Systems will offer to exchange 5/8ths of a share of its common stock for each share of Spectral Dynamics common . . . *Systems For Advanced Information, Inc.*, a Providence-based data processing firm, has acquired all the capital stock of the *J. R. Reilly Co.*, a management consulting firm in Boston which specializes in the data processing area . . . *Tracor Computing Corp.*, headquartered in Austin, and *Insurance Information Exchange, Inc.*, of Dallas, have reached an agreement in principle under which TCC will acquire the Dallas computer software company . . . *University Computing Co.* is still negotiating to acquire *Computer Technology Inc.*, a publicly-owned subsidiary of LTV Aerospace Corp. UCC recently acquired Computer Data Sciences Inc. of Cleveland, and, in a separate transaction, sold its Shreveport Data-Link Center to Computer Information Systems Inc. of Shreveport . . . *URS Systems Corp.* of San Mateo plans to acquire two large-scale data processing centers from *The Matrix Corp.*, which operates the centers in the Los Angeles and Boston areas . . . *Western Union International, Inc.*, has agreed in principle to purchase for \$25 million the domestic operations of *Telephone Answering Services* from *International Utilities Corp.* The business to be acquired includes 640 telephone exchanges located in 40 U.S. cities.

BOX SCORE OF EARNINGS

Company	Period	Revenues	Net Earnings (Loss)	Earnings (Loss) per Share
Alphanumeric	9 mos. 9/30/69	2,073,003	(287,190)	(-)
	9 mos. 9/30/68	385,502	(905,645)	(-)
Ampex	6 mos. 11/1/69	149,269,000	7,426,000	.69
	6 mos. 11/1/68	132,876,000	5,986,000	.62
Astrodata	6 mos. 9/26/69	10,390,000	548,000	.24
	6 mos. 9/30/68	10,343,000	(191,000)	(.13)
Beta Instrument	9 mos. 9/30/69	616,465	(322,310)	(.31)
	9 mos. 9/30/68	441,419	(109,810)	(.14)
Cybermatics	6 mos. 9/30/69	571,277	42,753	.07
	6 mos. 9/30/68	104,149	(26,077)	(.08)
Data Documents	Yr. 9/30/69	20,930,342	902,966	1.94
	Yr. 9/30/68	17,221,078	690,322	1.48
DPA	9 mos. 8/31/69	18,891,023	1,553,419	.65
	9 mos. 8/31/68	11,173,332	819,181	.39
Data Trends	Yr. 6/30/69	944,366	(2,031,795)	(2.42)
	Yr. 6/30/68	2,116,883	140,337	.21
Digitronics	6 mos. 9/30/69	9,244,507	625,731	.21
	6 mos. 9/30/68	7,690,066	440,414	.17
Fimaco	9 mos. 9/30/69	1,468,010	25,349	.04
	9 mos. 9/30/68	1,367,771	22,725	.04
Hudson Leasing	3 mos. 9/30/69	5,352,032	625,301	.41
	3 mos. 9/30/68	3,613,837	244,626	.24
Milgo	Yr. 9/30/69	8,267,000	767,000	1.06
	Yr. 9/30/68	4,654,000	(589,000)	(.92)
Mohawk Data Sciences	3 mos. 10/31/69	24,955,000	2,025,000	.37
	3 mos. 10/31/68	15,790,000	1,140,000	.21
Pitney-Bowes	9 mos. 9/30/69	177,611,000	10,163,000	.82
	9 mos. 9/30/68	156,919,000	9,965,000	.80
Robins Industries	9 mos. 9/30/69	2,004,194	104,505	.26
	9 mos. 9/30/68	1,884,991	99,472	.245
Sanders Associates	3 mos. 10/31/69	38,385,000	87,000	.02
	3 mos. 10/31/68	43,422,000	1,349,000	.30
Sterling Computer Systems	6 mos. 10/31/69	1,663,713	318,105	.13
	6 mos. 10/31/68	1,107,743	227,476	.09
Tracor	9 mos. 9/30/69	63,426,000	2,050,000	.97
	9 mos. 9/30/68	60,385,000	1,808,000	.88
Wyle Laboratories	9 mos. 10/31/69	77,196,554	1,166,902	.33
	9 mos. 10/31/68	44,277,555	1,857,180	.55



DC DATASCAN

1970 CENSUS — The National Microfilm Association reports that the Census Bureau will use 40 high-speed cameras to microfilm the multi-page questionnaires householders will be required to complete for the 1970 census. The resulting microfilm is expected to contain over 4 billion facts about 205 million Americans. The film will be read and coded for computer processing by FOSDIC, an optical scanning device first used in the 1960 census.

BROADBAND COMMUNICATIONS — The Electronic Industries Assoc. told the FCC that broadband communications as part of "the wave of the future" for the next decade should be treated as a "natural resource." "Because much of the equipment and most of the applications of this equipment in connection with broadband communications networks are still in early developmental stages," the EIA urged that the Commission "not specify industry standards at this time but instead keep the door open for new innovations and service concepts." In order to render services to meet a wide range of modern-day needs, EIA recommended that the FCC provide a regulatory environment that would allow the development of two types of broadband communication networks: (1) A video telephone system with the ability to allow limited keyboard access to computers as well as transmit and receive facsimile information at the rate of one page per second; (2) A network that would in effect be a minimum 300-megahertz "pipe" to provide broadcast video, first class mail, educational material, transportation information, and entertainment services for home, business, and the government.

COMPUTERS IN CONGRESS — Considerable efforts are being made by some Congressmen to remedy the lack of computer capability in Congress. A leader of this movement, Representative William S. Moorehead (D. Pa.), has called upon the House Special Subcommittee on Congressional Reorganization to provide for a Legislative Data Processing Center and an advisory board. The independent center would be manned by professionals for day-to-day operations. The advisory board would be made up of the Director of the Center, the Comptroller General, the Public Printer, the Librarian of Congress, the Secretary of the Senate, the Clerk of the House, the Legislative Counsel of both Houses of Congress, and four data processing experts.

Mr. Moorehead had MODERN DATA's October article, "Congress and the Computer," inserted in the Congressional Record. He said the article showed "a grasp of the information problem on Capitol Hill and the great need for modern management tools and techniques to help solve it."

SAFEGUARDS COMPUTER PROGRAM — During the heated debate on the Nixon Administration's Safeguard ABM system, Senator J. William Fulbright (D-Ark.) said one of the "extremely able and perceptive arguments" against the system was that computers could not realistically be programmed to deal with the matter. Senator Fulbright quoted Dr. John Edward Anderson of the University of Minnesota, who estimates that Safeguard's computer program would require 10 million instructions. About 10 thousand instructions a month appears to be the maximum that can be written for a single program, according to Anderson, no matter how many men are assigned. This would mean that even if strategies remained fixed, about 80 years would be required for programming. Since strategies would be constantly changing, Anderson believes Safeguard's computers could never be programmed. While Congress approved the administration's plan by a narrow majority, appropriations for the Safeguard program are being debated.

DOD STANDARDIZATION PROGRAM — Over the next two to three years, the Dept. of Defense plans to acquire a new family of standardized computer systems. A minimum of 34 new medium-to-large computer systems will be acquired. Unit cost will be between \$1 to \$5 million. The systems will be used in the World-Wide Military Command and Control System (WWMCCS) and a related portion of the Intelligence Data Handling System (IDHS). Since additional systems may be used in certain subordinate operational headquarters, the procurement will also contain an option for 53 additional computers. The Air Force Electronic Systems Division is responsible for purchasing the systems and the Joint Chiefs of Staff will be responsible for allocating the machines and developing common software.

SOCIAL INVOLVEMENT — Computers and the systems approach will allow engineers to increase their "potential for service" by incorporating social, as well as engineering considerations into their planning. Speaking to a Washington, D.C. meeting of the IEEE, Asst. Secy. of Commerce Myron Tribus said that by relieving the engineer of the burden of *solving* routine problems, computers will permit him "to concentrate on *formulating* problems." This, Dr. Tribus said, together with the capability for handling large masses of data, will allow the engineer to incorporate complex social considerations in his analyses and design, "opening the door to his direct involvement in contemporary social problems," and promising him "a higher ratio of success to failure in future designs which affect the technology/society interface."

DRUG CODE DIRECTORY — The Food and Drug Administration has published a national drug code directory — a sort of telephone book and encyclopedia containing codes and information on more than 12,000 drug products submitted by 171 firms. The two-year effort has also established a standard system for drug classification. A magnetic tape extract of the master file used to print the directory will be updated periodically by FDA to reflect changes, additions, and deletions. Copies of the directory may be ordered from the Superintendent of Documents, Government Printing Office, Washington, D.C., 20402 at \$2.75 per copy. (Catalog #FS 13.134.969.) Tapes can be purchased from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

DREAMING? — "Sometimes I envision the day when the typewriters, the mimeographs, the copying machines, and the computers all run amok and we perish as the dikes of management collapse and paperwork, at last, inherits the earth," General Services Administrator Robert L. Kunzig told a Conference of the American Records Management Association in St. Louis, Mo. Using "The Changing Concepts of Management" as his subject, Kunzig spoke of the paperwork explosion of the last two decades. "There was an eight-fold increase in records from 1940 to 1967. You have to think of 50 million filing cabinets, half a million office copiers, ten thousand computers." Taking a "hard line" on paper management, Kunzig told his audience that he preferred a total systems approach: "Zero-in on what exactly your particular organization is to accomplish, and introduce paper management concepts that support your objectives."

FEDERAL COMPUTER CONTROLS — Senator Sam J. Ervin, Jr. (D. N.C.), has called for Federal protection of individual privacy through the creation of a new regulatory agency to govern computer systems. Sen. Ervin, who is Chairman of the Senate Constitutional Rights Subcommittee, believes the "national dimensions of computer technology as a medium of communications 'raises' vast problems too delicate and complicated for Congress or any existing agency to handle alone." Sen. Ervin called for more self-regulation by the computer industry and more built-in protection in the computer. While there should be much more thought and discussion devoted to the legal and social implications of a computer-based civilization, he has concluded that we know "enough now about this technology to begin taking action both in the private and public sectors to bring the electronic brains under effective control of the human beings they are created to serve."

AID FOR ARMY PLANNING — Three major automation programs aimed for 1970-75 are among the responsibilities of a new directorate for Automatic Data Processing/Management Information Systems (ADP/MIS) at Fort Belvoir, Va. The programs are: Tactical Operations System (TOS), Tactical Fire Direction System (TACFIRE), and the Combat Service Support System (CS3). TOS assists commanders in the field by providing them with information for general operational decisions. TACFIRE is specifically artillery-oriented. CS3 automates certain areas of personnel and logistics at division, corps, and brigade levels.

READING THE MAIL — Postmaster General Winton M. Blount is so well pleased by the POD's optical character readers, which can read up to 43,000 addresses an hour, he has ordered the planning of a new, improved model. Philco-Ford Corp. received a two-year \$1,983,160 contract to design, fabricate, and test the new model, which will be expected to utilize advanced interpretative techniques to fill in gaps of information that the present reader cannot comprehend. OCR, Mr. Blount believes, "is one of the tools which can help bring the postal service into the final third of the 20th century." Postal authorities estimate that the ten readers now in operation will process nearly one billion pieces of mail in 1969 — saving about \$2 million.

In Brief

A Univac 1108 system has been selected to replace all major computers now being used at the Navy's Oceanographic Office.

A comprehensive industry study of the defense acquisition and procurement process has been initiated by the National Security Industrial Association.

Maryland Governor Marvin Mandel has signed an executive order designed to centralize control over the State's computer system and make the use of computers more efficient. An economy survey indicated that about \$10 million might be saved by the elimination of waste and duplication in EDP activities.

The National Bureau of Standards published Federal standards for general-purpose tabulating cards in the Federal Register of November 11, 1969.

In November, Commerce's Environmental Science Services Administration conducted the largest effort ever made to collect information on global weather conditions. The data gathered will be used in computer experiments that simulate the behavior of the atmosphere and help in producing more accurate weather forecasts.



THE 1969 FJCC — The Telephone Company Will Never Forget It

COMMUNICATIONS CLINIC is a regular monthly column written by the staff of **Berglund Associates, Inc.** Questions from readers on any aspect of communications and its integration with computers will be answered, as space permits. Address questions to: **Ralph Berglund, Data Communications Editor, 1060 North Kings Highway, Cherry Hill, N. J. 08034.**

Earthquakeologists noticed a modest quiver on their scales in the Nevada region in mid-November. The Central Telephone Company, an independent serving Las Vegas, observed a major shock, however, as though someone had pulled the plug out of the tub where they keep the dial tone. We're writing, of course, about the Fall Joint Computer Conference, wherein, according to reports, about 100 exhibitors connected terminals to the telephone lines, overloading long-distance trunks, thus the city was without long-distance telephone service during the show hours.

A previously unreported fact about the show is that it was rated X, for audiences mature enough to sort out and understand the wealth of offerings, to wit: 15 keyboard-printer terminals; 5 keyboard-printer-cassette terminals; 21 video data terminals, including some with cassettes for batching and excluding graphic units; 13 multiplexer/concentrator/front-end systems; 8 remote batch terminals; and 17 modem suppliers.

Consistent with an emerging applications technology, we underwent such frustrations as the salesman who knowingly advised us that 1200 bps was top speed for a voice line. (The first three correct guesses as to the speed of his product will receive a Sahara Hotel cocktail stirrer.) As readers will recall, we have been disappointed at communications products at the last two shows. This time, however, we felt that it was a major factor, competing equally with time-sharing and data entry.

As to distinctly new products, those which were most impressive from the standpoint of immediate widespread

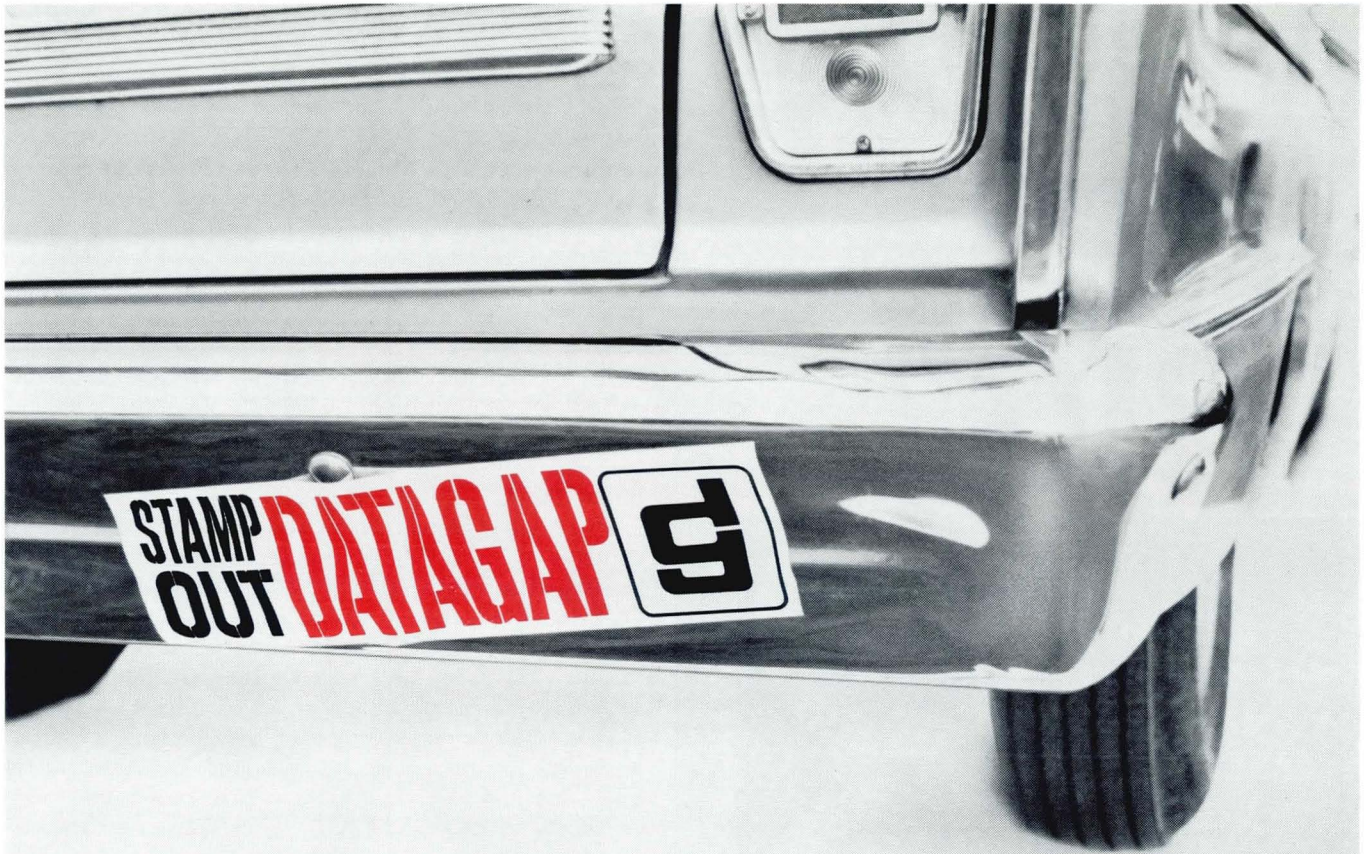
usefulness to users were: American Data Systems' ADS-715 terminal; International Communications Corp.'s Model 3300 modem; Univac's DCT 500 terminal; Teletype Corp.'s magnetic tape terminal.

The ADS-715 is yet another version of the peripatetic IBM Selectric with communications interface. The ADS version is distinctive in that: (1) all the extra electronics are installed within the Selectric cover; (2) the interface is switch-selectable between ASCII, BCD, and IBM correspondence code; (3) the small quantity price is impressive at \$2,800.

The ICC Model 3300 modem is a 3600 bps (*Why in the world do they make the model number so close, but not the same as the bit rate?*) modem with a reverse channel of 150 bps. The unit is intended for use on either private lines, or, through a data access arrangement, on the switched network. This is the first independently-supplied modem to be offered for 3600 bps on the switched network. Functionally, it is comparable to the Western Electric 203 data set, but we do not have a feel for cost comparison. Recent press releases report the first sale of these as an OEM deal to Digi-tronics.

Univac's DCT 500 is a keyboard-printer terminal with paper tape options. The printer provides up to 132 print positions, and transmission speed is switch-selectable to 110, 150, or 300 bps. Fully-loaded with paper tape punch and reader, unattended operation feature, an interface for a 103 data set, and white-wall tires, the monthly rental, with service, is a very attractive \$183. By way of comparison, the interstate rate for a Model 35 sprocket feed, 10 cps ASR is \$135. Although not at the show, a similar version, called the DCT 1000, includes polling logic and buffers for automatic retransmit on error detection.

Finally, the Teletype magnetic tape terminal made its long-rumored appearance. We had to be impressed because, since the Bell System will tariff and offer it, it's likely to be widely used. We were disappointed at its lack of retransmit error correction and the use of a non-standard magnetic tape cartridge, and somewhat disappointed at the price. Purchase price is \$2,800, and monthly rental is likely to be \$120 to \$150. To this price must be added the price of an associated I/O



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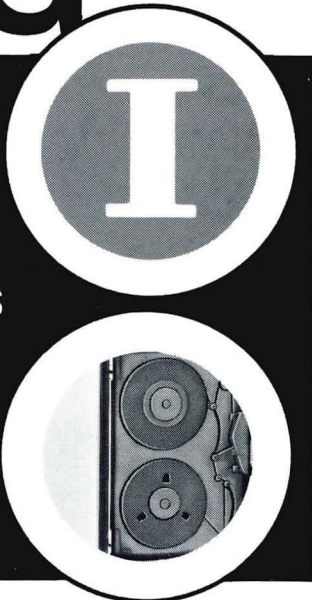
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COMMUNICATIONS CLINIC Cont'd

terminal, such as a Model 33, 35, or 37. As to compatibility, one could operate it on-line. However, an obvious new product now will be a tape station to interface these cassettes with a computer. We look forward to seeing the Flushtank Float Valve and Communication Company demonstrate their Tektype Cassette Reader at SJCC.

Aside from the above, other new offerings impressed us, either as innovative, technically neat tricks, or because they were interestingly priced.

Dasa, continuing on their comeback trail, introduced the Datakwik, a mag-tape unit into which data is keyed via a Touch-Tone type keyboard. The stored contents of up to 6000 characters can be transmitted at low speed through either the 401A or 401H data sets. Its primary function is to batch small volumes of data entry — e.g., field sales order entry — to reduce transmission toll time, and receiving CPU holding time. Price was indicated at \$585 in lots of 100.

Ford Industries, a long-time supplier of telephone answering equipment to business and the independent telephone industry, made their first probe into data communications at the FJCC. They showed an acoustic coupler with unattended operation capability for \$395, quantity one. They also showed a mag-tape cassette system storing 125K characters and interfacing a 103 data set for \$575. A 202 version, with 450K storage and blocking is forthcoming at \$1,295. At these prices, someone will build them into a terminal if Ford doesn't get a better idea.

For sheer innovation, Intermec and Datatype picked up the trophies. Intermec introduced a system for reading, writing, or transeiving paper tape. Characters appear on tape in their conventional graphic form, as well as in a machine-readable graphic code. As we said, it's innovative, but we can't judge its worth yet. Datatype introduced a somewhat similar system, a page OCR reader which reads a special font. Documents to be read are printed with a machine-readable graphic representation beneath each conventional graphic character. Presumably this is a lower cost OCR system, since the reading logic is simpler. Also, the human-readable graphics can be in any desired style.

The trophy for neat tricks goes to Technitrend. Their RP-2800 terminal is designed for Touch-Tone transmission and voice response, or page copy output. The keyboard produces Touch-Tone tones which are fed to the network through a 401A or E data set. For short messages, the CPU can respond through an Audio Response Unit. For extensive messages, however, the CPU responds with digital signals in a 103-type compatible signal. This signal passes through the terminal's 401 data set, appearing on the set's answerback lead (usually connected to a loudspeaker when used). The signal is then fed into the terminal's FSK demodulator and printed on the Model 33 printer. Hence, the terminal, with one telephone company data set, provides the blessings of both the Touch-Tone and FSK worlds. Neat. ▶

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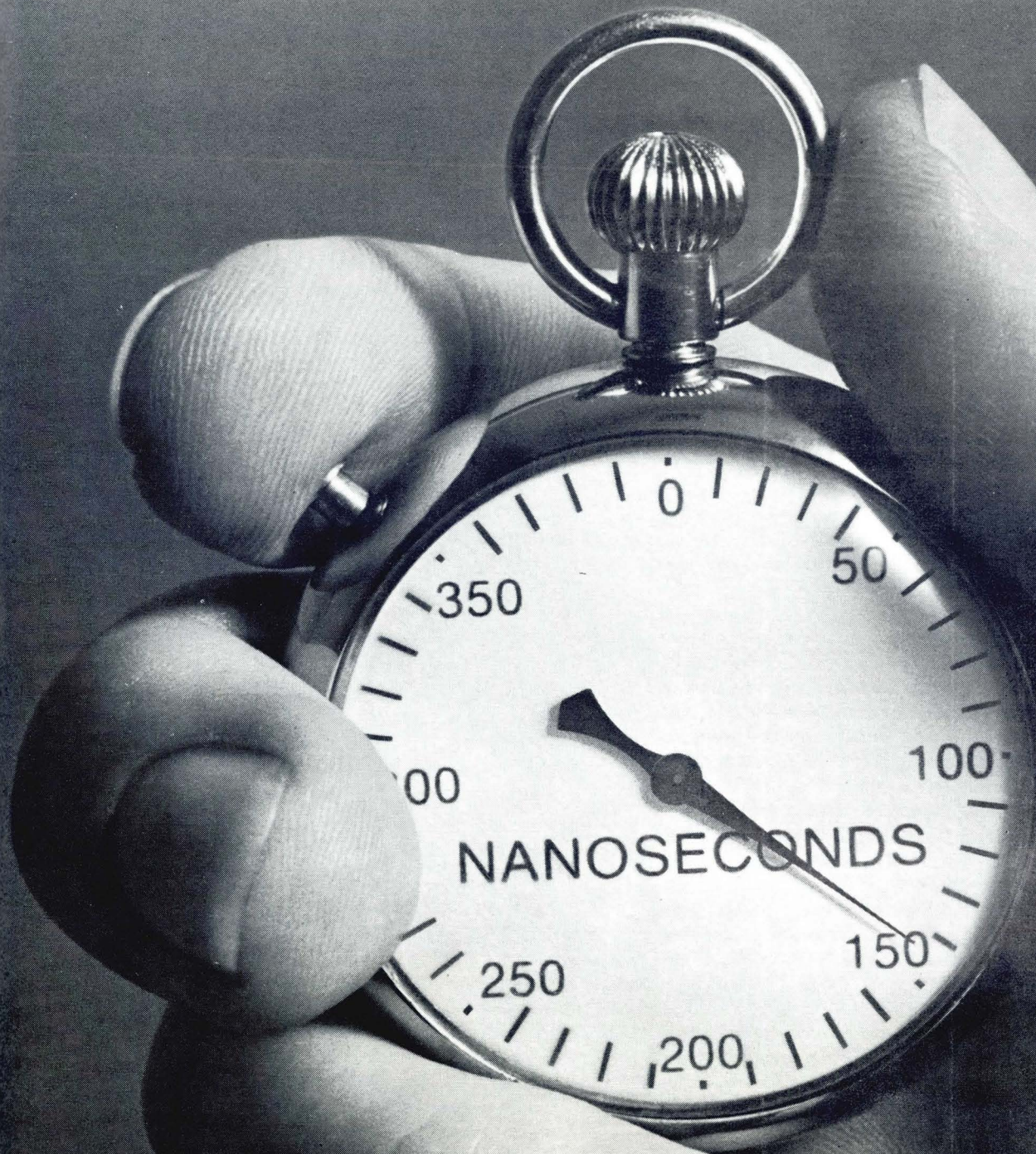
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STOCK TALK

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There is probably no scientific concept so misunderstood or more maligned and maimed by the investment community than the laser. Reams of glowing prose about the enormous powers and utility of lasers have created an aura of unreality and illusion around the entire subject.

It was only slightly over a decade ago that two physicists, Charles Townes and Arthur Schawlow, calculated that under certain conditions electrons could be stimulated to emit a highly concentrated beam of coherent light. This single wave length of controllable visible energy was said to be capable of generating tremendous heat-energy at its point of focus. But not until 1960 did Theodore H. Maiman, at Hughes Aircraft, actually produce the first laser beam using a jury-rig device containing a man-made ruby.

Subsequent to this first demonstration, scientists have made great strides in perfecting and expanding this new technology. Yet, at the same time, far less progress has been made in attempts to move the laser out of the laboratory and into the commercial world. In fact, 1968 was, relatively speaking, a disaster for the industry. Hordes of companies developed the ability to turn out lasers. But they lacked customers.

Although the Pentagon is extremely interested in the utilization of lasers for military purposes, the Vietnam War has diverted funds and its military laser research and development outlays have leveled off to approximately \$20 million.

The other major purchaser of lasers, the research laboratory, also was not in a buying mood last year, partially because of the dearth of Federal subsidies available for basic research.

Nearly every firm fighting for a piece of the laser market, therefore, turned up an operating loss last year as they chased their engineers back to the drawing boards.

Analysts believe that these drawing board efforts, which concentrated on the design of commercial applications for the laser, should begin to pay off soon. Says one expert in the field, "Recent advances in lasers have made them compatible with routine production-line use. They are no longer the delicate and

temperamental laboratory devices of a few years ago."

In the broadest sense, the laser industry has been actively laying the foundation for a third generation of laser-based equipment. The first lasers produced were finicky one-of-a-kind laboratory-type research tools. They were the playthings of scientists and technicians and required constant attention.

Second generation devices, in contrast, were production models with a reasonably good reliability factor that could be purchased off-the-shelf. Once these rugged and easily-operated lasers became common and the growth of the research field began to level off, work began on a third generation of equipment in which the laser was but a sub-system. The optics itself has become the business end of a total system which in essence guides the laser in a particular function.

This type of equipment includes instruments to monitor the effects of the laser action and forward this data to other sub-systems which control the laser. Visual control is often maintained via closed circuit television and positioning is effected with punched tape by computer.

Laser systems are gaining a wide range of industrial applications. Materials processing, drilling, cutting, welding, and balancing are only a few. As a result of this more aggressive commercial-industrial orientation of the industry, total equipment sales are expected to regain their momentum this year.

Industry-wide laser equipment dollar volume should rise 33 percent in 1969 to \$80 million from \$60 million last year, according to Wall Street analysts. More important is the long-range picture which projects total laser sales skyrocketing 650 percent to \$600 million by 1977. Not included in these bullish estimates is the \$150 million being spent currently on contract research and development. Also, it is believed that on the order of \$200 million is presently being expended annually by laser users to explore new applications of "the light fantastic."

INCOMING MAIL

Q) I have 100 shares of Alpine Geophysical at an average price of \$23. Should I buy additional shares now that it is lower or should I build up my holdings in another stock such as Executone? I can invest approximately \$300 a month. S.L.

A) Alpine Geophysical's diverse ocean-oriented interests should eventually pay big dividends. Patience, however, will be required. A modification of the Food and Drug Administration's regulation on the use of marine protein as a food additive is being sought by Alpine. However, in light of the investigations now underway on food additives, cyclamates, MSG, etc., early approval seems unlikely. The company's five bulk cargo vessels continue to provide a sizeable percentage of total revenues. Whether you should add

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to your shares would depend on what portion of your capital is now invested in risk situations and how much you can afford to assign to this category. Executone reported good third quarter results and is still selling at a relatively reasonable multiple. Additional purchases are warranted.

Q) I purchased American Motors some time ago at \$14. Should I continue to hold? A.M.

A) Your loss in American Motors is not sizeable and our advice would be to accept it. The purchase of Jeep Motors, in our opinion, has not added to the company's growth prospects. The transaction will cost \$20 million in cash and five-year notes plus 5.5 million shares. The increase in equity is not apt to be offset by profits from these quality but limited-appeal vehicles. Had a sizeable new group of dealers been added to the roster, the merger would have been of greater potential value. It is difficult at this time to assess how detrimental the strike will be to American's earnings in fiscal 1970. Despite public acceptance of the Hornet, earnings for the current year will not reach a level necessary to support higher share prices. Cyclical automotive issues historically command low multiples and American Motors, at 60-times 1969 earnings, estimated at \$0.20 per share, is not very attractive.

Q) Would you give me your opinion on the capital gains potential of Sterling Precision? T.P.

A) Over the years, Sterling has had a hand in a widely diversified number of industries. Incorporated in 1955, the company has acquired more than 25 other firms and over the years has sold off approximately half of these. Sterling now concentrates on real estate holdings, financial services, and varied manufacturing. Sales in fiscal 1968-69 through April were over \$16 million, with only \$180,000 or \$0.04 a share taken down to earnings. President M. Carroll announced at that time sales were running at a \$65 million annual rate, but since then Sterling has agreed to the sale of its office furniture business with volume of \$10 million yearly. Until fiscal 1962-1963, Sterling operated at a deficit. After two years breaking even, a \$0.39 a share profit was reported in fiscal 1965. Last year, earnings reached \$0.43 a share. Share price remained below 10 until last year but has since fallen well below that level. All in all, this is not a picture that inspires confidence. You should aim a bit higher and buy fewer shares in a high grade issue, such as Consolidated Foods.

Q) I have several hundred shares of Cubic Corp. at an average cost of \$30. I have been given conflicting buy, sell advice and am confused. What is your opinion? C.P.

A) Cubic reported a good gain in sales and earnings in the September quarter. Full-year results are expected by management to set new records. Although high volume from the production of antenna systems for the F-111D will continue through this year and next, the program is being phased out. Cubic is confident that newly developed products will take up this slack. One promising development is the KOM-

90 computer output microfilmer produced under contract to Eastman Kodak. However, a lower-cost competitive product which has been introduced by another company may take over the market. We understand that a credit card reading device which will search on-site memory banks for fraudulent or lost cards has been developed. Cubic is currently holding discussions with a major oil company about the production of these low-cost readers. We look for recovery on better earnings and would hold but not add to these shares.

Q) I would like to sell some stock but am not certain of the proper procedure for signing. Should the stock certificates be sent by regular mail? P.E.

A) There are two commonly used methods of endorsing and mailing stock certificates. Perhaps the safest way is to use a form called a stock power which your broker will be glad to furnish. The stock power is endorsed exactly as your name appears on the stock certificate. This is then mailed to your broker. Your stock certificate remains unsigned and is mailed in a separate envelope. In this case regular mail suffices. If you endorse the back of the stock certificate, then you should use registered mail. Remember your signature should match your name as it appears on the face of the certificate. You must sign on the line below the date line. Your broker's firm name should be entered between the words "appoint" and "attorney to." If you carefully follow either of these methods the transaction should be completed without problems. ▲



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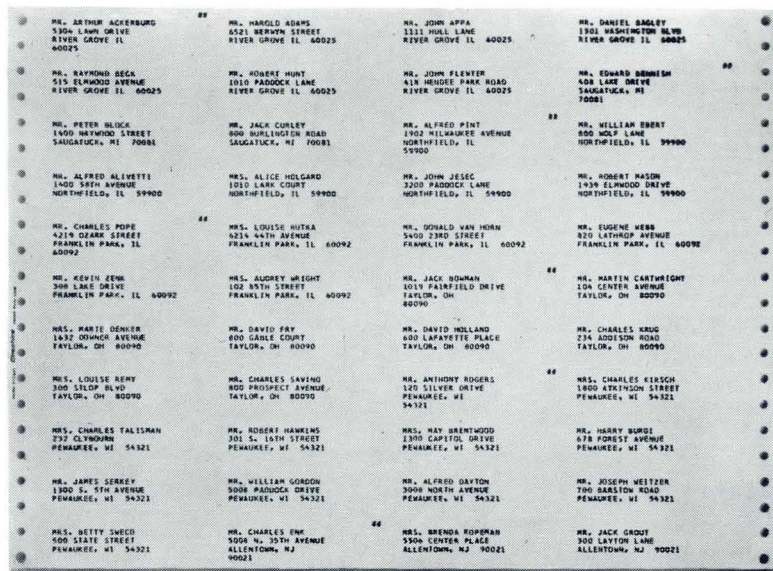
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	COMPANY	EXCH.	VOL. (SHARES IN 100's)	1969 HIGH	1969 LOW	PRICE 12-5-69	NET CHG.	EARN./SHR.	P/E
							FROM MONTH AGO	(LATEST 12 MONTHS)	RATIO
SUPPLIES & ACCESSORIES	ACME VISIBLE RECORDS	OTC	-----	47.0	31.0	37.0	1.0	1.82	20
	ADAMS MILLIS	NY	526	22.3	11.5	13.4	- 3.4	0.86	15
	BALTIMORE BUS. FORMS	OTC	-----	27.4	23.0	25.0	- 2.0	0.92	27
	BARRY WRIGHT	AM	397	29.2	17.6	22.2	- 2.3	0.99	22
	CAPITOL INDUSTRIES	AM	626	56.2	29.0	50.0	- 4.4	1.59	31
	DATA DOCUMENTS	OTC	-----	44.4	26.0	32.0	- 2.0	1.94	16
	*DATA PACKAGING	OTC	-----	30.2	17.6	26.6	- 2.4	-----	---
	DENNISON MFG.	NY	1573	54.7	21.1	21.5	- 7.3	1.96	10
	DUPONT	NY	2905	165.4	101.2	105.6	-16.2	7.48	14
	ENNIS BUS. FORMS	NY	137	42.2	28.2	36.4	- 2.0	1.78	20
	GENERAL BINDING	OTC	-----	43.0	30.0	32.0	- 1.0	-----	---
	GRAPHIC CONTROLS	OTC	-----	28.6	16.0	19.0	- 3.0	-----	---
	LEWIS BUS. FORMS	OTC	-----	23.0	16.0	17.0	1.0	0.08	212
	MEMOREX	NY	9515	173.7	65.0	154.0	- 7.0	1.83	84
	3 M	NY	2974	118.4	94.0	111.4	- 5.3	3.18	34
MOORE CORP. LTD.	TSE	1811	39.7	29.5	35.5	0.1	-----	---	
REYNOLDS & REYNOLDS	OTC	-----	48.4	30.0	43.0	-----	1.27	33	
SAFEGUARD INDUSTRIES	AM	883	25.4	10.0	14.2	- 4.3	0.52	26	
STANDARD REGISTER	OTC	-----	31.0	23.0	25.2	- 0.6	1.93	12	
UARCO	NY	159	36.2	25.3	34.4	- 0.1	1.80	18	
WALLACE BUS. FORMS	OTC	-----	37.2	27.4	36.0	- 1.0	2.16	16	
SOFTWARE & SERVICES	APPLIED DATA RESEARCH	AM	3359	40.0	19.0	21.4	- 2.4	0.65	32
	APPLIED LOGIC	OTC	-----	24.4	16.4	21.2	- 0.2	0.07	---
	ARIES	OTC	-----	19.0	6.0	6.6	- 2.2	0.04	150
	AUTOMATIC DATA PROC.	AM	621	122.0	63.2	114.0	- 1.0	1.53	74
	BOLT, BERANEK & NEWMAN	OTC	-----	19.0	7.4	14.0	- 1.0	-----	---
	BOOTHE COMPUTER	OTC	-----	45.4	23.0	25.6	0.6	1.62	15
	BRANDON APPLIED SYS.	OTC	-----	17.0	7.0	10.0	3.0	-----	---
	COMPUTER APPLICATIONS	AM	496	21.7	9.4	11.7	- 2.5	0.22	50
	COMPUTER ENVIRONMENTS	OTC	-----	16.0	6.4	12.4	4.4	-----	---
	COMPUTER EXCHANGE	OTC	-----	18.0	4.0	7.6	- 2.2	-----	---
	COMPUTER INVESTORS	AM	273	25.0	7.6	10.4	- 3.5	0.38	26
	COMPUTER LEASING	AM	3026	34.7	10.0	17.2	- 1.4	0.62	27
	COMPUTER METHODS	OTC	-----	12.4	1.6	1.6	- 2.0	-----	---
	COMPUTER PROPERTY	OTC	-----	13.0	9.0	11.0	- 0.2	-----	---
	COMPUTER SCIENCES	NY	14222	34.6	19.4	28.6	- 3.3	0.60	46
	COMPUTER TECHNOLOGY	OTC	-----	36.0	13.2	19.0	-16.0	-----	---
	CTC COMPUTER	OTC	-----	24.0	14.0	19.4	- 0.4	-----	---
	COMPUTER USAGE	OTC	-----	40.0	7.6	10.4	- 7.4	(d)1.82	---
	COMPUTEROLOGY	OTC	-----	6.4	1.4	1.4	- 2.0	-----	---
	COMPUTING & SOFTWARE	AM	1779	72.6	37.0	59.3	- 8.1	0.99	59
	COM-SHARE	OTC	-----	23.0	11.4	18.4	2.4	-----	---
	CYBER-TRONICS	OTC	-----	13.4	7.0	11.2	- 1.6	0.11	100
	CYBERMATICS	OTC	-----	15.0	6.0	11.0	2.0	-----	---
	DATA AUTOMATION	OTC	-----	30.2	13.0	30.2	8.1	-----	---
	DATA DYNAMICS	OTC	-----	16.0	3.4	3.7	0.2	-----	---
	DATA NETWORK	OTC	-----	10.4	4.6	5.0	0.2	-----	---
	DATA PROC. FIN. & GEN.	AM	2203	60.2	23.5	31.6	- 5.3	2.56	12
	DATA SYSTEMS ANALYSTS	OTC	-----	11.0	3.0	3.4	- 0.4	-----	---
	DATRONIC RENTAL	OTC	-----	16.0	5.0	6.6	- 1.6	0.44	13
	DEARBORN COMPUTER	AM	1302	52.6	24.3	25.2	- 4.6	2.10	11
	DECISION SYSTEMS	OTC	-----	8.6	3.0	3.4	- 0.4	-----	---
	DIGITAL APPLICATIONS	OTC	-----	15.0	3.0	4.4	- 1.4	-----	---
	DIGITEK	OTC	-----	15.0	4.0	6.1	1.1	-----	---
	DPA	AM	1115	13.5	8.1	10.0	- 1.7	0.69	14
	EFFICIENT LEASING	OTC	-----	15.4	3.0	3.6	- 0.2	0.18	16
	ELEC. COMP. PROG. INST.	AM	301	38.2	8.4	9.2	- 4.1	0.14	64
	ELECT. DATA SYSTEMS	OTC	-----	144.0	34.0	144.0	13.0	0.30	480
GRAPHIC SCIENCES	OTC	-----	70.0	37.0	39.6	- 1.2	(d)2.09	---	
GREYHOUND COMPUTER	AM	767	28.5	12.0	13.5	- 2.3	1.25	10	
INFORMATICS	OTC	-----	30.6	11.0	17.0	- 1.0	0.05	---	
INTL. COMPUTER	OTC	-----	17.0	8.0	8.0	- 2.4	0.07	114	
LEASCO	AM	4428	54.0	22.4	25.0	- 3.5	2.68	9	
LEVIN-TOWNSEND	AM	4186	57.4	17.4	19.2	-11.7	4.03	4	
LMC DATA	OTC	-----	8.2	2.0	2.6	- 0.2	0.07	28	
MGMT. ASSISTANCE	OTC	-----	14.7	2.0	2.7	- 0.1	(d)0.48	---	
NATIONAL COMP. ANAL.	OTC	-----	22.0	4.6	6.4	- 1.4	-----	---	
PLANNING RESEARCH	NY	2045	48.7	23.7	46.7	0.7	0.68	67	
PROGRAMMING METHODS	OTC	-----	20.0	13.0	19.4	2.4	-----	---	
PROGRAMMING SCIENCES	OTC	-----	37.0	11.0	26.4	- 5.4	-----	---	
PROGRAMMING SYSTEMS	OTC	-----	11.4	4.0	4.0	- 1.0	-----	---	
SCIENTIFIC COMPUTER	OTC	-----	8.4	3.0	3.2	0.2	0.13	23	
SCIENTIFIC RESOURCES	NY	3128	26.4	10.3	12.3	- 4.6	(d)1.26	---	
STRATEGIC SYSTEMS	OTC	-----	37.0	3.0	3.5	- 0.3	-----	---	
SYSTEMS CAPITAL	OTC	-----	34.0	5.0	5.4	- 0.6	-----	---	
TIME SHARE	OTC	-----	13.4	5.4	7.4	0.3	-----	---	
URS SYSTEMS	OTC	-----	31.2	17.1	26.0	- 1.1	-----	---	
UNITED DATA CENTERS	OTC	-----	7.0	3.2	5.0	0.1	-----	---	
UNIVERSITY COMPUTING	NY	8557	155.0	55.0	96.0	- 8.7	2.51	38	
US TIME SHARING	OTC	-----	16.0	7.0	7.2	- 0.6	-----	---	

(d) Deficit
 * New listing in this issue

All security prices and net change are expressed in eighths of dollars (e.g. 62.2 is 62 1/4). Trading volume is not given for over the counter stocks. ALL DATA COMPUTED BY SCANTLIN ELECTRONICS, EXCLUSIVELY FOR MODERN DATA.

COMPANY	EXCH.	VOL. (SHARES IN 100's)	1969 HIGH	1969 LOW	PRICE 12-5-69	NET CHG.	EARN./SHR.	P/E RATIO	
						FROM MONTH AGO	(LATEST 12 MONTHS)		
PERIPHERALS & COMPONENTS	AMP	NY	1858	58.2	32.5	56.2	- 0.5	1.89	29
	AMPEX	NY	3016	49.7	32.4	44.0	- 5.2	1.42	30
	APPLIED MAGNETICS	OTC	-----	36.4	22.4	35.2	2.2	-----	---
	ASTRODATA	AM	3406	29.7	15.1	27.4	2.5	0.28	96
	ASTROSYSTEMS	OTC	-----	13.4	5.0	6.6	0.2	-----	---
	BUNKER RAMO	NY	4679	17.5	9.4	13.0	- 2.3	0.43	30
	CALCOMP	AM	2176	37.4	18.2	26.2	- 8.2	0.56	46
	CHALCO ENGRG.	OTC	-----	8.4	3.2	4.0	- 1.0	-----	---
	CODEX	OTC	-----	47.4	15.0	38.0	- 6.0	-----	---
	*COGAR	OTC	-----	73.0	68.0	68.0	-----	-----	---
	COGNITRONICS	OTC	-----	38.4	12.4	13.2	- 4.7	-----	---
	COLLINS RADIO	NY	1582	69.6	36.1	37.7	-20.1	2.50	14
	COMCET	OTC	-----	46.0	27.0	38.0	-----	-----	---
	COMPUTEST	AM	1064	33.5	14.2	26.5	- 3.5	0.60	43
	COMPUTER COMM.	OTC	-----	48.0	19.2	38.4	- 4.4	-----	---
	COMPUTER CONSOLES	OTC	-----	26.0	8.0	17.0	- 3.2	-----	---
	COMPUTER INDUSTRIES	OTC	-----	52.0	12.0	21.0	-----	-----	---
	CONRAC	NY	620	59.3	30.4	32.2	- 6.4	1.54	20
	*DATA 100	OTC	-----	19.0	16.6	5.0	-----	-----	---
	DATA PRODUCTS	AM	9442	27.7	12.3	21.1	0.7	0.34	61
	DATA-RAM	OTC	-----	16.4	8.4	12.6	- 1.4	(d)0.46	---
	DATASCAN	OTC	-----	32.0	15.0	22.4	- 0.4	-----	---
	DIGITRONICS	OTC	-----	22.4	13.0	15.4	- 0.4	0.18	83
	ELEC ENGRG. OF CAL.	AM	218	28.3	10.0	15.3	- 4.1	0.25	60
	ELEC MEMORIES & MAG.	NY	2266	83.1	43.1	78.1	- 3.5	2.02	38
	EPSCO	OTC	-----	20.4	7.0	7.2	- 1.2	0.17	41
	EXCELLO	NY	945	37.3	22.5	22.6	- 2.2	2.63	8
	FARRINGTON MFG.	OTC	-----	37.4	13.0	15.2	- 5.2	0.08	187
	FABRI-TEK	OTC	-----	12.7	6.0	6.1	- 2.3	(d)0.11	---
	GENERAL INSTRUMENT	NY	4372	43.2	26.0	30.6	- 4.7	1.07	28
	GERBER SCIENTIFIC	AM	329	37.3	20.2	33.6	- 2.1	0.85	38
	HI-G	AM	-----	33.4	9.6	13.5	- 4.1	0.43	31
	INFORMATION DISPLAYS	OTC	-----	21.4	9.4	15.0	- 4.0	-----	---
	*ITEL	AM	-----	36.3	14.2	34.2	5.7	-----	---
	LOGIC	OTC	-----	23.0	7.0	11.6	0.6	-----	---
	MILGO	AM	6176	63.0	17.7	59.3	5.1	0.35	169
	MOHAWK DATA SCIENCES	AM	2140	89.1	59.6	71.4	- 8.4	1.15	61
	NORTH ATLANTIC IND.	OTC	-----	22.0	8.0	8.4	- 1.4	0.70	12
	OPTICAL SCANNING	OTC	-----	118.0	41.0	53.0	- 6.0	(d)0.55	---
	POTTER INSTRUMENTS	AM	3203	46.0	23.6	34.4	- 4.0	0.80	42
RECOGNITION EQUIP.	OTC	-----	76.0	52.0	72.4	2.4	(d)0.57	---	
SANDERS ASSOCIATES	NY	4280	61.7	22.0	25.0	- 4.2	0.59	42	
SANGAMO	NY	3127	43.4	19.2	23.6	- 9.7	0.60	38	
SCAN-DATA	OTC	-----	85.0	27.0	34.0	1.0	-----	---	
SEAELECTRO	AM	218	15.6	7.0	8.2	- 2.0	0.20	40	
TALLY	OTC	-----	36.0	15.0	18.0	- 5.0	-----	---	
TELEX	AM	10301	101.7	20.6	97.6	16.5	1.26	76	
TEXAS INSTRUMENTS	NY	3537	140.2	94.6	124.0	- 2.7	2.66	46	
*TRACOR COMPUTING	OTC	-----	5.6	5.2	5.4	-----	-----	---	
VARIFAB	OTC	-----	13.0	6.2	6.2	- 1.6	-----	---	
COMPUTERS	APPLIED DYNAMICS	OTC	-----	18.2	14.2	17.2	- 0.6	0.34	50
	BECKMAN	NY	1362	63.4	43.7	47.0	-14.2	1.39	33
	BURROUGHS	NY	5900	167.4	120.6	158.3	9.6	3.04	51
	CONTROL DATA	NY	8485	159.2	110.0	115.0	- 5.4	3.61	31
	DIGITAL EQUIPMENT	AM	2926	102.2	54.4	92.0	1.0	1.14	80
	ELECTRONIC ASSOCIATES	NY	1767	25.2	11.0	11.5	- 6.1	0.40	27
	GENERAL ELECTRIC	NY	6597	98.2	76.2	79.1	- 5.7	4.10	19
	HEWLETT-PACKARD	NY	2783	114.5	75.2	101.0	-11.4	1.67	60
	HONEYWELL	NY	1593	157.2	107.6	143.4	- 9.2	4.00	35
	IBM	NY	4468	368.6	291.6	357.0	- 8.0	8.25	43
	LITTON INDUSTRIES	NY	8126	74.4	37.1	48.7	- 7.1	2.43	19
	NCR	NY	3454	150.4	108.0	144.4	- 3.4	3.91	36
	RCA	NY	5998	48.1	35.0	36.5	- 3.5	2.44	14
	RAYTHEON	NY	2059	50.2	30.5	34.5	- 3.2	2.30	14
	REDCOR	OTC	-----	49.0	25.0	30.0	5.0	-----	---
	SCIENTIFIC CONTROL	OTC	-----	43.4	3.4	4.4	-15.4	(d)1.30	---
	SPERRY RAND	NY	7517	55.4	38.3	43.1	- 3.2	2.27	18
	SYSTEMS ENGRG. LABS	AM	6613	51.7	26.1	49.0	- 0.6	0.73	67
	SYSTRON DONNER	AM	1051	32.3	13.5	25.5	- 5.5	1.07	23
	VARIAN ASSOCIATES	NY	8985	37.2	24.4	27.7	- 7.2	0.91	29
VIATRON	OTC	-----	58.0	14.2	35.4	- 8.4	-----	---	
WANG LABS	AM	2248	61.4	47.3	54.0	- 2.1	0.75	72	
WYLE LABS	AM	1697	20.2	8.0	8.6	- 3.1	0.53	15	
XEROX	NY	8389	115.0	85.0	104.4	- 4.6	2.03	51	
AVERAGES	COMPUTER STOCKS		47.2	25.1	35.4	- 6.8	1.09	32.4	
	DOW JONES INDUSTRIALS		968.85	793.03	793.03	- 7.8%	3.80	17	



CORPORATE PROFILE

Featured this month:

ADVANCED COMPUTER TECHNIQUES CORP.

(over-the-counter)

437 Madison Avenue
New York, N.Y. 10022

DIRECTORS: Charles P. Lecht, Chairman of the Board and President, ACT; Bonny H. Boncompagni, Director, United Funds, Canada International Ltd.; Robert Colin, Partner, Faulkner, Dawkins & Sullivan; Jacqueline Greenan Wexler, Consultant, Academy for Educational Development, Inc.; William Lone, Jr., Executive Vice President, ACT; Oscar H. Schacter, Vice President, ACT; William O. Harden, Vice President, ACT.

BACKGROUND: Advanced Computer Techniques (ACT) was organized in 1962 and renders a wide variety of services in the computer field including consulting, systems analysis and programming, education, facilities management, service bureau operations, publishing, and market research analysis. From its inception the company has concentrated its efforts in the more advanced areas of computer technology and has worked with major computer manufacturers in the development of new computer systems.

FACILITIES AND PERSONNEL: Advanced Computer Techniques is headquartered in New York City, and has offices which provide a full range of consulting, educational systems analysis, and programming services in Washington, Boston, Phoenix, Chicago, and Milan, Italy. In addition, the company operates a service bureau in Phoenix, Arizona and has facilities in New York and Milan devoted to its educational services. ACT's market research subsidiary, Informa-Tab Corporation, operates a service bureau in New York, and its printing subsidiary R.I. Lithograph Corporation is located in Providence, Rhode Island. ACT employs approximately 150 personnel including over 100 professionals.

PRODUCTS AND SERVICES: ACT's products and services include the following:

★ **Consulting Services.** The company consults with high level management of computer manufacturers and users in all areas of computer usage and systems development. In this regard, ACT has developed project management techniques and has written a basic text in the area of project management controls.

★ **Systems Analysis and Programming.** ACT designs and implements computer software systems such as operating systems, language compilers, utility systems, and other basic software systems for computer manufacturers. It designs and implements commercial systems such as financial systems and performs computer-based modeling for new product introductions.

★ **Documentation.** The company provides independent documentation services for manufacturers of computer equipment. It has designed and written numerous documents which computer manufacturers supply to their customers and also prepares sales brochures and literature for computer manufacturers.

★ **Publishing.** Prior to 1969, ACT authored 4 books, 3 of which were published by McGraw-Hill, and the 4th by the American Management Association. The company's first independently published volume, "A Guide for Software Documentation," was printed in 1969 and the company has entered into a joint venture with McGraw-Hill for the distribution of this book, which is a basic reference for software documentation.

★ **Education.** The company provides educational services, at a facility designed for that specific purpose in New York City, to top management and EDP personnel.

★ **Service Bureau Operations.** ACT provides a full range of activities, from systems design, and programming through processing and "turn-key" operations at its service bureau in Phoenix, Arizona.

★ **Market Research Analysis.** Informa-Tab provides statistical and tabulating services to market research companies. Its staff is composed of market research and EDP personnel who assist clientele in preparing surveys and in the analysis of the completed surveys.

★ **Printing.** R.I. Lithograph operates a full service printing and binding facility including color printing for a wide variety of clientele. It also prints the books which ACT publishes in the computer field and other documents which ACT writes for its computer clientele.

★ **Proprietary Packages.** ACT has designed and implemented two proprietary packages. The first, known as "HELP," is a general-purpose macrogenerator. The second, known as "ARS," is an accounts receivable program for professional and commercial businesses.

CURRENT POSITION: ACT's operating philosophy is to be a "full service" software company, enabling its customers to use one service for the analysis of a problem, the designing of a solution, implementation of the design, and operation of computer systems on a continuous basis. Through facilities management contracts ACT will also relieve EDP users of the burden of recruiting personnel and owning their own hardware systems.

OUTLOOK: ACT has broadly diversified the scope of its computer activities over the past year. It has invested considerable resources in a number of new areas such as service bureau operations, proprietary software packages, educational services, and publishing. It anticipates that in future years a substantial portion of its income will be derived from these activities.

FINANCIAL SUMMARY: During fiscal 1970, the company has increased its revenue substantially and has remained profitable while devoting considerable resources to enlarging and diversifying the scope of its activities in the computer field.

The company's first public offering of stock was made in May 1968 when 240,000 shares were offered at \$7.50 per share. As of December 19, 1969, the high, low, and closing bid prices were 14½, 4¾, and 5 respectively. Operating results for the past five years are summarized as follows:

Year	Revenue	Net Income (Loss)	Net Income (Loss) per share
1969	\$2,475,000	\$ 96,000	\$0.15
1968	2,058,000	102,000	\$0.19
1967	1,377,000	91,000	\$0.18
1966	976,000	107,000	\$0.21
1965	363,000	39,000	\$0.05
6 mos. ended 9-30-69	1,683,000	31,000	\$0.04
6 mos. ended 9-30-68	1,199,000	55,000	\$0.09

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TEXAS INSTRUMENTS
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The Systems Scene is a regular monthly column written by Jerome Wiener and Thomas DeMarco of Mandate Systems, Inc. Readers are invited to submit comments and questions on new developments in systems to: **The Systems Scene, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

What is your computer doing right now? Chances are it's waiting for: (a) the operator, (b) a peripheral, (c) the C.E., (d) a spare part, (e) delivery of more core. In any event, it is almost certainly not computing anything since computers very rarely do that. You will be comforted, however, to know that a team of twenty highly-skilled engineers would take 3 years to do as much waiting as your machine will do today.

It is interesting to ask questions like: *How efficiently do systems run in general? How efficiently can they be made to run? What aids are available to trace lost time and increase efficiency?*

We have come to the conclusion that most medium sized systems with general-purpose work loads, run at less than 30% CPU efficiency even when they are running. This estimate is based on a sample of some forty 360 installations. At the FJCC, we tested this figure on a number of others who concern themselves with efficiency and it checked out well. We also asked how well the best run systems perform, and a generally accepted figure was 80%. We know of three 360 configurations in the New York area that run at around 75% efficiency. Better than 80% seems like magic. (Remember, at 80% the wait light doesn't even flicker.)

The figure of 30% is indeed distressing. Most manufacturer supplied software runs at about 30% on a medium-sized machine. The obvious inference is that few systems run in a multiprogramming mode. We tested this hypothesis on five MVT shops running 50's or better. The average number of simultaneous active partitions was one and a quarter! Multiprogramming was like a new toy: nice on Christmas Day, but in the closet ever since. Most of these shops had made a big show of setting up and benchmarking their systems and circulating memos about their use. Still they continue to run with only one enormous partition.

There are several reasons for this. One is a derivative of Parkinson's Law: "Jobs expand to fit core." Another reason is that status is not as well served by running three partitions as it is by running three machines. Both these problems are political in nature but might be solved by a purely technical innovation: demand paging. Running a system like CP/OS, the oversize job could not usurp physical core (which it probably doesn't need) and thus block any effort to cover I/O time with another job. Also, the status conscious man-

ager running CP/OS could say that he had virtually three computers under his control.

We were speaking of performance and CP/OS is still pretty much of a dog in that respect. The concept is sound, however, and we should see some tuned-up versions soon.

Another reason that so little multiprogramming is done is poor job stream management. Shuffling jobs to make an efficient mix can pay off handsomely. One large data center in Hartford has a highly-touted industrial engineer who decides which way to stack the decks in the card hopper. IBM has a new Job Stream Management Package that will perhaps replace the engineer deck stacker. Job stream management, when done properly, can achieve better use of core (more partitions active), more evenly balanced activity between the channels, less arm movement, etc. — all of which contribute to efficiency.

At least one of the over 80% efficient systems now running can be attributed to a fine-tuning project by Dudley Warner, President of Computer Synectics Incorporated. This California company specializes in a complete line of tuning products and services. They have a device that monitors critical points in the system and generates a tape which is then used to produce a graphic summary of efficiency as a function of time, channel utilization and activity, interrupt overload, and other parameters selected by the user. This data can be used to tune up the system by moving data sets, reconfiguring peripherals, cleaning up bottleneck programs, etc.

The precedent for hardware performance tuning devices has been set by IBM with their giant SAMI system. This modified 360/40 is used internally at IBM to test system efficiency and seek out lost real time.

The COMCET-60 can be configured with an activity display unit that monitors loading at selected key points. This might also be useful for tuning although the hard copy version seems better.

An old Bell Labs trick that helped in tracing performance blocks was an oscilloscope hooked to the memory read amplifiers. The Y-coordinate drove the vertical and the X-coordinate drove the horizontal. Each spot on the scope corresponded to one word in memory. By observing the resultant pattern and its brightness in different spots, some information could be gleaned about the use and misuse of real time.

There have also been a number of software approaches to performance evaluation, e.g., AMAP. But although these are useful for cleaning up gross disorders, the hardware approach seems more valid to us. At least the results to date have been more impressive. There is, however, a third alternative: the "Intuitive Approach." And that is why most systems run at less than 30% efficiency. ▲



ON-LINE

GRAPHIC CALCULATIONS WITH HARDWARE

On-Line is a regular monthly column concerned with various developments in computer technology particularly in the areas of computer graphics and computer-aided design. The author, Thurber J. Moffett, is a nationally-recognized expert in interactive graphic systems. Readers are invited to submit comments and questions regarding subjects covered in this column to: On-Line, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701

The prize at the 1968 FJCC in San Francisco was "A Clipping Divider" by Robert F. Sproull, formerly of Harvard and now of Stanford, and Ivan E. Sutherland, also formerly of Harvard and now a member of the Evans and Sutherland Computer Corp. Mr. Sutherland's company presently offers a complete computer graphics system for about \$200,000 which contains, as its most expensive element (\$68,000), a piece of hardware called The Clipping Divider.

As the paper pointed out, most of today's computer display equipment cannot resolve pictures very well — not nearly as well, for instance, as those which mechanically produce large (roll-size) engineering drawings. Typically, CRT display equipment has a 10-byte digital-to-analog converter, and uses a 1024 X 1024 raster. Even some of this limited capability is not available, since adjacent dots and lines often overlap. Using a computer memory, however, to represent a drawing, results in graphics with a very high degree of precision and resolution — considerably better, in fact, than can normally be put on paper. Unfortunately, the limitations of the display equipment prevent a user from seeing the entire drawing and the fine detail it contains simultaneously.

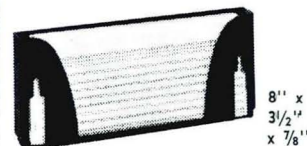
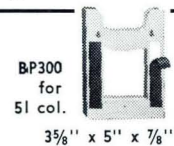
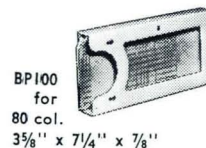
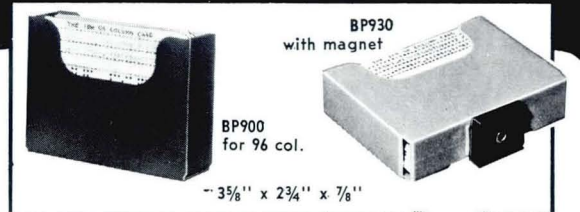
This is partially compensated for by the "zooming" feature found in sophisticated graphic systems, which permits the user to enlarge a selected portion of the picture so that the fine details of that portion approach the resolution of the display itself. The unselected portions of the drawing move off the display screen as the selected portion is enlarged. In order to make this happen, computer programs which will enlarge (or reduce) drawings must compute not only the location of each line of the enlarged (or reduced) drawing, but also which parts of each line, if any, are to be visible to the user. This process of determining and then eliminating the lines and portion of lines which lie outside the user's field of view after "zooming", either up or down, has become known as *windowing*.

The most efficient windowing method for large drawings is called *clipping*; it involves discovering which portions of a drawing are within the window and then computing appropriate scope coordinates for them. The result is then displayed. Clipping software must perform many tests to decide whether a line intersects an edge of the window and, if so, which one. Clipping programs

are, therefore, relatively slow, typically taking from 1 to 10 milliseconds per line clipped. All sophisticated computer graphic systems do a lot of clipping when that method is used, because the entire drawing must be processed each time the picture shown on the scope is moved or changed in scale. This is obviously costly from a computing standpoint, and inconvenient or even intolerable to the user from a response standpoint.

Enter E & C's Clipping Divider, which utilizes a *hardware* approach to enable a user seated at a graphics console to select and view any portion he wishes of the entire picture stored in memory. (At full magnification, the drawing has an effective area of about an acre.) The device automatically eliminates those parts of the picture which are outside the viewing region. And, best of all, it performs the division essential to making true perspective presentations from three-dimensional drawings. It does this in about 10 microseconds per line clipped — making it at least two orders of magnitude faster than the best available software schemes. ▲

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SOFTWARE FORUM is a regular monthly column written by Ken Falor and the staff of **Cullinane Corporation** exclusively for MODERN DATA. Questions from readers on any aspect of software will be answered, as space permits, in this column. Address all questions to: **Software Forum, MODERN DATA, 3 Lockland Avenue, Framingham, Mass. 01701**

Should you develop a software system in-house or buy an existing one? This make or buy decision is becoming increasingly important, particularly with separate pricing now a cash fact.

Historically, this decision has been the purview of computer professionals — professionals who in a real sense are systems and software architects. Like all architects, they have great pride of authorship. As a result, the goal has too often been to design the ultimate system using the latest hardware and software technology with little consideration given to the possibility of buying existing software. Unfortunately, the history of such “make” efforts has demonstrated that the ultimate system rarely ends up as ultimate as it originally was envisioned. Invariably it takes longer to develop than originally planned, costs more than budgeted, has many bugs, and is not completely understood or appreciated by the eventual user.

Thus the make or buy computer software decision has historically been made by individuals who are technically competent to do so, but lack the objectivity and broad management viewpoint to tradeoff in planned system sophistication (make) for the benefits that are available to the company from an existing system available now (buy).

New management pressure and the profit squeeze call for fundamental changes in the attitudes of computer professionals, whether they be data processing personnel, systems managers, or programming personnel. These fundamental attitudes are related to what business they feel their company is in. *Is their company in the business of making a profit or is it in the business of funding advancements in the computer state-of-the-art? Just how much competitive advantage is it practical to try and get, and how much real competitive advantage is there in, say, a central data base system anyway?*

As this fundamental question of corporate economics is recognized, it becomes easier for the computer professional to make better software decisions, taking advantage of what exists, and reserving his in-house capability for the really unique problems and systems.

Where suitable software exists, there is only one good reason for the company to develop software in-house: when the software will provide the company with a competitive advantage. Otherwise, it is obvious the advantages are overwhelmingly in favor of buying

ADVANTAGES

MAKE

1. System tailored to meet company's requirements
2. May be more efficient from a computer standpoint
3. Technical staff understands program thoroughly
4. May provide company with competitive advantage

ADVANTAGES

BUY

1. System details and cost known in advance
2. System is proven
3. System is error-free
4. System is available now
5. Documentation available
6. Substantially lower cost
7. Frees technical staff for other projects

DISADVANTAGES

MAKE

1. System can't be proven until completed
2. Development lead times are lengthy
3. Company's requirements often change during development
4. System will not be error-free when declared operational
5. Substantially more expensive
6. Requires experienced and scarce technical talent
7. Documentation may not be adequate

DISADVANTAGES

BUY

1. May not meet company requirements 100%
2. May be less efficient on computer
3. May not be an advanced system
4. Unfamiliarity with system may cause problems in maintenance and modification
5. May have negative effect on technical staff.

proven software. This is no longer really a matter of debate in most circles. The matter under discussion now is how to find the right package.

The major problem is confidence in the software being considered for purchase. The number of firms offering software packages are numerous and growing. The number of software products offered from software houses and other sources is growing in proportion, presenting a tremendous problem in choosing the right one. *Is the system proven? Does it work as advertised? Does it suit your particular application? Is the documentation adequate? What sort of maintenance provisions are available?* The best way to cope with these problems is to speak to users of the systems to determine what problems they have had and how satisfied they have been.

As better packages appear and as more computer managers begin to appreciate the advantages of buying software (and, equally important, learning how to find the best), more are becoming enthusiasts of this approach to system implementation.

The accompanying table summarizes what we believe are the major factors affecting a make or buy decision.

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The HP 7200 Graphic Plotter generates visual presentations of mathematical and engineering functions, no matter how sophisticated. Or it plots business computations like bar graphs and pie charts. It can spot a trend, prove a theory, compare data, generate engineering designs. It lets the time-share user get more use out of a

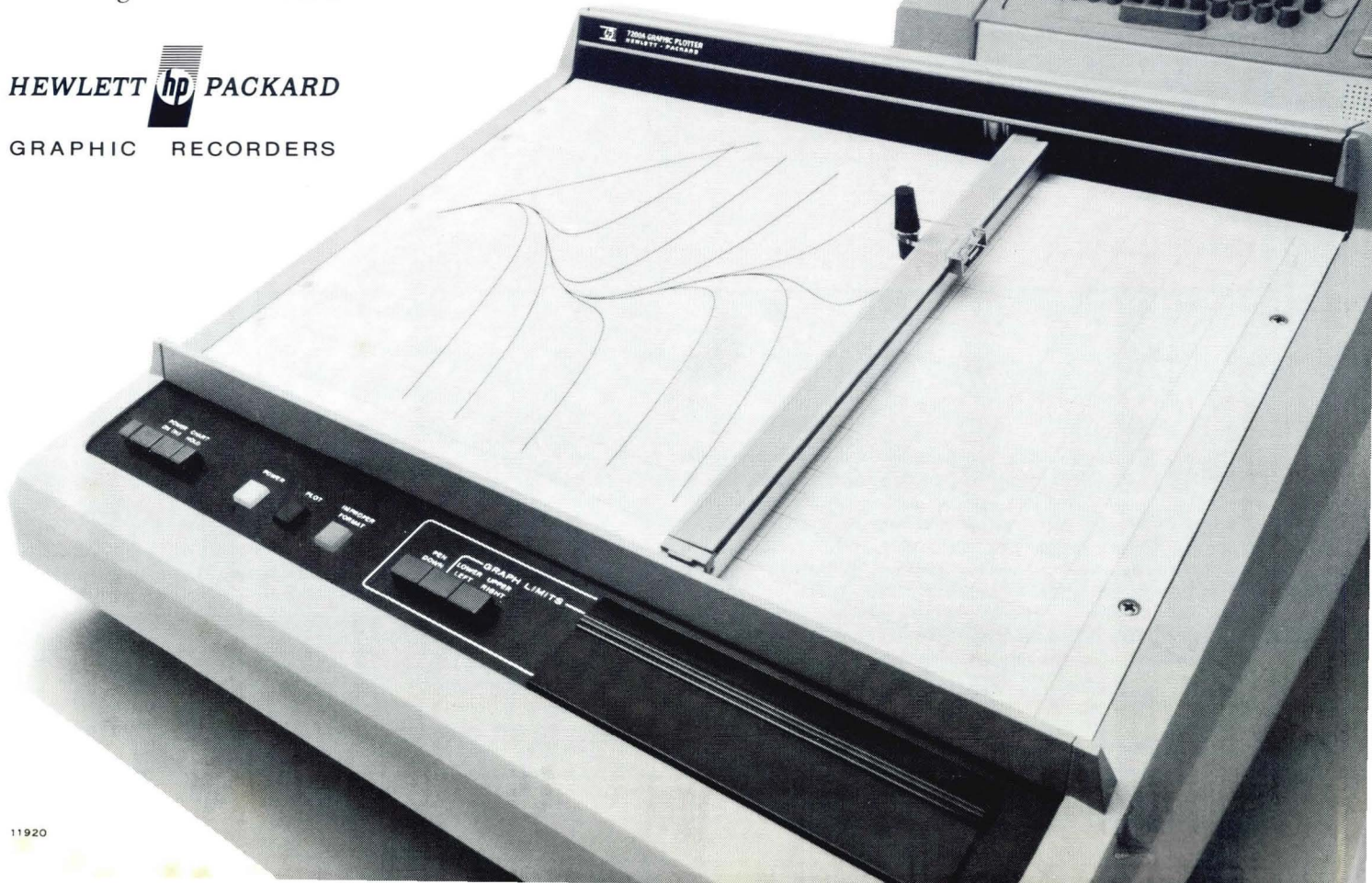
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Check out Hewlett-Packard's new

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SAFEGUARD — A Forum of Opinion

The safeguard ABM system has been variously called "technologically unreliable," "within the current state-of-the-art," and "theoretically impossible to program." It is, for better or worse, whether we like it or not, an issue which concerns us all. With few exceptions, however, most of those individuals whose remarks on this controversial subject have been reported by the popular press are not computer professionals. Instead, they are usually quoted for their academic or political affiliations.

We do not belittle these statements or the individuals who make them. Indeed, the relative practicality-impracticality of a projected ABM system is secondary to its social, economic, and political significance. But the issue is not served by either side when non-technical spokesmen develop semi-technical arguments in an attempt to resolve a purely technical question: *Is the ABM system capable of being practically implemented, or is it beyond our current state-of-the-art?*

This is a question which only individuals with actual computer experience are equipped to answer. Granted, the intricacies of Safeguard are not available to us as data. Perhaps this data may never be available to us, or, for that matter, ever be capable of development at all if we accept the advice of some. But we believe that from a "macro" point-of-view, the basic Safeguard concept has been reported in sufficient detail to warrant a "macro" opinion: "Yes, because," or "No, because"

Both of the following letters were written by individuals of proven professional ability. The first, from Dr. John S. Foster, Jr., Director of the Dept. of Defense, Office of De-

fense Research and Engineering, results from a direct request made by MODERN DATA's Washington Editor, Harold V. Semling, Jr., for a reply to "the number of questions raised in connection with the Safeguard ABM computer system." The second letter was forwarded to MODERN DATA, on my request, by Daniel D. McCracken, a well-known software authority and the author of ten books on programming. It is a copy of a statement prepared in behalf of the members of "Computer Professionals Against ABM," of which Mr. McCracken is chairman. To the best of our knowledge, C.P.A.B.M. is the only *ad hoc* organization of acknowledged computer professionals to take a position either for or against the Safeguard Antibalistic Missile system.

We have printed these letters in the hope that those of our readers who are qualified to shed some additional light on this important issue will do so by sending us their comments. We offer them as the starting point of an experiment to help us determine not only whether we can accept Safeguard as a viable program, but whether you, the professional, care enough to think about it.

Alan R. Kaplan
Editor

Dear Mr. Semling:

This refers to your letter of August 28th regarding questions about the computer system for the Safeguard ABM system.

First of all, there is nothing about the system that essentially hasn't been done before. Computer-controlled phased array radars are operating in the field today. Hundreds of missiles have been fired, most under computer count-down control. Many antiballistic missiles have been fired and successfully tracked and guided to intercepts of live targets. Computers are being used to monitor all aspects of very complicated systems, determine faults and failures, and immediately reconfigure the system accordingly; again, the NASA programs are probably the best example of this.

Thus, the only real task that the Safeguard system has, is to integrate all of these functions in the computer pro-

grams and to check thoroughly and test out the programs before the system is made operational.

The programs will be developed and tested at a data processing center identical to those at the tactical sites, installed at the Bell Telephone Laboratories in Whippany, N.J. In addition, these centers will contain portions of Perimeter Acquisition Radar (PAR) and Missile Site Radar (MSR) receivers and the digital equipment that connects these receivers with the data processors. Also, a very complete system exerciser is being installed at the centers and at the sites. This equipment generates in real time signals that are injected into the radar receivers. These signals appear to the computer system just as real signals would in a real engagement and the data processor programs are tested accordingly.

During this same time, major portions of the programs will be tested at the KWAJALEIN Missile Range. There

an MSR will operate against live targets (except for nuclear warheads) and conduct both Spartan and Sprint intercepts. Therefore, all of the programs involved in preparing the missiles, launch control, guidance, and missile commands will have been thoroughly tested for months before they are needed at the Safeguard sites.

After the programs have been fairly well debugged and tested at the centers, they are then installed at the sites and many, many months of the schedule are devoted to on-site final debugging, checking, and thorough testing. Here threat signals from tapes are injected in parallel with the actual returns from satellites, space junk, meteors, and aurora. Also, the threat tapes are synchronized at all the sites so that the entire system is exercised just as it would be in an actual battle.

I have every confidence that the system will work.
I hope this information will be of help.

John S. Foster, Jr.
Director
Dept. of Defense
Office of Defense Research and Engineering



Dear Mr. Kaplan:

We, the undersigned members of the computing profession, wish to record our professional judgment that there are grave doubts as to the technical feasibility of the computer portion of the Safeguard Antiballistic Missile system. These doubts range from a profound skepticism that the computing system could be made to work, to a conviction that it could not.

Although no project of precisely this nature has ever been attempted before, the difficulty may be understood in terms of a close analogy. Suppose the task were to design and implement the computer portion of a national air traffic control system, and that it were part of the design requirement that at some unspecified instant the control of the air traffic of the entire nation would be transferred to the computer, without any period of parallel operation, testing under actual operating conditions, or evolutionary development. This, by analogy, is what Safeguard would require. Our experience with large-scale computer systems convinces us that such a pattern of development is highly unlikely to lead to a successful computer system.

Another analogy that may be instructive is the use of computers in predicting and reporting election results. These have been used in presidential elections since 1956 and in many local contests, allowing steady evolutionary development. The task is well defined. Realistic testing is possible and is done. It is known in advance exactly when the system will be required to act.

Despite these favorable factors the election systems often fail. In 1968 the data-gathering computer malfunctioned, delaying results by hours. One computer, because of a programming error, reported a total vote exceeding 100%.

If such systems produce blunders, we must conclude that the Safeguard computer probably could not be made to work at all, since the conditions for it are much less favorable:

1. The computing task is much more complex than those of the examples cited.
2. The precise nature of the computing task cannot be defined. It cannot be known what kinds of electronic and other countermeasures would be used, for example, or what evasive maneuvers the attacker might employ. The offense has more strategic options than the defense in any case, and the defensive reactions have to be programmed and tested well in advance of an attack.

3. Realistic testing is impossible since it would require nuclear explosions in the atmosphere. Only artificial test data could be used.

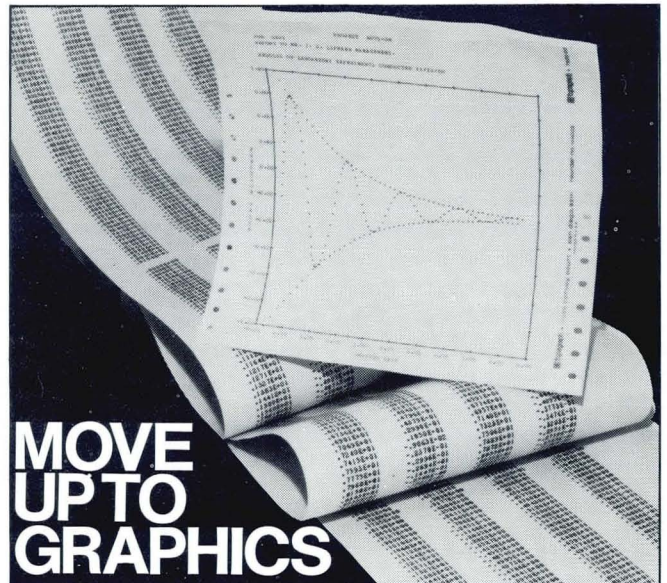
4. Evolutionary development is out of the question. The computer systems for elections are used every four years or oftener and are improved on the basis of experience. The Safeguard computer would never get a second chance.

It is important to realize that the computer would have virtually all of the decision-making power, because the warning time in a nuclear attack would be so short — minutes at most — that presidential or senior military review would be almost impossible. Our experience with the failures of large computers (not to mention those that send out department store bills) makes us extremely reluctant to place so much life-and-death power in the control of a complex and untested machine.

Worse, the ABM system could by itself initiate a firing sequence without any attack taking place. This could happen through the misinterpretation of radar signals from harmless objects or because of machine malfunction or programming error. Since the defensive missiles themselves would carry nuclear weapons, destruction of American cities might result, or the action might be misinterpreted by other nations as hostile.

Our grave doubts as to the technical feasibility of the Safeguard computer system, coupled with our recognition of the possible consequences of system failure, lead us to the view that the project is a dangerous mistake. Whatever other arguments may be brought to bear, for or against Safeguard, our conviction is that on technical grounds alone the project does not deserve the support of the Congress.

Computer Professionals Against ABM
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THE INTERPLEX SYSTEM I

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The New England Telephone Co., under pressure from Waltham, Mass. residents to improve service, recently sent its customers a flyer which pointed-out that 25% of all Massachusetts computer companies are located in Waltham. The flyer implied that a large part of Waltham's phone problems could be attributed to the many time-sharing companies (with their "talkative machines") that have grown up in Waltham's Route 128 area. Ironically, another new Waltham computer company, Interplex Corporation, has developed a time-sharing system for the small problem-solving user that does away with the need for phone lines altogether.

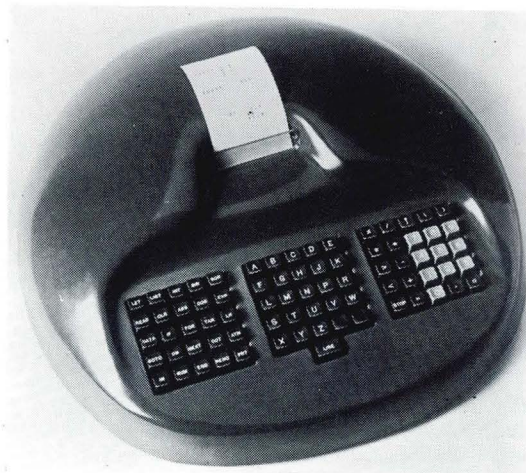
The Interplex System I is a BASIC-language, in-house, time-sharing system. It is **not**, of course, the **only** time-sharing system designed specifically for in-house use. It is, however, the least expensive. \$46,780 buys the CPU (a Honeywell H-316), 12K 16-bit words of core, concentrator/interface, full software, and 4 Interplex terminals (more about these little wonders in a moment). Additional terminals (the system will accept a maximum of 16) cost \$1,520 each.

FURTHER ECONOMIES

This low cost becomes even more appealing once the prospective purchaser fully appreciates that: (1) There are no hidden or additional charges (e.g., for software or terminals). The basic price includes everything necessary to make the system operational. (2) Usage is unlimited. The user can experiment with the system or use it for training purposes without penalty. Since it is entirely a fixed-price system, there are no variable CPU charges or telephone line costs; consequently, no requirements for special accounting or control procedures. (3) Finally, there is no loss of valuable man or machine time due to busy signals, wrong numbers, or poor or interrupted phone connections.

NO-FRILLS TERMINAL

Interplex describes its System I terminal as "distinctively designed," which is probably how they would describe the Taj Mahal. About the size of a statistical calculator, the Interplex terminal looks like a giant inkblot. Nonetheless, it is a model of uncluttered functionalism. The keys are logically arranged in three groups. The left-hand group contains the BASIC language instruction repertoire (e.g., LET, GOTO, NEXT) and the major mathematical functions (e.g., SIN, SQR, EXP). The center (alphabetic) keys represent 23 (no I, O, or Q) variable storage registers. The right-hand keys are for



The terminal end of the new Interplex System I in-house time-sharing system.

numeric data entry and calculator operation. Users communicate with the central processor by means of a data printer located over the keyboard, which also produces hard copy printout in simplified BASIC format.

PRESENT AND FUTURE

By eliminating all the bells and whistles, Interplex has been eminently successful in combining BASIC language and calculator abilities in one simple, inexpensive terminal system. This is not to say, however, that the company does not plan to offer expanded versions of System I and add-ons at some future date. Auxiliary storage, line printer, and even remoting(!) via modem or acoustic coupler options may become available sometime after first deliveries of System I are made in mid-summer. But Interplex believes the markets for System I are broad enough as they stand without the necessity for rushing headlong into less novel territory. According to Pat Toomey, Interplex's Director of Marketing, between 25% and 50% of present time-sharing users eventually plan to take the in-house route. Furthermore, almost 1/3 of all T-S users already program in BASIC, and indications are that this figure will increase. These statistics, together with the galloping estimates of what the commercial and educational time-sharing and desk calculator markets will look like in the next 2-3 years, would certainly support the kind of effort that resulted in System I.

For more information
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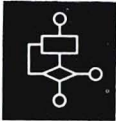
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RAYTHEON



WHAT IS A COMPUTER PROGRAM?

Because of the controversy surrounding program patentability, the exact definition of a computer program is of added importance. Here, the author gives a unique definition and provides new insight into both the computer and the program.

All too often the why or what of a thing gets lost in the confusion of using and improving it. Blinded by our narrow viewpoint or infatuated by our own cleverness, we pursue specific aspects and allow the overall value of the thing to stand still or even regress. *Remember when Detroit equated increased visibility with larger glass area?* Recognizing the obvious value to the driver, they engaged in a fierce race to "out-greenhouse" each other. We wound up with huge windows on such extreme angles that visibility was actually decreased.

Indeed, the automobile industry stands as a prime example of the danger to computers expressed in my opening statement. The car's function is irretrievably lost in a maze of conflicting concepts. The auto's function is now secondary to the welter of status, esthetic, sexual, legal, economic, and social values that swirl around it. A similar fate must not befall the computer. It is too important.

The definition of computers and programming that I shall give is intended to provide new insight. Your initial shock at this unique definition should not stop there. Its inherent validity will be supported and leads to analogs that provide additional insights. These analogs will be referred to often and, I hope, help the reader to view the computer from a fresh vantage point.

DEFINITION

As a phonograph record captures the sound of a jazz performance, a program is skill expressed in a reproducible form. The computer is the playback device.

The computer and its program share with other recording and playback devices three major elements: a recording technique, a storage medium, and a reproducing technique. Let's consider each of these elements.

SKILL (skill), n. 1. the ability, coming from one's knowledge, practice, aptitude, etc., to do something well 2. competent excellence in performance; expertness; dexterity 3. a craft, trade, or job requiring manual dexterity or special training in which a person has competence and experience.

The Random House Dictionary of the English Language
Random House, New York

PROCESS (pro-cess) n. 1a. Progress, advance b: something going on: proceeding 2a: a natural phenomenon marked by gradual changes that lead toward a particular result (of growth) b: a series of actions or operations conducing to an end; esp: a continuous operation or treatment esp. in manufacture 3a: the whole course of proceedings in a legal action b: the summons, mandate, or writ used by a court to compel the appearance of the defendant in a legal action or compliance with its orders 4: a prominent or projecting part of an organism or organic structure (a bone).

PROGRAM (pro-gram or pro-gramme) n. 1: a public notice 2a: a brief outline of the order to be pursued or the subjects embraced (as in public entertainment) b: the performance of a program; esp. a performance or radio or television. 3a: a plan of procedure b: a proposed project or scheme c: a comprehensive schedule 4: Prospectus, Syllabus 5: a printed bill card, or booklet giving a program; specif. a dance order 6a: a plan for the programming of a digital computer b: a sequence of coded instructions for a digital computer.

Webster's Seventh New Collegiate Dictionary
G & C Merriam Company, Springfield, Mass.

RECORDING

We defined a program as a skill-recording and compared it to a phonograph record. Before the invention of the phonograph was possible, the essential nature of sound had to be discovered. Then a way of representing sound had to be found. A fruitful representation treated sound as a wavering line with an amplitude varying from a constantly moving null point. These are pressed into the plastic surface of phonograph records. In a similar fashion, the development of formal logic and a method for representing information was a prerequisite for the computer's development.

Babbage's computer owed at least a nod to the Jacquard loom. The loom permitted a weaver of intricate patterns to break down his skill into a set of actions of shuttle, warp, and woof. These steps were recorded as carefully positioned holes on a wooden card.

The wooden cards were connected in an endless loop and fed into the loom. The loom "felt" each wooden card and performed the actions dictated by the holes. The weaver's skill was preserved and could be repeated.

At a jazz recording session two kinds of skills are represented; the skill of the jazz musicians and the skills of recording technicians. These totally different skills are required to produce the record. To prepare a program, one must have the skill to be recorded and the skill necessary to record **and** to preserve that subject skill. *How are these skills combined?*

The more common path has been to teach the subject-skills to the trained programmer rather than programming skills to people with subject-skills. Past experience has demonstrated that a good programmer is able to maintain an open-mindedness that permits him to learn new application skills. Within our industry, the programmer is often seen learning file management techniques before writing a file updating program, or learn-



John Berg graduated from Villanova University in 1956, after which he spent three years as a naval officer. He entered the computer industry in 1959 as a member of the team that developed the RCA Narrator, the first working Cobol compiler. Later at GE, he held responsibilities in the development of

Gecom and GE 635 Cobol compilers. Joining Informatics in 1965, he has since implemented a cobol, Fortran, and two Jovial compilers. As a Senior Systems Analyst at Computer Symbolic, Inc., Mr. Berg is currently Project Director of a Neliac compiler enhancement project at NAVCOSSACT.

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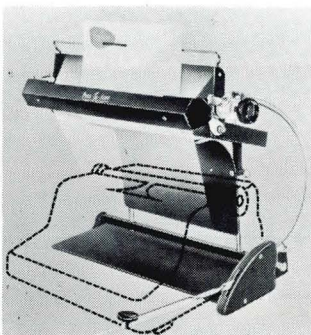
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WHAT IS A COMPUTER PROGRAM?

continued

ing information retrieval techniques or accounting procedures, or inventory control techniques.

Sometimes this subject-skill may be obscured by the recording technology. And sometimes the subject skill may be some aspect of the recording skill itself. (Compilers embody certain skills attendant to programming.) Indeed, often the major skill recorded is the scheduling of sub-activities so that each sub-activity may get its required input at the right time. Machines are notoriously impatient and timing is important!

Not surprisingly, certain aspects of recording skills resulted in skills and professions unique to this art. Nor is it surprising that some recording techniques permit the special way some skills are recorded and performed. Les Paul and Mary Ford's recordings in which Mary sings multiple parts of a trio are examples.

Those of you familiar with current recording techniques are aware that performances are "debugged" and sometimes spliced together from different sessions.

If the sound recording analog seems far-fetched, stretch your mind to include the movies.

Compared to the movies, the current programming is more like cartoon animation in which each frame requires individual and tedious composition. Each frame, a painstaking effort, is just one of many such individual efforts, all planned to be combined and thus form a sensible aggregate.

Like the programmer, the animation artist has learned to save effort by "subroutining". He produces two distinct scenes by using the identical foreground action against two different backgrounds. Or perhaps you have seen a cartoon character repeat a movement cyclically which, when overlaid on a moving background, gives the impression of a period of running.

Will we reach the point when a device can follow and record a selected subject's skill as he demonstrates it? This would be similar to the camera's capturing a performance. Could this skill then be repeated at will? Or edited to eliminate false paths and blunders? Or to insert omissions or superior short sections?

In a sense, any machine is a skill recording (the wedge's existence records man's successful usage). The computer's difference is its general-purpose nature. Like a phonograph it can play many different skills by playing a different record (and perhaps "snapping-on" a new manipulative device). These "different records" are, of course, computer programs. Let's now consider the program as a storage medium or record.

STORAGE MEDIUM

What is the medium and method of skill-storage? The computer provides a set of definite but limited commands, some of which can sense or produce external actions. With some end in mind, these are studied by a programmer and then linked in a sequence to produce the desired result, a process reflecting two skills, the

subject skill and the skill to record it. This resultant process or program is a statement of the skill in terms that can be followed by the computer. Like the wiggly engraving on plastic and sound, the program represents skills.

Sound can be stored in plastic as a wavering line, on magnetic tape as a variation in a magnetic flux, and on a film as a variation in light transmission. Similarly, the description of the process steps may be encoded as holes in a card, magnetic spots on tape, or states of core memory. All these forms exist to permit ease of "reading" the process steps by some device; all can be precisely decoded and encoded into another storage medium. Unfortunately, most computers have different command sets and even different codes in which the commands and data will be stored. Unlike the sound and movie industries, standards were not adopted. Similar skills must be recorded for each new computer type because of this lack of inter-changeability. Perhaps, what caused the standardization in those industries can be studied by ours. It wasn't the USASI!

Programs written and thus stored in a "higher language" like Cobol or Jovial are just as precisely decoded as the other media. Certainly the decoding is much more involved. Perhaps the compiler, as a statement of the decoding algorithm, contains errors. Perhaps the algorithm itself has ambiguities. Nevertheless, one intuitively grasps that once a skill is described properly in a series of steps of the higher language, all translations of these steps into the machine language will produce the same program or a program with differences that clearly do not matter. An example of the latter could be the originating of a program at two different starting locations. Although every address in the machine language will be different, this difference is of no real importance.

The technology for recording the skill to be reproduced by the computer is also that which is used to record data. This von Neumannian characteristic is fitting. The program, as an expression of some skill in a list of steps, is data. The "eyes" for reading and "hands" for writing data were developed before the computer. The existence of tab equipment and similar devices accelerated the computer's growth down the particularly needed path of data processing.

COMPUTER AS A PLAYBACK DEVICE

A successful computer run is a faithful (in the sense of hifidelity) reproduction of a faultless skill-recording as applied to all new (but generally foreseeable) circumstances. The playback of skills requires a "speaker", or "screen", or "hands." The programmer must have available to him a way of directing external conditions appropriate to the skill being produced. Pizza dough spinning remains unautomated while waiting for the appropriate external devices!

As mentioned earlier, many card-reading and card-

punching devices predated the modern computer. The computer's birth as a calculator of arithmetic data (reproducing repetitively and quickly the stored skills required for sorely needed ballistic calculations) provided the initial impetus for devising additional means to manipulate data.

"But the computer's role has been revolutionary in the area of data handling and information processing" you might say. Once again, necessity was the mother of invention. It arrived at the right place at the right time. And in doing so, shaped its future development.

The computer fell fruitfully into an environment of mushrooming need for paper-handling skills and a limited, increasingly expensive manpower pool. *Do you doubt for a moment that the Metropolitan Life Insurance Company would not use a million abaci-armed workers if they were cheaper than a computer?*

But in spite of the current emphasis of data handling, one should not forget the growing role of the computer in process control, message switching, traffic control, numerically controlled machinery, and many others which use other kinds of "hands" to reproduce the skill embedded in the program.

Nor should the amazing speeds of the computer obscure the basic nature of a computer and its program. The speed-amplification in reproducing a recorded skill has undoubtedly been a major factor in the computer's utility. (Like the sound amplification of phonograph records made possible high school dances.) Some applications are only now feasible because of this speed-amplification power. Message switching is an excellent example of this.

Still, many computer uses would be valuable even at human speeds. In these cases, accuracy of reproduction or cheapness of accomplishment are the important factors. Process control and traffic-sensitive intersection signals provide examples.

CONCLUSION

A program is not merely a list of instructions because, unlike a cooking recipe, it is intended to be used in a playback system. It is more than a process because, in addition to the skills needed to design the process steps, the very manner and order in which the process steps are found expresses the recording skills needed to insure valid reproduction.

The concept of machine independence defines the separation of the subject skill from the individual quirk of machines. A distillation of a program to a wholly machine-independent, but reproducible, condition would result in pure skill. This skill would embody knowledge, competence, and experience of the individual or group which prepared the program as surely as a Rubinstein record reflects the artist. Thousands of artists may have previously recorded Brahms's Lullaby but Rubinstein could say that his recording is uniquely his. ►



DIGITAL/GRAPHIC RECORD ACCESS

This article examines the "only-digital" on-line system and a digital/graphic "companion" system, and presents the findings of a study which delineates economic cross-overs.

A specialist in graphic storage and a digital computer specialist would likely agree that documents requiring the preservation of handwriting, such as signatures, or documents containing continuous-tone photographs could best be stored in some graphic format. They would also agree that any information required for processing by a computer could only be stored in digital form.

THE GRAY AREA

Between these two "poles of agreement", however, lies a very large gray area in which the choice of storage medium will vary considerably among the specialists. This would include activities which require the regular processing of both computer-generated records, and printed or typewritten records from the outside world. While the computer-generated records in the system are required in digital form in order to carry out the processing activities, there is also a considerable need for humans to refer to them between periodic updatings by machine. This need for sporadic human reference continues throughout the entire life of the records. Examples are plentiful: customer records of a utility company, insurance policy records, manufacturing inventory records, and mailings lists of names and addresses are only a few.

Let's consider a set of records pertaining to an insurance policy-holder. The EDP specialist would recognize that information about the amount of insurance in force on each customer, for example, should be in digital form. He would further assume that this information could, when stored on disc or unit tapes, be made available for human examination in a fraction of a second on a great variety of digital terminal equipment. As for some of the more textual documents, he may decide that they could be translated by optical character readers into a digital format for storage along with the computer-generated records. Again, humans could refer to them only with digital terminals.

On the other hand, the graphic specialist might look

at these same records and feel that they were static for long enough periods of time to be translated, at the time of updating, from digital form into an analog or a picture record and stored in image form for human reference more efficiently and more economically than they could be stored in digital form. The graphic specialist might further wish to print-out computer-generated records for storage in his graphic system. Resolving these differing opinions on record storage is complicated by the seemingly wide range of digital and graphic equipments and the varying degrees of total automation provided by the hardware.

Choice number one, then, is to store all material digitally, using some form of on-line system. Choice number two is to use two record stores: one for cyclical machine processing, and the other, some form of automated graphic storage that can be interrogated directly by humans at less sophisticated terminals. Of course, each time the digital records are updated, a new set of records for the graphic system must also be prepared.

The on-line digital storage techniques used for choice number one in this comparison are a typical disc system and a typical unit record or strip magnetic tape system. The automated graphic storage used for choice number two in this comparison is an analog electronic system — specifically, an Ampex Videofile Information System.

Since the success of choice number two depends upon a graphic system suitable for storing dynamic records generated on a cyclical basis, it is well to review the considerations that led to this choice. There are two primary requirements for a file which stores cyclically processed records: (1) ability to cope with dynamic, as opposed to archival file conditions, and (2) ability to serve many users from a central file which is maintained in current, updated condition.

The first condition can theoretically be met by microfilm. However, the insertion of a new microfilm image into the midst of an existing film file of related documents often involves a manual splicing activity which is not very adaptable to the conditions we have described for requirement number two.

The second requirement is not met by microfilm because the central file cannot be easily viewed from

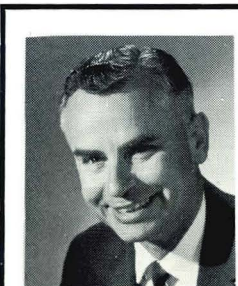
remote locations. Remote "access" to a microfilm file would require supplying distant personnel with duplicate films and equipments. Such duplication of files severely complicates the constant updating encountered in dynamic files.

Some closed-circuit television systems do provide remote access to a central file of original documents. But this requires that an operator physically pull a single document and place it before the television camera, much as a floor man places cards before the camera in a television studio. Furthermore, as noted previously in the insurance policy file example, a file (perhaps more correctly a file folder) is usually a collection of documents rather than a single page.

THE VIDEOFILE SYSTEM

Videofile systems store high-resolution television images on video tape, instead of optical images on film as with microfilm systems. Along with each page or image, an address can be stored containing up to 19 numeric digits or 12 alphanumeric characters.

An 8½" x 11" page and its digital address are stored on one-third of a linear inch of two-inch-wide tape — a packing density of 36 frames to the foot. Documents 5½" x 8½" or smaller can be stored on half that amount of tape, or 72 frames to the foot.



Robert A. Miner is presently product manager for the Videofile Information Systems Division of Ampex Corp. and has held this position for the past four years. His activities at Ampex for the past ten years have all been related, at least in part, to television document storage systems.

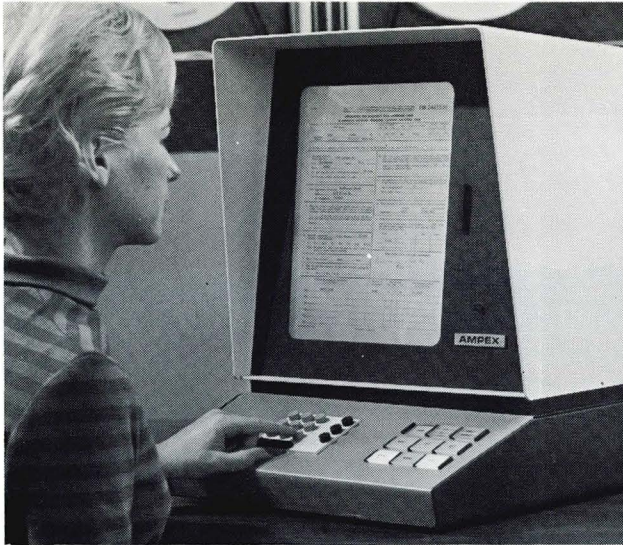
Because the medium is magnetic tape, a document image can be written at a particular location on the tape and later replaced with a new image under the same address, or the address only can be changed. In a system with a numeric address format, the search for an image can be initiated at one moment for all 19 characters and at the next moment for just one character or some combination of one to 19 characters, thereby calling up a complete file or just certain pages of the file.

Documents entering the file are placed on an illuminated platen before a television camera, an address is entered from a keyboard, and a file control is actuated. Normally, the document is written into the system in one-fifteenth of a second.

Documents are retrieved from viewing/retrieval stations — television monitors with keyboards or punched card readers. The requester keypunches the address or inserts a punched card. The master tape storage section finds the document(s), reads it into a temporary storage device called a video disc buffer, and the buffer then reads the document into the requester's television monitor. It is also possible to obtain full-size hard-copy facsimiles of the document from electrostatic printers.

BASES FOR ANALYSIS

The three basic functions of any record system are: (1) document input, (2) document storage, and (3) document retrieval. In the digital storage system, computer-generated information has already been put into the system in order to conduct the processing. Therefore, the record input function only exists for those records entering the system from the outside world. The input of records to the digital system has an advantage over the graphic system if the amount of outside information is small compared to computer-generated records, and automated input can be used. The graphic system has an advantage if such records would otherwise be keystroked into the digital system.



Push-Button Access To File: Operator "pulls" document image from Ampex Videofile information system by key-punching proper address code. Personnel of American Republic Insurance Co., which has ordered a \$1.3 million Videofile system, will use any of 17 viewing/retrieval stations (like that shown above) to retrieve any of up to 7 million documents for viewing or for print-out as full-size facsimile hard copies.

A range of five record or document conditions were considered:

1. Records with a maximum of 25 characters, such as an inventory listing of an item and its part number;
2. Documents with 75 characters, such as a name and address listing, plus a few more characters to identify account characteristics;
3. Documents with 350 characters, such as 6 type-written lines on an 8½" wide sheet;
4. Documents with 2,500 characters, such as a 5½" x 8½" page full of normal text;
5. Documents with 5,000 characters, such as an 8½" x 11" page full of normal text.

ECONOMIC ASSUMPTIONS

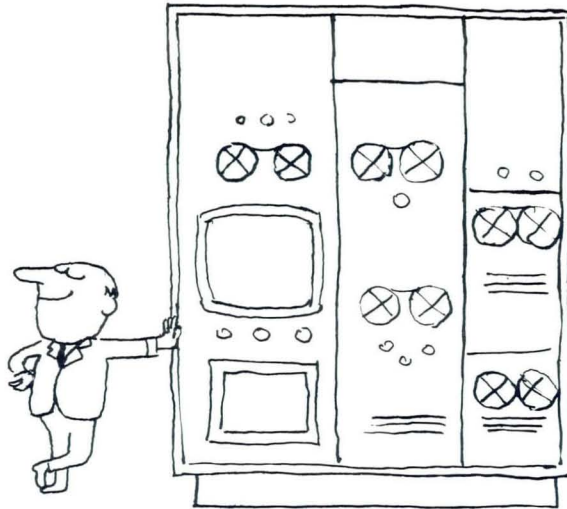
Two sets of economic assumptions have to do with record storage and with the display of stored information. The record storage assumptions are:

- *Digital disc storage will average \$0.001 per character. It was also assumed that the wide variety of available hardware could be adapted to any size of system.*
- *Unit record or strip tape storage will cost \$0.0004 per character; however, this low cost was assumed to*

TABLE 1
COMPARISON OF ON-LINE STORAGE COSTS

FILE SIZE & STORAGE MEDIA	25 CHARS. PAGE/RECORD	75 CHARS. PAGE/RECORD	350 CHARS. PAGE/RECORD	2500 CHARS. PAGE/RECORD	5000 CHARS. PAGE/RECORD
500,000-Page File					
DIGITAL DISC	\$12,500	\$37,500	\$187,500	\$1,250,000	\$2,500,000
DIGITAL STRIP	160,000	160,000	160,000	500,000	1,000,000
VIDEOTAPE	108,000	108,000	108,000	108,000	154,000
1,000,000-Page File					
DIGITAL DISC	\$25,000	\$75,000	\$375,000	\$2,500,000	\$5,000,000
DIGITAL STRIP	160,000	160,000	160,000	1,000,000	2,000,000
VIDEOTAPE	154,000	154,000	154,000	154,000	292,000
10,000,000-Page File					
DIGITAL DISC	\$250,000	\$750,000	\$3,750,000	\$25,000,000	\$50,000,000
DIGITAL STRIP	160,000	300,000	1,500,000	10,000,000	20,000,000
VIDEOTAPE	1,352,000	1,352,000	1,352,000	1,352,000	3,042,000
40,000,000-Page File					
DIGITAL DISC	\$1,000,000	\$3,000,000	\$15,000,000	\$100,000,000	\$200,000,000
DIGITAL STRIP	400,000	1,200,000	6,000,000	40,000,000	80,000,000
VIDEOTAPE	5,408,000	5,408,000	5,408,000	5,408,000	12,168,000

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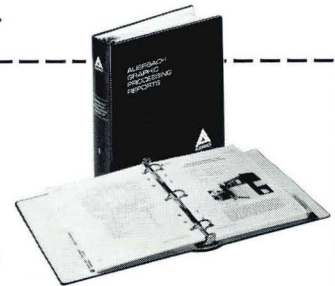
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GP-151

Digital/Graphic Record Access Cont'd

be possible only in large systems with a minimum capacity of three to four hundred million characters.

■ Videofile system storage — including the cost of a tape handler and its associated electronics, its prorated share of all controllers, and switching equipment — will cost \$0.00006 per character. This cost is achieved through the use of 5000-foot reels of tape storing 350,000 images, each image with 2,500 characters; or 175,000 images, each image with 5,000 characters.

The record display assumptions are:

■ A TV-type digital display terminal capable of displaying records up to 1,000 characters will average \$20,000;

■ A TV-type digital display terminal capable of displaying a 5000-character document will range from \$55,000 upward;

■ A Videofile display, including a pro-rated share of the buffered video storage and all other supporting system elements to display either a 2,500-character record or a 5,000-character record, will average \$19,000.

It was further assumed that for these cyclical types of records, magnetic tape storage could be used for processing purposes.

From the foregoing, we can assume that digital display terminals for small records (under 1,000 characters) are comparable in cost to Videofile terminals; digital display terminals for full-size documents are more than twice as expensive as Videofile terminals.

After input and display, the remaining factor to be considered is the cost of storage. Again, in making such comparison, it is well to select a broad range of file sizes:

■ Files consisting of a half-million single page records, such as those that might be found in a utility company customer file in a major metropolitan area.

■ Records that might consist of a million units, such as a magazine mailing list.

■ A record consisting of ten million units, such as perhaps the inventory and stock records of a major corporation.

■ A file consisting of forty million pages, such as the policy holder file in a medium-size insurance company.

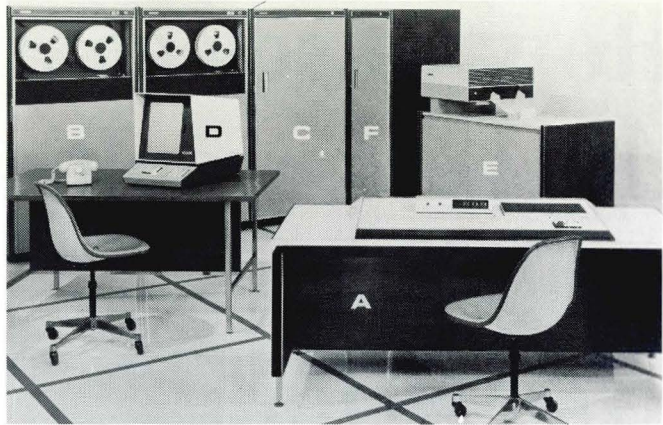
Based on the preceding assumptions, the cost of storing these various size records for each of the different file sizes is outlined in Table 1.

CONCLUSIONS

We can make the following conclusions based on the comparison in Table 1.

1. For smaller records (under 350 characters) and smaller files (under 1,000,000 pages), disc storage would appear to be the most economical method.

2. For smaller records (under 350 characters) and larger files (over 10,000,000 pages), strip tape files should be the most economical form of storage.



A typical Ampex Videofile system includes: (A) file console, (B) tape transport, (C) buffer or intermediate filing centers, (D) viewing/retrieval station, (E) electrostatic printer, and (F) system control center.

3. For any size file over the range from 500,000 to 40,000,000 pages, in which the number of characters per record is more than 350, Videofile would seem the most economical storage technique.

One other economic fact evident from Table 1 is the high cost of storing on-line files of 40,000,000 pages or even 10,000,000 pages, particularly for those records with a large number of characters. Often the updating, replacing, and copying capabilities of a magnetic tape graphic system allow the generation of work tapes or scratchpad files which can contain those records experiencing activity peaks on-line, while records with reduced reference needs can be stored off-line. It's not unusual to find that 1% to 5% of the files, stored on such scratchpad tapes, can accommodate 75%-90% of all on-line reference requests.

A factor which has not yet been discussed in this comparison is access time. Either of the digital tape storage systems discussed can provide "millisecond" access to a record, whereas the graphic system's access time is at best "seconds" on a short scratchpad tape. Access time in a graphic system is really a measure of the system's speed in answering requests for information — throughput. A more important question for human reference is the system's ability to answer all of the requests for information presented to it each day by the users. Typical reference rates for the type of files considered here range from 0.1% to 0.25% of the total files stored — a practical maximum of perhaps 10,000 files (each average file with 10 or more pages) per day. A graphic system, such as the videotape system described, can be set up to handle such request volumes in a number of ways. One of the most convenient is the use of the aforementioned scratchpad tapes.

An analysis such as this involves too many assumptions to be all-inclusive for all record storage conditions, but it has identified a cross-over point to be considered in planning the automated storage of records for human reference. As the number of characters increases beyond 350 characters, the most economical form of storage switches from digital to graphic, even though the original information may, in part, be computer-generated. The fact that this cross-over point seems to exist for such a relatively few characters per record may well trigger additional analysis. ▲

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COMPUTER - CONTROLLED DATA ACQUISITION SYSTEMS

A staff survey of ten "Off-the-Shelf" systems

Several computer manufacturers in the mini-computer area are now supplying "off-the-shelf" data acquisition and control systems built around their basic mini-computer models. Because of the relatively high cost of interfacing special-purpose data acquisition systems with small computers, a number of these manufacturers have decided to offer a selection of basic analog-to-digital, digital-to-analog, and discrete I/O modules integrated as an operating system with their computer line. This means the user of the small data acquisition system can be assured that his real-time data acquisition requirements could be met fairly easily with a ready-to-use system without bearing the non-recurring systems engineering costs. Significant price advantages are realized by the user since one-time engineering costs are spread over a number of customers.

Some customers have preferred to buy only basic computer systems and have their engineering personnel build an interface to meet their exact requirements, but this usually means a longer lead time after the arrival of the computer. Some data acquisition systems manufacturers have taken this concept even one step further by offering ready-to-use programming systems, so that when the hardware is delivered, it is usable with only a minimal amount of operator training.

This survey of ten systems currently available describes the basic features included in each system as well as the expansion capabilities which can be expected. Typical application areas as reported by the manufacturers include the small research lab, product testing systems, engine testing, oceanographic investigations, and structural testing. Several large chemical companies have used the standardized computer data acquisition system for rapid pilot-line feasibility studies prior to erecting much larger petro-chemical plants.

As far as standardization is concerned, about the only similarity among all the systems is that they all contain a computer and ASR-33, have some basic analog-to-

digital converter system, some discrete sensing or control elements, and are readily deliverable within 90 days. Beyond these basic characteristics, typical additional items include ready-to-use software for logging, plotting, and displaying; and either paper or magnetic tape peripherals.

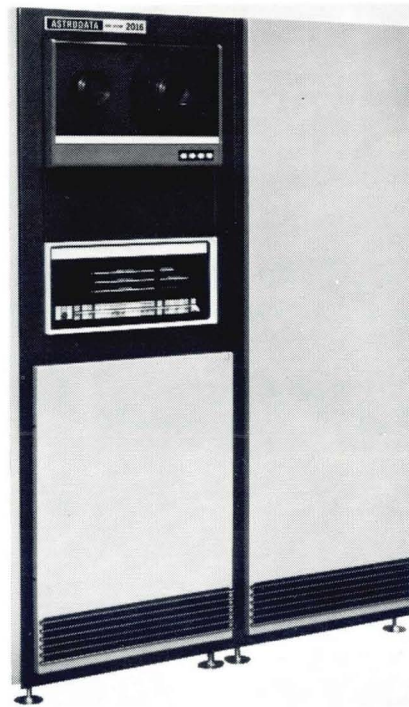
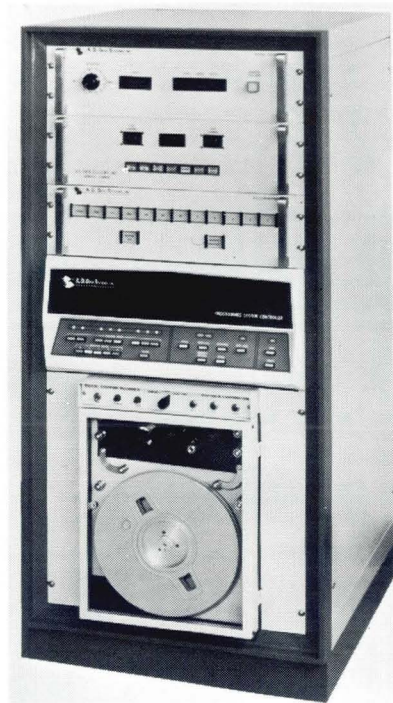
ADDS' 100C

Analog Digital Data Systems' 100C "computerized datalogger" incorporates either Computer Automation's 8-bit PDC-808 (see Table 1) or the 16-bit PDC-816. ADDS also provides the datalogger without processor or in custom configurations for other mainframes. Optional software consists of a symbolic processor and diagnostic and debugging packages. Features of the 100C include programmable alarm limits for each channel and expandability to more than 1000 channels. "Off-the-shelf" versions are available with software for a wide range of specialized monitoring applications.

ASTRODATA'S ADAC

This system, the newest of the ten described in this survey, features a versatile intercoupler assembly which eliminates the need for rack-wiring groups of standard p-c cards to form individual peripheral interfaces. Instead, Astrodata offers a wide selection of relatively-inexpensive modules (device couplers) which plug into the intercoupler as specific device packages. Each intercoupler (two maximum) will accept seven device couplers. Additional features include A/D low-level channel expansion to 100 channels per multiplexer for up to five multiplexers; a high-level multiplexer assembly expandable to 128 single-ended or 64 differential (2-wire) channels; and extensive DEC software.

**TABLE 1
COMPUTER-
CONTROLLED
DATA
ACQUISITION
SYSTEMS
CHARACTERISTICS**



COMPANY
MODEL

ANALOG DIGITAL DATA SYSTEMS, INC.
ADDS 100C

ASTRODATA INC.
ADAC

BASIC COMPUTER
Word Size (bits)
Memory Size (words)
Cycle Time (μ sec)
Hardware Multiply/Divide
Index Registers

Computer Automation PDC-808
8
4K-16K
8
No
None

DEC PDP-8/L
12
4K-8K
1.6
No
8 Auto-Index

BASIC A/D SYSTEM
Input Range
Input Channels
A/D Converter (bits)
Sampling Rate

0-10V
100
11 + Sign
10 KHz

$\pm 5mV - \pm 100mV$
10
11 + Sign
10 KHz

BASIC D/A SYSTEM
Output Range
Output Channels
D/A Converter (bits)

Recorder Only

Supplied as Option

DIGITAL I/O SYSTEM
Inputs
Outputs

40
40

Supplied as Option

OTHER STANDARD ITEMS

ASR-33; Write-only Mag. tape

ASR-33; Write-only Mag. tape

SOFTWARE

Supplied as Option

Diagnostics; Basic Acquisition Packages, All
DEC Standard Software (Fortran, Focal, Algol,
Basic, etc.)

BASIC PRICE

\$22,500

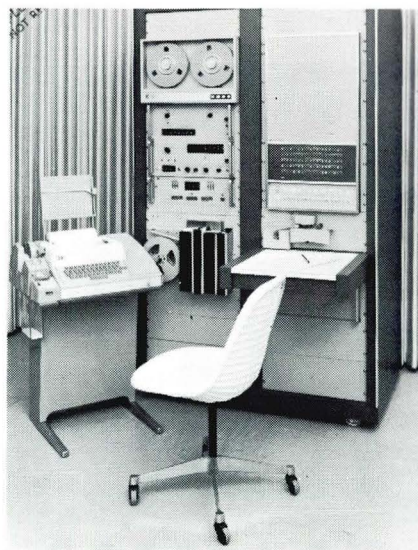
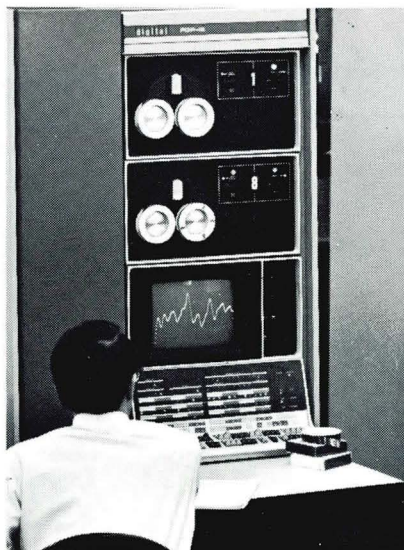
\$29,900

OPTIONAL ITEMS

Mag. & Paper Tape I/O; CRT Display; Plotter;
Sample/Hold; Card Reader; Line Printer; Real-
time Clock; Memory Parity.

Mag. & Paper Tape I/O; Card Readers; Line &
Column Printers; CRT Displays; Plotter;
ASR-35; Auto-Calibration Unit

**TABLE 1
COMPUTER-
CONTROLLED
DATA
ACQUISITION
SYSTEMS
CHARACTERISTICS
Cont'd**



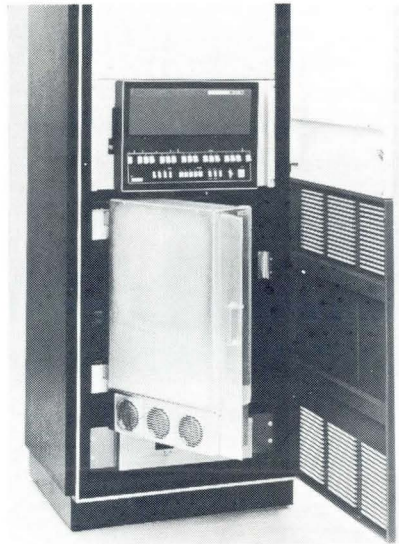
COMPANY MODEL	DIGITAL EQUIPMENT CORP. PDP-12	HEWLETT-PACKARD HP-2114 A
BASIC COMPUTER	PDP-8	HP-2114 A
Word Size (bits)	12	16
Memory Size (words)	4K-32K	8K
Cycle Time (μsec)	1.6	2
Hardware Multiply/Divide	Multiply Only	No
Index Registers	16 Auto-index	None
BASIC A/D SYSTEM		
Input Range	± 1V	100 mV-1000V
Input Channels	16-32	10-200
A/D Converter (bits)	10	14
Sampling Rate	5 KHz	14 Hz
BASIC D/A SYSTEM	Supplied as Option	Supplied as Option
Output Range		
Output Channels		
D/A Converter (bits)		
DIGITAL I/O SYSTEM		Supplied as Option
Inputs	12 Sense	
Outputs	6 Relays	
OTHER STANDARD ITEMS	ASR-33; 2 DECTapes; CRT Display	ASR-33; Real-time Clock
SOFTWARE	Fortran; Assembler; Math. Library; Utility Routines; Display Package	D.A. Executive; Basic Fortran; Algol; Basic Assembler; Utility Routines
BASIC PRICE	\$27,900	\$29,360
OPTIONAL ITEMS	Mag. & Paper Tape, Disk I/O; Card Reader; Line Printer; Plotter; Communications Interface	Mag. & Paper Tape, Disk I/O; CRT Display; Plotter

DEC's PDP-12

DEC has developed a number of special-purpose computer-controlled data acquisition systems for a variety of markets, such as the GLC-8 for the biomedical user.

The PDP-12 is a computer-based system for general lab application, and uses the PDP-8 as the basic computer. Two major features of the PDP-12 are a 7 by 9 inch graphic display system along with two DEC tape units.

**TABLE 1
COMPUTER-
CONTROLLED
DATA
ACQUISITION
SYSTEMS
CHARACTERISTICS
Cont'd**



COMPANY
MODEL

HONEYWELL COMPUTER CONTROL DIV.
H-1603

INFORMATION INSTRUMENTS INC.
PDQ Mobile Data Acquisition System

BASIC COMPUTER

Word Size (bits)
Memory Size (words)
Cycle Time (μ sec)
Hardware Multiply/Divide
Index Registers

H-316
16
4K-16K
1.6
Optional
1

Varian 620/i
16 or 18
4K-32K
1.8
Yes
9

BASIC A/D SYSTEM

Input Range
Input Channels
A/D Converter (bits)
Sampling Rate

$\pm 10V$
8
12 + Sign
10 KHz

0-5V
16
10, 11 or 12
25 KHz

BASIC D/A SYSTEM

Output Range
Output Channels
D/A Converter (bits)

$\pm 10V$
1
10

0-100V
10-500
10, 11 or 12

DIGITAL I/O SYSTEM

Inputs
Outputs

16 Sense
12 Levels

16 to 64
16 to 64

OTHER STANDARD ITEMS

ASR-33

ASR-33

SOFTWARE

Real-time Executive; Assembler; Math. Library;
Utility Routines

Utility Routines

BASIC PRICE

\$24,500

\$27,500

OPTIONAL ITEMS

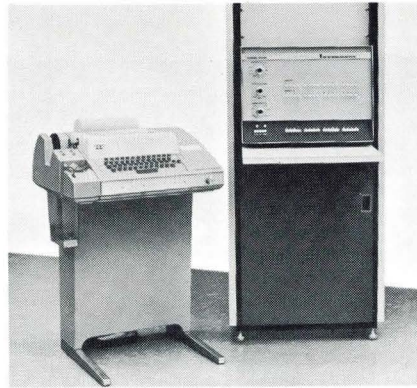
Disk, Drum I/O; CRT Displays; Cardreaders;
Communication Interface

Mag. & Paper Tape, Disk I/O; Line Printers;
Plotter; Real-time Clock; Communications
Interface

The analog input system has 16 channels with an analog-to-digital converter that handles an analog input voltage of 1 volt. In addition to standard Fortran, an assembler, and an extensive math library, special-pur-

pose display and averaging routines are supplied. The PDP-12 is the lowest-priced system of the units described. However, it utilizes a smaller word length (12 bits compared to 16 bits for the other systems surveyed).

**TABLE 1
COMPUTER-
CONTROLLED
DATA
ACQUISITION
SYSTEMS
CHARACTERISTICS
Cont'd**



COMPANY MODEL	INTERDATA Interdata 4	IRA SYSTEMS, INC. SPIRAS 65
BASIC COMPUTER	Interdata 4	SP-65
Word Size (bits)	16	16
Memory Size (words)	2K-32K	4K-65K
Cycle Time (μ sec)	1.0	1.8
Hardware Multiply/Divide	Yes	Yes
Index Registers	15	4
BASIC A/D SYSTEM		
Input Range	$\pm 10V$	0-10V
Input Channels	16-64	6-180
A/D Converter (bits)	12-15	11
Sampling Rate	40 KHz	20 KHz
BASIC D/A SYSTEM		
Output Range	0- $\pm 100V$	0-10V
Output Channels	2	2
D/A Converter (bits)	12	11
DIGITAL I/O SYSTEM		Supplied as Option
Inputs	16 Sense	
Outputs	16 Relay	
OTHER STANDARD ITEMS	ASR-33; Real-time Clock	ASR-33
SOFTWARE	Interactive Fortran; Assembler; Math. Library; Utility Routines	Fortran II; Assembler; Math. Library; Utility Routines
BASIC PRICE	\$25,500	\$23,770
OPTIONAL ITEMS	Mag. & Paper Tape, Drum I/O; CRT Display; Plotter; Communications Interface; Floating Point Hardware	Mag. & Paper Tape, Disk I/O; Card Reader; Line Printer

HEWLETT-PACKARD's HP-2114A

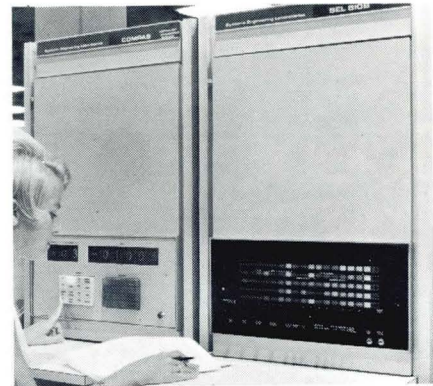
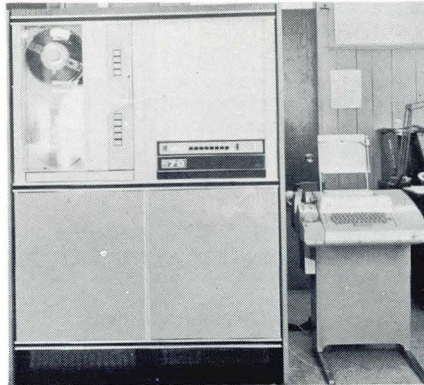
The basic system described in the accompanying table is an outgrowth of a series of non-computer-controlled data acquisition systems. In addition to the analog input system shown in the table, HP offers a variety of other speeds and input voltage ranges. Also, the HP2115A and 2116B computers may be supplied in versions which offer increased performance in terms of machine speed and memory size. A real-time executive with foreground/background capability for use with larger com-

puter systems is also available. To complement the basic analog input system, signal conditioners are available which permit measuring resistances and frequencies.

HONEYWELL's MODEL H-1603

Honeywell's Computer Control Division recently introduced the H-1603 real-time control computer system. The H-1603 uses Honeywell's new H-316 computer.

**TABLE 1
COMPUTER-
CONTROLLED
DATA
ACQUISITION
SYSTEMS
CHARACTERISTICS
Cont'd**



COMPANY MODEL	REDCOR CORP. REDCOR 785	SYSTEMS ENGINEERING LABS., INC. COMPAS
BASIC COMPUTER	RC 70	810 B
Word Size (bits)	16 + Parity	16 + Parity
Memory Size (words)	8K-32K	8K-32K
Cycle Time (μ sec)	0.860	0.750
Hardware Multiply/Divide	Yes	Yes
Index Registers	1	2
BASIC A/D SYSTEM		
Input Range	$\pm 10V$	5mV-5V
Input Channels	32-128	8-512
A/D Converter (bits)	12	12/15
Sampling Rate	20 KHz	200 Hz
BASIC D/A SYSTEM	Supplied as Option	
Output Range		$\pm 5V$
Output Channels		2
D/A Converter (bits)		10
DIGITAL I/O SYSTEM	Supplied as Option	
Inputs		64 Sense
Outputs		32 Levels
OTHER STANDARD ITEMS	ASR-33; Mag. Tape I/O	ASR-33; Real-time Clock; CRT Display Console
SOFTWARE	Fortran IV; Assembler; Math. Library; Utility Routines; Diagnostics	Real-time Executive; Fortran IV; Assembler; Math. Library; Utility Routines; Diagnostics
BASIC PRICE	\$34,800	\$56,300
OPTIONAL ITEMS	Paper Tape I/O; Logging Typewriter; Plotter; Sample/Hold; Real-time Clock; Discrete I/O.	Mag. & Paper Tape, Disk I/O; Card Readers; Line Printers; Plotter; Communications Interface.

The H-316, although smaller than the DDP-516 currently offered by Honeywell, is less than half the price. Several analog and digital system configurations are available which allow the user to select the type of analog voltage being monitored. The 1603 is also supplied with discrete I/O digital logic. Honeywell also offers a variety of disks, drums, displays, and communication equipment. Other features that can be added to the system at additional cost include a real-time clock and hardware multiply/divide capability.

Software supplied with the basic 4096-word system is

an operating package called OP-16. The basic system uses EXEC-16, a minimal-configuration real-time executive; and OPS-16, a basic operating system. More extensive software can be made available to the user for larger core and disk configurations. Standard software permits scanning digital and analog inputs, commanding digital and analog outputs, and providing communications with an operator's console. Expanded versions of the system permit the use of OLERT, Honeywell's On-Line Executive for Real-Time operating systems.

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Data Acquisition Systems Cont'd

INFORMATION INSTRUMENTS' PDQ

Information Instruments Inc.'s PDQ (Programmed Data Quantizer) system appears to be less dependent on any single manufacturer's CPs than any of the other systems covered in this survey. PDQ systems are supplied for use with the IBM 1130 and 1800; DEC PDP8/I and 8/L; Varian 520/i and 620/i; and Hewlett-Packard HP-2114 and HP-2116.

The basic PDQ package, without CP, sells for \$10,500 and offers substantial expansion capabilities, including up to 1,000 analog channels and 10,000 discrete commands. The mobile data acquisition system described in Table 1 utilizes a Varian 620/i.

INTERDATA's MODEL 4

Interdata uses a 1.8 μ sec. processor as the control computer for their standardized data acquisition system. An important feature of the system is the read-only memory which can be customized to meet user requirements for special subroutines on a micro-coded level. An interactive Fortran package further simplifies utilization.

Like many of the other manufacturers, Interdata provides a wide range of peripheral devices. Paper tape, magnetic tape, and disk equipment may be added to the basic unit. Communications equipment is also available. Floating point hardware is optional for users who require faster computation.

IRA SYSTEMS' SPIRAS 65

IRA Systems, recently acquired by USM Corporation, uses their Spiras 65, an MSI computer with a read-only memory. The standard "front end" can either be a solid-state, high-speed input system or a low-level reed-relay input system. The multiplexer permits either single, double, or three-wire guarded inputs.

In addition to an ASR-33, IRA offers either magnetic tape or disk bulk storage. Software is provided for either sequential or random access, logging, display, recording, scaling, and conversion to engineering units. Another standard feature of the Spiras 65 is floating point hardware.

REDCOR's 785

The Redcor 785 data acquisition system uses the sub-microsecond RC70 as its central computer. Memory parity and memory protect are standard in the basic 785 system, as in an IBM-compatible magnetic tape transport. The software includes a data acquisition executive which permits random or sequential scanning of data for storage either in the processor or on tape.

The Redcor system places particular emphasis on repeatability and system accuracy, and provides a calibration histogram program whereby selected channels can be constantly digitized with a print-out of channel values. Discrete input/output lines are not included in the basic system, but are available as optional features.

SEL's COMPAS SYSTEM

Systems Engineering Labs uses its 810B as the basic computer in its COMPAS system. The 750 nanosecond 810B offers a speed advantage over every other computer surveyed, and is supplied with a Real-Time Executive (RTX) foreground/background software package for disk-oriented systems.

Other standard features of the system include an operator's console and interactive COMPAS software. The operator's console is supplied in addition to the computer console, and allows an unskilled operator to scan, log, display, and record both discrete and analog data under control of the real-time executive. Other options include a wide selection of conventional peripherals and analog/digital input systems.

TABLE 2 • REFERENCE LITERATURE

For more information on the computer-controlled data acquisition systems described in this article, circle, on the reader inquiry card, the appropriate numbers listed below.

Company	Reader Inquiry Card Number
Analog Digital Data Systems, Inc., Rochester, N.Y.	120
Astrodata Inc., Anaheim, Cal.	121
Digital Equipment Corp., Maynard, Mass.	122
Hewlett-Packard, Cupertino, Cal.	123
Honeywell, Computer Control Div., Framingham, Mass.	124
Information Instruments Inc., Ann Arbor, Mich.	125
Interdata Corp., Oceanport, N. J.	126
IRA Systems Inc., Waltham, Mass.	127
Redcor Corp., Canoga Park, Cal.	128
Systems Engineering Laboratories, Ft. Lauderdale, Fla.	129

SUMMARY

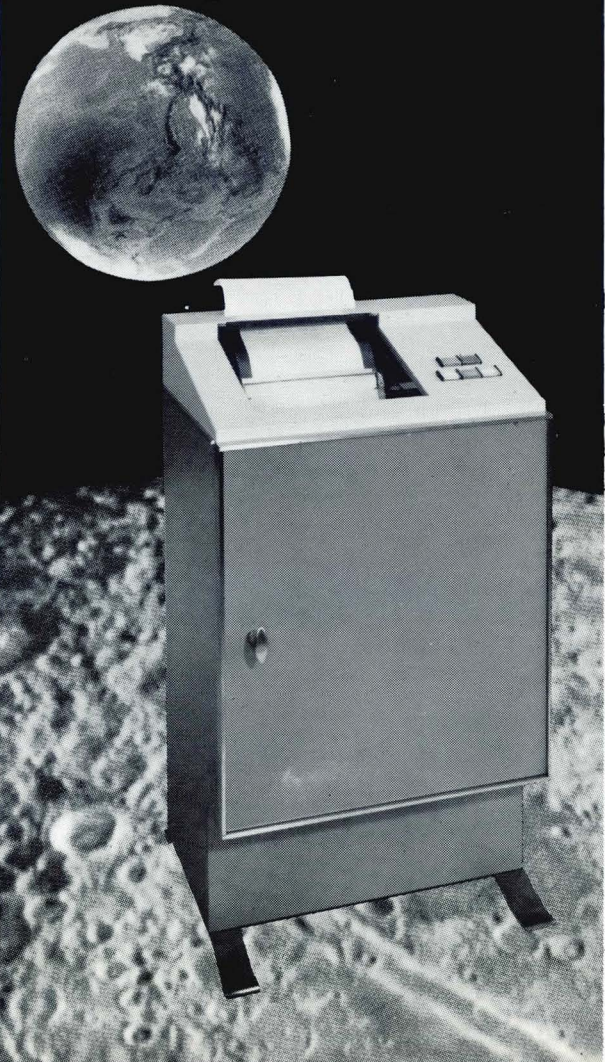
The wide range of system capabilities of each of the basic systems apparently substantiates the price spread of \$20,000 to \$60,000. This array of price-performance selections should offer a prospective customer a data acquisition system to meet his precise needs at an optimum price. Systems expandability is a necessary consideration and should be taken into account prior to the initial purchase. Inevitably, the user finds other application areas that may require additional storage or hardware capabilities. In some cases, operation on a time-sharing basis becomes necessary or desirable.

Developments within this market in the next few years will tend to provide more and more systems for specific application areas, such as laboratory automation, pulse height analysis, production line monitoring, etc. A substantial amount of application software can also be expected from the manufacturer. New designs, volume production, and increased competition among suppliers should bring about further price reductions, while cutting the time necessary to get a computer system on-line and producing effective results. ▲

The Shepard 880C, telecommunications printer is an 80 column, high speed, impact printer that can be tied directly to a telephone line for time sharing or remote data communications applications. The 880C has already been interfaced with the WE 201A, 201B, 202C and equivalent modems in both dial-up and lease-line applications (BAUD rates up to 2400 bits per sec.) This printer is also available with a standard computer type interface. We can't promise you the moon, but will 30 day delivery do? 131st Street & Jamaica Avenue, Richmond Hill, New York 11418 Phone 212-641-8800

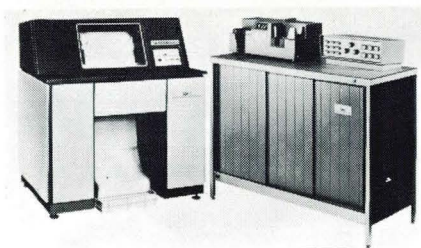


Space age communications printer at earth prices.





NEW PRODUCTS



COMMUNICATION TERMINAL

The CP-4 high-speed remote communication terminal is compatible with most major computers using ASCII, ASCII-8 or EBCDIC. The basic four-wire, full-duplex system allows simultaneous read, transmit, receive, and print operations. Two-wire, half-duplex systems are also available as optional equipment. Bit rates are up to 4800 b/s on a private line, up to 2000 b/s on a switched line, and up to 240,000 b/s on microwave. The CP-4 is suitable for either batched or time-shared operation and can have up to 30 input/output devices operating on-line. Prices range from \$29,000 to \$42,500 depending on model and options. *Data Computer Systems, Santa Ana, Cal.*

Circle No. 181 on Inquiry Card.

"UNIVERSAL" KEYBOARD

A "universal" solid-state keyboard with large-scale integrated circuit that encodes outputs to any communications terminal or data-preparation device features a metal-oxide semiconductor (MOS) encoding circuit that enables a keyboard operator to generate up to four levels of code from the same key. This makes it compatible with remote communications terminals or data-preparation devices such as keypunch machines, and key-to-magnetic tape, key-to-disk, and key-to-cassette machines. The MOS-encoded keyboard is scheduled to be sold at \$88 for a 50-key array in volume quantities by 1971. Production will begin in 1970. The MOS circuit, which packs the equivalent of 5,000 transistors and other discrete components onto a tiny metal-oxide-coated silicon chip, replaces two terminal boards containing discrete encoding circuitry. The dual in-line encoding pack was designed to Micro Switch specifications and will be produced by Texas Instruments Inc. *Micro Switch, a division of Honeywell, Inc., Minneapolis, Minn.*

Circle No. 199 on Inquiry Card.

MASS MEMORY

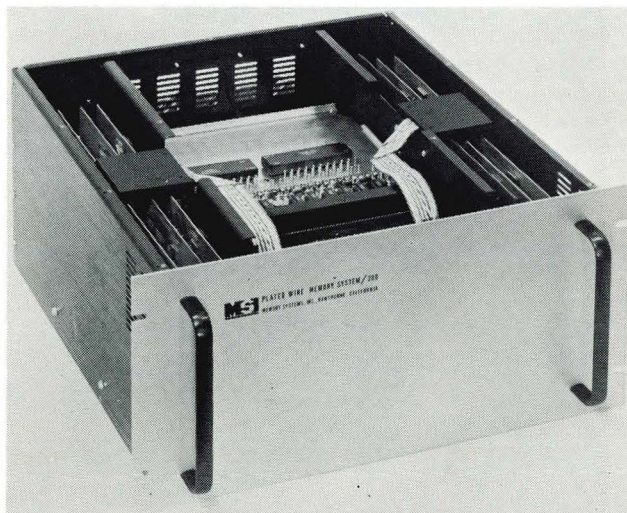
A new data storage device packs 26 million digital bits into just one square inch of recording medium. By using a laser beam to etch digital bits into the "Unicon" mass memory unit permanently, a trillion bits of data can be made available for on-line access. The Unicon memory utilizes a single 4" x 31" data strip to hold the equivalent of over 25 reels of ordinary computer magnetic tape, and is said to reduce the cost per bit of data storage to under \$1 per million bits. This compares with several hundred dollars for conventional computer memories. Price tag of a typical Unicon system is on the order of \$1 million, including software. *Precision Instrument Co., Palo Alto, Cal.*

Circle No. 228 on Inquiry Card.

NEW MINI

The EMR 6120 system, a 16-bit mini that will be sold for less than \$10,000, features central memory modules of 4K up to 32K, high- and low-speed I/O, and CPU communication addressing for 128 peripherals with up to 28 levels of priority. Available software includes a real-time operating system, utilities, assembler, and specialized data communications packages in addition to compatible 6130 and 6135 user software. *EMR Computer, Minn., Minn.*

Circle No. 231 on Inquiry Card.



PLATED WIRE MEMORY

The MSI System/200 is a very high-speed (200 ns) plated-wire memory configured for service in fast digital systems. The basic module comprises 1024 36-bit words. Systems may be structured in smaller or larger modules ranging from 256 words of 9 to 36 bits up to 4096 words of 9 bits. Larger systems may be packaged as multiples of the basic digit module. Optimally utilizing the NDRO properties of plated wire, the memory is organized as a 2D Multiplexed system (2DM) and operates in READ, WRITE, or BUFFER modes. The interface logic is such that the system may be easily configured for special customer features. Systems may also be provided to customer requirements. *Memory Systems Inc., Hawthorne, Cal.*

Circle No. 175 on Inquiry Card.

how to slash \$30,000 per month from your computer overhead

DatagraphiX systems save a fortune in machine rentals, staff time, computer time, print time, 87% less paper/carbon consumables, 99% less storage. Compared to impact printing, DatagraphiX output is roughly 27 times faster, takes 1/18th the computer time, cuts 7/8ths of your supplies cost. If you do multi-part printing in any volume, your paper consumption alone can run into 6 figures. One user switched to DatagraphiX Micromation after discovering the purchase price of his paper had exceeded \$300,000 for one year.

Micromation also provides multiple economies in retention and retrieval. Translating computed data into report formats and shrinking storage requirements to 1/525th. Offering access to thousands of facts within a matter of seconds from

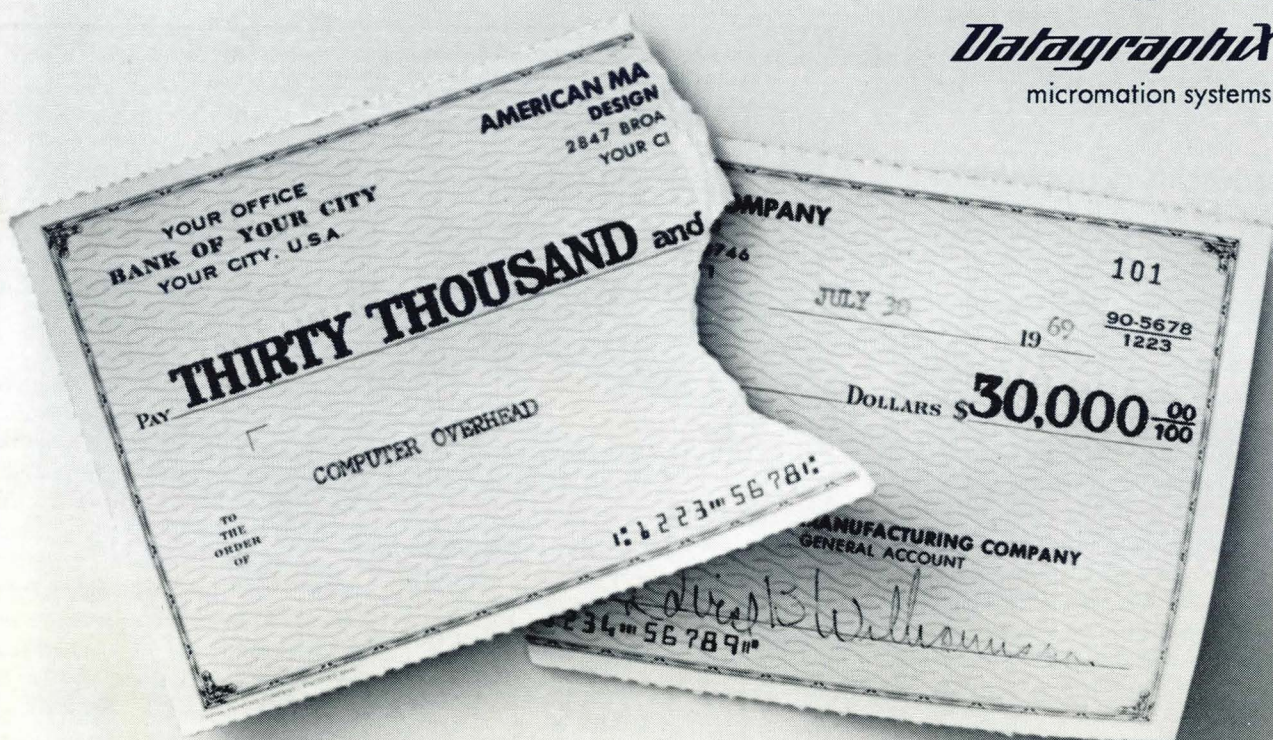
screen display inquiry stations. Instant replay of the facts in time to effect better decisions, improved profits. Hard copies on demand.

For high volume production printing, paper copies can be produced from data film at 5,200 pages per hour. That means you could turn out 20,000 bank statements in a lunch hour. Or thousands of direct mail pieces on preprinted, multi-color forms.

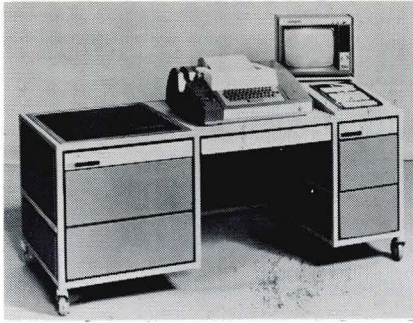
Only one company offers the complete family of machine systems; service centers; Kalvar dry film processing; all associated supplies; systems and software support; worldwide maintenance. Discover what Micromation can do for you. Contact our local office or National Sales Manager, James P. Whitfield.



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NEW PRODUCTS



TURNKEY SYSTEM

The Series 2000, a total-package, job-oriented computer system, can be used equally well as an independent business data processor or as an "intelligent" remote time-sharing terminal. The standard Series 2000 system includes an 8K, 16-bit, g-p computer; data set; automatic dialing unit for establishing communications with time-shared computers; cassette tape recorders; standard console and control panel; CRT display; and hard copy printer. Application software (e.g., an accounting package) and special equipment for unique applications are also available. The Series 2000 turnkey systems are available on either a lease or purchase basis. In addition, arrangements can be made for monthly charges based on services performed. *Miller Ellis Computer Systems, Inc., Palo Alto, Cal.*

Circle No. 217 on Inquiry Card.

FLUIDIC PROCESS CONTROLLER

The Model FC-100A all-fluidic process controller features individual positive and negative response rate adjustments to control non-symmetrical process upsets. A separate damping adjustment permits full stability control over the process and also a means of imposing controlled cycling about the set point. Using digital techniques internally, the FC-100A accepts and outputs at conventional 3-15 psi analog levels. The system uses no moving parts, carries a 5-year warranty, and is priced at \$495. *Applied Fluidics, Inc., Stamford, Conn.*

Circle No. 198 on Inquiry Card.

DISK DRIVE

The Telex Model 5311 disk drive is compatible in all aspects with the IBM 2311 disk pack drive except that it features an average access time of 30 milliseconds compared to IBM's 75 milliseconds, and a start-up time of 15 seconds compared to IBM's 60 seconds. The Model 5311 is a ten disk — ten head memory capable of storing 7.25 megabytes. Data transfer rate is 156,000 bytes/sec. *Telex Corp., Tulsa, Okla.*

Circle No. 206 on Inquiry Card.

CORE MEMORY SYSTEM

The Model 480 core memory system is a 3D, 3-wire, random-access storage unit with a capacity of 4096 words by 18-bits or 8192 words by 9-bits. It will sell in a range starting from under \$2,000. Plug-in expansion permits a capacity of up to 16,384 words by 18-bits or 8,192 words by 36-bits. The system has full- and split-cycle modes of operation and an access time of 350 nanoseconds. Full-cycle times are 900 nanoseconds; split-cycle time is 900 nanoseconds plus modify time. *Fabri-Tek, Inc., Minneapolis, Minn.*

Circle No. 223 on Inquiry Card.

TAPE CERTIFIER

A high-speed tape certifier performs 9-track, 3200 FCI certification; 9-track, 800-bit certification; and 7-track, 800-bit certification — all simultaneously. An automatic error removal technique reduces stop time and operator fatigue. Surface errors are removed by an electronically-controlled scraper which functions only over the defective area. The Certex System 99 certifier is said to be 25% faster than other certifiers on the market and operates at a speed of 200 ips. It is priced between \$20K and \$23K. *Certex Corp., Fairfield, N. J.*

Circle No. 225 on Inquiry Card.

VIDEO TERMINAL

A video terminal with a microprocessor and buffer storage that can interface with any computer over standard telephone lines, the T-6 connects to a computer exactly as a standard Teletype and operates in either duplex or half-duplex mode. Compatibility with standard IBM interfaces are planned. The T-6 is priced at \$5,500. *Sugarman Labs, Inc., Great Neck, N.Y.*

Circle No. 211 on Inquiry Card.

Last month we inadvertently ran the photo of the CPA 7700 over a description of Allied Computer Technology's new CPM-II Computer Performance Monitor.



PERFORMANCE ANALYZER

A versatile, low-cost computer performance analyzer costing less than \$5,000 allows users of any size of computer to analyze the operation of their system. The CPA Series 7700 analyzer consists of modular units capable of monitoring up to eighteen different computer functions without interfering with nor-

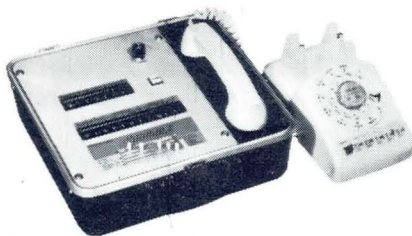
mal computer operations. The unit consists of a control module, a counter module, and probes. The control module supplies the power and master control functions for the system, and contains the master counter, which uses binary clocking circuitry to supply accurate, synchronized timing information in direct, real-time with increments as small as one ten-thousandth of an hour. The counter module contains a series of six-digit counters and the logic and control to drive the read-out devices. By using the individual mode switches, interval time (time between pulses) and accumulated elapsed time or number of events can be measured. *Computer and Programming Analysis, Inc., Cherry Hill, N.J.*

Circle No. 183 on Inquiry Card.

MAG TAPE SYSTEM

The Infotec Model TS-1130B, MOD 1 magnetic tape system is designed for use with the IBM-1130. It consists of a controller, a 9-track tape handler, and a software package for updating the disk monitor. The system reads and writes data on 1/2-inch magnetic tape at 5 ips, which corresponds to a data rate of 4,000 cps. Maximum reel size is 6 1/2 inches; tape format is IBM compatible. The TS-1130B system package includes all operating subroutines and these can be accessed by using either READ/WRITE statements in FORTRAN, or CALL statements in 1130 Assembly. Installation consists only of plugging in power and connecting the I/O cable of the TS-1130B to the SAC connector on an IBM-1130. An optional connector can be provided for connecting more than one peripheral to the SAC connector. Purchase price is \$7,200. *Infotec Inc., Plainview, N. Y.*

Circle No. 234 on Inquiry Card.



PORTABLE COMPUTER TERMINAL

The Computone portable computer terminal provides as many as 72 data inputs by use of panel-mounted rotary and slide switches. Careful proofreading of the entire message prior to transmission is said to virtually eliminate keyboarding errors. Rapid electronic scanning and transmission of the message (including a hard-wired security code) is actuated by a single push button. Normal output from the computer is audio response, printed copy, or both. The terminal weighs 8 lbs., is housed in an attache case, operates from battery and AC power and, in several models, is priced under \$500. *Squires-Sanders, Inc., Liberty Corner, N.J.*

Circle No. 186 on Inquiry Card.

DATA COUPLER

A new, low-cost data coupler housed in a high-impact resistant plastic case will accept any standard telephone headset (i.e., Western Electric 500 Series) and is compatible with various models of teletype-writers and units containing EIA RS-232 signal interfaces. Available

for acoustical or magnetic coupling of received data signals, each unit contains solid-state active filters for noise rejection and frequency separation. Price of the Model DC 820 is approximately \$450 in small quantities, and includes a one-year warranty against parts and repairs. *Paragon Systems, Inc., Houston, Texas.*

Circle No. 196 on Inquiry Card.

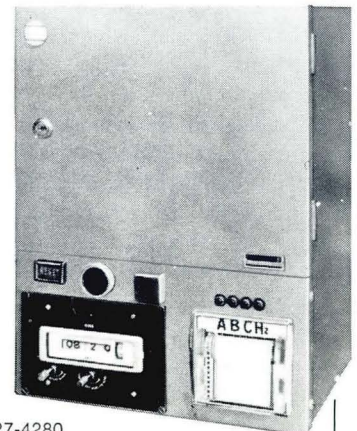
Are you processing undetected computer error?

Chances are good that you are! Consider this. Typical computer specifications require a power input range of -8% to +10% of voltage and a frequency stability of $\pm 1/2$ Hz. Typical fluctuations greater than 10% for as much as 3/4 Hz are regularly experienced by leading utilities. If undetected, these fluctuations can cause computer errors resulting in costly down time and program reruns.

The Airoyal System Monitor provides visual and audible warnings of any deviation in power (as well as in temperature and humidity, optionally) and fixes the time of fluctuation on a digital clock. The cost is generally recovered the first time the horn blows. For complete information, send for our catalog.



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NEW PRODUCTS

TERMINAL INTERFACE

The Model 6213 Terminal Access Unit (TAU) serves as the interface between the large-scale Univac 1108 computer and the time-shared terminal units. In its standard configuration, the TAU 6213 can accommodate up to 32 serial Teletype data channels on one Univac 1108 input-output channel, answering and disconnecting calls under complete control of the 1108 software. *Intranet Industries, Inc., Los Angeles, Cal.*

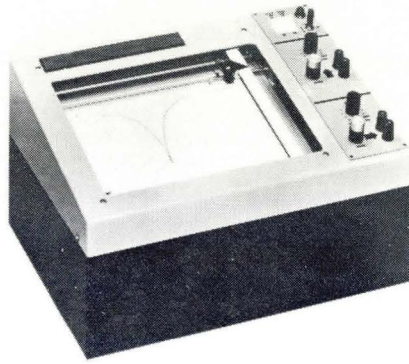
Circle No. 182 on Inquiry Card.



DESKTOP OPTICAL READER

The Dataflow optical reader is an inexpensive (under \$10K) input unit capable of translating typed data directly from source documents to magnetic tape. Teletype links, Dataphone terminals, or directly into a general-purpose computer. Source documents may be prepared on the Dataphone terminals, or directly into standard IBM Selectric by substituting a Dataflow code ball. The reading system is designed around the Dataflow coded font which prints a miniature digital code directly below each alphanumeric character. Optically scanning the miniature digital code rather than the alphanumeric character itself reduces the complexity of the recognition logic. When utilized with the incremental magnetic tape output, the Dataflow optical reading system translates typed source documents to magnetic tape in IBM-compatible format. Special symbols may be assigned for inter-record gaps or file gaps allowing the typist to format records or files of various lengths. Packing density of 200, 556, or 800 bpi is available at various character rates. *Datatype Corp., Miami, Fla.*

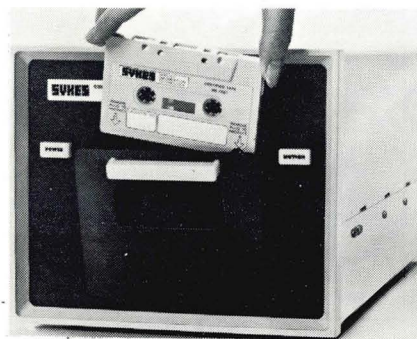
Circle No. 233 on Inquiry Card.



X-Y PLOTTER CONTROLLER

The TRANSPLOT X-Y controller features independence from software or computer control, the ability to describe arcs and lines of any slope, and the ability to perform incremental-mode plots. The standard TRANSPLOT controller includes Teletype-compatible interface search logic, plotting control resolution of one part in 1,000, the choice of operating from decimal or binary data, and automatic pen raising and lowering signals. No software is required for ordinary plotting with TRANSPLOT. When connected to an analog X-Y plotter or CRT and a digital input source such as a paper tape reader or teleprinter, the system will search and select the data addressed to it, drive the plotter appropriately, and revert to the search mode. *I/O Systems, Inc., Natick, Mass.*

Circle No. 179 on Inquiry Card.



MAG CASSETTE SYSTEM

The Compu/Corder 100, a new direct-access tape transport system, provides a bi-directional capability that enables a user to access any file on a 300 foot magnetic tape contain-

MULTIPLEXER

The TDML time division linking multiplexer is capable of accepting and channeling data from 18 simultaneously active data terminals for transmission over one 2400 baud data circuit. The maximum number of stations that can be connected on one data circuit is 10 — the originating station, eight intermediate stations, and the terminating station. The TDML is designed to work with single-speed terminals (110 baud), and is compatible with both the Teletype Model 33 and Model 35. It can be adapted for data speeds other than 110 baud. *Communications Logic, Inc., Houston, Texas.*

Circle No. 204 on Inquiry Card

REMOTE OCR SCANNER

A remote optical character recognition scanner fits on a desk-top and can be easily installed on the customer's premises. Data from printed or hand-written copy is transmitted at the user's convenience over leased voice-grade telephone lines to a Cognitronics time-sharing center where it is converted and recorded on magnetic tape ready for computer processing. *Cognitronics Corp., Mt. Kisco, N. Y.*

Circle No. 194 on Inquiry Card.

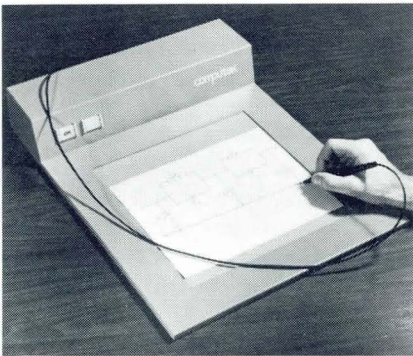
ing 3.6 megabits of information within an average of 15 seconds. The Compu/Corder 100 is provided with comprehensive software and complete interfacing to DEC, Varian, and Data General minicomputers, with other interfaces optional. Additional features include a read/write speed of 5 ips and a bi-directional search/fast rewind speed of 120 ips. Block length is dynamically variable and is limited only by length of tape. Recording density is 100 bpi and a bit-serial, bi-phase encoded wide field recording technique allows transfer rates of up to 5000 bps. *Sykes Data-tronics, Inc., Rochester, N.Y.*

Circle No. 214 on Inquiry Card.

KEY-TO-TAPE

The Data/Tape 2100 multiple keyboard-to-magnetic tape data processing input system is described by company officials as the "Cadillac" of its generation. The system, which is compatible with all computers, will sell for approximately \$150,000 in a 19-operator configuration. Components of the system include the keyboard-printers; sight verification stations; a supervisory control station with a page printer; a Computer Automation 816 data accumulator with a core memory of 12K in 16-byte words; a Data Disc, Inc. disk memory unit with 850K capacity; and two nine-track, 800 bpi Ampex TMZ tape drives. Both core and disk memories are expandable. In standard configuration, the system will accept 256 jobs with 50 records per job and 50 fields per record. All jobs are available to all operators at all times with the system. *General Computer Systems, Incorporated, Dallas, Texas*

Circle No. 202 on Inquiry Card.



GRAPHIC TABLET

A new graphic tablet for converting hand-drawn data to digital form uses a novel electromagnetic sensing technique incorporating a proprietary printed digital pattern. Pattern accuracy is ± 0.005 inch (0.05% of full scale) and linearity is $\pm 0.05\%$ of full scale. The tablet provides a writing surface of $11\frac{1}{4}'' \times 11\frac{1}{4}''$, and can be used with graphic display terminals such as the Computek Series 400 models or as a stand-alone unit. Two models are offered: the Model 50/10 provides resolution of 10 bits (91 lines/inch or 0.011 inches/line); the Model 50/8 provides resolution of 8 bits (23 lines/inch or 0.044 inches/line). *Computek, Incorporated, Cambridge, Mass.*

Circle No. 229 on Inquiry Card.

OFFICE COMPUTERS

North American Philips Corp. has entered the office computer field with a family of low-cost computerized accounting machines for invoicing, accounts receivable, payroll, inventory control, general ledger, and all related reports. The new P-350 Series comprises three basic systems with pre-programmed software packages plus a wide assortment of peripheral equipment. The P-350 CPU has a cycle time of 3.2 usesc and an average execution time per 3-address command of 1.5 msec. Magnetic core storage is modular from 300 to 1200 16-digit words (!) Each of four simultaneous I/O channels for additional peripherals can accommodate four I/O devices. *North American Philips Corp., New York, N. Y.*

Circle No. 176 on Inquiry Card.

REMOTE BATCH TERMINAL

The COPE .41 remote batch terminal can print 1250 lines per minute and read 600 cards per minute. Its monthly rental, \$2090, includes a 4800 bps modem and the necessary software. Along with four other members of the COPE family, COPE .41 operates in the full duplex mode on voice-grade telephone lines. *Computer Industries Inc., Dallas, Texas.*

Circle No. 230 on Inquiry Card.

DRUM SYSTEM CONTROLLER

The VRC 7100 drum system controller is designed to interface the entire line of VRC's compatible drum memory units. Operating capacities for the VRC 7100 range from a minimum of 32,768 words to a maximum of 17,000,000 words. The controller is available for 8, 12, 16, 18, 24, and 36 bit word machines and has the ability to vary data transfer rates under program control from 17,000 to 235,000 words per second. It can be implemented with up to four individually addressable drum channels, each capable of handling up to four individually addressable drums. *Vermont Research Corp., No. Springfield, Vt.*

Circle No. 218 on Inquiry Card.



MAG TAPE PERIPHERAL

A self-contained, automatic reel-to-reel magnetic tape peripheral, the DI 100C is a low-cost, modular digital incremental system for replacement of paper tape equipment, or as a sophisticated continuous record/reproduce device for direct computer entry. It offers 500,000 character storage capacity using 1/4-inch wide tape in a self-contained, self-threading 3-1/2 inch cartridge-type container. Applications for the DI 100C include: remote terminal equipment, point-of-sale devices, automatic typewriter/type composition equipment, and data logging systems. *Newell Industries Inc., Sunnyvale, Cal.*

Circle No. 222 on Inquiry Card.

DISK RECORDER

A low-cost, random-access bulk storage digital disk recorder of innovative design, The Model DDR-1 is expandable from 32,768 bytes (8-bit data words) to 524,288 bytes per side of each disk; and with expander-type slave recorders, to 2,097,152 bytes of fast access storage. Average access time is 16.66 msec. The unit features an interchangeable 14 in. nickel-cobalt plated disk on which data is recorded by fixed read/write heads. The disk is driven by an hysteresis synchronous motor in which the rotor shaft is supported by an air bearing spindle that moves up and down to load and unload the disk. The air bearing insures concentricity of the rotor, and fluidic logic controls spindle movement to insure disk positioning and prevent contact between disk and heads. *Digital Information Storage Corporation, Berlin, Mass.*

Circle No. 216 on Inquiry Card.

NEW PRODUCTS



G-P MINI

The Raytheon 704, a 16-bit, 1.5 msec general-purpose minicomputer, sells for under \$10,000 and is fully software-compatible with Raytheon's 706 and 703 computers. In its minimum configuration, the 704 includes 4,096 words of core memory, byte manipulation, direct and indexed addressing, one level of automatic priority interrupt (expandable to 16), and an operator console with a lock-out key switch. Options include memory expansion to 16,384 words, high-speed direct memory access, memory parity, hardware multiply/divide, hardware bootstrap, interrupt expansion to four or sixteen levels, real-time clock, ASR 33 or 35 Teletype, 12-bit A-to-D convertor/multiplexer with power supply, and power fail-safe hardware. *Raytheon Computer, Santa Ana, Cal.*

Circle No. 177 on Inquiry Card.

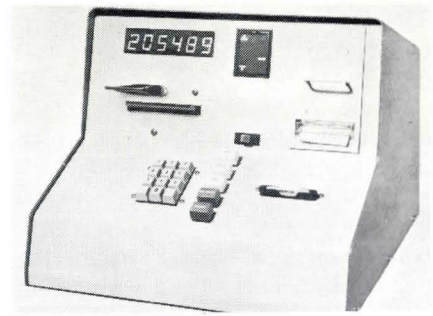
PORTABLE ACTUARIAL TERMINAL

Keyfact, an eight-pound, briefcase-sized terminal, allows insurance agents to make an analysis "on the spot" of a client's insurance investment needs, considering such factors as estate settlement costs, investment calculations, tax considerations, rates of interest, mortgage factors, and loan and premium calculations. Premiums, as well as cash and retirement income values, are transmitted audibly to the agent and client through a speaker located on the side of the acoustically-coupled terminal. *Bowles, Andrews and Towne, Inc., Atlanta, Ga.*

Circle No. 191 on Inquiry Card.

DATA COLLECTION EQUIPMENT

The SDA-770 remote terminal is part of an industrial data acquisition system for the non-clerical production worker. The system is computer-controlled with multiple terminals at remote sites for the acquisition of data which is converted to machine-readable form. Up to 128 terminals can be managed by a single central controller, which includes a communications multiplexer, a general-purpose digital processor, and an output control unit. The SDA-770 remote terminal includes a card and/or badge reader, a numeric keyboard, operator instruction indica-



tors, a visual display for operator instruction indicators, a visual display for operator verification, and a printed output as a receipt for the variable input data. *Sierra Research Corp., Burlington, Mass.*

Circle No. 190 on Inquiry Card.

ACOUSTICAL/DAA DATA COUPLER

The DM328 two-way data coupler permits users to go on-line immediately via acoustical coupling and, as DAAs are delivered by the telephone company, convert to hardware coupling at no additional cost. The unit offers high reliability and the advantage of portability when acoustically coupled, but the hardwired system is considered superior against room noise, vibration, or other possible interference. The DM328 is small in size and weighs less than 5 pounds. *Carterfone Communications Corp., Dallas, Texas*

Circle No. 226 on Inquiry Card.

PORTABLE CONTROLLER/PLOTTER

The Model C/P 701 high-speed X-Y controller/plotter combines an interface-controller and a plotter in a single desk-top package and is connected to a remote computer terminal with a single cable. The C/P 701 can share the narrow bandwidth telephone line at the user's terminal without affecting normal terminal operation and is said to operate with all standard acoustic couplers and teleprinters. *Timeshare Devices, Inc., Waltham, Mass.*

Circle No. 212 on Inquiry Card

COMMUNICATIONS TERMINAL

The basic ASC 1170 system combines an Applied Systems Corp. Model 110 general-purpose processor with a printer/keyboard and paper tape and card reader/punch. Normal EBCDIC or ASCII transmission rates are 2000 to 4800 baud in full or half-duplex modes. The 1170 system can also be supplied with multiple low-speed line and adapter for implementation as a data concentrator. *Applied Systems Corp., Detroit, Mich.*

Circle No. 197 on Inquiry Card.

TAPE EVALUATOR/CLEANER

The Model TEC Tape Evaluator Cleaner may be used by computer tape users to serve as (1) tape tester, (2) tape cleaner, and (3) tape winder. In the tape test mode this machine is also capable of removing loose oxide and debris from both sides of the tape to minimize temporary errors due to dirt particles. It also provides a constant tension wind which results in a uniformly packed reel to prevent cinching and edge wrinkling during handling and storage. Price of a standard unit is \$6,250. *Recortec, Inc., Mountain View, Cal.*

Circle No. 209 on Inquiry Card.

HEAD-PER-TRACK REMOVABLE DISK MEMORY

The "Disc(k)stor" 505 head-per-track, removable media, rotating memory system can be used for such applications as: auxiliary storage for small computers; process control; automatic testing and message concentration; and data acquisition. In peripheral systems, Disc(k)stor 505 may be used as memory for multiplexing data between computer and terminals. The system uses a single 14" diameter aluminum disk with 128 data tracks and a full complement of flying heads. Storage capacity is 2,500,000 bits per surface (5,000,000 bits per disk). Disk rotation is 3600 rpm, giving an average access of 8.7 ms. Bit transfer rate is 1.5 MHz. *Systematics/Magne-Head Div. of Gen. Instrument Corp., Hawthorne, Cal.*

Circle No. 213 on Inquiry Card.



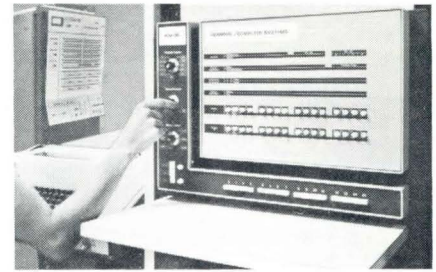
I/O TERMINAL

The "Teletype" is a low-cost input/output device for computers. Measuring only 13" x 18" x 7", and weighing just 25 lbs., the Teletype is directly interchangeable with the Model KSR 33 Teletype. A very low operating noise level is achieved by replacing most of the mechanical operation for coding, multiplexing, etc. with highly-reliable solid-state circuits. The only mechanics used in the Teletype is that part of a typewriter necessary for key striking. The printer input and the keyboard output are serial 8-bit ASCII code. The keyboard produces an even parity bit for error detection. Speed is 10 operations/second (100 wpm); price is \$835. *Electronic Information Systems, Inc., Boulder, Colo.*

Circle No. 205 on Inquiry Card.

MULTIPLEXING SYSTEM

A new multiplexing computer system, the KM-36, provides an interface between System 360 and up to 64 terminal devices operating at transmission speeds from 60 to 2400 baud. Data transmission speeds of 4800 and 9600 baud can be made available. The KM-36 performs such terminal traffic functions as line control, line sampling and bit storage, character and message assembly, code conversion, and message editing. A typical KM-36 unit capable of handling 32 lines is priced at approximately \$60,000. This cost in-



cludes a processor with a memory capacity of 16,384 bytes, data set adapters, line control units, all cabling, an IBM 360 interface, and associated software. *Terminal Computer Systems, Greenwich, Conn.*

Circle No. 210 on Inquiry Card.

SINGLE-DISK DRIVE

A new, low-cost disk memory drive, the Model MD-2101, is designed primarily to meet removable-media storage needs of the mini-to-medium-size computer OEM. The MD-2101 utilizes the IBM 2315 single-disk cartridge to provide unlimited off-line storage, and a detentless electromechanical positioner with flying heads and a disk speed of 1500 rpm to obtain an access time of less than 2 msec track-to-track. Average access time is 115 msec. Storage capacity is 11,577,600 bits with a data transfer rate of 720 kilo bits/sec. *Computer Memory Devices, Inc., Glendale, Ariz.*

Circle No. 193 on Inquiry Card.

NETWORK CONTROL PROCESSOR

The Universal Network Control Processor, a modular high-speed communications front end for third-generation IBM and Univac computers, is designed to direct the interchange of data between remote terminals and a large-scale central computer. The Universal NCP is a "total" system including all necessary hardware and software. It operates with IBM 360's from the Model 30 up, plus the Univac 1107 and 1108, and is said to sell or lease for substantially less than comparable systems. *Universal Systems, Inc., Rockville, Md.*

Circle No. 187 on Inquiry Card.

COMMUNICATIONS SYSTEM

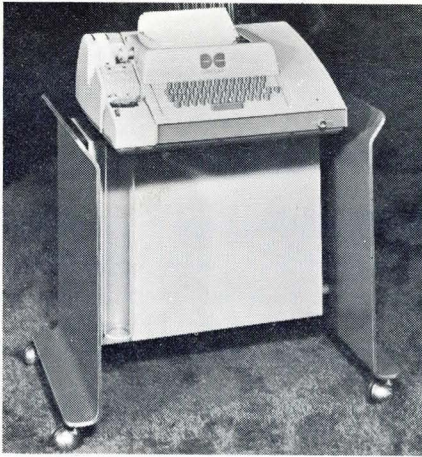
The Telematics 578 communications system for the IBM 1130 is comprised of a 64-line communications adapter and a software support package. Through a simple plug connection, it enables the computer to utilize a greater variety of remote terminal devices in such networks as those of IBM, AT&T, and Western Union. Among the capabilities offered by the Telematics 578 are: store and forward message switching, front end and remote concentration to the IBM System/360, expanded remote job entry, data collection and dissemination, and on-line inquiry.



It also provides for the use of standard IBM 360 disks and magnetic tape peripherals and communications interfaces. *Telematics, Inc., New York, N. Y.*

Circle No. 201 on Inquiry Card.

NEW PRODUCTS



OEM MINI

The Clary Datacomp 404 is designed especially for the equipment manufacturer who services the business community. The 404 has much of the normal business computer software built into its hardware, such as: programmed word-length operating modes of 16, 32, 48, and 64 bits; sixteen addressing modes, including double-index and relative; decimal arithmetic instructions, including multiply and divide combined with scaling; and automatic code conversion and formatting. Memory speed is 2 microseconds per 16-bit word. Memory capacity is 1024 16-bit words, or 4096 16-bit words in main-frame, expandable to 65K. *Clary Datacomp Systems, Inc., San Gabriel, Cal.*

Circle No. 227 on Inquiry Card.

TAPE PUNCHES AND READERS

Three bi-directional tape punches, one combination tape reader/punch, and three bi-directional tape readers, all with speeds of 50 cps, are available with discrete negative logic (no buffer) or positive logic (and a single character memory buffer) which permits asynchronous operation. Punches handle 11/16", 7/8", and 1" standard tape of 5-, 6-, 7-, or 8-level code structure by adjustment of variable tape guide. *Automated Business Systems, Div. of Litton Industries, Carlstadt, N. J.*

Circle No. 188 on Inquiry Card.

MAG TAPE TERMINAL

Teletype Corp.'s Model 37 set operates at 150 words per minute but when associated with the new Teletype Model 4210 magnetic tape data terminal, data can be transmitted or received at speeds up to 2400 words per minute. Both machines accommodate the ASCII code, and the Model 37 set can print all 94 ASCII graphics in both upper and lower

case. An additional shift-out feature allows printing of either 16 or 32 more graphics. The mag tape terminal uses a compact and interchangeable tape cartridge about the size of a pack of cigarettes to record up to 150,000 characters, and convenient search capability enables the user to locate previously recorded blocks of data on the tape. *Teletype Corp., Skokie, Ill.*

Circle No. 208 on Inquiry Card.

Here's proof that one North Data Collection System does it all!

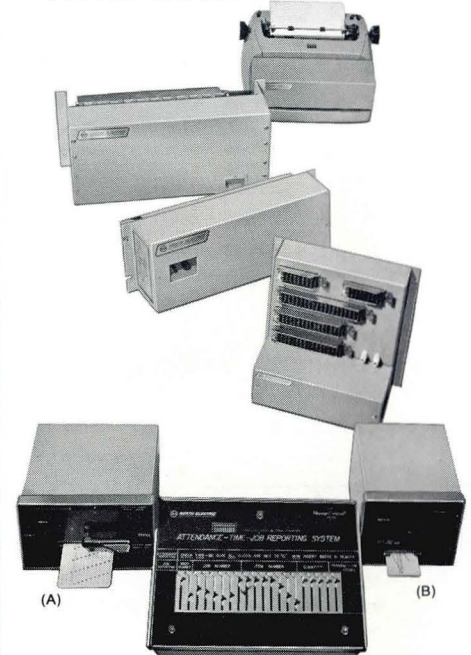
Today's most efficient time-saving method of handling employee time/attendance records. Using special employee badge cards, the system automatically produces punch cards or mag tape with employee number, department number, and time. North Attendance Reporting Stations (A) are placed in all key departments. Type-written hard copies may be produced at each station if desired.

ATTENDANCE REPORTING



The system permits you to automatically record job assignments. Input data including job information may be encoded on pre-punched cards. Variable data (quantity produced) may be composed by employee using keyboard. Employee identification is registered by inserting his ID card in the badge reader. Time and date are incorporated automatically. The number of Card Readers (A) and Badge Readers (B) needed is determined by job requirements. Punch cards, mag tape and hard copy may be produced at central location.

JOB REPORTING



COMPUTER CONTROL SYSTEM

The ASC 1100 computer system for automation control and product-testing applications features a powerful instruction repertoire, microprogramming capabilities which permit emulation of other computer instruction sets, and a wide range of peripheral devices. It is configured for real-time control operations and op-

tionally expandable for data acquisition functions. The central processor incorporates read-only storage, expandable to 1024 words, and a 1.1 usec cycle time magnetic core memory expandable to 32K bytes in 4K modules. Delivery is scheduled for the first quarter of 1970 with equipment prices ranging from a \$5,000 base. *Applied Systems Corp., Detroit, Mich.*

Circle No. 224 on Inquiry Card.

Below are listed four of the many applications you can accomplish with just one Message-ComposeR® System — all you do is vary the components. A basic set of components leases for less than \$100 per month.

Why not contact North's Data Products Manager and indicate which applications fit your requirements. He will provide you with complete information and equipment costs. For immediate service: Call 419/468-8590 or TWX 419/464-4860.

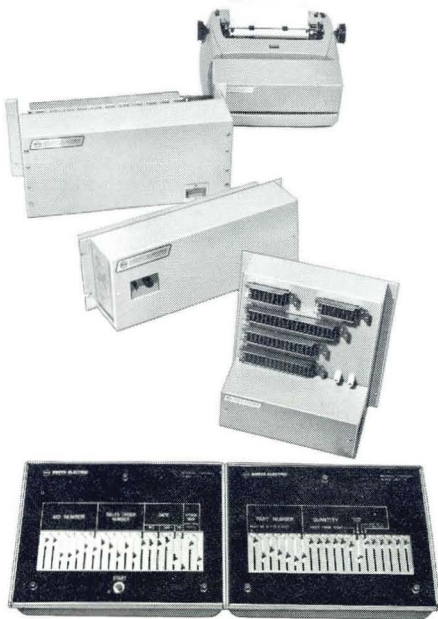


NORTH ELECTRIC

Electronics Division / Galion, Ohio 44833
A subsidiary of United Utilities, Incorporated

All types of inventory control input can be handled with the Message-ComposeR System. The stock clerk can input disbursement information such as part numbers, manufacturing orders, sales orders, etc. and automatically produce punch cards, mag tape and hard copy. Pre-punch cards can also be used to input semi-variable data.

INVENTORY CONTROL



Accurate receiving and inspection information can be quickly handled through the use of pre-punch cards with order information as to the vendor, your part number, etc. The operator registers such data as 'received quantity,' 'accepted quality,' 'rejected quantity,' etc. on the keyboard. The system will then automatically generate punch cards or mag tape and hard copy as desired.

RECEIVING/INSPECTION



"SYNERGETIC" PROCESSOR

A new multi-processing computer system from Redcor, the RC 77 Synergetic Processor, is priced at \$111,000, or at monthly lease rates of \$3,888 for the basic system. The processor incorporates two RC 70 "Midi" computers as processing elements, both under control of Redcor's new "Synercizer" and a software system incorporating a real-time monitor (RTM) and a batch processing monitor (BPM). The RC 77, with a 20K to 65K memory and a million-word disk memory, was described as designed to cope with the problem of processing two tasks concurrently, usually one task being on-line or real-time and the other being off-line, non-real-time, as in the case of problems involving on-line data acquisition and off-line development and data reduction. *Redcor Corp., Canoga Park, Cal.*

Circle No. 180 on Inquiry Card.



PORTABLE DATA TERMINAL

A new, \$230 portable data terminal operates on six ordinary batteries and weighs only 7-1/2 lbs. including its attache carrying case. Designed for use with computer-controlled voice response systems, the user places the telephone handset in the terminal's cradle, dials the computer, waits for an audible tone response, and depresses pushbutton keys to input messages to the computer (16 buttons: 10 standard numeric keys plus 6 special purpose keys). The spoken response from the computer is heard through the terminal's speaker. Optional hard copy capabilities, specialized keyboards, packaging, and other modifications are available. *Technitrend, Inc., Pennsauken, N.J.*

Circle No. 189 on Inquiry Card.



NEW SOFTWARE AND SERVICES

BOOKKEEPING SYSTEM

A bookkeeping system, which posts to general ledgers and generates financial statements from journal input, can process several divisions (company units with separate sets of books) in one processing run. The system, written in COBOL, functions on an IBM System/360-30 under DOS with a minimum of 65K core and two 2311 disk storage drives. Up to four sets of financial statements from as many divisions can be generated: current and year-to-date comparisons to last year, and current year-to-date comparisons to budget, each set containing a variance to the comparison figure and a percentage of variance based on the comparison figure. The financial statement flexibility is achieved by printing the financial statement from a user-built pattern with a program that has direct access to all general ledger accounts for all divisions being processed. *Utica Computer Services, Inc., Utica, N. Y.*

Circle No. 259 on Inquiry Card.

MIS

The VICOM Management Information System is a general-purpose on-line file management system designed for use by personnel with limited or no prior data processing experience. The minimum configuration required is 32,000 bytes, 3 magnetic tapes, and 1 disk. The system's capabilities include: file generation, file maintenance, data retrieval, and report generation. These functions are accomplished by the use of a user-oriented language. The VICOM System can be used for the application of statistical methods, the analysis of historical data, and to fulfill the requirements of an automated set of tools for research, analysis, forecasting, and planning. A security system is also provided. *Software Methods, Inc., New York, N. Y.*

Circle No. 239 on Inquiry Card.

REFERENCE GUIDES

A new service to programmers consists of a series of page-sized, three-color reference guides to the most common compilers and operating systems. The durable plastic-coated guides reduce operating manual look-up time and errors due to faulty statement formats and punctuation. The guides are currently available for FORTRAN IV for IBM OS & DOS/360; COBOL for IBM OS & DOS/360; DOS/360 Control Language; and OS/360 JCL. *Compusys, Inc., Albuquerque, N. Mexico.*

Circle No. 260 on Inquiry Card.

PHOTO COMPOSITION

New photo composition capabilities utilize photocomposition or microfilm systems for computerized type composition of columnar format publications. System options offer extensive composition flexibility to govern type style and format, thereby simplifying input transcription requirements. Oriented toward printing environments employing multiple type font capabilities, the options offered include (1) editing and translation modules to accept data from a variety of input devices; (2) file creation and allocation facilities to aid in initializing composition data files; (3) updating techniques to permit efficient random modification of multiple text files. Utilizing specifications parameters, the system combines absolute text with command codes to produce output for most photo composition or microfilm equipment. The photo facilities typically utilized an IBM 360 with disk storage in addition to the appropriate photo composition or microfilm output equipment. These system capabilities are offered on several contractual arrangements which include software support. *Applied Systems Corp., Detroit, Mich.*

Circle No. 255 on Inquiry Card.

SELF-RELOCATOR

DOSRELO functions under the System/360 DOS environment for the purpose of making application programs, even those coded in higher-level languages (e.g. RPG, COBOL), self-relocating. DOSRELO eliminates the special programming presently required for assembler language programs, and also eliminates the requirement of cataloging the same program several times in the core image library. Only one set of JCL statements are required per program. *Boothe Resources International, Inc., L. A., Cal.*

Circle No. 263 on Inquiry Card.

SPECTRA 70 UTILITY

SCUP, a third-generation utility package for the Spectra 70, was designed to enhance the normal tape/card/printer and card/tape/printer options required for efficient program debugging and as an operations aid. These options include: selective record extraction, tape positioning capabilities, techniques for building effective test files, and flexible re-blocking. SCUP features can be used either independently or in conjunction with any other option in the same pass. The company provides a 15-day trial period at no cost. *CGA Computer Associates, East Orange, N. J.*

Circle No. 252 on Inquiry Card.

APPLICATIONS PACKAGES

Six new applications packages written in Fortran IV are: KDA — For automatic analysis of kinetic data (\$10,000); OPTRAN — For complete analysis of linear or non-linear parameter optimization problems (\$13,000); HEATRAN — A general-purpose thermal analyzer (approx. \$2,000); GE POL — A generalized processor for command-oriented languages (\$3,000); PART-RAN — A parallel tangents optimization program (\$1,000); DYDAT — A basic Fortran dynamic data allocator (\$2,000). *Electronic Associates, Inc., West Long Branch, N.J.*

Circle No. 250 on Inquiry Card.

PROGRAM LIBRARY STORAGE

PLUS for Program Library Update System, provides for storage and maintenance of source language programs on tape or disk. Any program language may be stored or intermixed in the file including COBOL, Assembly, PL/1, and FORTRAN. Test data decks, object decks, and job control language decks may also be stored. PLUS will generate a job stream file with job control setup to compile or assemble modified programs. It will also generate three reports: a library index report, which provides a detailed description of each program in the library; a report of changes; and a job schedule report. *Cullinane Corp., Boston, Mass.*

Circle No. 245 on Inquiry Card.

COBOL SHORTHAND

A new shorthand notation system for COBOL programmers called SPEEDBOL provides mnemonic abbreviations for the most frequently used COBOL reserved words. The system is also designed to permit the user to abbreviate his own data and procedure names, and to use and remember only those SPEEDBOL abbreviations he chooses. The complete system, including full documentation, consists of the abbreviated language and a processor to convert SPEEDBOL to COBOL. Total cost is \$300. *Pioneer Data Sciences, Wilbraham, Mass.*

Circle No. 237 on Inquiry Card

COBOL CROSS-REFERENCER

REF-BACK uses one card to call a subprogram off the core image library at compilation time which generates a Cobol cross-referenced list of all data names and procedure names giving all page and line references used by data and procedure division names. The cross-referenced list indicates any fields which are used as subscripts, qualifiers, or data files. *Communication Dynamics Systems Inc., Westchester, Ill.*

Circle No. 261 on Inquiry Card.

STATISTICS PACKAGE

A general-purpose statistics package, STATPAC, comprises several Fortran software modules which can be used with any PDP-15 that has 8K of core, a high-speed paper tape reader/punch, and two DECTape transports. The five modules currently available are control, input, descriptive statistics, stepwise linear regression, and multiple linear regression. *Digital Equipment Corp., Maynard, Mass.*

Circle No. 235 on Inquiry Card.

MAILING LIST MAINTENANCE

A new service removes duplicates from name and address lists even in cases where the name is misspelled or misformatted. Charges are made only for actual duplicates identified and range from \$0.20 to \$0.05 per duplicate, depending on the volume of duplicates identified. There are no minimums, set-up charges, or charges per name processed. The system, called MAILSAVE, is said to handle virtually any S/360-compatible name and address tape, with or without fixed-field names. *Mathematical Applications Group, Inc., White Plains, N.Y.*

Circle No. 248 on Inquiry Card.

ADDRESSING PACKAGE

GALS, for Generalized Address Label System, operates under IBM/360 DOS. GALS uses either fixed- or free-format cards for input and the purchaser has the option to specify his own input card layout. The purchaser also specifies the selection fields for such data as SIC codes, salesman codes, etc., System requirements are at least 1 disk and 1 tape, 2 disks, or 2 tapes. The programs are written in COBOL, and Assembler, and require a 32K background partition. GALS is available for a sale price of \$1450, including an operating guide, source decks, key-punching instructions, and sample cards. *Macrodata, Inc., Union, N.J.*

Circle No. 247 on Inquiry Card.

DATA BANK PROCESSOR

The DCI/Multi-Purpose Information Processor is designed for creating, processing, and extracting information from a data bank in a form the requestor can understand and use for analysis and reporting. A DCS/MIP data bank can be created using DCS/MIP variable format input or present user files in fixed-length format that are contained on cards or tape. The processor gives the user the flexibility to extract selectively fixed-length records and to maintain the file by adding, deleting, or changing records without costly programming. The DCS/MIP is a set of assembler language programs designed for basic configuration of IBM S/360s with 65K capacity, two disk units (2311), and two nine-track tape drives. It may be operated in either a DOS or OS environment. Outright purchase price is \$15,000. *Dynamic Computer Systems, Inc., Houston, Texas.*

Circle No. 246 on Inquiry Card.

1130 FORTRAN T-S

WESTIME Fortran extends the program entry capabilities of the IBM 1130 to remote multi-terminal conversational operation. It has been developed as part of the software support for WTI's multi-channel transmission controllers and is closely patterned after 1130 FORTRAN IV. Using the essential functions of 1130 FORTRAN, conversational command statements together with over 140 comment and error messages have been combined in a system supporting multiple terminals simultaneously in a 16K, single-disk 1130. A minimum system consists of (1) a 16K, IBM 1130 equipped with the storage access channel, (2) a 1442 card read/punch, and (3) a WTI TM150 (formerly TM113) transmission controller. Terminals supported are IBM 2741 and teleprinter models 33ASR/KSR in any combination. During the time-shared operation the system is dedicated but can be quickly converted to the normal 1130 batch mode for stand-alone processing. *Western Telematic, Inc., Arcadia, Cal.*

Circle No. 265 on Inquiry Card.

NEW SOFTWARE AND SERVICES

S/360 TIME-SHARING

Two program packages from IBM offer new time-sharing capabilities for System/360s from the Model 25 to the Model 195. Time-Sharing Option (TSO), for users of System/360 Models 50, 65, 75, 85, and 195 provides for time-sharing concurrent with batch processing and allows terminal users to select from as many as seven different computer languages. TSO also enables the terminal user to interact with any applications program. Interactive Terminal Facility (ITF), for users of System/360 Models 25, 30, 40, 50, 65, 75, 85, and 195, provides two conversational programming languages: BASIC, and an interactive subset of PL/I. ITF, which runs under the Disk Operating System or OS/360, provides time-sharing concurrent with batch processing. *International Business Machines Corp., White Plains, N. Y.*

Circle No. 243 on Inquiry Card.

MATHEMATICAL PROGRAM

The MPS-10/SYSTEM, a time-shared, mathematical programming technique for use on DEC PDP-10 computer systems and through the AL/COM time-sharing network, is composed of two parts: MPS-10/OPTIMIZER and MPS-10/PROCEDURES. The MPS-10/OPTIMIZER represents an adaptation of the SoCal/RAND Code adapted to a time-sharing environment. This program consists of single-precision routines for the solution of both linear and/or separable programming problems. Among its important features are an upper-bounding algorithm, post-optimal procedures, simplified control agenda, and two separable algorithms (unbounded and upper-bounded) which permit the representation and mathematical modeling of many non-linear functions and situations. *Davis Computer Systems, Inc., N. Y., N. Y.*

Circle No. 264 on Inquiry Card.

REAL-TIME SYSTEM

ROSCOE (Remote OS Conversational Operating Environment) is an on-line real-time system developed for use with IBM/360 Models 40 and larger. The program was developed for use in large computer installations with heavy debugging loads to assist in writing and testing computer programs. ROSCOE is available for delivery at a lease price of \$1,000 to \$1,500 a month, depending on the selected options. *Applied Data Research, Princeton, N. J.*

Circle No. 257 on Inquiry Card.

"TRUTH-IN-LENDING" SERVICE

A time-sharing service for consumer credit grantors has programmed the Federal Reserve System's formula for computing irregular payment contracts as required by regulation "Z" of the new "Truth-in Lending" Act. The program is run on an IBM 360/50 and is on-line 12 hours a day, 7 days a week. Subscribers call in through a toll-free telephone network and give the receiving operator the information necessary to calculate the annual percentage rate. Hard copy verification is sent to the subscriber on the same day. *Credit Data Corp., Anaheim, Cal.*

Circle No. 249 on Inquiry Card.

SYSTEMS MAINTENANCE SERVICE

A systems generation and maintenance service called INFOGEN is a series of programs, including on-site visits, designed to give the user a level of operating systems sophistication commensurate with his own requirements and desires. INFOGEN was designed because companies differ in their attitude toward desired levels of operating systems and the importance of various new releases. With these differences in mind, INFOGEN offers a series of programs and enhancement services which can be implemented at varying degrees of intensity and cost. *Information Standards, Inc., New York, N. Y.*

Circle No. 254 on Inquiry Card.

THE OUTSTRIPPER

More message in less line time. Because this readout terminal sprints as it prints . . . it literally outstrips the field . . . and does it far longer, with a minimum of 100 million maintenance-free operations! Size and weight are surprisingly small, but the 64 characters (ASCII code) are large. Result: virtually instantaneous readout of .120" high x .079" wide characters, spaced nine per inch. Send coupon today.



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CDC 6000 OPERATING SYSTEM

Designed for a broad spectrum of time-sharing data processing applications, a new operating system, KRONOS, has been developed jointly by CDC and United Computing Systems for use on UCS's and other CDC 6000 Series computers. In fully interactive, on-line time-sharing, KRONOS can accommodate up to 384 terminal lines as well as local batch processing. For remote batch processing, the system is designed to handle 256 lines and 16 Control Data user terminals. User languages available with the KRONOS operating system include FORTRAN, BASIC, TEXT EDITOR, and ALGOL for both interactive and batch processing, with COBOL, SORT/MERGE, PERT/TIME, APT, and OPTIMA available for batch processing exclusively. *Control Data Corp., Minneapolis, Minn.*

Circle No. 242 on Inquiry Card

1130 ASSEMBLER

SELEMBLER/1130 is a SEL 810A/810B assembler that will run on the IBM 1130. SELEMBLER/1130 accepts all SEL mnemonic instructions and pseudo-ops plus five additional specifications which describe and format output. Programs are input as punched cards in SEL format. The output options include: (1) object paper tape acceptable to the SEL relocating loader; (2) a listing almost identical to the SEL listing; and (3) an alphabetized symbol table. *Datanetics, Pittsburgh, Pa.*

Circle No. 262 on Inquiry Card.

T-S INFORMATION SYSTEM

A time-shared information storage and retrieval system, User Language/1 (UL/1), allows more than 100 information seekers at different locations to use concurrently the full resources of the Spectra 70/61. UL/1 is a generalized data base management system which processes requests from many on-line users simultaneously. Functions performed include file creation and updating, file structure revision, on-line inquiry response, interactive browsing and the on-line initiation of more complex operations. *RCA, New York, N. Y.*

Circle No. 266 on Inquiry Card.

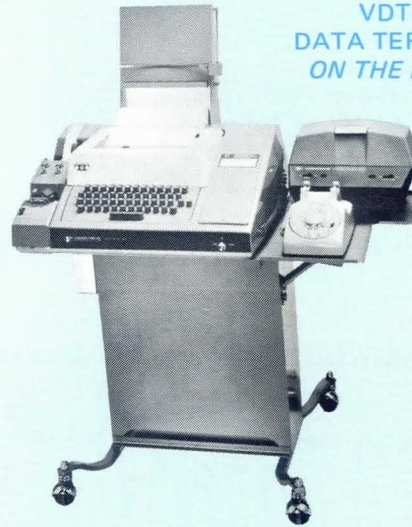
SYMBOLIC EDITOR

An expanded version of DEC's Symbolic EDITOR package operates on a line number or context basis and permits intra-line character string editing. Specifically, it can (1) search for a character string within a line or a group of lines and delete, insert, replace, or list the character string; (2) list file contents with or without line numbers; and (3) terminate a logical string at whatever point is specified by the user. These new features are in addition to those already included in DEC's program, such as the ability to create new files; delete files; and add, delete, insert, replace, or list lines. *Comsonic Corp., New York, N. Y.*

Circle No. 251 on Inquiry Card.

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NEW LITERATURE

EDP SERVICES

Two brochures describe services rendered by New York City-based EDP service company. They are: DataSystem, which is described as a unique business accounting service integrating all common commercial applications into a single system using a common data base; and Infogen, a series of programs to generate and maintain IBM operating systems at various user-desired levels. *Information Standards Inc., New York, N.Y.*

Circle No. 300 on Inquiry Card.

TIME-SHARING SYSTEM

A brochure and fact sheet from ITS Industrial Computer Laboratories, Inc. describes Command 690, a series of low-cost computing systems for process control, scientific computing, and remote job entry. *ITS Information Network, Inc., Salt Lake City, Utah.*

Circle No. 312 on Inquiry Card.

XDS SIGMA 3

Sigma 3, Xerox Data Systems' new computer is described in a 20-page brochure. Included are details on the computer's various compilers, assemblers, and operating systems, as well as some of its application areas and hardware features. *Xerox Data Systems, El Segundo, Cal.*

Circle No. 311 on Inquiry Card.

DATA ACQUISITION SYSTEMS

A 20-page brochure discusses the general-purpose approach to data acquisition and details the RC 785 system, the RC 745 Datalogger, and the Redcor 70 "Midi" Computer, which is the processor for both systems. *Redcor Corp., Canoga Park, Cal.*

Circle No. 304 on Inquiry Card.

A/N, GRAPHIC COM

Sixteen-page brochure describes a computer output microfilmer capable of printing high-resolution alphanumerics at a speed ten times faster than high-speed impact printers and plotting images sixteen times faster than typical mechanical plotters. *Beta Instrument Corp., Newton Upper Falls, Mass.*

Circle No. 310 on Inquiry Card.

TIME-SHARING BOOKLET

"Time Sharing and You" is the title of a free booklet designed to aid understanding of the computer time-sharing concept. The booklet explains how and why time-sharing developed; how it works; and what may be expected of it. *Call-A-Computer, Minneapolis, Minn.*

Circle No. 305 on Inquiry Card.

NUMBER CRUNCHER

"Number Cruncher" is the title of a new brochure which describes McDonnell Automation's remote job entry system. The "cruncher" is an IBM S/360 Model 65/75 ASP (Attached Support Processor) system operating under MVT. *McDonnell Automation Co., St. Louis, Mo.*

Circle No. 301 on Inquiry Card.

CONVERSION SERVICES

A 4-page brochure from URS Data Sciences describes services available to computer users who are planning or undergoing a conversion from one computer system to another, and to users who are now running under emulation. The new brochure outlines services provided in hardware evaluation, conversion analysis, conversion software, and program and file conversion. *URS Data Sciences Co., San Mateo, Cal.*

Circle No. 318 on Inquiry Card.

COMPUTING SERVICES

Literature from General Automation defines the services provided to the industrial automation market by the company's Automation Sciences Division (ASD). Two brochures detail ASD's service capabilities and experience in applications programming and systems engineering. A third covers the facilities and services available on a local basis through regional GA Technical Application Centers. All the 8-page, 2-color brochures are fully illustrated. *General Automation, Inc., Orange, Cal.*

Circle No. 307 on Inquiry Card.

DISK DRIVE

Eight-page illustrated brochure describes operational, reliability, and maintenance features of new MD-2101 single-disk drive designed to meet the removable-media memory storage needs of small- and medium-sized computers. Also described in detail is CMD's unique positioner which provides an average access time of 115 milliseconds. *Computer Memory Devices, Inc., Glendale, Ariz.*

Circle No. 306 on Inquiry Card.

VOICE RESPONSE SYSTEM

A means of providing an immediate dialogue between man and computer is described in a 4-page illustrated brochure. The VRS, a hardware/software, field-expandable turnkey system, was designed primarily for non-technical personnel in manufacturing, engineering, purchasing, production/inventory control, finance, credit, sales, management, and retailing. The basic system features a portable acoustical terminal and an integral programmable director which provides modular field expansion of vocabulary and lines. *Voice Response Systems, Inc., Elmsford, N.Y.*

Circle No. 302 on Inquiry Card.

DIGITAL DATA SYSTEM

A comprehensive, 24-page brochure describes the H4200 Digital Data System from Howell Instruments, Inc. The new, modular system scans up to 1000 channels with 1000 individual limits at speeds up to 20 channels per second. *Howell Instruments, Inc., Ft. Worth, Texas.*

Circle No. 315 on Inquiry Card.

REMOTE ACCESS EDITING

An illustrated 2-color, four-page brochure describes the G. E. RAES (Remote Access Editing System) and its use in filing, retrieving, and editing information. The system is designed for contracts, catalogs, lists, personnel files, legal abstracts, form letters, and publications work. *General Electric Information Systems, Schenectady, N. Y.*

Circle No. 314 on Inquiry Card.

CAPABILITIES BROCHURE

Q-Data Corp.'s systems design, custom programming, installation management, and management consulting services are described in a 12-page brochure. Q-Data specializes exclusively in NCR-Century applications. *Q-Data Corp., Hawthorne, Cal.*

Circle No. 316 on Inquiry Card.

PHOTOCOMPOSITION SERVICE

Four-page, four-color brochure describes Alphanumeric TEXTRAN, a keyboard-to-tape photocomposition service. Subscribers record text and format instructions on IBM MT/ST cartridges, send the cartridges to Alphanumeric's service centers for processing, and receive typeset masters. *Alphanumeric Inc., Lake Success, N.Y.*

Circle No. 309 on Inquiry Card.

DATA COMMUNICATIONS

A condensed catalog of data communications products contains comprehensive operational and functional descriptions of a broad range of signal processing, recording, multiplexing, and concentrating equipment. *Data-Control Systems, Inc., Danbury, Conn.*

Circle No. 319 on Inquiry Card.

RFL Builds Data Sets to meet every need



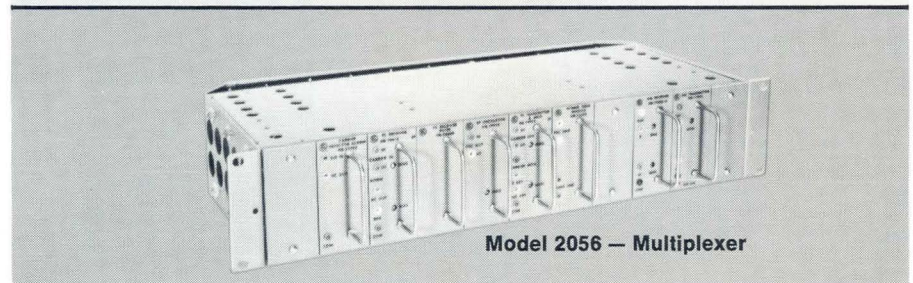
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Hardwire/Acoustical Coupler



Model 3952 High Speed Data Set



Model 2056 — Multiplexer

No matter what your data communication needs, look to RFL for the ultimate in dependable high-speed data communication equipment. RFL Data Sets handle computer, telegraph and telemeter data in combination or on an individual basis. The Model 2056 series provides the latest in transistorized multiplexing equipment — permitting the use of up to 23 channels over a single circuit, and RFL's "Plug-in" interchangeability feature gives you a choice of data speeds up to 2400 bits per second.

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RFL offers an outright purchase or rental plan . . . so if you have requirements for data communications equipment, be sure to check RFL . . . we make a set to fit your needs. We've been building quality data sets for over 12 years . . . with prompt delivery.

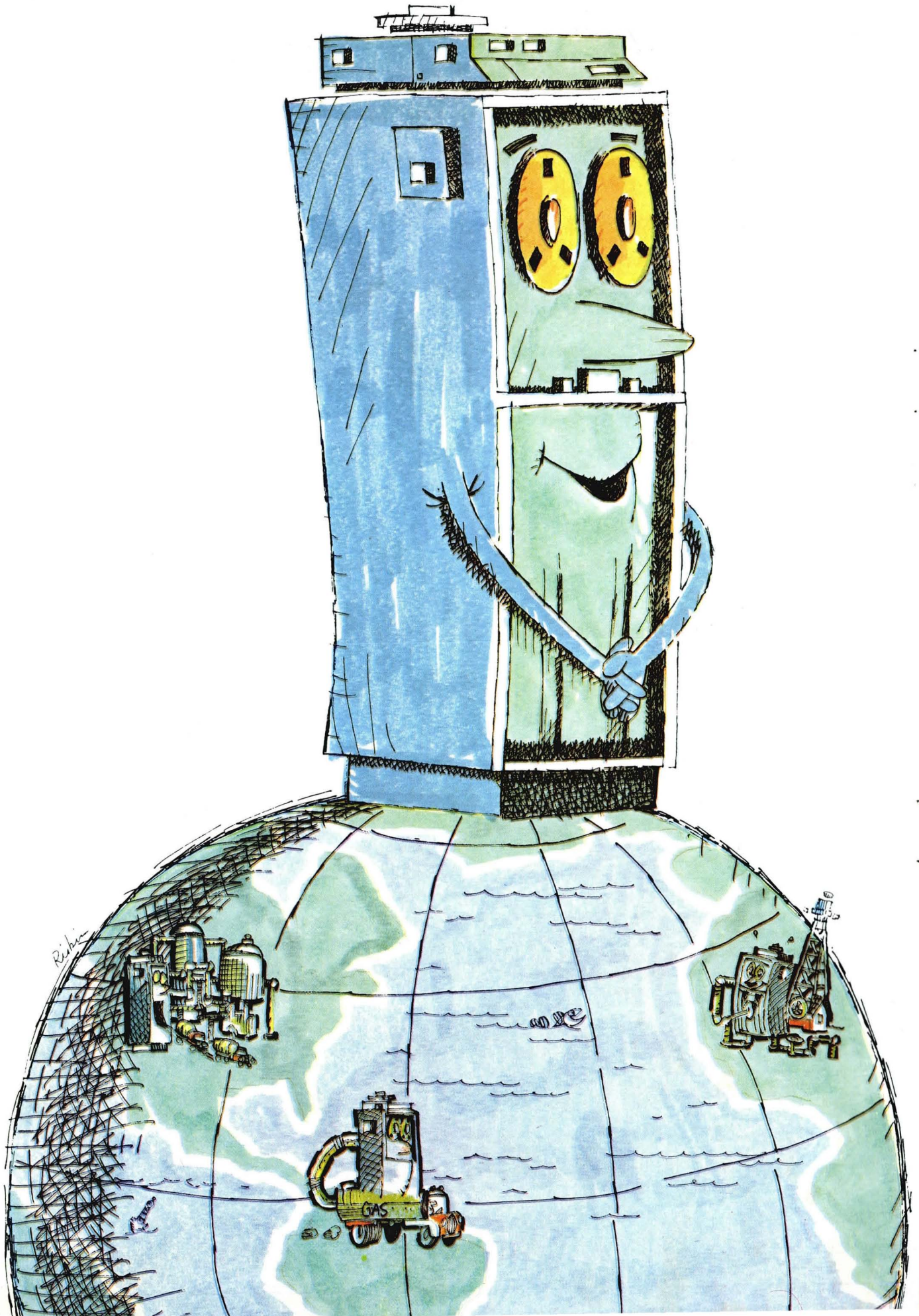
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NEW LITERATURE

MICROFILMED DOCUMENTATION

A descriptive case study on the handling of engineering documentation points out the use of microfilm. The described system uses a new type of Diazo copy card which allows, in turn, for the distribution of multiple-image aperture cards. *Microseal Corp., Evans-ton, Ill.*

Circle No. 303 on Inquiry Card.

ELECTRONIC ORDERING SYSTEM

An electronic ordering system specifically designed for supermarkets is fully detailed in a new 8-page brochure. The system, now used by eight of the nation's 15 largest grocery operations, is said to have effected savings of up to several days in the order-delivery cycle and as much as 40 hours per week per store in clerk time. *Marketing Systems Inc., Los Angeles, Cal.*

Circle No. 313 on Inquiry Card.

PDP-10

A 32-page general description of DEC's PDP-10 computer system features a discussion of processor hardware, system software, peripherals, service, and applications. The PDP-10, a 36-bit word length computer, is widely used for commercial and in-house time-sharing, hybrid simulations, and plant monitoring. *Digital Equipment Corp., Maynard, Mass.*

Circle No. 308 on Inquiry Card.

DIGITAL A-V SYSTEM

A four-page brochure describes a new line of digital controls for audio-visual retrieval systems being used in schools, libraries, and training centers. The controls can be assembled into flexible automatic systems for channeling TV and audio signals from a central source to classrooms and individual student carrels. *Valtec Corp., Irvine, Cal.*

Circle No. 317 on Inquiry Card.

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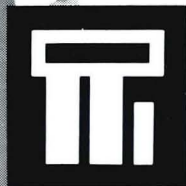
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- ASCII hard copy capabilities plus voice response —you won't find that combination anywhere!
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- All delivered within 60 days!



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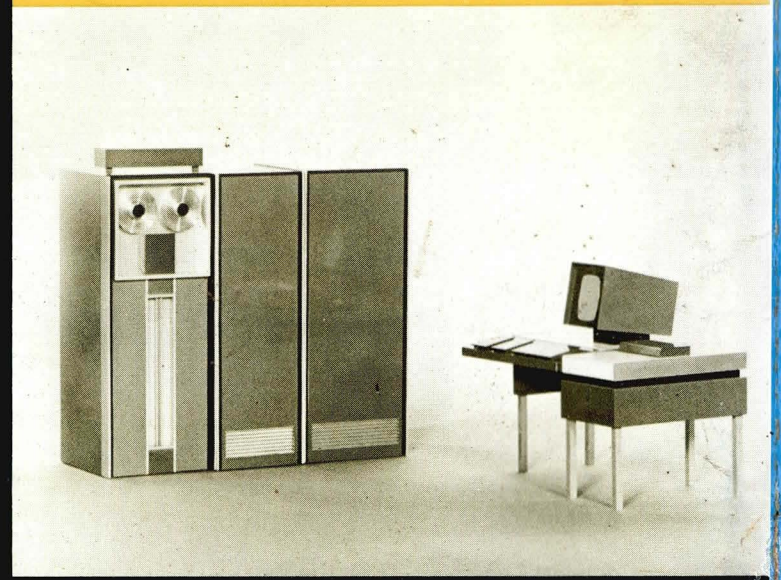
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... In the same time, General Electric's Rapid Search Machine, Model GESCAN-1, can search through 4,166 words! This represents a search speed of 3 minutes for a 2,400', 3.5 million word magnetic tape file.

The General Electric RSM Model GESCAN-1 is a revolutionary new free standing information handling device designed expressly to perform high speed versatile search and retrieval of textual data on magnetic tape files.

The GESCAN-1 is a digital, solid state, wired logic machine that uses an associative, natural language processor to compare any search request entered on the console keyboard to the entire contents of the tape, word for word, seeking a match.

The output of a search will be printed in natural language on the system printer and may be either records, selected sub-records, or up to 990 characters on either side of the matched word or phrase.

The search request, or query, may be linked by the logical connectives "and", "and not", "or", "or not". Erroneous and alternate spellings, as well as incomplete words or phrases in the search query are accommodated. These features allow greater system versatility and flexibility to the user.

The digital magnetic tape data file to be searched is formatted, simply, into "records" and if desired, "sub-records" which may be any logically complete quantity of information as a report or abstract or both. Records may be in any location on the tape and need not be in any sequence. No physical indexing is necessary and no record gaps are required.

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