DATAMATION®

71

November 15

Last Spring, you met our thoroughly modern mini.

Hey, look at her now!

Take another look at our gal on the go. Now our 2100's moved up to a minisystem. The new HP 2120. With big system power at a pocketbook price: $32,950.

This buys a high-speed paper tape reader, teleprinter, our new 5 megabyte, fast access 7900 disc drive — plus our thoroughly modern mini. And when we say modern, we mean a processor with value features like control read only memory (ROM), direct memory access, hardware multiply-divide and the latest in MSI/LSI technology. For special applications, our mini also offers convenient options like floating point hardware. Pulling it all together is the 2120's unique disc operating system. It puts you into the big performance league with program chaining, extended file management, and a job processor that mixes FORTRAN IV, ALGOL, and assembly language programs.

Our new 2120 Minisystem's flexible, too. Its modular design lets you easily expand both capacity and capability. As you need it. For instance, when you want more disc memory, move up in easy and convenient steps and go all the way to 47 megabytes.

When you need a tape drive, line printer, card reader, or other peripheral, add it. Our minisystem is designed to handle them all. Plus as many as 47 HP instruments. And everything plugs right in.

As your needs change, we have software that keeps pace. Library programs, statistical routines, application packages and more. All are fully compatible with our over three thousand computer installations in industry, science, and education.

Now combine all this with a sales and service organization of 141 offices throughout the free world. They're an important part of our minisystem story. Big support, big performance, reasonable cost. That's our gal on the go.

So why not take a look at her now. Just call your HP computer specialist. Or write for the system brochure. Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

22128

Be sure to visit us in Booth 2000 at FJCC.

HEWLETT hp PACKARD

DIGITAL COMPUTERS

NOVEMBER 15, 1971

volume 17 number 22

TECHNICAL

MANAGEMENT

DATAMATION®

About the Cover

Gentlemen (and ladies) will be placing their wagers on all that's bigger and better in the industry when they gather at Las Vegas this month. Our design by Byron Andrus sets the appropriate scene for this red hot roulette game.

DATAMATION®

NOVEMBER 15, 1971

volume 17 number 21

This issue 118,371 copies

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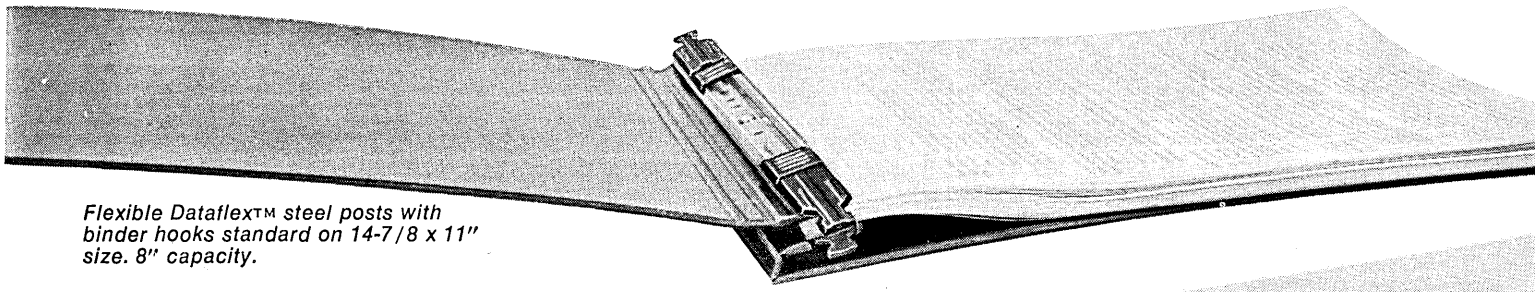
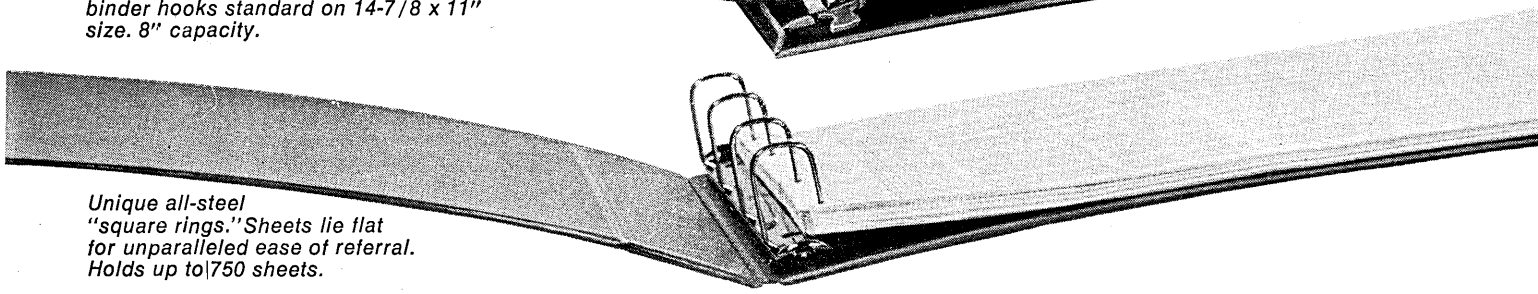
Printed by Beslow Associates, Inc.

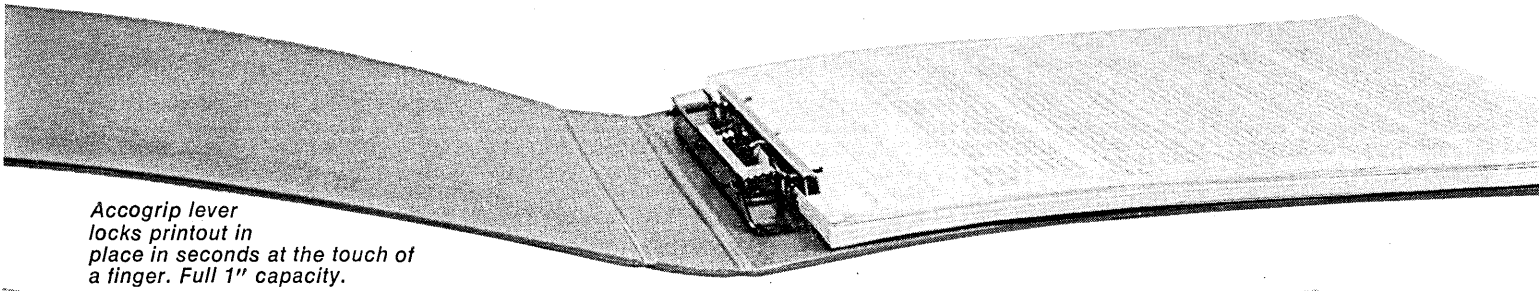
New 90 pt. Accohide data binders: good for "generations" to come.



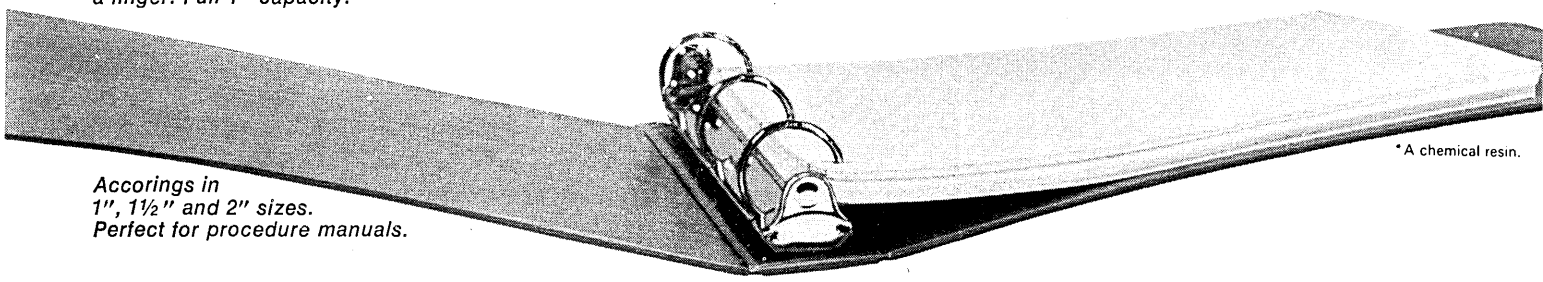
Flexible Dataflex™ steel posts with binder hooks standard on 14-7/8 x 11" size. 8" capacity.



Unique all-steel "square rings." Sheets lie flat for unparalleled ease of referral. Holds up to 750 sheets.



Accogrip lever locks printout in place in seconds at the touch of a finger. Full 1" capacity.



Accorings in 1", 1½" and 2" sizes. Perfect for procedure manuals.

*A chemical resin.

Whether your printout comes from a 2nd or 3rd generation computer, these new 90 pt. Accohide* data binders will be around for a long, long time. The covers are *rigid,* with a special new grained finish that's extremely attractive in any office decor. Because these 90 pt. binders stand on their own two covers, they stack or hang neatly on desktop, credenza or file without slumping. Scuffproof, tearproof, washable, "indestructible" 90 pt. *rigid* Accohide data binders in executive red and blue. Ask your Acco dealer or write for our 4/color, 12 page Accodata catalog: helps you put printout in place. Properly.

ACCO

ACCO INTERNATIONAL INC.

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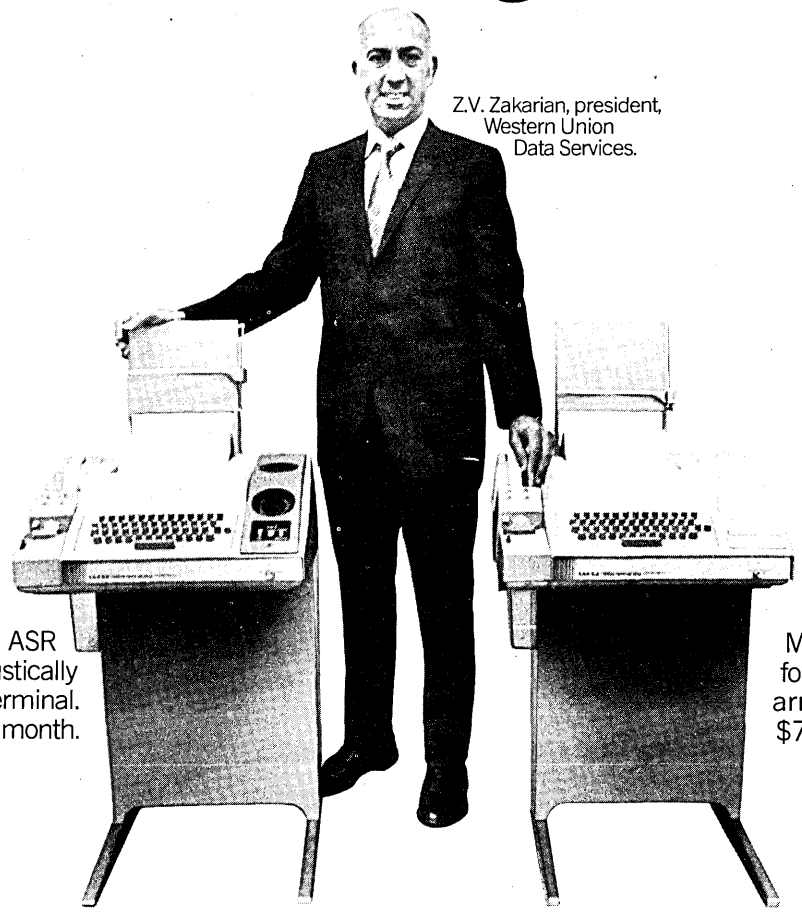
Two ways to save money on practically any time-sharing service.



Z.V. Zakarian, president, Western Union Data Services.

Model 33 ASR accoustically coupled terminal. $65 per month.

Model 33 ASR for data access arrangement $75 per month.

With about 150 in the U.S. there is no shortage of time-sharing services. What there is a shortage of, is low-cost terminals and service for them.

So about a year ago we decided to offer terminals that would be compatible with virtually every time-sharing service. And we offered terminals at the lowest prices ever. Add to that nationwide support and it's not surprising that we have leased literally thousands of terminals.

We offer models for every purpose. The Model 33 ASR with acoustic coupler works with any standard telephone. And we can provide Model 33 or Model 35 for use with Data-Phone* or data access arrangements.

Regardless of which data terminal configuration you select, you can depend on Western Union Data Services Company for nationwide servicing, applications engineering, training and support.

Interested in the most economical and efficient data terminal for your needs?

Contact me at Western Union Data Services Company, 16 McKee Drive, Mahwah, New Jersey 07430. Phone: 201-529-4600. Outside N.J. call toll-free 800-631-7050. Telex: 12-5077.

*Registered trademark of AT&T.

western union data services company

MOHAWK TO INTRODUCE SHARED PROCESSOR

Mohawk Data Sciences will join the key-to-disc shared processor data entry sweepstakes any day now. We hear there will be three models--from the small systems with a half dozen or so key stations to the large and sophisticated systems able to handle scores of key stations. MDS will be using an Atron computer, a Calcomp disc, and Colorado Instruments' keyboards. MDS will make the crt. Atron and Colorado Instruments, of course, were taken over recently by MDS.

IBM EUROPE: BUNDLED, PRICE BOUND, COLORED SHIRTS

IBM Europe is re-thinking its announced plan to unbundle its 360 line July 1 in Western Europe. The antitrust pressures which figured in its decision to unbundle in the U.S. do not exist in Europe. Even if it decides to continue with the unbundling plan in Western Europe, many European observers feel IBM will present a bundled stance in Eastern Europe, regarded as a prime market for peddling old 360 models.

While it has no significant antitrust problems in Europe, IBM Europe nevertheless must obtain permission from some countries--France and Belgium, to name just two--before it can raise prices. That explains the lag in the price increases for the 370 line that were announced in the U.S. last summer.

European IBMers look with great amusement upon former chairman Thomas J. Watson Jr.'s celebrated memo in which he chided U.S. employees for their appearance. "No one pays any attention to that stuff in Europe," said one ex-IBMer in Paris. "You see a lot of colored shirts on IBM salesmen in Europe."

H-P'S BIGGEST TASK: THE SYSTEM 3000

Some $5 million was spent by Hewlett-Packard developing its new system, the System 3000. That's the most H-P has ever spent on an r&d project since entering the computer market in the mid sixties. It's counting heavily on the scientific and education markets for the 32K to 128K system with 960 nanosecond core speed. The system handles time-sharing, real time, and multiprogram batch, all at the same time. And in two languages, Fortran and Basic. The price is $100,000, going as high as $300,000. H-P will have a model at the FJCC and begin deliveries in a year. It's reported the company expects to sell $5 million worth of the System 3000 to the education market in the first year.

DATA NETWORKS THERE ...AND FOR SALE

National BankAmericard Inc. last month sent RFPs to 22 firms for installation and operation of a nationwide credit card authorization system. Edwin Henlein, NBI system development director, said 54 firms sought to qualify for the RFPs. "There's a lot of unused data network out there."

FM DISCIPLE SCORES IN NORTHWEST

One of facilities management's newest disciples has been stomping the economically depressed Northwest on behalf of fm and when not addressing area trade groups on "facilities management is the way the industry has got to go," has been parlaying his belief into

$1 million worth of business. That's the backlog of Denny Brown's Data Enterprises of the Northwest, Inc., all accumulated in 1971, a bad year for the Seattle area where DEN is based. The firm was organized by Brown right after the Honeywell-GE merger when the GE Seattle branch office survived the merger by virtue of its serving two of GE's largest customers, Weyerhaeuser Inc. and Seattle First National Bank. Brown, who had been Honeywell's Seattle branch manager opted for the Northwest over moving to Wellesley, Mass. and so, DEN and his fm crusade.

AUTOMATING WORTHLESS CAN BE WORTHWHILE

Many strange but useful things are being automated these days. But automating something worthless? When the Los Angeles Police Department received a $322,000 grant from the California Council on Criminal Justice to establish an Automated Worthless Document Index (AWDI) a lot of eyebrows were raised quizzically. But Lt. Clyde L. Cronkhite, of the department's Advance System Development Section, notes that worthless documents (forged checks, credit cards, airline tickets etc.) are being produced at a rate in Los Angeles that is 40% above last year's. With today's manual system, he says, up to 15 officers can be working independently for up to six months on what can turn out to be the same case. The automated index will be designed to correlate similarities in forged documents, daily, cutting duplication of efforts and investigation. Conversion started Nov. 1. When complete, the system will be first of its kind in the country.

INFOREX ITALY BOUND

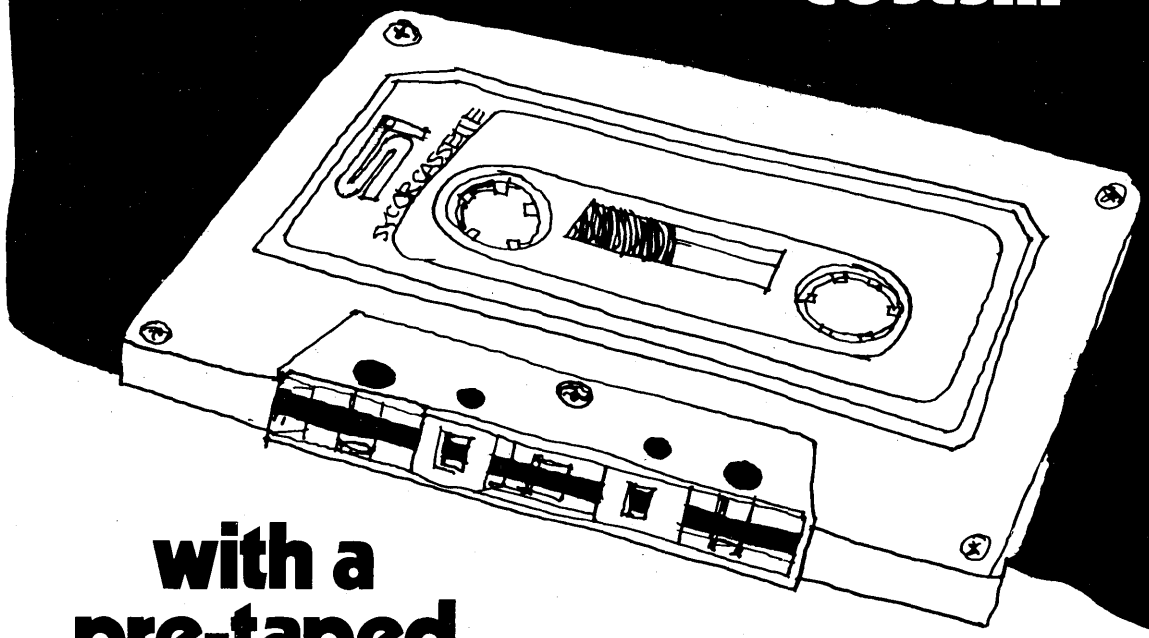
Although Inforex remains tight-lipped about its plans in Europe, the data entry company is about ready to establish an Italian subsidiary and is taking a hard look at the Japanese market. Elsewhere, Inforex claims to have some 80% of the booming German key-to-disc market.

RUMORS AND RAW RANDOM DATA

Dr. Edward Bennett, founder and guiding light of Viatron, will make one of his rare speaking appearances Dec. 6 at the International Business Forms Industries' EDP Forum at Hollywood Beach, Fla...IBM, which claims more than 5,000 System/3s installed and more than 10,000 on order and is obviously prone to please this army of users, has initiated a new service called Golden Cable at its Western Business Systems center through which users can convert 360/20 programs for S/3 use at no charge...There's such a thing as too much faith in a computer system. Two Los Angeles police officers, advised by data from the city's experimental Pattern Recognition and Information Correlation System (PATRIC) they might find a particular burglary suspect in a particular five block area in a specific time period, carrying a tv, caught the man in the right area at the right time but were miffed because he was carrying a radio...Field Enterprises, Inc., which, among other things publishes World Book Encyclopedia, has become the first large Chicago based firm to order a Honeywell 6000.

Sycor's intelligent terminal...

tailored programming without high-priced programming costs...



with a pre-taped Program Library:

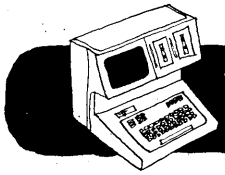
■ Range Checking ■ Table Look-Up ■ Value Comparison ■ Multiplication / Division
■ Code Conversion ■ LRC or CRC checking for communications ■ Card Reader and Card Punch drivers
■ Check Digit generation / verification ■ Conversational Mode—And more to come

Of the 12K bytes of total memory available in the 340 terminal, 3K bytes are optional MOS / LSI read / write memory. Our Program Library, developed to help you make the most of this, loads from cassette and executes at the push of a button. Now you can simply add memory and powerful programs as you need them. And, at a fraction of what it would cost to create your own software, as other systems expect you to do. The 340 already contains field-proven, general purpose programs in its 8K bytes of ROM. We spent 27 man years of machine language programming to develop them—so you wouldn't have to absorb the expense, and risk your schedules, doing it. We developed the software library for the same reason!

ROM programs to optimize your application: Omission Detection™ ■ Capacity Control™ ■ Addition / Subtraction (zero balancing / batch totals) ■ 1200, 2,000 and 2400 baud binary synchronous communications ■ Unattended communications ■ Data Compression ■ 30 cps printer, 50 lpm printer ■ 1,000 cps cassette recorders ■ Automatic Paging™ ■ Tab Compression

100 Phoenix Drive, Ann Arbor, Michigan 48104

SYCOR INC

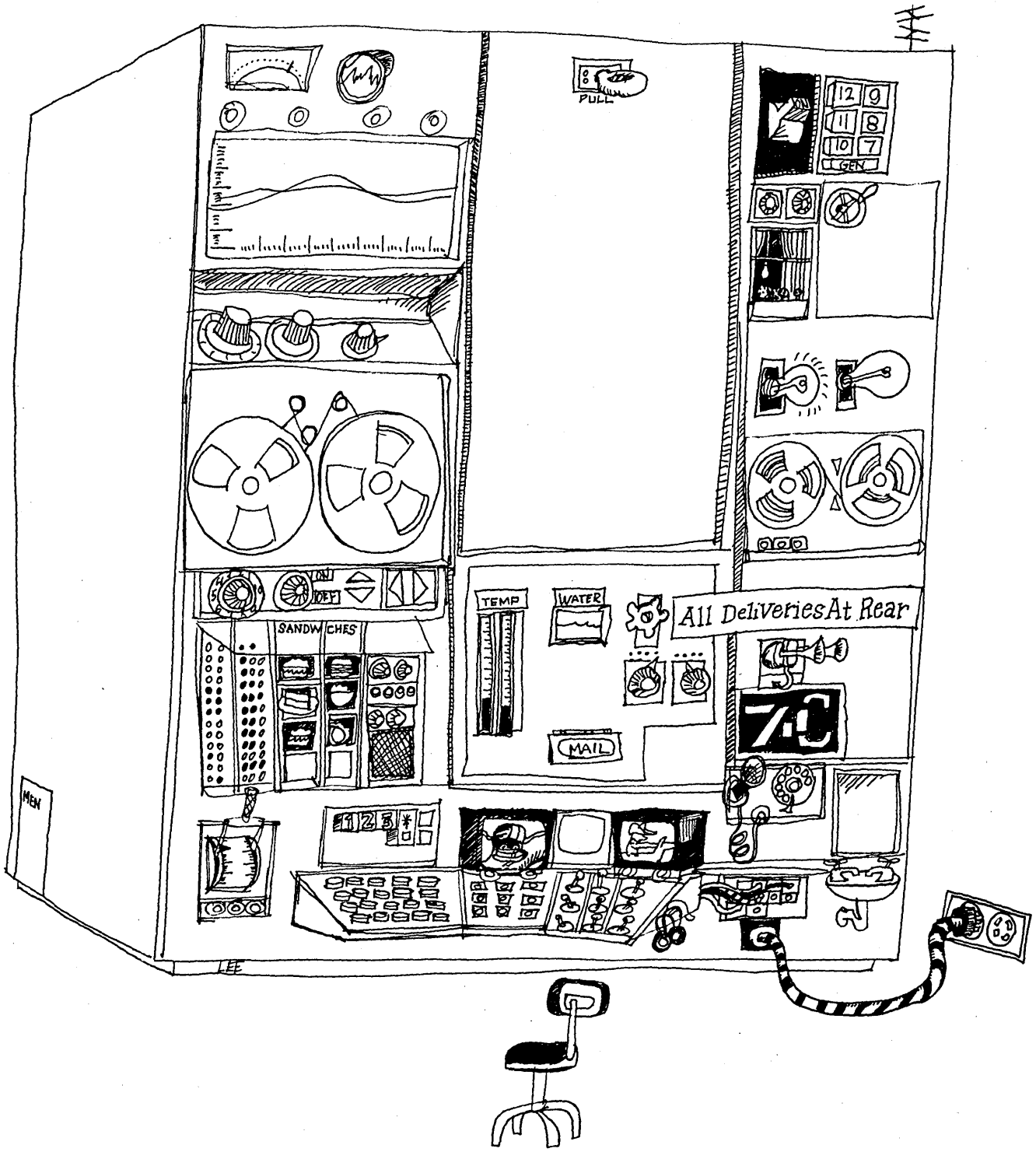


Thousands of Sycor terminals are in service in 25 countries worldwide.

See the 340 at booths 2823-2829 at the FJCC.

CIRCLE 53 ON READER CARD

Why do they try to sell you a whole new system,



when all you need is a little memory.

Get Smart.

Built-in obsolescence can play financial havoc with a data processing operation. When the trade-up bugaboo rears its ugly budget, consider adding on a SMART system. Standard Memories Add-on and Replacement Technology can expand your IBM 360 Mod 30 up to 128K bytes, your Mod 40 to 512K, and your Mod 50 to 1.0M. And Standard Memories can promise you savings ranging from 15 to 25%. And with no charge for extra shifts, savings can jump to 45%.

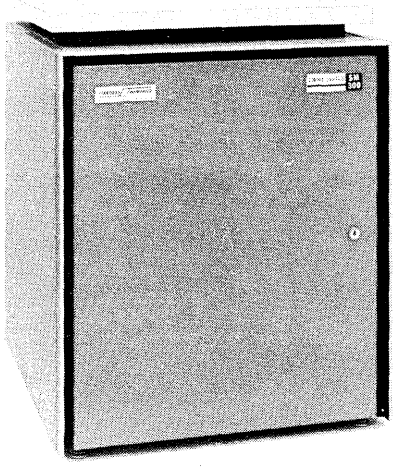
At the FJCC...
booth 1412

Everything's there: plug-to-plug compatibility, reliability, instant 24-hour nationwide service, simple installation, and on-site reconfiguration.

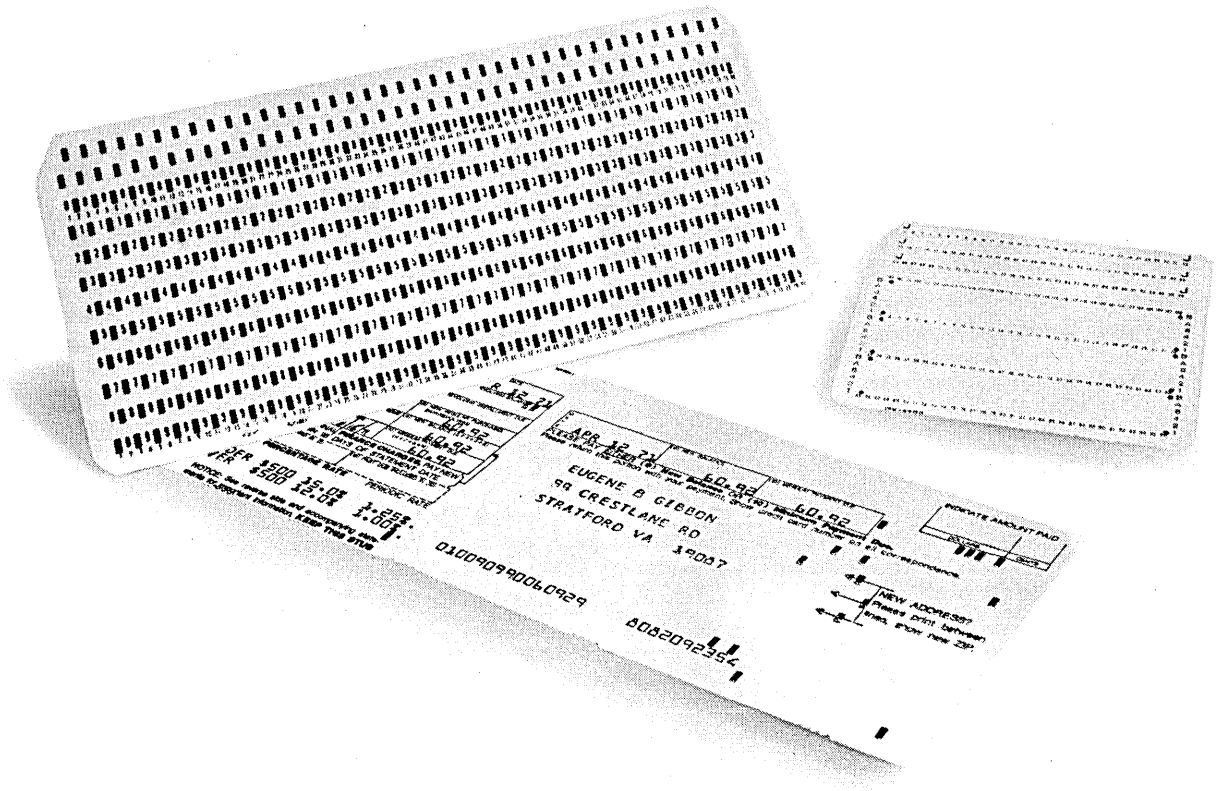
Standard has been in the core memory field for years. Along with our parent company, Applied Magnetics, we are one of the major component suppliers to the computer industry. It is quite logical, therefore, that our promise of reliability and maintenance has real teeth.

Write now for your free SMART brochure. It will be the first step toward a very intelligent decision.

STANDARD MEMORIES
INCORPORATED
A Subsidiary of Applied Magnetics Corporation
2801 East Oakland Park Boulevard
Fort Lauderdale, Florida 33306
Telephone (305) 566-7611



System/3 users:



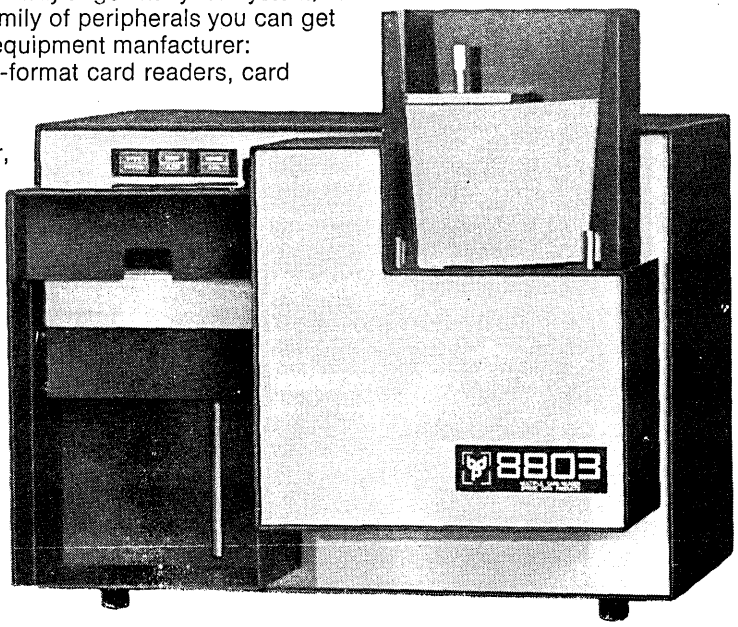
Now you can get a reader that reads more kinds of cards, and reads them faster, than the one you're using-for half the price.

That's about $200 or so a month, rather than $500 and more.

And it's better: 20% to 40% faster, depending on the card size you're reading, 80-column, 96-column, or stubs. (Yes, it reads all three. That's two more than the one you have.)

The new Bridge Data 8803 System/3-matched Multiple Card Reader, a simpler, faster, more versatile—and cheaper—way to get into your System/3.

And it's just one of a complete family of peripherals you can get from Bridge Data, the very original equipment manfacturer: single-format card readers, multiple-format card readers, card punches, and the like.

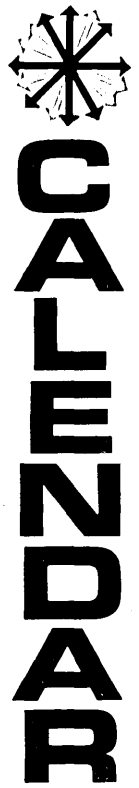


Matter of fact, you probably already have used our equipment or, at least, seen it at work—wearing somebody else's name or initials. We've been turning out computer-related electromechanical things, although somewhat anonymously, for over 13 years.

For information on the new 8803, or any of our System/3-compatible peripherals, drop us a line. *Bridge Data Products, Inc. 738 South 42nd Street, Philadelphia, Pa. 19104.*

BRIDGE DATA PRODUCTS, INC.

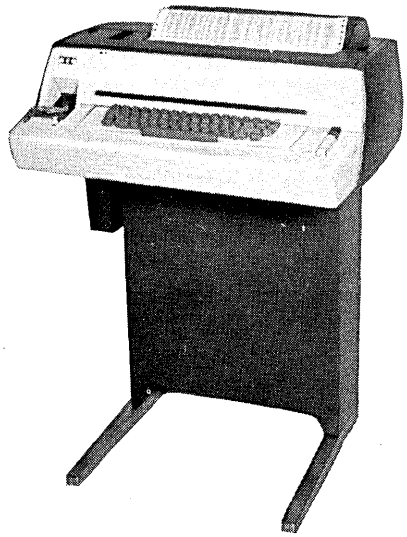
A subsidiary of Photon, Inc.



DATE	EVENT/SPONSOR	LOCATION	CONTACT	COST
Nov. 17-19	ADP Symposium on Military Activities	Camp Hill, PA	SPCC (710) Mechanicsburg, PA 17055	$30, federal, state, local government employees
Nov. 22-23	Conference on Statistical Methods for the Evaluation of Computer Systems Performance	Providence, RI	Prof. Walter Freiberger Div. of Applied Math Brown University Providence, RI 02912	None
Dec. 8-9	OCR User Association Meeting	Corpus Christi, TX	OCR User Association 9415 S. Western Ave. Chicago, IL 60620	Not given
Dec. 8-10	5th Conference on Applications of Simulation: ACM, AIIE, IEEE, SHARE, SCI, TIMS	New York City	Dr. Michel Araten Celanese Chemical Co. 245 Park Ave. New York, NY 10017	$60, prereg. $80, at door
Jan. 19-21	Hospital Information Systems Sharing Group Meeting	Atlanta	J. P. Howell Compucare 8550 W. Bryn Mawr Chicago, IL 60631	$125, members $100, others
March 22-24	Conference on Effective vs. Efficient Computing	Los Angeles	Dept. K, UCLA Univ. Ext. P.O. Box 24901 Los Angeles, CA 90024	$100
March 24-25	ACM SIGCSE Symposium on Education in Computer Science	St. Louis	Dr. David Matula Box 1045 Washington University St. Louis, MO 63130	$18, SIGCSE $23, ACM $27, others
April 4-6	U.S. Defense Research Agencies Symposium on Computer-Communications Networks and Teletraffic	New York City	Jerome Fox MRI Symposium Committee Polytechnic Institute 333 Jay St. Brooklyn, NY 11201	$18, members $21, others
April 10-12	IIA 4th National Meeting	New York City	Information Industry Assn. 1025 15th St., NW Washington, DC 20005	$100, members $150, others
April 17-19	NCS 9th Annual Meeting and Technical Conference	Chicago	Numerical Control Society 44 Nassau St. Princeton, NJ 08540	$110, members $140, others
May 9-12	National Microfilm Assn. 21st Annual Meeting	New York City	Daniel J. Edelman, Inc. 1717 Penn. Ave., NW Washington, DC	Not yet available
May 16-18	Spring Joint Computer Conference	Atlantic City	AFIPS 210 Summit Ave. Montvale, NJ 07645	$20, members $50, others
May 21-24	ASM 25th International Systems Meeting	Miami Beach	Assn. For Systems Mgt. 24587 Bagley Rd. Cleveland, OH 44138	$125, members $175, others
June 27-30	DPMA International Data Processing Conference & Business Exposition	New York City	Richard H. Torp DPMA 505 Busse Hwy. Park Ridge, IL 60068	$90, members $115, others

Right! It's a new low-cost, wide-platen data terminal

It's the Teletype® model 38. And its capabilities go far beyond the wide format aspect of operation.



The new model 38 line design incorporates many of the things that made the Teletype model 33 so popular: It's a modular line. Exceptionally reliable. Extremely economical; costs very little for all of its capabilities. It's really a logical extension of the model 33 design concept and is system compatible with it.

. . . the important differences

```
1         2         3         4         5         6         7         8         9         10        11        12        13
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      model 38 prints a 132 character line

                                    Generates all 128 ASCII code combinations

                                                                  Prints in two colors if desired

      PRINTS IN UPPER and lower case

                                Accepts standard 14-7/8" fan-fold computer stock

                                                                    Offers a variety of interface options

.....and doesn't cost very much!!!!

                                                          On a price performance basis you won't find a better buy!
```

The model 38 prints 132 characters per line at 10 characters per inch. This wide format enables you to send and receive data using the same fan-fold computer paper stock used in your computer room. So you can move the data generated by your computer to any number of remote locations across the nation without time-consuming reformatting problems.

The model 38 generates *all 128 ASCII code combinations*. You can print the full complement of 94 standard graphics, including upper and lower case alphabet characters. And it provides all the functional control necessary for easier operation.

If you would like to input computer data in red and receive output data in black, or vice versa, the Teletype 38 terminal has this capability, too.

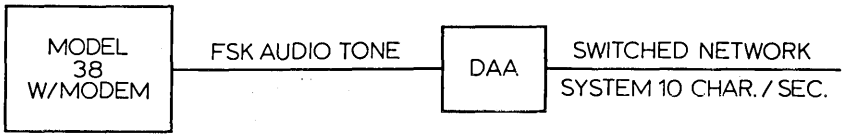
As you can see, the 38's format flexibility makes it easier to get your data in and out of the computer. And it broadens your on-line capabilities as well.

. . . the line is complete

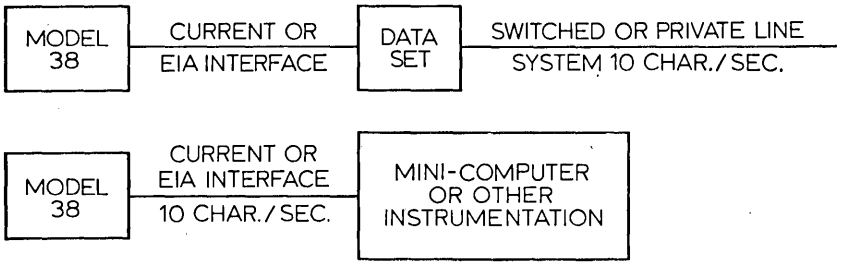
The Teletype 38 terminal is available in receive-only, keyboard send-receive and automatic send-receive configurations. Which means all of the reports, forms, and tabular material you generate can be moved *instantly* to all office, plant, warehouse, and sales locations that need the data using a terminal that best fits system requirements. Saving valuable time, and providing more efficient and profitable operation.

. . . plug to plug compatibility

The model 38 is available with several interface options, operating at 10 characters per second (110 baud).

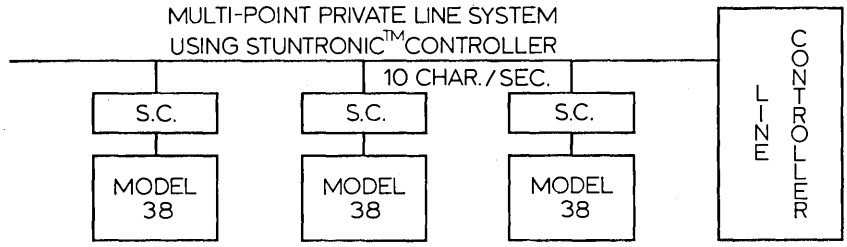


The terminal can be equipped with a built-in modem with simple two-wire, audio tone output which connects directly to the data access arrangement.

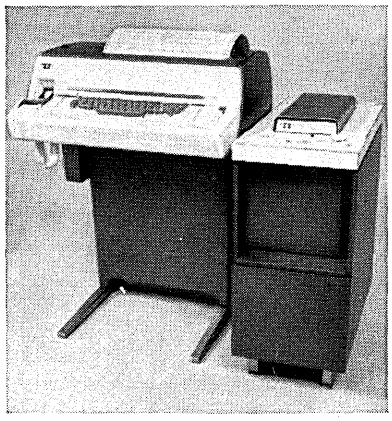


A second interface option is really two options in one. The set is equipped with both a voltage interface that conforms with EIA Standard RS-232-C *and* a current interface of 20 or 60 ma.

This means you can readily fit the model 38 into just about any switched network, private line or time-sharing system going without special "black box" engineering. Or use it to add maximum input/output capabilities to your minicomputer at a realistic price.

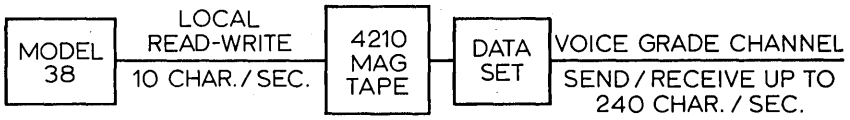


You can even use the model 38 in multi-point "selective calling" systems by adding a Teletype Stuntronic™ station controller.



. . . automatic send-receive operation up to 2400 words per minute

For systems requiring higher speed capabilities, the model 38 can be used with the Teletype 4210 magnetic tape data terminal. This combination provides on-line speeds up to 240 characters per second. The 4210 uses compact 3″ x 3″ x 1″ magnetic tape cartridges that hold up to 150,000 characters of data. Tape recording, editing, and correction functions are extremely simple.



If you are generating heavy-data loads in a teleprocessing or remote batch processing system, the on-line time saving aspects of this terminal combination are exceptionally dramatic. It is also possible to send or receive data on-line with the model 38 at 100 wpm using the optional built-in modem, if required.

So take a close look at this new wide-platen terminal offering. If you would like more information on the model 38, or any other part of the total line of Teletype data communications equipment, write: Teletype Corporation, 5555 Touhy Ave., Dept. 81-29, Skokie, Illinois 60076.

We would like to be of service.

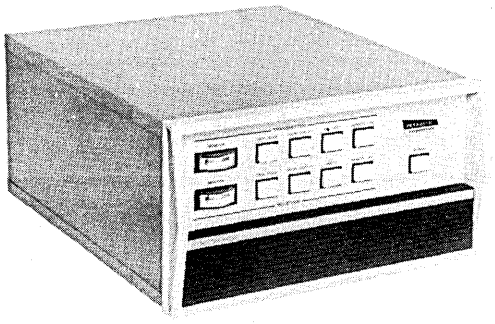
TELETYPE

machines that make data move

Teletype is a trademark registered in the U. S. Pat. Office

Only one dial-up modem can

Double your 2780* throughput



The Paradyne BISYNC

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LETTERS

Array for APL!

Sir:
I enjoyed reading Mr. Reeves' article (Sept. 15, p. 71) if for no other reason than to see the APL language discussed in publications in the field. I did consider some of Mr. Reeves' criticisms unfair, however, because they appear to disregard ways in which APL processes arrays and thus avoids interative programs more efficiently handled in a compiler language.

His nonoperational function named "BOMB" was one example. Rather than thinking of the problem in terms of selection, an APL programmer would work around the case where X is 0 like this:

```
R←((1−X=0)÷X)−X=0
```

or:

```
R←(X≠0)×÷X+X=0
```

These solutions work without branching and have the added feature of being able to handle arrays as their inputs.

DONALD RUETER
Costa Mesa, California

Creative executions

Sir:
Mr. Reeves' problem with using zero as a divisor in APL can be reached by reformulating the expression.

Mrs. Sandra Pakin of Chicago, author of the "APL/360 Reference Manual," developed the following function, which executes as Mr. Reeves desires:

```
    ∇ R←NOBOMB X
[1]   R←(X×⌊X=0),÷X×⌊X≠0
    ∇
```

It might be reasonable to surmise that Mr. Reeves' other problems with APL could be resolved with similar creative thought.

G. PETER SCHREIBER
Wappingers Falls, New York

Marketing time

Sir:
Your item on the TSS/360 system (Sept. 1, p. 58) might leave some readers with a slightly distorted version of the history of the 360/67 and TSS.

The Model 67 was originally a special system for the Univ. of Michigan, and was later upgraded to a standard product with TSS as the committed software. It is certainly true that TSS took a lot longer to become productive than was expected, and it did not support as many terminals as originally predicted; but one could only classify it as "one of the . . . least successful programs" from a marketing viewpoint. Technically, it is enthusiastically supported by its users. That IBM prefers to concentrate on one major system rather than several is a marketing strategy, not a comment on the success of TSS

To say that "TSS was responsible for the Mod 67" is not exactly correct, either. The Model 67 was designed to support time-sharing systems, and one system which was developed was TSS. Another system, in very heavy use at several universities, is the Michigan Terminal System (MTS). It is the combined success of MTS, TSS, and CP/67 that makes the Model 67 "highly respected in the industry."

I think it is safe to say that the Model 67, together with the MULTICS effort on the GE 645, was responsible for the increasing provision for virtual storage organization throughout the industry. Please let us not confuse marketing pronouncements with technical evaluations.

BERNARD A. GALLER
Ann Arbor, Michigan

We passed no judgment on the technical status of the TSS program. The main thrust of the article was that TSS was a marketing flop; i.e., IBM spent a great deal of money on the project—perhaps as much as $100 million—but was never able to attract more than a few customers. The fact that we did not mention the Univ. of Michigan system was not meant as a slight on the Michigan contributions.

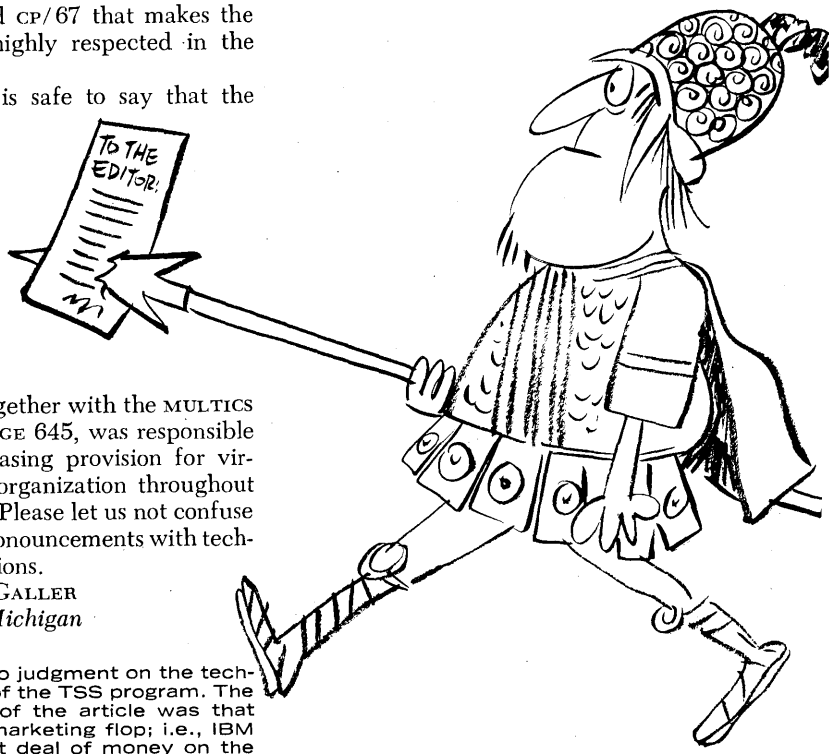
Ogdin strung up

Sir:
Disagreements with "The Case Against BASIC" by Jerry L. Ogdin in the Sept. 1 issue (p. 34) have probably risen from several sectors of the reader community, but may I try only to correct the erroneous concept of dimensioned string variables and character manipulation, then point out a somewhat different view of the growth of the BASIC language.

String variables are implemented on Honeywell Series 6000, 600, 400, and G-200. A statement such as DIM A$(n) will allocate n separate strings of some given initial length, not *one* string of n characters. Initial string length on the Series 400 and 6000 is 12 and 20 characters, respectively, and any string can grow up to 132 characters at execution time.

We at Honeywell are the guilty compiler creators who not only implemented a substring function for BASIC, but a strong concatenation statement as well. Both features are operational on the Series 6000 and have been well received. Mr. Ogdin's opinion of the CHANGE statement does flow with the majority—there *is* a better way to manipulate characters. The substring extraction function and string concatenation statement comprise one good way.

With respect to adding new capabilities to the BASIC language, I must be counted among those who believe that BASIC should grow as its one-time beginning users become more skilled in the art of programming. The suggestion that progressive pro-



Letters . . .

grammers should switch to FORTRAN at an intermediate stage has been evaluated by both manufacturers and users, but has largely been rejected by customers because of the relearning process involved. The divergence problem among various implementations of BASIC is not as great as one might think in the absence of a formal standard. Most compiler veterans do not operate in isolation . . . User organizations and marketing personnel provide major inputs to our work.

While it is true that the fast evolving BASIC language has produced various levels of implementation, compiler designers have not gone off in as many different directions as the article would lead an unsuspecting reader to believe. For the most part, enhancements and capabilities are sound and are receiving favorable recognition by increasing numbers of BASIC users.

WILLIAM JACKSON
Project Leader-BASIC Development
Honeywell Information Systems
Phoenix, Arizona

Bathroom humor

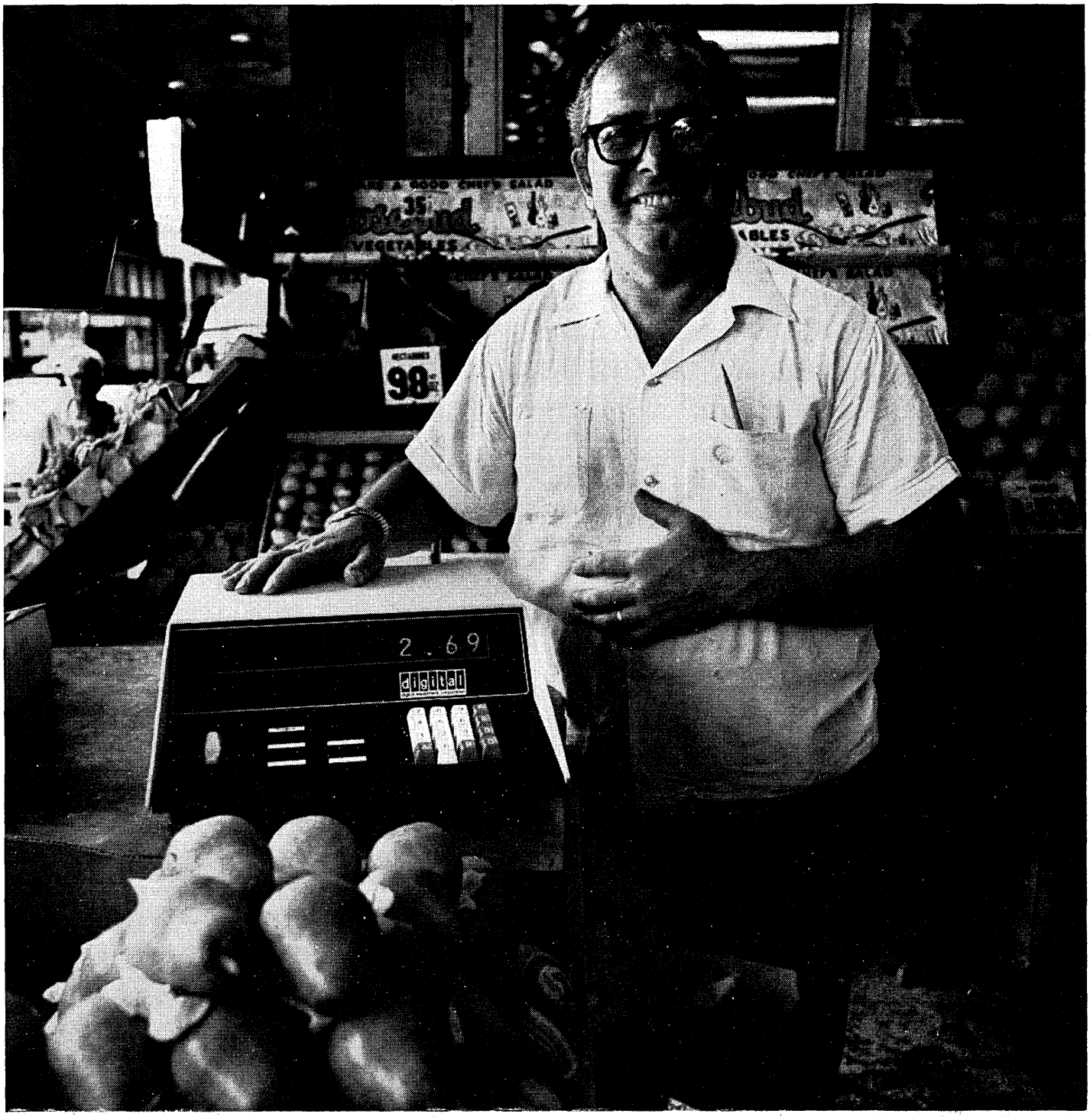
Sir:

The highlighted quotation, "Where documentation is lacking or is incomplete, the program itself must be considered to be defective," in the article by B. Menkus in the Sept. 15 issue (p. 30) struck a responsive chord with me. It deserves wide distribution, along with a statement in the same vein of a few years back by Frank Wagner that "If it isn't written down, it doesn't exist."

Although it is traditional, and with considerable justification, to decry the unwillingness of programmers to document their products, I don't believe the fault lies entirely with the programmers. It is a rare management indeed that will say to a programmer, "Your job for the next two weeks is to write, not for the machine, but for people." Managements too often share the view of neophyte programmers that the programming job is done with the first successful run on the computer.

I recently saw a cartoon clipped from a magazine which made the point vividly. Beneath a picture of an outhouse was the caption, "You haven't finished till you've done the paper work." It couldn't be said any better.

THOMAS G. SANBORN
Harbor City, California ■



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WATFOR... Speedy

THE WATFOR is a FORTRAN language compiler originally developed at the Univ. of Waterloo for use on an IBM 7040 computer. In 1967, the compiler was adapted for use on IBM 360-model computers.[1]

The primary purpose of this paper is to acquaint the general IBM 360 user with the value of employing WATFOR as a *time-saving debugging* procedure. FORTRAN examples will be presented to demonstrate that, for example, even though a program may compile "successfully," there still may be errors present in it. Usually, such errors detected by WATFOR, will probably not be detected by using, for instance, the DEBUG facility available in G.

Unlike many other computers, the IBM 360-model machines have several different FORTRAN compilers. These compilers are:

1. G
2. H
   a. Optimization 0 (H0)
   b. Optimization 1 (H1)
   c. Optimization 2 (H2).

In addition, computer facilities having IBM 360's installed often have the capability of processing FORTRAN jobs via the WATFOR compiler.

The G and H compilers are discussed in detail in the manual *IBM System/360 Operating System, FORTRAN IV (G and H) Programmer's Guide* (File No. S360-25, Form C28-6817-1). At present, there is no official publication which discusses the WATFOR compiler. Consequently, many 360 users are unaware of how WATFOR can be of assistance to them. In fact, all that many users seem to know about WATFOR is that it is "the compiler used by undergraduates who are taking introductory computer courses." Hopefully, this article will make 360 users more aware of what WATFOR has to offer them.

It is to be emphasized that all of the FORTRAN examples to be discussed in this paper are either (1) expressly forbidden by the 360 FORTRAN manual, and/or (2) bad programming practices. Nevertheless, users are often prone to incorporate these types of errors into their programs; in addition, it usually turns out that these types of errors are difficult to detect by conventional means. Also, what may not be valid in IBM 360 FORTRAN, may be perfectly acceptable in other versions of FORTRAN. Consequently, much of the material to be presented in this report has particular relevance for users who wish to adapt FORTRAN programs to the IBM 360 which have run successfully on other machines (e.g., CDC, PDP, or IBM models other than the 360).

Specifically, the examples which are presented below are intended to indicate to 360 users why the following may (and often *does*) happen:

1. A program compiles successfully but does not execute properly (e.g., gives numbers which are obviously incorrect);

2. A program compiles and executes successfully in H0 but not in H2 and/or H1;

3. A program executes successfully in G but does not execute at all in H.

1. Detailed information concerning WATFOR (and its newest version, WATFIV) may be obtained from:
Department of Applied Analysis and Computer Science
University of Waterloo
Waterloo, Ontario
Canada

Fortran Debugger

by Stan Siegel

The material to be presented here (prepared in cooperation with the Center for Computer and Information Services at Rutgers Univ.) is by no means all-inclusive. In fact, it is hoped that 360 users, once they are made aware of some of the vagaries of the various compilers (via WATFOR), will make known to other users through reports like this one, similar problems which they have encountered during the course of their work.

Consider the simple program[2] below (Example 1):

Example 1

```
      X = 3.14159
      X = X + Y
      WRITE (6,1)X,Y
1     FORMAT (10X, 'X = 'F10.5,1X, 'Y = 'F10.5)
      STOP
      END
```

The problem here, of course, is that the variable Y has not been defined. This program, in exactly the form shown above, was run under G,H(OPT=0,1, and 2), and WATFOR. Except for the run under WATFOR, the program compiled (no diagnostics) and executed. However, the results obtained were not the same, as is illustrated below:

```
G:  X =  3.14159        Y =   0.0000
H0: X =  3.14159        Y =  -0.0000
H1: X =  3.14159        Y =   0.0000
H2: X =  2.73313        Y =  -0.40846!
```

In the cases run under G, H0 and H1, the undefined variable Y is set to zero, as we might expect. However, in the case run under H2, Y contains garbage, with the result that X also contains garbage. Now, when this same program was run under WATFOR the following set of diagnostics was obtained:

```
***ERROR***  UV-0      Y
    PROGRAMME WAS EXECUTING LINE 2
      IN ROUTINE M/PROG WHEN TERMI-
      NATION OCCURRED.
```

In other words, in contrast to the G and H compilers which indicated no error at all, the WATFOR compiler informed the user that the variable Y is undefined (UV-0 Y) and, in addition, that this error occurs in line 2 of his program.

Now, of course, it could be claimed that Example 1 is so simple that anybody could have spotted the error without any help from the machine. True. But consider what troubles could arise should Example 1 be part of some long and complicated program or subroutine. How easy would it be to detect the error in that case?

Consider now the program in Example 2:

Example 2

```
      DIMENSION A(11)
      L = 10
```

2. Example 1, and Examples 2 and 3 which are given later, were tested on the Rutgers University IBM 360/67 during the summer and fall of 1969 under OS Release 16. These three examples were retested under OS Release 17 during the winter of 1969 and 1970 and yielded outputs identical to those obtained from the summer-fall runs. Example 4 was run in part on the Rutgers IBM 360/67 and in part on the Princeton IBM 360/91, also during the summer and fall of 1969. However, it is to be expected that the results of these examples are valid for 360 models other than the 67 which operate with the G and H compilers (e.g., 65 and 75).

```
      DO 1 I = 0,L
      A(I) = I
      WRITE(6,2)I,A(I)
2     FORMAT(10X, 'I = '13,1X, 'A(I) = 'F10.1)
1     CONTINUE
      STOP
      END
```

Strictly speaking, the zero in the range of the DO-loop in line 3 of Example 2 is not permitted in "standard" IBM FORTRAN (according to the manuals). That these statements are not strictly valid does not mean, of course, that the machine will inform the user that such is the case. In fact, such statements may work properly, as will be seen below. The point of discussing the problems which may arise from zeroes in DO-loops and zero-subscripts is that these statements *are* valid FORTRAN on other computers, such as the PDP. Consequently, users who receive programs which have run successfully on machines such as the PDP, but which they cannot get to run (properly) on the 360, should check for things such as those given in Example 2 as a possible source of their problems.

When Example 2 was run under the G, H1, and H2 compilers, the following output was obtained (without any diagnostics):

```
I = 0  A(I) =  0.0
I = 1  A(I) =  1.0
I = 2  A(I) =  2.0
   .
   .
   .
I = 10 A(I) = 10.0
```

That is, the cases I=0 and A(0) were apparently handled properly by the computer as well as the cases I=1-10 and A(1)-A(10), (see footnote 3).

What happened when Example 2 was run under the H OPT=0 compiler is, perhaps, somewhat more interesting. Under H0, Example 2 yielded the following output:

```
I = 0  A(I) =  0.0
```

That is, the DO-loop in line 3 was apparently executed only once. Somewhat more surprising (perhaps alarming) is that no error messages of any sort accompanied the above output. In fact, because of this absence of diagnostics, Example 2 was rerun under H0 in order to validate whether or not this result was spurious. The rerun yielded an identical output.

The following output resulted when Example 2 was run under WATFOR:

```
      1          DIMENSION A(11)
      2          L = 10
      3          DO 1 I = 0,L
**WARNING**    DO-5  NAMELY  0
      4          A(I) = I
      5          WRITE(6,2)I,A(I)
      6     2    FORMAT(10X, 'I =
                   'I3,1X, 'A(I) = 'F10.1)
      7     1    CONTINUE
      8          STOP
      9          END
        $ ENTRY
***ERROR***  SS-1
   SUBSCRIPT 1 OF A HAS THE VALUE 0
   PROGRAMME WAS EXECUTING LINE 4
      IN ROUTINE M/PROG WHEN
      TERMINATION OCCURRED.
```

The WARNING message after line 3 contains a limit, namely "zero," which, although it is a valid limit in WATFOR, *may* not be valid in other versions of FORTRAN. The ERROR message after the $ ENTRY explains to the user explicitly why his program did not run.

To further test the problem of zeroes in DO-loops, Example 2 was simplified to the following:

Example 3

```
      L = 10
      DO 1 I = 0,L
      WRITE(6,2)I
2     FORMAT(10X, 'I = 'I3)
1     CONTINUE
      STOP
      END
```

Under the G, H0, H1 and H2 compilers, Example 3 yielded the following expected output (and, again, no diagnostics):

```
I = 0
I = 1
.
.
.
I = 10
```

When Example 3 was run under WATFOR, it also yielded this same output. In addition, the WATFOR compiler printed the same WARNING message after line 2 as it did after line 3 in Example 2.

Since, from Examples 2 and 3, it is apparent that WATFOR permitted a zero as a *lower* limit in DO-loops, would the same thing hold true if the *upper* limit were zero too? For this purpose, line 1 in Example 3 was changed to

```
L = 0.
```

When Example 3 was rerun under WATFOR with this change, the same WARNING message appeared after line 3 as did before. However, when the program began to execute, the following ERROR message appeared:

```
***ERROR***  DO-7
   PROGRAMME WAS EXECUTING LINE 2
      IN ROUTINE M/PROG WHEN
      TERMINATION OCCURRED.
```

The DO-7 message indicates that the range of the DO in line 2 has been exceeded. In other words, the WATFOR compiler probably handles properly statements like

```
DO 1 I = LMIN,LMAX
```

as long as $0 \leq LMIN \leq LMAX$ and $LMAX > 0$. As far as the G and H compilers are concerned, it is preferable to restrict *both* LMIN and LMAX to integers greater than zero.

As a final example of the usefulness of WATFOR as a time-saving debugging procedure, consider some of the problems which may arise when working with nested DO-loops. As a start, consider the following:

Example 4A

```
DO 1 I = 1,10
```

3. It is to be emphasized that the fact that Example 2 apparently executed correctly under G, H1, and H2 is no guarantee that such a sequence of statements would be executed properly were they part of some more complicated program.

```
      DO 1 J = 1,10
      .
      .
      .
    1 CONTINUE
```

Of course, this sequence of statements is an acceptable way to nest DO-loops in FORTRAN. However, for reasons which will become clear below, it is perhaps more desirable to rewrite Example 4A as follows:

Example 4B

```
      DO 1 I = 1,10
      DO 2 J = 1,10
      .
      .
      .
    2 CONTINUE
    1 CONTINUE
```

Suppose, for example, that the sequence of statements which appears in Example 4A is part of some complex and lengthy program; suppose further that the two DO 1 statements are separated from one another by many other statements, so many in fact that the programmer may forget that he has two DO-loops which terminate at the same CONTINUE statement. Finally, suppose that the programmer has decided to revise this program, and suppose that some of these revisions involve statements which are situated between the (presumably long-forgotten) DO 1 statements. To be specific, consider the following program:

Example 4C

```
      DIMENSION X(20)                    1
      DO 1 I = 1,10                      2
      WRITE(6,11)I                       3
   11 FORMAT(10X,'I = 'I3)               4
      IF(I.EQ.3)GO TO 1                  5
      X(I) = I                           6
      WRITE(6,100)X(I)                   7
  100 FORMAT(10X,'X(I) = 'F5.0)          8
      DO 1 J = 1,10                      9
      WRITE(6,2)J                       10
    2 FORMAT(10X,'J = 'I3)              11
    1 CONTINUE                          12
      STOP                              13
      END                               14
```

In lines 2 and 9 of Example 4C there appear DO 1 statements while in line 5 there is a branch to 1 when I=3. Strictly speaking, this branch is illegal since it is a branch from outside the DO 1 in line 9 to inside this DO at line 12. Also, the IBM manuals explicitly declare the branch illustrated in Example 4C to be illegal. However, when Example 4C was run under the G compiler and each of the three H compilers, the following output, without any error messages, was obtained with all four runs:

```
I = 1
X(I) = 1.
J = 1
J = 2
.
.
.
J = 10
I = 2
X(I) = 2.
J = 1
J = 2
.
.
.
J = 10
I = 3
I = 4
X(I) = 4.
J = 1
J = 2
.
.
.
J = 10
I = 5
.
.
.
J = 10
```

When Example 4C was run under WATFOR, the program did not execute, and a DO-1 ERROR message appeared after line 12 which indicated to the

"I'd have more confidence in its impartiality if it didn't keep recommending computer stocks."

user the source of the problem.

Now, to illustrate graphically how nested DO-loops like those in Example 4C can cause quite a lot of trouble, consider Example 4D below. Example 4D is taken verbatim from an actual subroutine (call it SUBX) which has the following interesting history:

1. When used in conjunction with many different main programs many different times on the IBM 7040, SUBX worked properly;

2. When used in conjunction with many different main programs many different times (mostly under H OPT=2) on the 360/67, SUBX worked properly;

3. Recently, when used in conjunction with another main program run under H OPT=1, an OC5 completion code appeared in the output, and the program did not execute; when this program was rerun under H OPT=0, the program again did not execute and an OC5 message again appeared; finally, when this same program was run under G (with DEBUG SUBCHK to locate the source of the OC5), it ran to completion without any error messages! Since the G compiler obviously could not furnish the solution to the OC5 problem, the program was once again run under H OPT=0 with a request for a LIST and a COREDUMP. With this information, it was possible to trace the source of the problem to somewhere in SUBX. However, even with this information, the particular statements in SUBX which were causing the problem could not be pinpointed.

Before continuing with the intriguing history of SUBX, it is perhaps appropriate at this point to reproduce that part of SUBX which the COREDUMP had indicated was causing the problem:

Example 4D

```
      DO 160 LA1P = LP                          1
      LA1 = LA1P--1                             2
      LA2 = L-LA1                               3
      JW = L1-LA1                               4
      JX = L2-LA2                               5
      JY = IABS(JW)                             6
      J7 = IABS(JX)                             7
      KMINP = MAXO(JY,J7)+1                     8
      IF(NRSUBN)155,153,155                     9
153   KV = KMINP/2                             10
      IF(KV+KV-KMINP)
        155,160,160                            11
155   JB1LA1 = L1+LA1                          12
      JB2LA2 = L2+LA2                          13
      KMAXP = MINO
        (JB1LA1,JB2LA2)+1                      14
      NU1 = NLF1-LA1                           15
      NU2 = NLF2-LA2                           16
      DO160 KP = KMINP,KMAXP,2                 17
      K = KP-1                                 18
      CALL GEOMET(P,FL,LT2S,LP,
        JB1B2,JB1MB2,JB1LA1,                   19
    1 JB2LA2,JW,JX,JB1T2S,
        JB2T2S,K,KP)                           20
      CALL COMBIN(R,NU1,NU2,
        NRN,B,K,KP,FL,NR,N)                    21
      OBP = OBP+P*R                            22
160   CONTINUE                                 23
      GO TO 210                                24
```

A close scrutiny of Example 4D reveals that the DO-loops in line 1 and line 17 both end at line 23. Even closer scrutiny of Example 4D shows that the branch to 160 in line 11 is illegal (cf. Example 4C). (In passing, it should be mentioned that SUBX in the problem under discussion here was part of a 2,000 card deck.) Once this illegal branch was discovered (thanks to WATFOR), the source of the OC5 generated by the H0 and H1 compilers was finally pinpointed. It turned out that because of the illegal branch in line 11, the locations JB1LA1 and JB2LA2 in lines 12 and 13 contained garbage. These garbaged variables were in turn transmitted to the subroutine GEOMET (lines 19 and 20). In GEOMET, JB1LA1 and JB2LA2 were used to compute a subscript of a dimensioned variable. This subscript turned out to be a very large number because of the garbage which was in JB1LA1 and JB2LA2. Since the subscript of a dimensioned variable had been exceeded (in GEOMET), an OC5 error message thus resulted.

The rest of the history of SUBX goes as follows (with, for a change, a happy ending!):

4. Since the COREDUMP mentioned in 3 above could not pinpoint the source of the OC5, it was decided to run the program through WATFOR at Princeton (which, at that time, had just become available to Rutgers users); see footnote 4. This procedure finally uncovered the reason for the OC5, namely the improper branch to 160 in line 11.

5. Once the error was discovered, it was corrected by inserting a

```
159 CONTINUE
```

between lines 22 and 23, and line 17 was changed to

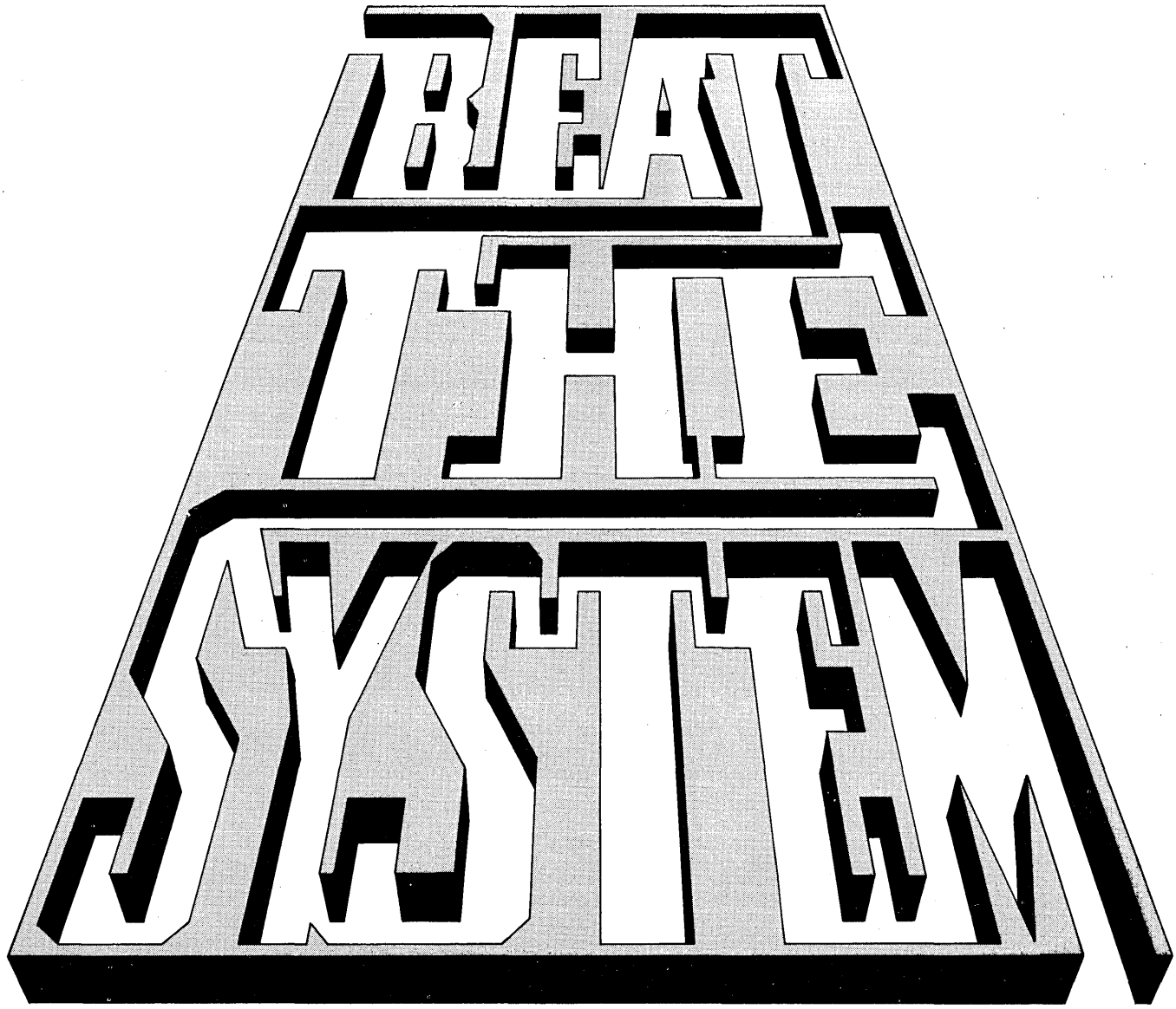
```
DO159KP=KMINP, KMAXP, 2
```

With these changes, the program was rerun under H OPT=0. This time, the program ran to completion and *yielded the same numbers as had the run under the G compiler before these changes had been made.*

In summary, the sequence of events embodied in Examples 4A-4D should be sufficient documentation for: (1) Avoiding any FORTRAN statements which the IBM manuals even *imply* may be incorrect (even though these statements may appear to work under certain circumstances), and (2) using WATFOR for time-saving debugging. Similar remarks obtain for Examples 1, 2, and 3. ■

Dr. Siegel is currently working in the Analysis & Programming Branch, Computer Division, National Oceanic and Atmospheric Administration in Suitland, Maryland. He holds AB, MS, and PhD degrees in physics from Rutgers Univ., where he was a teaching assistant and research fellow. He has also studied at Hebrew Univ., Jerusalem, Israel.

4. The size of the 2000 card program made it too large to run under WATFOR at Rutgers.



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Management is less likely to overlook MIS if it can see the information

Display Systems

by A. Kenneth Showalter

As our knowledge of what an MIS consists of continues to grow and new systems are developed and refined, the existence of several generic subsystems that support the MIS has become evident. One of the most important of these subsystems is the Management Information Display System or MIDS. The MIDS is the primary vehicle of information transfer to management. It is through the various media of the MIDS such as crt's, TV, and micrographics, that managers gather intelligence, digest information and communicate ideas so necessary to the decision making process.

Much was promised and expected for MIS development in the past ten years. Indeed we have seen many significant developments. On the other hand, almost no senior managers and very few middle managers are using an MIS in direct support of their management function. Certainly they are utilizing computers in many valuable ways to support their operations and in some cases depend almost exclusively on data processing to handle certain functions. However, simply using or having a computer is not to have an MIS. Even a manager in an organization that has designed and implemented information systems finds there is still a lot that he would like to know left out of the reports he sees and a lot more put in than he could possibly digest. Development of new techniques for MIDS will be necessary before it can provide truly effective support to the MIS.

Most of the major display system developments in the past decade have grown out of government research and applications. Many different approaches were tried and abandoned and then tried again. Some, like the light gun and crt console developed for the SAGE system, set a standard for industry development and commercial use. Others such as the ill-fated 473L Large Screen Color Display were dropped as being too complicated and expensive even for the military. Probably one of the most successful display systems—which has been seen by nearly the whole world—is at NASA Mission Control at Houston, which has the highest concentration of display equipment at any one site. (Fig. 1.)

Many managers have been misled into believing that all displays are pretty much the same and only the information to be displayed was important, it being just a matter of what speed and sophistication you wanted that determined the cost and utility. Somehow, around the corner, what you really needed was the on-line, color, dynamic, large screen, etc., display that would really solve all your problems. We now know better, and many organizations have come to realize the hard way how to best take advantage of display technology.

DISPLAYS IN MISSION CONTROL	
140	Command Control
350	TV Group Displays
7	Large Screen CRT Projectors
10	X-Y Plotting Boards
16	Multi-Channel Chart Recorders
20,000	Event Indicators
6	Hard Copy CRT Printers

Fig. 1.

As our MIS experience has grown and theories of management information have developed, it has been recognized that the MIS must support all levels of management, not just the top, and that each level has different information needs for detail, volume, and

timing. Many system designers and planners have also come to realize that in order to best serve these distinct requirements and levels some display types are more suitable to one level than another. In the following table (Fig. 2) an attempt is made to relate appropriate display types to Anthony's management hierarchy and point out the types of displays, timing and frequency for creating the displays, corresponding examples of displays, etc., for the various management levels.

These categories are not necessarily mutually exclusive; rather they represent the pattern of use now and in the near future. As the software and hardware improve there will be greater cross-utilization of various types of displays by top and middle managers, and new, more appropriate displays will be developed. Managers at lower levels will, however, seldom use a higher level display. Executive furniture will probably then give way to the display as a status symbol.

When one thinks of a display he commonly thinks of some sort of computer driven device. True, it has that connotation; however, most top level managers currently are not using computer driven or, in most cases, even computer derived displays. What they have been using and what they will continue to use in the near future are audio visual techniques as well as oral and typed or printed reports.

1. *Audio-visual displays.* Audio-visual techniques have been perfected to a high art over the past 20 years. Almost any concept can be conveyed or portrayed through the use of slides, filmstrips, films and the ever present flip chart. Anyone can be his own AV man—all he needs is a typewriter, a copy machine, and an overhead projector and he is in business. At the other extreme, for $200,000 or more you can have an EXPO-67 type multiple screen, multi-film simultaneous "happening" boardroom, or an annual show to project your corporate image at your sales or stockholders meeting. All types of AV techniques are used in some fashion to present information, data, ideas, and concepts to management. The most sophisticated systems in use today for the presentation of management information use two or more addressable random access slide projectors with fade and dissolve capability and several screens. (Fig. 3.) Employing this type of equipment in conjunction with additive graphics techniques which gradually built up information on a slide—e.g., first slide showing January sales, second slide January and February, third slide January, February, March, etc.—a highly condensed, high information content presentation can be put on clearly and succinctly. One firm using this approach reduced its an ual budget review from three days to one-half day.

At present audio-visuals play the most important role in management communications. However, the time is near when they can only function effectively and keep up with the volume and flow of information by utilizing computer control and computer support.

2. *Teleprinters and printouts.* Most of the output from our line printers has been very low level, high detail *data* and not *information* of use to management for decision making. In cases where there is a need for detail or several copies of the same report, and the timeliness[1] and accuracy of the information base is maintained, a print run may prove useful.

Teleprinters are useful mainly at the operating level for "one liners"—brief items of information, limited input and output (the most commonly used teleprinter taking roughly 5 minutes to print a full page).

3. *Plotters.* An on-line or remote pen plotter can be very useful for problem solving output where the time requirements are not crucial (an average plot taking several minutes).

4. *CRT displays.* It is useful to divide crt's into two classes: alphanumeric only and graphic crt's having a line drawing capability. Alphanumeric displays can be used for some straight-line charts, e.g. histograms, but for the most part are used only in a textual or tabular mode. The graphic display with a light pen or tablet is by far the most versatile display now currently available, though more costly than alphanumeric displays. They have been used in several instances to

[1]Any item of information has what may be called "half life" in that its value to a decision maker diminishes rapidly as a function of time.

Management Levels	Time And Frequency	Examples	Display Types	Nature
Planning Board President Vice President Comptroller	Five Year Plan Annual Quarterly Monthly	Quarterly Earning Gross Obligations Net Profit	Slides Charts Large Screen Displays Micrographics	Predetermined Formats Summary Information Audience: Group
Management Control Division Head Operations Res. Analyst System Analyst	Monthly Bi-Weekly Weekly Daily	Forecasting Scheduling Simulation Modeling Budget Prep. Project Selection	Graphic CRT's Light Pen Rand Tablet Pen Plots Micrographics	Flexible Format Interactive Exception Reporting Audience: 1-3
Operating Control Foreman Broker Prod. Controller	Daily Hourly Minute-Minute	Stock Quotes Inventory Control Acct. Status Bank Balance Info. Retrieval	A/N CRT's Teleprinters Printouts Facsimile	Predetermined Formats Detailed Information One Liners Audience: Individual

Fig. 2. Hierarchy of Management Information Displays.

support an interactive decision making mode. Most current MIDS developments are taking place in this area, supporting management/science type projects.

Recently several terminal manufacturers have begun to offer digital television (DTV) displays. Their primary incentive was to develop a low cost alpha-

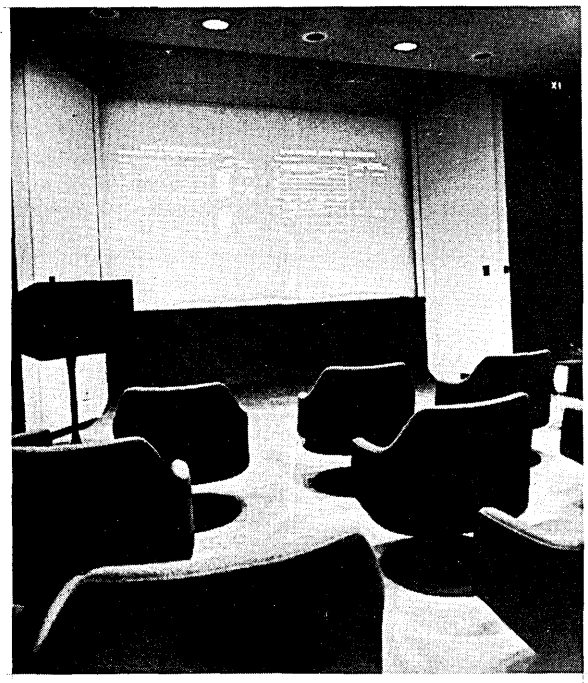

Fig. 3. One of the three control rooms of the new management communications center of the First National Bank of Chicago is shown here with its dual image screen.

numeric display capable of displaying characters and TV images as well. The displays are in most cases a standard TV monitor or set with a low cost electronics package and character generator added. (A versatile system can be built up using DTV components such as those built by Data Disc, which offers a video disc, 4000-character terminals, high resolution TV compatability, etc.) It is both easy and economic to assemble a video time-sharing system using DVT as the integrating factor. Such a system can handle digital data, live, color, and still TV, EVR, televised microforms and videostores as well. Certainly this approach is one of the most attractive available to the MIDS designer.

5. *Large screen displays.*[2] There are many types of large screen computer displays commercially available but few in use outside of government. For the most part they are special order, high cost systems with little in the way of generalized software support. Representative of those that have seen at least partial success are crt to film projection systems, crt projection systems, and slide scribing systems. Most of these systems can quickly produce a large screen B&W or color display under computer control but they lack versatility or have drawbacks of one sort or another, such as limited or no display storage and retrieval, or they require a darkened room for viewing. Much has been done and is being done to perfect these systems and, depending on one's requirements, they may be acceptable but only after a detailed and careful evaluation and justification. Those organizations that have installed LSD's are doing so in the same spirit of faith prevalent in early computer installations.

Probably the most sophisticated MIDS installation to date has been made by Boeing in Seattle and they installed an identical configuration for the Air Force SRAM Project Office at Wright Patterson AFB. The system has a hierarchical capability, a large screen display for project management meetings, and a graphic crt for the project staff. A Teletype I/O and hard copy generator are also available.

Several military installations are using slide scribing systems and at least two large New York banks are planning to install Kollsman Instruments' Delphic scribing projector, which has a color capability.

Computer micrographics

The most efficient computer output devices for alphanumeric listings have proven to be COM systems. They are now on the verge of becoming as significant for management reports as well. Several COM systems offer a graphic plotting capability which is being increasingly used for management graphics rather than just for the scientific plotting for which it was primarily designed. Computer micrographics systems can produce 35mm slides, 16mm film, aperture cards, and microfiche in seconds. The FR-80 of Information International also offers color which is almost a necessity for management graphics.

Several software routines have been developed for converting the output from other computer devices to COM output directly, e.g. a 2250 crt display to a Stromberg DatagriphiX 4060 COM system. These graphic COM systems can handle almost any type of output required by management and are currently the most attractive and economical option available for MIDS support.

By far the most glamorous, the most attention getting, the most talked about, and for many the least useful temple for management display is the management information center, management communication center, etc. It is here that many corporations have focused their attention and it is here that it has been most difficult to implement computer displays.

There are several reasons for the difficulties encountered: lack of defined requirements, lack of experience by both system designers and managers, inadequacy of the software and hardware, etc. Lack of experience is the most important of these factors and perhaps the only way to gain the necessary experience is through painful trial and error. With costs being what they are, few are encouraged to try. Several organizations are designing interim systems having various levels of sophistication but they are not locked into any particular concept or large hardware investment. The key word for these developments is evolution rather than revolution.

Most, it not all, of these large boardroom type environments are now using sophisticated audio-visuals and in some cases closed circuit TV. One such system has been installed at the First National Bank of Chicago.

[2] A Large Screen Display is normally 30" X 40" or greater, 30" being the largest CRT available; more importantly, the LSD is aimed at a group.

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The systems staff at First National and the designers of the facilities, Information Management International, have carefully tailored the installation to existing requirements but have also built in the capability for the later addition of various types of computer display. Several alphanumeric crt's now are in use, including units for the office of the senior vice president and the chairman of the board. (Fig. 3.) There are also TV monitors in the chairman's office that are linked by closed circuit to the management

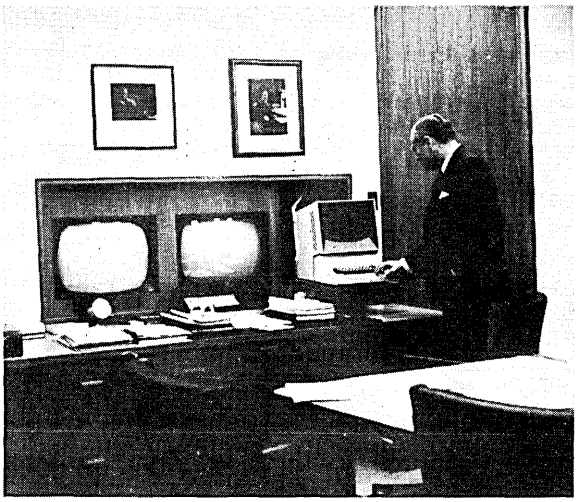


Fig. 4. Dual image terminals are shown in the office of chairman Gaylord A. Freeman, Jr., of the First National Bank of Chicago.

communication center for remote viewing of information displayed there. A similar system including closed circuit TV links from the conference rooms to the executive offices has been installed by Owens-Corning Fiberglas Corporation in Toledo, Ohio.

The trend in these rooms is definitely toward the most advanced in AV systems with closed circuit TV in some cases and, more rarely, computer generated or computer derived slides made from a printout or plot.

MIDS configuration

In designing a MIDS it should be kept in mind that several types of users must be served (see Fig. 2). It is self-defeating and extremely expensive to tailor each display application to just one level. If a familiar relationship among displays is adhered to from the beginning, far more effective use can be made of all of the systems involved, and the integration and modification of new systems will be much easier.

Much of our early trial and error with various bits and pieces of display systems is now beginning to fit together. However, much more needs to be known about how well we can satisfy a manager's needs. More important, how do we stimulate and facilitate new requirements and requests to support his decision and planning functions.

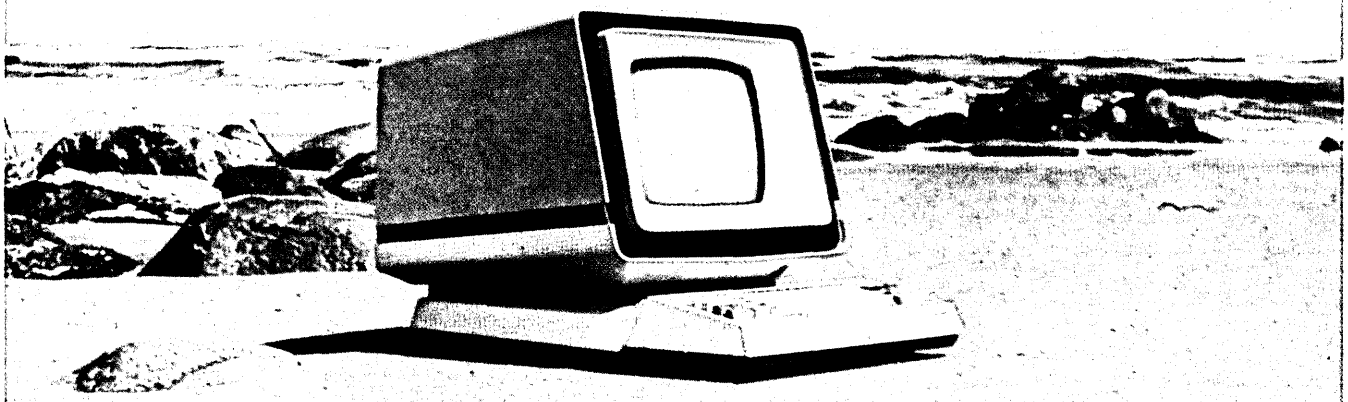
Since 1967, IBM at corporate headquarters in Armonk has been developing an evolutionary MIDS to support their senior managers. Their efforts have focused on the development of a corporate headquarters information center. The designers of the center have recognized management's multiple needs for various information media, computerized and non-computerized. They have also recognized the need for a hierarchy of sophistication in the types of equipment and the skills needed to use them. To access their MIDS, a manager needs only to turn on a TV monitor switch and talk through an intercom to the information center. The center provides a man in the loop—at least initially—in this case an information specialist, who helps the manager define his request and then arranges to provide the information needed. Many different devices and media are used in the center. The primary display at the manager's end is a TV monitor. The information specialist, through the monitor, can provide the manager access by sending a TV picture of the appropriate display device.

Television is used as the least common denominator. No matter what technique or device is used to obtain the information it can be displayed on the TV monitor by converting it to a TV compatible signal. Devices available in the center are an alphanumeric crt, a graphic crt, a microfiche reader, a 16mm projector, videotape recorder, hard copy generator, etc., all of which can be used to display information on the monitor.

More and more organizations are finding it necessary to experiment in order to build a MIDS to their needs and to learn how to use it effectively. The Boeing Corporation and First National Bank of Chicago are among the handful presently using these systems. A few years ago the Naval Materiel Command installed a very sophisticated display system which had been originally designed for command and control to test its potential in supporting an MIS environment. The system had computer graphics capability for creating B&W or color microforms in a minute or two, it had several large screen displays, closed circuit TV, hard copy, random access information retrieval, etc. This MIDS system was well received by some managers and most system types. However, it proved to be too much too soon for its intended environment and was subsequently sent back to a laboratory for further research.

Much has been learned from all of these efforts and they give good indications as to how a MIDS can be configured and what will and won't work. As successful MIS systems are implemented it is certain that the MIDS will play an important role. ■

Mr. Showalter is with the Information Systems Program of the Office of Naval Research, where he is responsible for various research programs in MIS, displays, and information retrieval. He has spent five years working on various aspects of MIS, including the development of a prototype MIDS while at the Naval Materiel Command. He is the author of several papers on aspects of information science.



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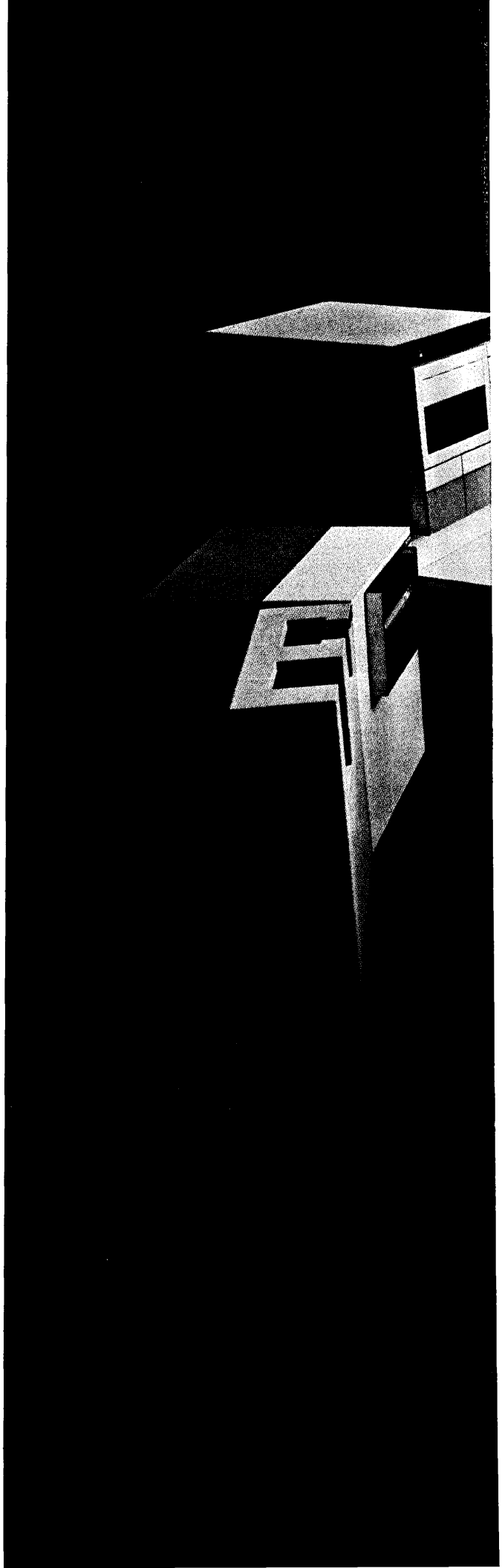

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A philosophical essay
on the plausibility
of dividing by zero

The Fallacy in the Fallacy

by Jeryl W. Lafon

It happens to virtually all computer programmers. If it has not yet happened to you, the odds dictate that someday it will. Your program has been running smoothly for weeks, months, maybe even years. But suddenly one day, out pops a tell-tale message on the console typewriter: ZERO DIVISOR!

Have you ever noticed, when the console type-out results from a limitation in the hardware or software, the message comes out in the form of some obscure code, like "ERR NO. X-15-P2A"? (When you look up the meaning of Error No. X-15-P2A, it probably says something like "UNDERFLOW EXCEEDS FIXED-POINT BOUND IN MIDDLE CURTATE OF REGISTER Q," which is a deliberately ambiguous way of admitting that Register Q is not adequate to handle numbers beyond the range of ±999. But when the message results from some microscopic oversight on the part of the programmer, the message comes out in plain English—DIVISION BY ZERO—so that all of the computer operators will know you goofed. ("Old Berkenheimer has been dividing by zero again—har, har, har!")

If you are lucky, the software has been designed to ignore the zero divisor and give you a correct answer in spite of the error message. If you are not lucky, you will have to modify your program to test for a zero divisor, and branch around the offending instruction in case the zero divisor occurs.

My question is, how much longer do we intend to put up with this indignity? Since it might be asking a bit much of the compiler writers, software experts, and hardware designers to handle such problems automatically, I am formally prepared to advance a plucky new hypothesis that could do away with this zero-divisor nonsense forever.

The mathematicians assure us that division by zero is not permitted. The mathematicians say (and not without cause) that when we divide by zero, mysterious things happen. Examples they are fond of using to illustrate the problem frequently start out by asking the student to assume that $x = y$. From this, a series of apparently innocent equations are developed (e.g., $x^2 = xy$, or $x^3 = y^3$), which end up by offering seemingly incontrovertible proof that $2 = 1$ (or similar anomaly). After the student has been given time to ponder the enigma, the mathematicians will explain that the fallacy lies in some step where both members of the equation were surreptitiously divided by $x - y$, which must be zero since x and y are equal.

But it seems to me that there is a fallacy in the fallacy. (One of my computer associates, Mr. L. Eisenzimmer, refers to this as a *nested* fallacy.) Granted that the mathematicians have been operating under this premise for quite a while now, I nevertheless resent being told that I am not *permitted* to divide by zero, on such tenuous grounds as displayed in the usual examples. Therefore, I will attempt to show that dividing by zero is logical, desirable, and practical.

In order to clarify the ensuing discussion, I am introducing a new word to describe such concepts as *zero* and *nothing*. The word is *pragmadox*. A pragmadox (*pragmatic* + *paradox*) is defined as a concept which is inherently meaningless or self-contradictory, but which nevertheless has practical application. Imaginary numbers (e.g., the square root of -1) and geometrical points are classical examples of a pragmadox. Geometrical points, for instance, have been defined as locations in space, without size or shape. Now if a point has no dimensions, it cannot

be properly said to exist, except as a figment of the imagination. But without such concepts we could never have reached the moon.

The word *nothing* is another example of a pragmadox. *Nothing* can only be defined with respect to *something*—i. e., as the opposite of something, the absence of something, or as that which does not exist. Yet even *nothing* must seemingly be *something*, in order to be an "opposite" or a "that which." As the poet Wallace Stevens once put it, "There is not nothing; no, no, never nothing." Well, maybe there isn't and maybe there is. But in either case, we definitely need the concept.

Okay. If we select a quantity, x, and refuse to divide it by anything, the quantity (I think any competent mathematician will agree) remains the same. In slightly more mathematical terms,

$$x \text{ (not divided by anything)} = x$$
$$\text{—or—}$$
$$x \text{ (divided by nothing)} = x$$
$$\text{—or—}$$
$$\frac{x}{\quad} = x$$

Now if *zero* may be considered to be the mathematical equivalent of *nothing*, I see no great harm in expressing the foregoing bit of philosophy in an equation of the form, $x/0 = x$. But here, some mathematician will pounce gleefully on the fact that $x/1$ (is also) $= x$, and will accuse me of saying, in effect, that zero equals 1. (These mathematicians really know how to hurt a guy.) Well, in a peculiar sort of way, that may be exactly what I *am* saying—as I will attempt to demonstrate in a moment.

First, however, let's examine the problem from a slightly different angle. When we divide a number, x, into another number, y, we are trying to determine the minimum number of x's contained in y, without exceeding the value of y. If the numerator, y, happens to be zero, and the denominator happens to be 2, we are asking how many pairs of units are needed to equal zero. And the answer, of course, is *no* pairs. We need a total absence of units, and the answer is therefore zero. Conversely, when we divide a positive number by zero, we are asking how many non-units are needed in order to equal or closely approximate a given number of units. But it seems intuitively obvious that if Dick had no apples, Jane had no apples, and Spot had no apples—in fact, if everybody in the universe had no apples and pooled them all together—there still wouldn't be enough non-apples to make even one tiny fraction of a real apple. The answer, therefore, is *no* amount of non-apples (or non-units or zeroes). Thus the true quotient of $x/0$ is zero.

This answer may come as a shock to some readers. Being conditioned to the idea that the smaller the divisor the larger the quotient, such readers might suppose the quotient of $x/0$ to be of infinite magnitude—which is, in fact, what the calculus textbooks attempt to teach. But as will be seen later, this is true only under limited conditions—one of which is that the dividend, x, also be of infinite magnitude.

Readers who are familiar with the surface of the Moebius strip (or the shape of Klein's bottle) shouldn't have too much difficulty in grasping the reasons underlying my theory that the quotient of $x/0 = 0$. (In fact, anyone who finishes reading the article may find that his mind has been bent into approximately the same shape.) The average computer programmer may find the idea easier to grasp if he associates it mentally with a wrap-around computer memory. And, for my mathematician friend, I will express the concept symbolically as follows:

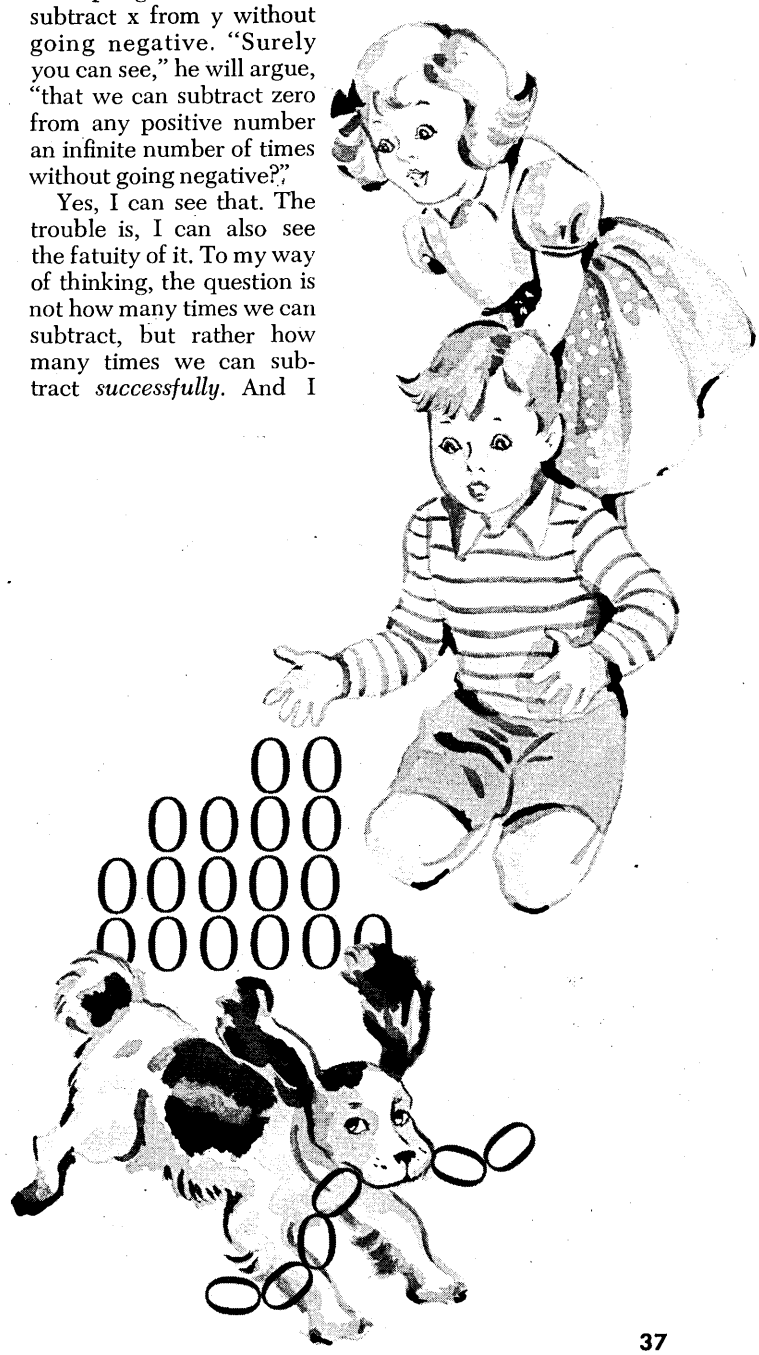
WRAP-AROUND INFINITY
(Also courtesy of Mr. L. Eisenzimmer)

$$\left|\frac{x}{a}\right| \longrightarrow \infty \text{ as } a \longrightarrow 0$$

$$\frac{x}{a} = 0 \text{ when } a = 0$$

But there is still a third way of approaching the problem of $x/0$, and I'm sure my mathematician won't overlook it. He may wish to interject, at this point, that when we divide x into y we are actually attempting to determine how many times we can subtract x from y without going negative. "Surely you can see," he will argue, "that we can subtract zero from any positive number an infinite number of times without going negative?"

Yes, I can see that. The trouble is, I can also see the fatuity of it. To my way of thinking, the question is not how many times we can subtract, but rather how many times we can subtract *successfully*. And I



submit that we do not add or subtract successfully unless we succeed in increasing or decreasing the original quantity. For example, when we add 5 to zero we have done something meaningful, because we have altered the original amount. But if we attempt to add zero to 5, we accomplish nothing. (We can alleviate the embarrassment of this dilemma by saying that we are adding zero *and* 5, rather than zero *to* 5.) The mathematician, however, adds zero to 5 with a flourish, smacks his lips in satisfaction, and deludes himself that he has obtained a constructive result. In actuality, he has merely gone through an exercise in futility, and obtained an *inevitable* result. If he has done anything constructive at all, it is to demonstrate the utter impossibility of adding zero to *anything*. Therefore, although we subtract zero from *x* an infinite number of times, we subtract successfully exactly *zero* times (the true quotient).

If my mathematician is still around, he will probably want to ask me how I propose to reconcile my original proposition ($x/0 = x$) with the statement I just made ($x/0 = 0$). In order to bridge this seemingly impossible chasm, I must touch briefly on a subject which has gone too-long neglected—namely, the relativity of numbers. Obviously, numbers *are* relative, and the usual practice is to define them as either positive or negative with respect to zero. But we showed earlier that the word *nothing* can only be defined with respect to *something*, and the same is true here—i.e., zero itself can only be defined with respect to some other number (or numbers). If our hypothesis is correct that the true quotient of x/0 is zero, then the immediate problem is to isolate the *relative* value of zero on the imaginary mathematical scale (Cartesian horizontal axis). Since we know that zero lies exactly halfway between +n and −n, we can express the relative quotient of n/0 by the following equation:

$$\left(\frac{n}{0}\right)_R = \frac{n-(-n)}{2} = \frac{n+n}{2} = \frac{2n}{2} = \tilde{n} \qquad [1]$$

In other words, by halving the difference between +n and −n, we have found that the relative quotient of n/0 is a neutral *n*—i.e., it lies *n* units in a negative direction from +n, and *n* units in a positive direction from −n. (I have stressed the neutrality of *n* in this case by using the Spanish letter, ñ, which is doubly appropriate because the neutral *n* was discovered in New Mexico.) The practical application of this pragmadox is manifested in the fact that it satisfies the mathematician's craving for a unique result—i.e., it is not the same *n* that we would have obtained if we had divided *n* by 1 instead of by zero.

But my mathematician loves consistent results as well as unique results, and he won't overlook the apparent fact that my answer still doesn't check. He will be quick to point out that if my neutral *n* had a value, say, of 5, then 5 zeroes wouldn't make 5, and zero fives wouldn't make 5 either. Well, I absolutely agree that zero fives wouldn't make five, but I'm not so sure about the first proposition. If we start out with *one* zero, then multiply that zero by 5, it seems fairly reasonable to me that we should end up with *five* zeroes. In fact, I am gripped by an urge to place a string of five zeroes right here on the printed page, then ask my mathematician to count them for himself and *see* if they don't add up to 5. His immediate response, naturally, would be: "Ah, but that is mere word-trickery. You are treating zeroes as if they were units, which isn't cricket at all." (Back to the old 0 = 1 pragmadox.)

Very well. For the time being, I'm prepared to let my mathematician have his way. We will treat zeroes strictly as non-units, and we will assume that there is no distinction in magnitude between 1 non-unit and 5 non-units. (To do otherwise would be to equate non-units with negative numbers.) Under these restrictions, I confess that my answer doesn't check. I can only say, by way of defense, that when my mathematician has a value, x, and doesn't divide it by anything (i.e., divides it by nothing), he is left with a value of x. And if then he divides that x by 1, he is *still* left with a value of x. But do *I* run around accusing *him* of saying that 1 is equal to *nothing*?!? It would seem that my neutral x, as a quotient for x/0, is valid for all practical purposes, since it is basically the same answer that my mathematician gets when he *doesn't* divide x by zero.

In any case, if x is the relative quotient of x/0, the true quotient may be expressed by taking the algebraic sum of +x and −x, then dividing by 2 in order to obtain the average:

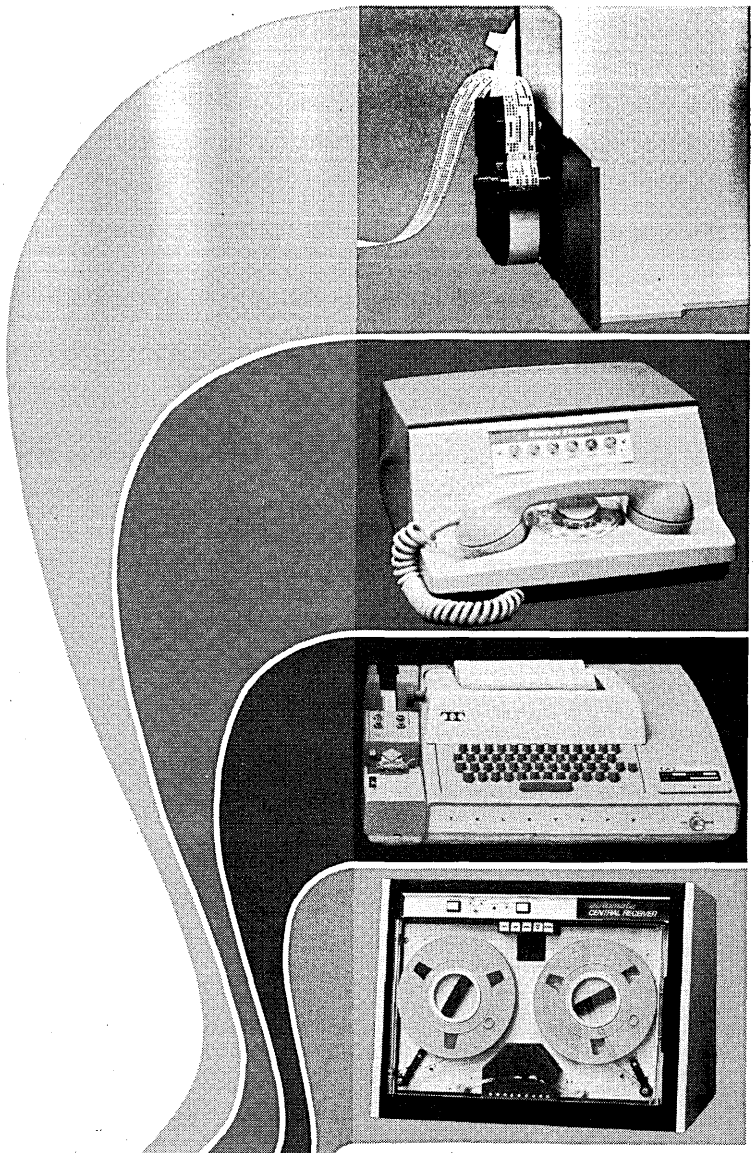
$$\left(\frac{x}{0}\right)_T = \frac{x+(-x)}{2} = \frac{x-x}{2} = \frac{0}{2} = 0 \qquad [2]$$

But here again my mathematician will attempt to pounce, tearing his hair and screaming that, in the first place, x/0 (can't be) = 0, because 0/x (is also) =0, and in the second place, how can x/0 be equal to x and zero at the same time (why don't I make up my mind, etc.), and in the third place, even if five zeroes do add up to 5, *zero* zeroes certainly wouldn't, because zero times *zero* is ZERO! (You know how these mathematicians always get in a lather about everything.)

Okay. In spite of the fact that this particular mathematician has been harrassing me ever since I began the article, I've grown somewhat attached to him. I think he is a good fellow at heart, and it gives me no great pleasure to stick another pin in his balloon. But I must gently point out that zero times zero, at least from a semantic point of view, does *not* equal zero. When we say that we have zero zeroes, we are actually saying that we have *no non-units*. And an absence of non-units implies the presence of an indefinite number of units. (In this case, my answer doesn't exactly check, but it doesn't exactly *not* check, either.)

My mathematician is not going to be happy about this at all. But please remember that we agreed to play the game according to his own rules. It was he who insisted that we treat zeroes as non-units. In fact, I think this conclusively proves that it is the mathematician who has furtively been treating zeroes as units.

And at long last we have reached the crux of the matter. The old nitty-gritty. The fallacy in the fallacy. Mathematicians have, for lo these many years, been harboring a mental image of zero as a non-unit, while simultaneously attempting to treat it as though it were a unit—a neutral unit, to be sure, but nevertheless as a unit. Well, we pays our nickel and we takes our choice. We are free to regard zero as a kind of neutral pseudo-unit, or we may treat it as a non-unit.



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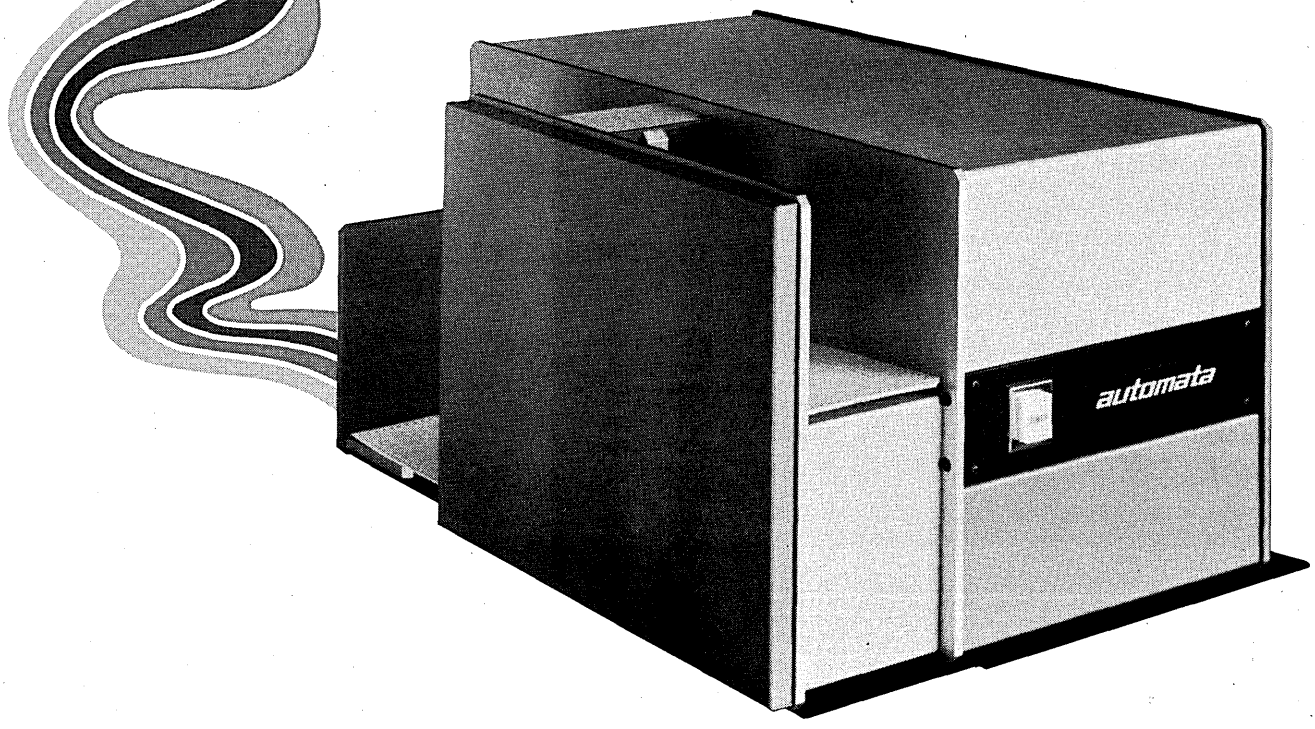

Fallacy . . .

But not both. If we elect to treat zeroes as non-units, we promptly deprive them of whatever neutrality they might have had, and they become essentially negative in character. (Hence the term *non*-unit or *no*thing.) Therefore, we cannot apply the same rules to a non-unit that we apply to true units, and expect the non-unit to meekly conform. As the mathematicians are fond of saying (or *were*, up to now), we simply cannot mix apples with oranges.

Now for a quick analytical summary of everything we've postulated:

1. If we treat zeroes as pseudo-units, then $n/0 = n$. (This is safe because, as previously noted, it is the same result that mathematicians get when they refuse to divide the number, n, by zero.)
2. If we treat zeroes as non-units, then $n/0 = 0$.
3. If we treat zeroes as pseudo-units, $n \times 0 = n$. But we cannot mix pseudo-units with true units any easier than we can mix non-units with true units; therefore, to avoid confusion and stay on the safe side, we must express the product of zero and n as zero—with zero in this case being understood as representing n pseudo-units, distinguished from true units and non-units.
4. If we treat zeroes as non-units, then $n \times 0 = 0$, provided n is not equal to zero; otherwise, the product is indeterminate.
5. The same reasoning applies when we divide zero by zero—i.e., the answer is 1 (necessarily expressed as zero) if we treat zeroes as pseudo-units, and indeterminate if we treat zeroes as non-units.

Conclusions: Plainly, we computer people are going to be in serious trouble if the mathematicians persist in regarding zeroes as non-units. We have already seen that multiplying one non-unit by another non-unit generates an indeterminate number of real units. There is nothing implausible about this, but it is equivalent to making something out of nothing, and we certainly don't want to be accused of that. Therefore, the only sane course of action is to treat zeroes as pseudo-units, whereby we common folk can more or less follow the conventional rules of mathematics.

Yes, that is the only path to follow, short of giving zero back to the Arabs; and I heartily recommend that we follow it.

(Unless, of course, there is a fallacy in the (fallacy in the fallacy).) ■

Mr. Lafon is a management analyst for the Bureau of Indian Affairs. He was previously ADP Coordinator for the Albuquerque district of the Corps of Engineers. He has had 10 years of experience in data processing and now specializes in dp standards and procedures.

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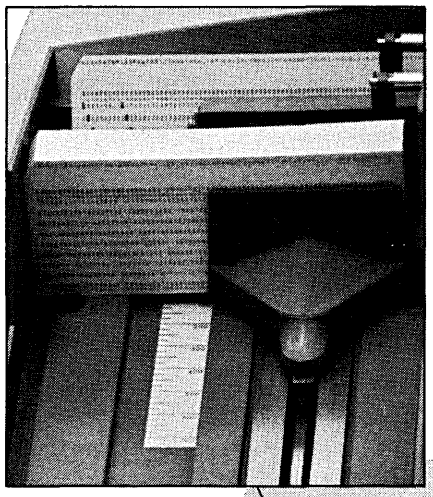

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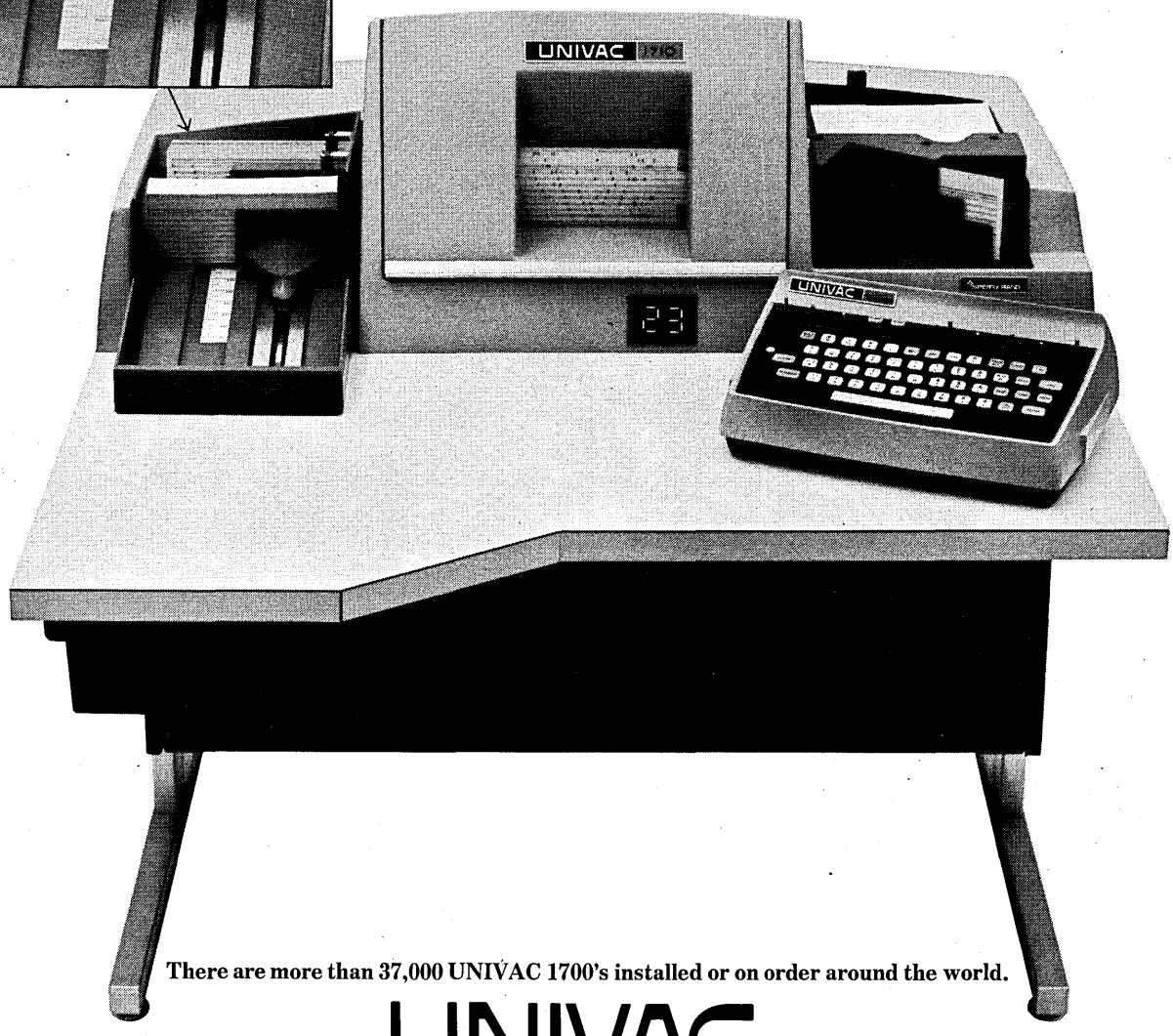

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The constantly increasing demand for quick and easy access to data processing will make this the decade of the small computer

Accessibility and the

Just as the 1960s was the decade of rapidly growing computer capacity, so the 1970s will be the decade of growth in computer accessibility. The physical delivery of information to or from a large central computer is too slow and disruptive to permit such a system to become a truly integral part of human decision-making. To be highly effective, access must be available at normal work stations and offices. Such direct access will improve efficiency in various departments of an organization and will permit true man-machine interfaces to develop.

Greater access can be provided to potential users by purchasing small computers, by acquiring terminals tied to medium-size central processors, or by having terminals hooked to intermediate communication equipment which in turn is connected to large computers. Choosing among such alternatives has major implications for all segments of the data processing industry. The central theme of this paper is that it will be the demand for access and not its mode which will account for growth of both small computers and terminals. The focus here is on computer access and specifically on the case for and against the small computer in gaining access.

Information for this article was obtained from reports by or for the U.S. government, the trade and technical literature, industry contacts, and trade associations. Data from annual reports and prospectuses of corporations, private services, and unpublished material such as doctoral theses were also utilized. Valuable as all these sources were, singly and in combination, it became clear that past and present statistics on the data processing industry are either incomplete or contradictory (or both). In some cases figures are simply not available. Three brief examples below show in stark relief the difficulty of obtaining reliable information in this area.

Example 1. If, in the mid-1960s, an analyst wanted to ascertain the market share of major computer manufacturers by industries, his search in the computer or economic literature or direct inquiries to companies would have proved frustrating. The only information on this topic, to my knowledge, at the time appeared in an advertising journal and was largely ignored, perhaps because of the date of issue.[1] Even this article failed to cover installations in government offices and gave no absolute figures by detailed industrial sectors. A request for clarification or elaboration to the consulting firm where the statistics for the article originated, brought not only refusal but disavowal of the published data, on the ground that the information was leaked.

Example 2. There are several authoritative censuses now available in the U.S., which purport to show the number of computer installations by manufacturer and by model number. But a comparison of such "expert" counts reveals major disagreements. Thus, as of July 1, 1969, there were 20,244 or 29,388, or 35,491 IBM computers in use in this country, depending on whether one accepted the census of *Computers and Automation*, *EDP Industry Report*, or *ADP Newsletter*.[2] Differing definitions or enumeration methods can account for only part of the discrepancy; in truth, no one knows for sure except IBM and it will not reveal the figures.

1. "IBM's World of Computers," **Printer's Ink**, December 24, 1965, pp. 10-14.
2. See "Monthly Computer Census," **Computers and Automation**, January, 1970, pp. 68-69; "Monthly Computer Census," **EDP Industry Report**, September 11, 1969, p. 11; "Diebold Semi-Annual Computer Census," **Automatic Data Processing Newsletter**, September 22, 1969, pp. 3-4. The first census is in fact as of December 15, 1969, so this would make its count an even lower figure for July 1, 1969—and it is already the

Small Computer

by Andrew C. Gross

Example 3. What is the future of the small computer in the small enterprise? One can find diametrically opposed opinions within the same article of a recent journal. Thus, according to Mr. Bennett of Novar Corp., "small businesses are not going to have small computers; it is not a practical way to go;" while according to Mr. Silverman of Miller-Ellis "the small computer more and more will enter the small business."[3] Reasons for such widely divergent views are given only in the briefest terms, though the two men obviously differ greatly on the future role of small computers, terminals, pricing patterns, confidentiality of data files, and accidental erasure of magnetic tapes and discs.

The above examples illustrate that experts differ on the impact of complex technical and economic cross-currents, on the number of installations, and on the role of the small computer. Analysis in this paper represents the dovetailing of numerous sources, with data usually based on two or more origins, and on the reconciliation of available statistics. While the views and forecasts of many persons were considered, the prognostications and the conclusions are the writer's own. The findings are derived from a much more extensive discussion, now available in published monographs. The methodology used for projections, known as composite forecasting, is based on successful results obtained over an 11-year period, a technique which is documented elsewhere.[4]

Small computers, as defined in this paper, are those whose mainframes cost $25,000 to $100,000 in 1970, where the usual word length is from 8 to 32 bits, and the usual memory range is from 4 to 32 thousand words. Examples are IBM's 360/20 (but no higher 360 models), 1130, 1800, and System/3, Honeywell's 1530, and Xerox Data Systems' Sigma 3. Minicomputers are those whose mainframe cost is under $25,000, where the word length is 8 to 18 bits, and the memory is at least 4,000 words. Typical of this category are Digital Equipment's PDP-8 and PDP-12, Data General's Nova, Honeywell's 316, Hewlett-Packard's 2114C, and Varian Data's 520/i model. Unless otherwise stated, the phrase "small computers" below includes mini units as well.

Large time-share systems have significant advantages over free-standing small computers and they also offer superiority over medium-size computers linked to terminals. The cost of time-shared data processing is falling rapidly and time charges in 1980 may be one-fourth or one-fifth of current rates. Prices of terminals and other data communication equipment are decreasing. To the extent that data process-

U.S. firms will encounter stiff competition from foreign manufacturers, especially those in Japan, West Germany, and the Netherlands.

lowest of the three.

3. "Decision Makers," **Computer Decisions,** January, 1970, pp. 48-49.

4. See **Small Computers** (Cleveland: Predicasts, Inc., 1970), one in a series of electronics trend monographs. Other volumes in the series include **Data Communication Equipment** and **Computer Peripheral Equipment,** published in 1970 and 1969, respectively.

ing is done for local users in metropolitan areas, transmission costs are not significant. The time-share systems provide access to large data banks, computing capacity, and a variety of peripheral equipment. Red tape and waiting time for access will be further reduced; programming will be less of a problem with terminals than with individual computers.

Free-standing small computers retain a series of real advantages, specifically rapid access time, avoidance of red tape, and protection for confidential data files. In addition to having complete control of the device, a definite prestige element is present for both management ("our own computer") and technical staff ("working with hands-on"). In dedicated operations, full utilization of small computers can yield costs which are likely to be below those of time-share systems. In locations remote from metropolitan areas, high transmission costs may lead to situations where small computers have a cost advantage. Finally, in vehicles and other mobile uses, small computers have little if any competition.[5]

The advantages of the two types of systems described above can be obtained by utilizing small computers as adjuncts or components of large time-sharing systems. The small (and especially the mini) computer can act as a terminal to the large computer; this would be the case for application requiring large data banks, appreciable core memory, and complex calculations. The minicomputer could act at times as a free-standing unit, offering low cost in dedicated operations, quick access, and privacy. Finally, the small computer or minicomputer can be part of a large communications network in such roles as error detection, message switching, and preprocessing. In sum, the large computers of time-share systems and the small/mini computers are complementary. Together, they will compete successfully against batch processing on medium-size computers which will decrease in relative significance.

Shipments of medium and large computers are projected to increase from $2.6 billion this year to $4.2 billion by the end of the decade. While this is impressive growth, the significant changes will come in two other areas: first, in upgrading the operations of such units and, second, in shipments of peripheral equipment. Both of these events should contribute to improving man-machine interfaces. Consumer sovereignty may not be as strong here as in other industries, but there is no question that this will be the decade of the user.

Shipments of all other computer system hardware, that is excluding medium and large computers, will rise from almost $6 billion this year to above $18 billion by 1980. This three-fold increase over the decade can be attributed directly to the rise in the number of persons seekng on-line access. In turn, this growth will be reflected in shipments of small and mini units, which should go from about $600 million in 1970 to almost $1.9 billion by 1980. At the same time, such shipments will not change appreciably as a share of the "all other computer system equipment," holding 10% both at the beginning and the end of the decade. This is due to the intense competition, both price and nonprice, which has already started in the industry.

5. One of the earliest and still the best contributions in this area is F. Gruenberger, **Are Small Free-Standing Computers Here to Stay?** (Santa Monica: The Rand Corp., 1965).

Strange as it may sound, it is easy to enter but difficult to leave the business of small/mini computer manufacturing. Entrance requires only limited capital, technical skills, and entrepreneurial courage. But exit is discouraged by good, long-range growth prospects, and prestige considerations. Thus, we find that there are currently close to 100 producers in this youthful industry. However, success *is* difficult and requires extensive software support and marketing know-how in addition to the resources mentioned.

Both the small-computer and the minicomputer industry have a dominant leader with satisfactory profit, followers with varying profitability, and many "also-rans" with either unsatisfactory earnings or outright losses. Mergers among companies in each industry and between the two industries are taking place for financial and marketing reasons. We can expect the number of U.S. manufacturers in the combined industry to be less than 50 by 1975.

In the small-computer industry, excluding now the mini segment, the undisputed leader is IBM, with 55 to 60% of this market. But the domination of IBM is somewhat less here than in the medium/large computer industry, where its market share is put around 70%. The Six Dwarfs [Ed. note: now five] behind IBM account currently for one-fourth of the small-computer market and can be expected to improve on this figure throughout the coming decade. The remaining companies, as a group, should also substantially improve on their market share; by 1980, they could

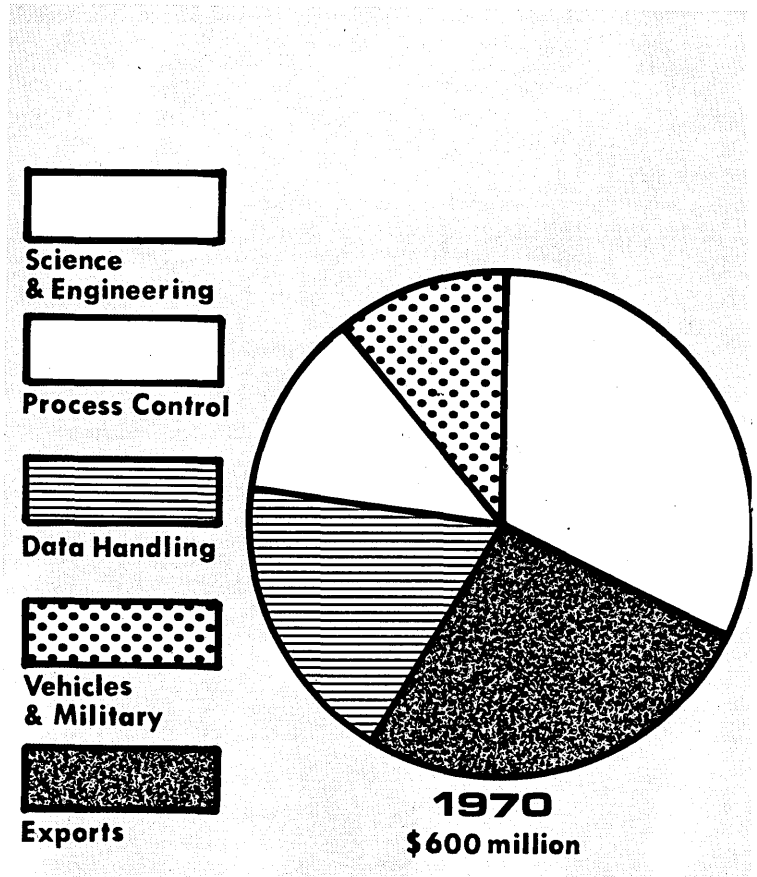


Fig. 1. Small computer and minicomputer shipments by end use.

account for over one-third of the total.

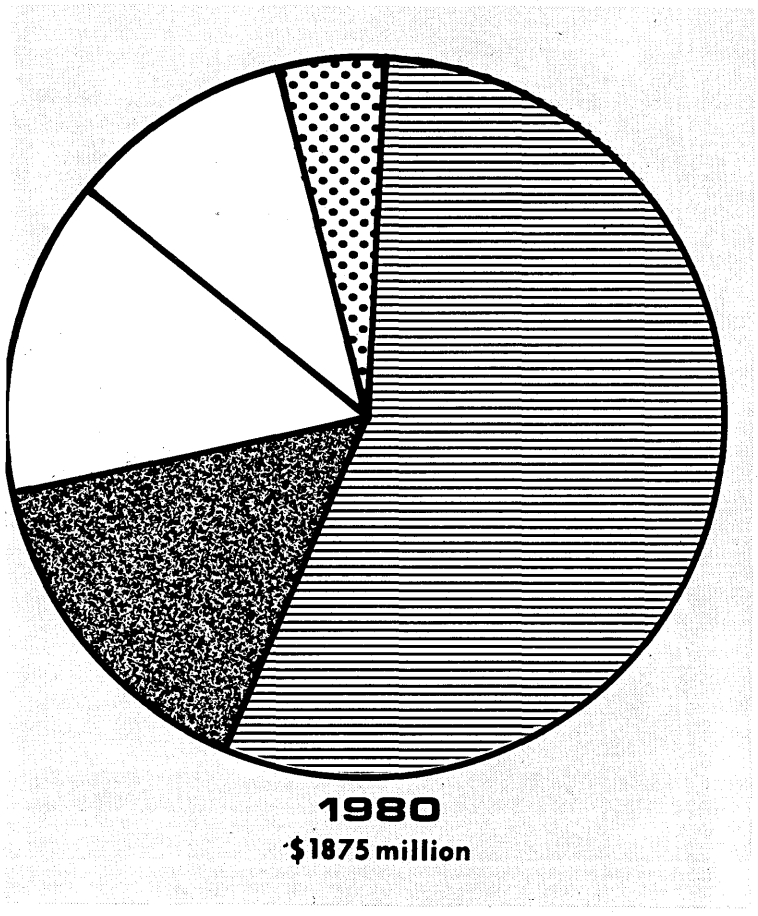
In the minicomputer industry, excluding now the small-computer segment, the pioneer has been Digital Equipment. As recently as 1965, this firm held about two-thirds of the market, but by now it has slipped to about two-fifths of the total. Nevertheless, Digital Equipment's sales of mini units this year will equal those of the Six Dwarfs and the Little Four combined (the latter group includes Hewlett-Packard, Systems Enginering, Varian Data, and Xerox Data). The remaining 20% of the market is now divided among dozens of companies, such as Data General, General Automation, Interdata, and Redcor. (In the spring of 1970, I predicted that IBM would enter the mini market, despite deep silence on this matter by the company. The announcement of its first mini model, the System/7, came on Oct. 28, 1970.)

Companies in the small-computer industry have joined or will enter the minicomputer market, while firms in the mini sector are solidifying their interests in small computers. In the unified industry which will emerge, as Table 1 shows, a dozen firms will do nine-tenths of the business. Large corporations with broad product lines should have substantial advantages in the industry, due to the relationship of mini to large computers, the need for software support, and marketing power coupled with a solid financial base. Thus, merger activities will become even more intense in the next two years.

Company	1965	1970	1975
IBM	67%	47%	29%
Six Dwarfs: Burroughs, CDC, Honeywell, NCR, RCA, Sperry Rand	14	22	27
Digital Equipment	13	14	16
"Little Four": Hewlett-Packard, Varian Data, Systems Engineering, Xerox Data	4	9	17
All others	2	8	12
Total	100%	100%	100%

Source: Research Group, Predicasts, Inc.

Table I. Trends in market share: small computer and minicomputer mainframe shipments (approximate per cent).



Source: Research Group Predicasts, Inc.

In 1960, U.S. manufacturers shipped less than 1,000 small and mini units to domestic and foreign users. By contrast, this year they will deliver over 13,000 units and continued growth to almost 100,000 units by 1980 can be anticipated. While unit shipments will increase seven-fold, the dollar value will only triple from $600 million this year to over $1.8 billion by the end of the decade, due to declining prices and a shift in emphasis to smaller units. In terms of the two segments of the industry, minicomputer shipments, which are now only about one-fourth as large as small-computer shipments (in dollar terms), will exceed the latter by 1980. The growth rate for mini units during the decade is about 23% per year, against the 6% rate for the small computers.

Fig. 1 shows the distribution of the combined small and mini market by major applications in 1970 and 1980. It is clear that end use patterns will be altered drastically. Scientific and engineering uses have dominated until now, but will occupy a much smaller share of the total market by 1980. The primary beneficiary of growth will be the data handling market which is projected to increase at the rate of 28% per year, to account for over half of all applications by 1980. Each of the five end use markets is discussed briefly in the paragraphs below.

Small computers and minicomputers were first applied in science and engineering. Traditionally, technical men have preferred to operate their machines with "hands on" and to interact with their computers. Digital Equipment has made its reputation in this area, providing units of low cost and high precision.

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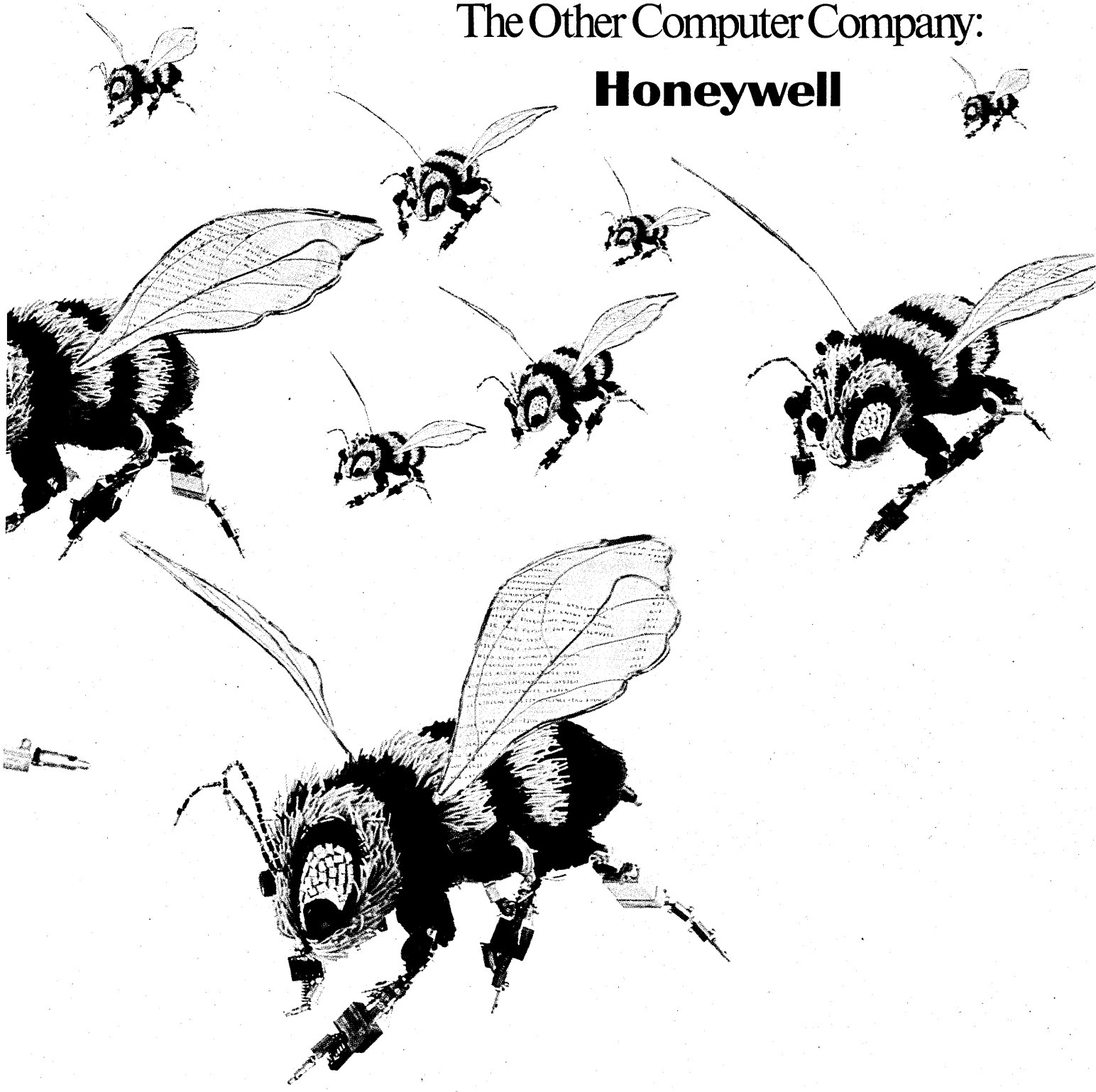

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But in this field, small computers are receiving increasing competition, on the one hand, from programmable desk-top calculators and, on the other, from large computers with much capacity and maneuverability. The small/mini units will be retained for man-machine interaction in the laboratory or classroom. In other scientific applications, such as complex calculations, terminals will become more popular, giving access to large computers. As Table 2 demonstrates, scientists and engineers will continue to have access to data processing, but much of this access will be in the form of terminals.

Item	1965	1970	1975	1980
Personnel				
Engineers and Scientists (mil persons)	1.3	1.7	2.1	2.6
Computer Access/000 such persons	4	17	61	198
Computer Access Units in Place (000)				
Terminals	—	11	96	470
Free Standing Computers	5.7	18	33	44
Total Access Units	5.7	29	129	514

Source: Research Group, Predicasts, Inc.

Table II. Computer access for scientists and engineers.

A second area of application for small (and especially mini) computers is process control. Process control generally requires accuracy, fast response time, and some analytical capacity from data processors; the mini unit is a good choice here because it can fulfill such needs at relatively low cost. Expenditures for process control are an increasing share of all capital spending and, in turn, computers are slated to take an increasing share of the process control budget.

The third and fastest growing application for small/mini computers is that of data handling. Free standing units, such as IBM's System/3 and Singer's System Ten, should find a growing, but still limited, market among small business firms for simple as well as complex accounting problems. In fact, some users envisage these machines as appropriate for both financial and technical calculations. But a far greater market within the data handling field is the use of small and especially mini units as part of large communications networks. While some units will function only in a dedicated mode, others will be used alternately as super-terminals and as free-standing data processors.[6]

The fourth and final domestic market is the use of tiny computers in mobile vehicles. Of necessity, such units must be free-standing and miniature in construction. The current typical model weighs under 50 lbs. and fits into less than a cubic foot. While current end use includes military and space vehicles, future applications will be on ships of all sizes, trains, buses and—in the not too distant future—in automobiles.

The fifth and final end use consists of foreign markets. The demand for data processing outside the U.S. is growing at about a 25% rate per year compared to a domestic growth rate of slightly over 15%. Both small computers and minicomputers should experience good growth abroad, but U.S. firms will encounter stiff competition from foreign manufacturers, especially those in Japan, West Germany, and the Netherlands. Swedish and British companies may also prove to be competitors for markets around the globe. Exports as a percentage of total U.S. output will decline for other reasons: "buy local" policies (e.g., Britain); trade barriers (e.g., Japan); and increased output of fully or partly owned U.S. plants abroad.

As the number of persons and organizations seeking on-line access to data processing grows, so will the demand for small computers and minicomputers. It will be this demand for access which will be the key factor in the sales of both small computers and terminals. In some cases, notably data handling, the distinction between these two types of equipment may well be eliminated. Small computers and minicomputers will function in a complementary fashion with very large computers; both sectors will grow at the expense of medium-size units. The largest end use market for small computers and minicomputers will be data handling, where growth is projected at 28% per year in the coming decade. The other applications, namely scientific-engineering, process control, vehicles-military, and exports, will also grow in absolute terms, but their relative shares of the total will decline. Price-cutting and nonprice competition will result in fewer U.S. manufacturers and only moderate growth in exports. ■

6. For further details, see such articles as "Mini-Computers for Real-Time Applications," **Datamation**, March, 1969, pp. 39-61; and "The Shakedown Decade," **Datamation**, January, 1970, pp. 69-78.

Dr. Gross is presently assistant professor of business administration at Cleveland State Univ. and senior research consultant at Predicasts, Inc. His previous work includes engineering at Ohio Edison, Sohio Pipe Line, and the Ohio Dept. of Highways; also teaching at Lehigh and Ohio State Univs. His BSEE and MBA are from Case Western Reserve; his PhD in economics is from Ohio State.

A Conference Report

SMIS in Denver

There was heavy snow in Denver the week after the third national meeting of the Society for Management Information Systems, but there was a notable lack of that troublesome substance in the presentations of major MIS innovators on Sept. 9 and 10. It was a conference unique not only in the candor and thoroughness of the speakers but also in the format of the discussions. Instead of several papers on disparate topics as in the past, the bulk of the meeting time was allotted to an in-depth examination of the experiences—good and bad—of two large companies known for their pioneering efforts in MIS: Westinghouse Electric Corp. and the Weyerhaeuser Co. In both cases, multiple presentations were made by teams of company representatives—including top management participants as well as systems people.

The Westinghouse delegation was captained with style and high good humor by Robert C. Cheek, president of Westinghouse Tele-Computer Systems, who recapped the extensive history of computer usage at Westinghouse, going back to Univac I and CPC days, and enunciated the company's present systems philosophies.

Computer progress at Westinghouse has resulted, according to Cheek, from a balance between "the possible and the practical," with what is technologically feasible being tempered by practical considerations. Among the points emphasized by Cheek as contributory to Westinghouse's systems successes is the importance not simply of strong top management support, but a *continuity* of such managerial backing—in this case extending over several generations of corporate executives.

The "guiding principles" adhered to by Westinghouse include:

1. Support of both centralized and decentralized systems depending on the application involved.

2. Reliance on more than one computer vendor.

3. Design of systems that reinforce the company's managerial philosophy of profit-center autonomy.

T. A. LaRoe, plant general manager in the Large Turbine Div., described a manufacturing plant information system and how it was developed. He was followed by John B. Ferguson, Westinghouse vp and controller, who discussed the company's early reporting system for monthly financial information, utilizing data links from some 100 profit centers to corporate headquarters in Pittsburgh.

Robert L. Custart, vp of Westinghouse Tele-Computer Systems, offered specifics on "on-going systems planning and implementation" for this $5 billion giant, stressing the goal of "transportable" application packages for multidivisional usage.

The Weyerhaeuser program segment was kicked off with a discussion of company growth objectives by Merrill D. Robison, senior vice president of the Pulp and Paper Group for this forest products company with annual sales exceeding $1.25 billion. This was followed by a presentation on the role of planning and management science in Weyerhaeuser, by Bobby V. Abraham, manager of operations research, and by an intensive discussion by Charles E. Carpenter, director of business systems, of the company's system development experiences. Though its data processing history is not so extensive as Westinghouse's, there have been some notable triumphs—and miscues—since a 1966 decision to centralize processing around four GE 635s located at Tacoma headquarters. On the plus side is an order entry system that has cut order processing time from two weeks to two days. But there have been unanticipated—and costly—problems in system development. For example, an injudicious decision to produce WEYCOS, a nonstandard operating system, instead of relying on manufacturer-supplied software, led to excessive costs and schedule slippages.

Weyerhaeuser now espouses a "modified centralization concept," much like that of Westinghouse, and also emphasizes transferable packages, consistent with its WATUSI policy (the Weyerhaeuser Approach To Uniform System Implementation). Significantly, Weyerhaeuser has been paring its edp expenditures which, at 1.1% of sales, had been running twice the industry average.

In a special conference feature, Westinghouse's Robert J. Soltis, vp of Westinghouse Tele-Computer Systems, teamed with Litton Industries' Ron Tucker, manager of information systems, and John Michel, manager of financial planning analysis, to discuss their respective experiences with on-line manager-computer interaction. In both cases this experience has been discouraging, and both companies have abandoned current efforts along these lines. Litton continues to telecommunicate financial data to Beverly Hills from its 150 U.S. and 50 foreign divisions, but the consoles have been removed from top corporate offices. Information is still available on-line, but is now retrieved upon request by financial analysts trained in computer methods. Westinghouse has discontinued its experiments with graphics terminals for managerial usage and its celebrated Picturephone system, which once displayed digital data as well as executive visages.

It is difficult to divine precisely why these efforts were so barren, aside from Soltis' comment that "costs were not consistent with needs." One was left wondering whether an improved and simplified man-machine interface might not have helped. And whether matters are likely to improve, as suggested by one comment from the floor, when a new generation of managers, more comfortable with computer technology, attains the presidential chair.

As has been true of earlier SMIS conferences, this one was distinguished by the generous use of impactive large-screen, split-image graphics, with Westinghouse especially employing a barrage of slides, film sequences, and recordings. Despite the relative remoteness of the meeting site, plus the handicap of a recession year, attendance held at about 250—on a level with previous meetings. Again, all formal sessions were plenary and there was spirited discussion from the floor. All three of the one-day workshops on specialized aspects of MIS held prior to the main conference were oversubscribed.

Taking over from meeting keynoter M. H. Schwartz as president of the society was professor James Emery of the Univ. of Pennsylvania. Newly elected to the SMIS executive council were Paul O. Gaddis, Westinghouse, and professors Gary Dickson, Univ. of Minnesota, and Daniel Teichroew, Univ. of Michigan.

Next year, Montreal!

—Robert V. Head

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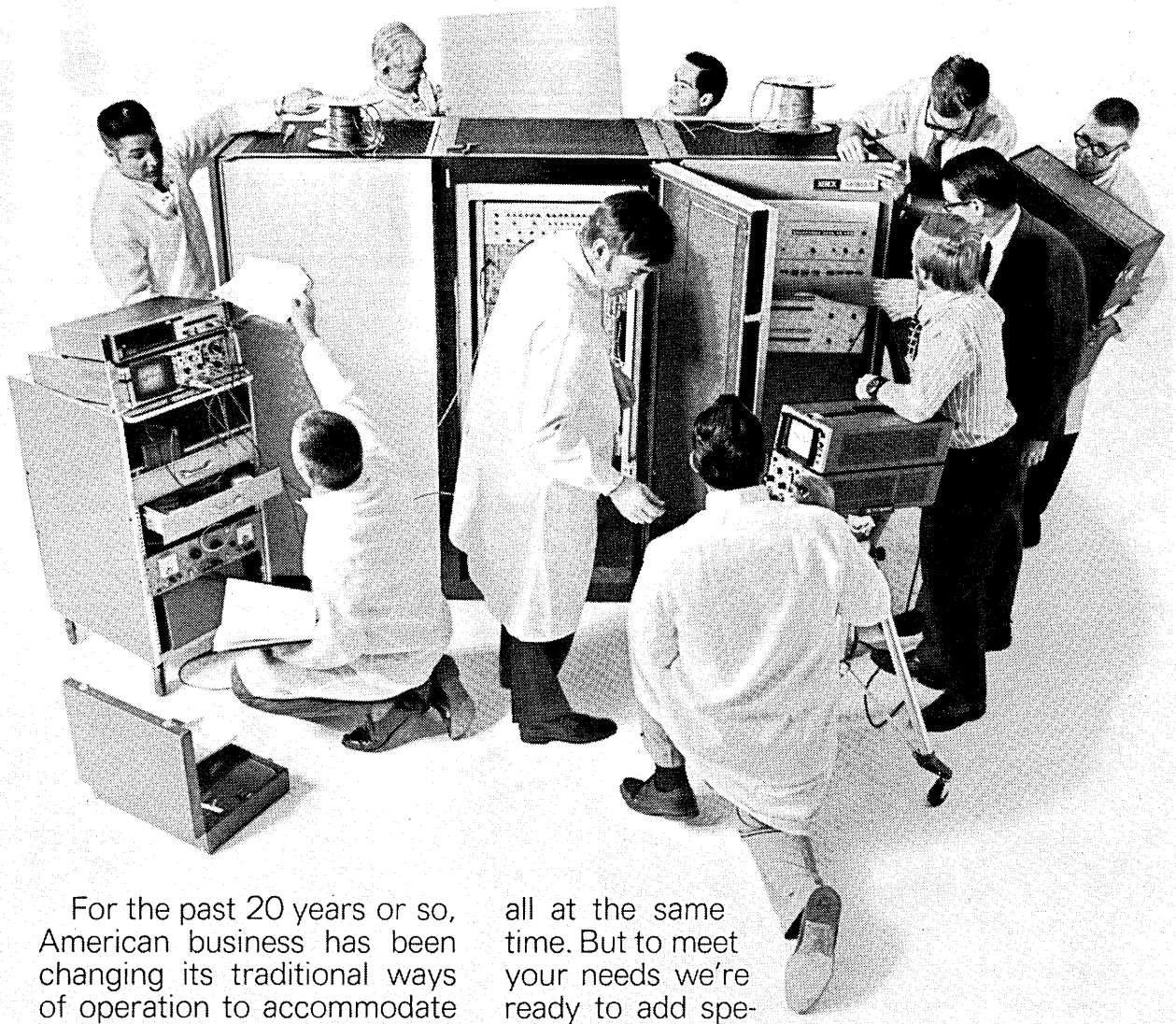

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CIRCLE 65 ON READER CARD

Scant attention has been paid in edp literature to the testing of systems

Systems Testing...

In June 1969, the Operations and Systems Development Branch of Canada's Dominion Bureau of Statistics began the development of an advanced systems analysis course tailored to DBS needs. A persistent problem at DBS has been a failure in communication between the user (client) of edp services and the analyst as to what any given system should do. As an aid to overcoming this communication problem, a session on the development of system test data was incorporated into the analysis course. Then came a rather startling and embarrassing discovery. Out of all the millions of words written over the past few years about edp, only one article[1] could be found that was devoted to testing, and that was primarily on program testing. (If some reader can provide additional references, this author would appreciate receiving them if only to restore his faith in edp writers.) This article is offered as a first step in filling this gap and as a tutorial paper for beginning analysts.

The failures in communication that have occurred between potential users of edp services and systems analysts are legion, and there seems to be no sure way of avoiding such misunderstanding. The important question then becomes, how can the probability of discovering any "failures to communicate" be increased? It is in this area that systems test data can provide the greatest advantages.

The user should be able to consider the entire edp shop as one big "black box," taking inputs and producing outputs. With this in mind, systems test data can be described as a set of constructed inputs prepared by the user and a set of outputs calculated from the input data. In essence, then, the user is saying to the edp department, if you can take these specific inputs and come up with these calculated outputs, then your system does what I want it to do. In more general terms, testing can be defined as the processing of documented data to produce predicted results. This is a somewhat broader definition than is given above, but leads directly to the concept that there are at least three levels of testing—modules, programs, and systems. Testing of modules is usually done by the programmer with data he has constructed, and is difficult to distinguish from debugging. ("Debugging" is the process of discovery and elimination of errors in programs *after* such have been shown to exist by testing.) The module is viewed as being independent of the rest of the program and tests a specific set of operations and logic. For instance, does this module extract a square root or find the correct value in a table?

One could argue that it is worthwhile using either constructed or modified data, but not both.

Program testing, while somewhat more involved, is very similar to module testing, except that the paths and interactions between modules are now the main issues. Such vital areas as multiple tape handling and all "end-of-job" conditions must be tested in all their permutations. Again the process is controlled by the programmer with data he has prepared.

Testing of the system, however, has a broader

1. Gruenberger, Fred, "Program Testing and Validating," DATAMATION, July 1968, pp. 39-47.

function. First of all, the systems test must make use of the data prepared by the user to prove the correctness of user-edp analyst communications. Second, it tests the data flow, not only within the edp system, but also the manual paper handling by the user's staff. Third, it tests all the links between programs as well as the man-machine links. Fourth, if the user is involved in the systems test, he will be forced to understand the system more thoroughly and thus have greater confidence in that system. Finally, the systems test may well serve as the acceptance test.

If the systems test is used as the acceptance test, then all of the documentation including the data handling and procedural instructions must not only be ready but be adhered to during the test.

A look at testing procedures in use in various environments reveals three basic categories: constructed data, actual data with modifications, and actual data in volume. Each seems to have a place in the test strategy, but none fills all the needs of adequate testing.

Constructed test data are invented by the user for a systems test or by the programmer in module or program testing. The knowledgeable user can usually construct a set of data that will give the maximum testing value for a minimum of machine time, since the user will tend to minimize his own clerical work while at the same time testing the most important elements. However, only those problems that the user recognizes as problems are included, and there is, thus, a lack of "reality" in the tests. Despite this, constructed data is a most useful first step in the systems test procedure.

Modified actual data are a selected set of "live" data which are deliberately changed to produce errors, but the calculations to compute the output are still necessary. This type of data overcomes one objection to constructed data in that it is at least partly real data and often contains some surprises. However, the amount of data is usually more voluminous, which increases the user clerical load to compute the output and, of course, increases keypunching costs. One could argue that it is worthwhile using *either* constructed or modified data, but not both.

The final test-data type is volume testing using actual live data, hopefully as a parallel run with an older system. If it is not being run in parallel, don't let the user promise results to his management at any particular time. And the programmer, himself, must also be wary of promises. Volume testing is a good final test, since it usually catches any number of oversights ranging from inability to shift from one tape volume to another, to a whole set of deviations in the data that the user didn't expect. Computation of expected output without a parallel run is usually a most time-consuming clerical job, if it is indeed possible. The great drawback of live data is that the system may run for days or months without some edit or logic path being used. Finally, when that unused logic path or edit is required by the data, that "old reliable system" (it ran three times in a row) blows up at two in the morning.

It would seem that the best test strategy would be to run constructed or modified data until all bugs resulting from those data are cleared up; then and only then, run the volume test using "live" data.

A word of caution to the analyst is necessary at this point. The user doesn't care how or in what form the data enter the machine or the characteristics of the master file. He wants to check *if* the system works, not *how* it works. If the system is to be repeated monthly, then the user should be advised to simulate two or three successive months. Don't ask him to check the format of the "new master," since that is not his concern. But if the user simulates two or three successive months, then he will know if the master file is working. The danger is in asking the user to get too involved in the "inwardness" of the system, and thus place a burden on him to prepare test data or examine results which are the province of the programmer or analyst.

a Taboo Subject?

by T. J. Vander Noot

The user . . . wants to check IF the system works, not HOW it works.

Many business systems can be broken down into certain fundamental units: input, edit, correction, summarization and manipulation, and output.

In order to construct test data, the first thing one must do is to prepare a data item dictionary for the system. The information needed for this document is, or should be, contained in the detailed system analysis and will include:

1. The name of the item as it appears on the input form;
2. A description of the data, whether it is alphabetic or numeric, the size range of the numbers, but not whether it is to be packed decimal or binary (that is the programmer's business—remember these are systems test data);
3. Where the data are "going," i.e., Table 1 Line 4, the master file, or just dropped along the way; and
4. What happens to the item along the way, i.e., is it added to other cases for a total on the table, or is it merely merged onto a new master tape?

The data item dictionary plus the input and output formats are all the user needs to begin preparing test data.

If the user prepares a set of input forms and calculates what the tables must look like when produced from that input data, then that set of data "proves" that the input-summarization-output elements of the system are as the user desired, *if* the computer produces the specified output. This is a moderately laborious job since most tables contain subtotals by region or province or by some other classification and each such additional subtotal must have data to test it.

For every edit check specified, both a correct and an incorrect entry must be prepared to see if the appropriate edit messages appear. With the results of the edit test run, the user must then simulate his own manual correction procedures. The errors must be corrected and passed back into the system exactly as if it were a real production run. Only by following the paper flow through the system *as the user sees that flow* can the user gain confidence in the system. In addition, simulating a complete production run will enable the clerical staff to gain experience before they have to make a system run under a deadline.

Some "rules of thumb" or examples may be useful at this point.

If the field is supposed to be numeric, try one field of alphabetic characters and one of blanks. Try a numeric field with one blank, and another with one alphabetic. Finally, try a numeric field.

If the edit conditions include ranges, try values on both sides of the range as well as one within the range. Note that those values just inside or outside the range are the ones most likely to give trouble.

If relationships between data fields are being tested, try all permutations of correct and incorrect data that can be constructed within some set period of time. The user should be encouraged to set a limit on himself here since the permutations of errors can rise to astronomical numbers very quickly.

An element of preparing edit test data that strikes fear into the heart of the experienced programmer is the order in which edits are performed. For this reason, the user should be encouraged to prepare edit test data with multiple errors on some input form in several permutations. This practice is guaranteed to break the heart of the programmer, but it is far better to discover this type of error at test time than at production time.

It is very easy to prove out the calculations required by the user if the data actually is the way he says it is. But too often a field that "could not possibly" be negative or zero has in fact turned out that way. For both the edp specialist and the user, the following checklist is provided:

1. Counter overflow;
2. Negatives;
3. Rounding;
4. Truncation;
5. Zero divide; and
6. Decimal alignment.

This article will not belabor the question of documentation other than to point out that every word that applies to documentation of systems, in general, applies to systems testing as well. But there are some special considerations which must be remembered. As edp "comes of age" the user is demanding more and more reliability from the edp shop. (These days the edp man can, with honesty, blame mistakes only infrequently on the machine.) The data used by the programmer for testing modules and programs as well as the data used for the system as a whole should be saved, along with the necessary listings. With such tools near at hand, the maintenance programmer has a good chance of finding the error in a relatively short period of time. This is especially true when the program was written long ago, by someone else.

Any extensive testing program is an expensive proposition, and the clerical and machine time devoted to testing a specific system must be a management-level decision. Not only must the user expend his resources on preparing the test data, but additional runs of the system on the computer will increase the development costs. Considerations in establishing how much testing should be done are: expected life of the system, development cost, length and frequency of runs, importance of accuracy to the organization, and effects of a missed deadline. If the edp specialist says that it will cost extra money to keep the system from falling apart in the future, then the user may well ask if the system is worth anything in the present. Adequate testing is a "capital investment" in the future, and as such it tends to be hard to defend.

Time-to-completion for the system is another cost of adequate testing. Too often, because the analyst or programmer missed his deadline, testing has been curtailed in order to get an apparently complete system to the user on schedule. Adequate testing takes time.

No matter how complete the testing program, it cannot assure complete reliability of any given program. If the program is of any size and complexity, latent errors are sure to be buried deep down inside. Time after time, new combinations or types of input have caused programs to fail that have been running successfully for months or even years. Seemingly minor changes in the operating system have caused

There are many systems that have completely failed after years of successful operation simply because of their previous success and reliability.

failures, as have equipment additions or deletions to the configuration. Thus, no absolute guarantee can ever be given for a program or system. All that can be accomplished is that the expectation of reliability can be increased.

There are many systems that have completely failed after years of successful operation simply because of their previous success and reliability. This happens when a system is pushed beyond its design limits. A data-base retrieval system designed for 50 million characters and 10 retrievals a night may either collapse completely or become grossly inefficient when the base grows to 200 million characters and

1,000 retrievals a night. In the test documentation, therefore, it is well to give a prominent place to a consideration of what was the tested "level of activity."

Testing is often a real embarrassment to an edp shop. A program or a system is promised for a certain time, but when tests are run, errors are found which must be corrected. The correction process, as well as the testing process, is difficult to cost and to predict time-to-completion. All programmers have at least one horror story to tell about the week it took to discover that the word "go" was keypunched "gee" "zero" rather than "gee" "oh," or some other similar trivial mistake. An added factor is that testing is all too frequently left out of the calculations of how long it will take to write a given program. A personal belief is that programmers estimate the time it takes to design and code a program and fail to take into account testing and documentation time. Therefore, the estimates tend to be only 50% of the actual time needed. But if testing is done in an orderly way—modules first, then programs, and then systems—test time can be held to a minimum and even estimated with a fair degree of accuracy, *on the average.*

It is better to "think testing" right from the start—modules, programs, system—all designed to be tested along the way. It will raise costs somewhat, but it gives a far better product. But built-in testing poses its own problems. Almost every program or program module requires inputs from a previous element. Thus, the programming supervisor has to decide whether to break the program into pieces and dole them out and wait for each module to be finished and tested before the next is tested (which, of course, increases elapsed time), or to write and test modules and programs in parallel (which increases cost since each module must have constructed data not available from the previous module). Elapsed time vs. cost is the question.

We must face two psychological hazards with regard to testing and debugging. None of us ever really believes that he personally can make a programming mistake (which is pragmatic nonsense), and as a result we refuse to learn all we should about debugging. Traces, monitors, dumps, and utility tape compares all tend to be ignored because it is hard to believe that *we* would need to use such things. But we do. ■

Dr. Vander Noot is currently associate director-general of the Operations and Systems Development Branch of the Dominion Bureau of Statistics in Ottawa, Canada. Previous to this he was senior economist for the Economic Council of Canada. Prior to moving to Canada he was chief analyst for the Board of Governors of the Federal Reserve System. His BA is from Duke Univ., and his MA and PhD are from the Univ. of Minnesota.

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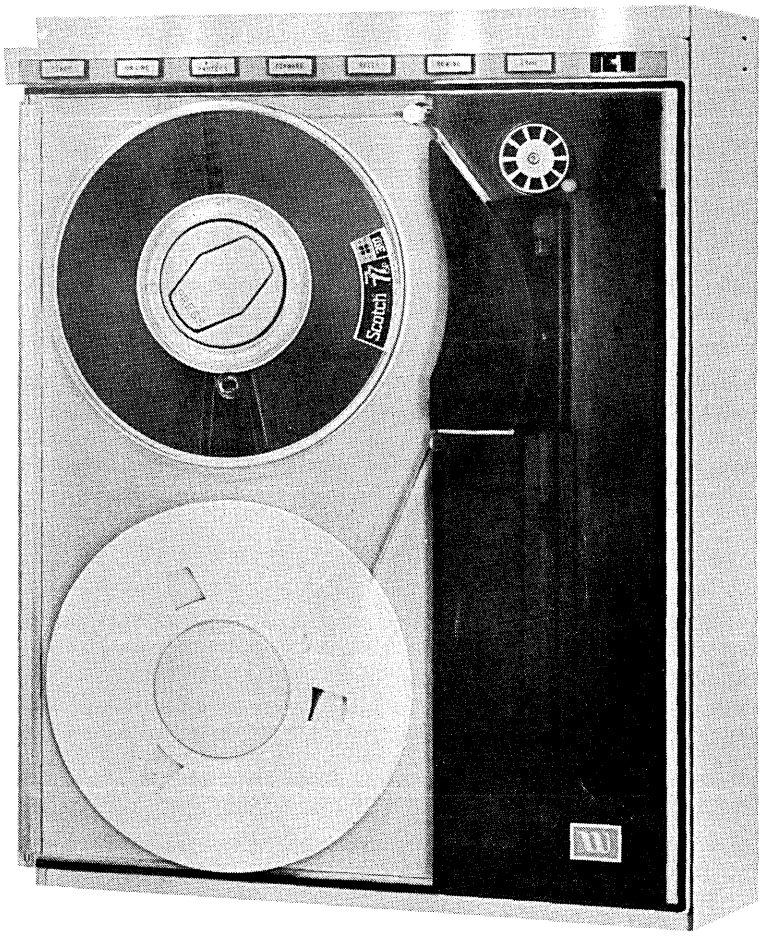

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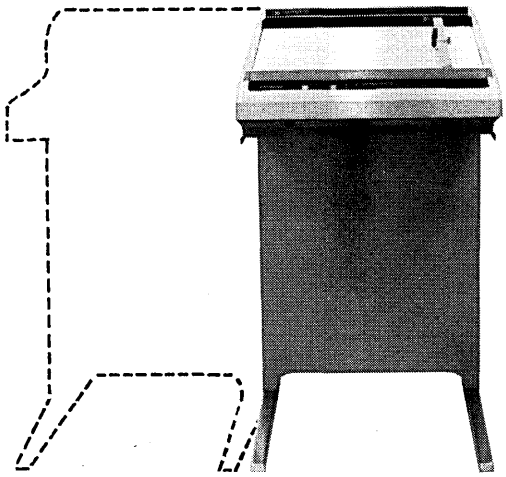

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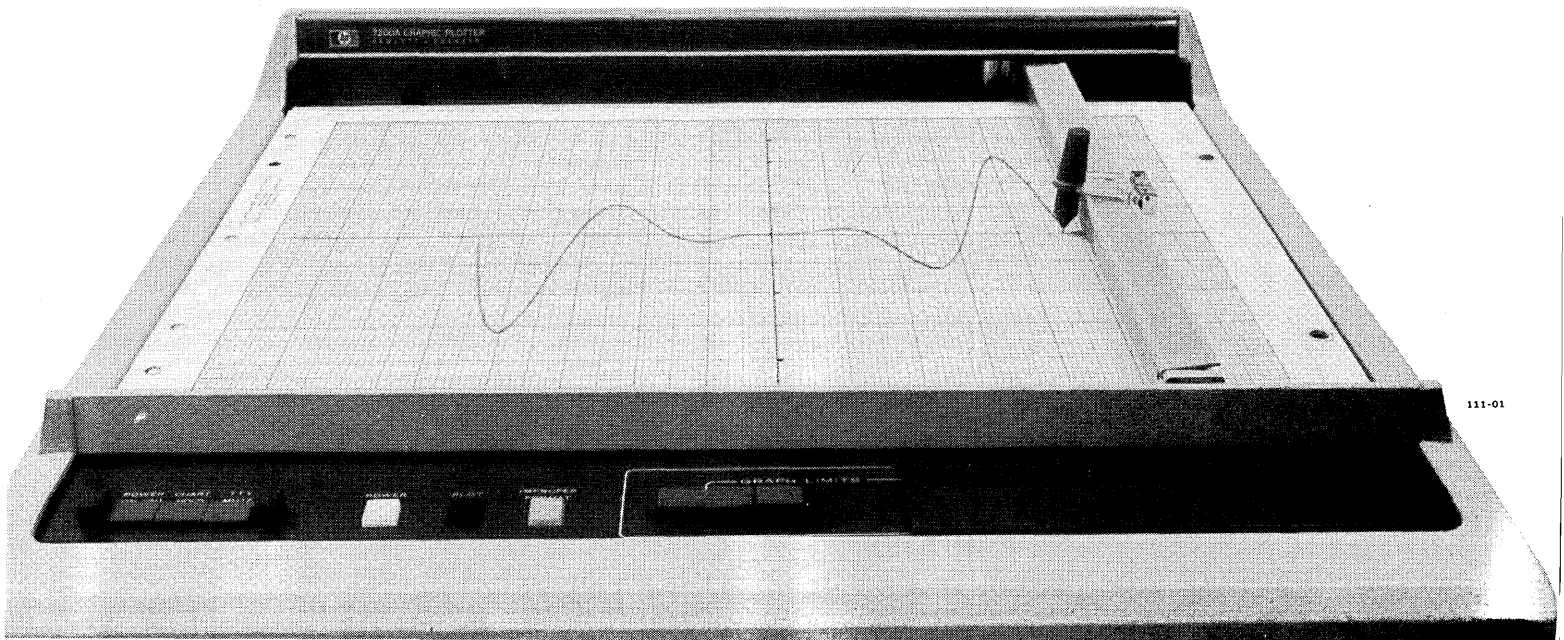

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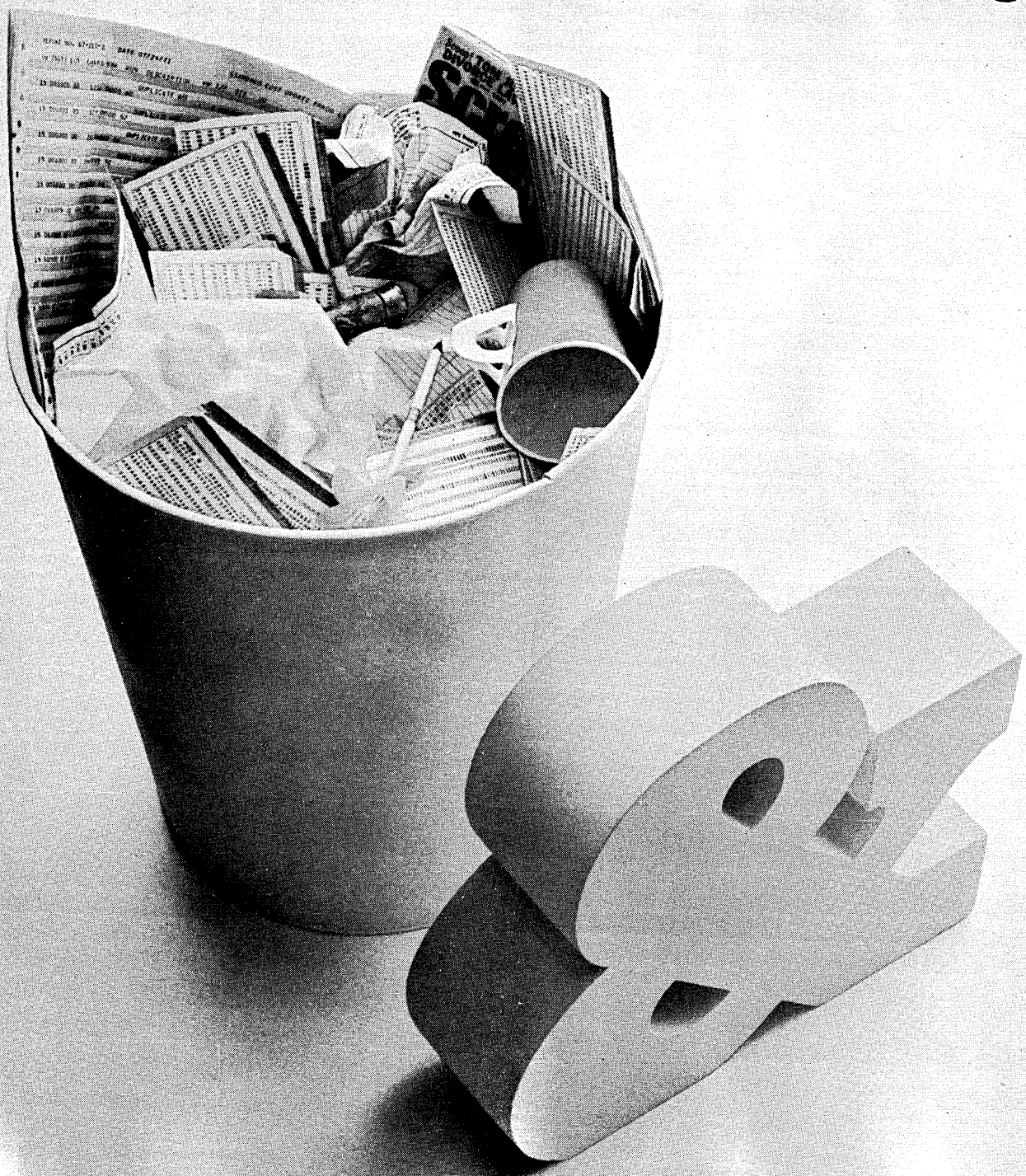

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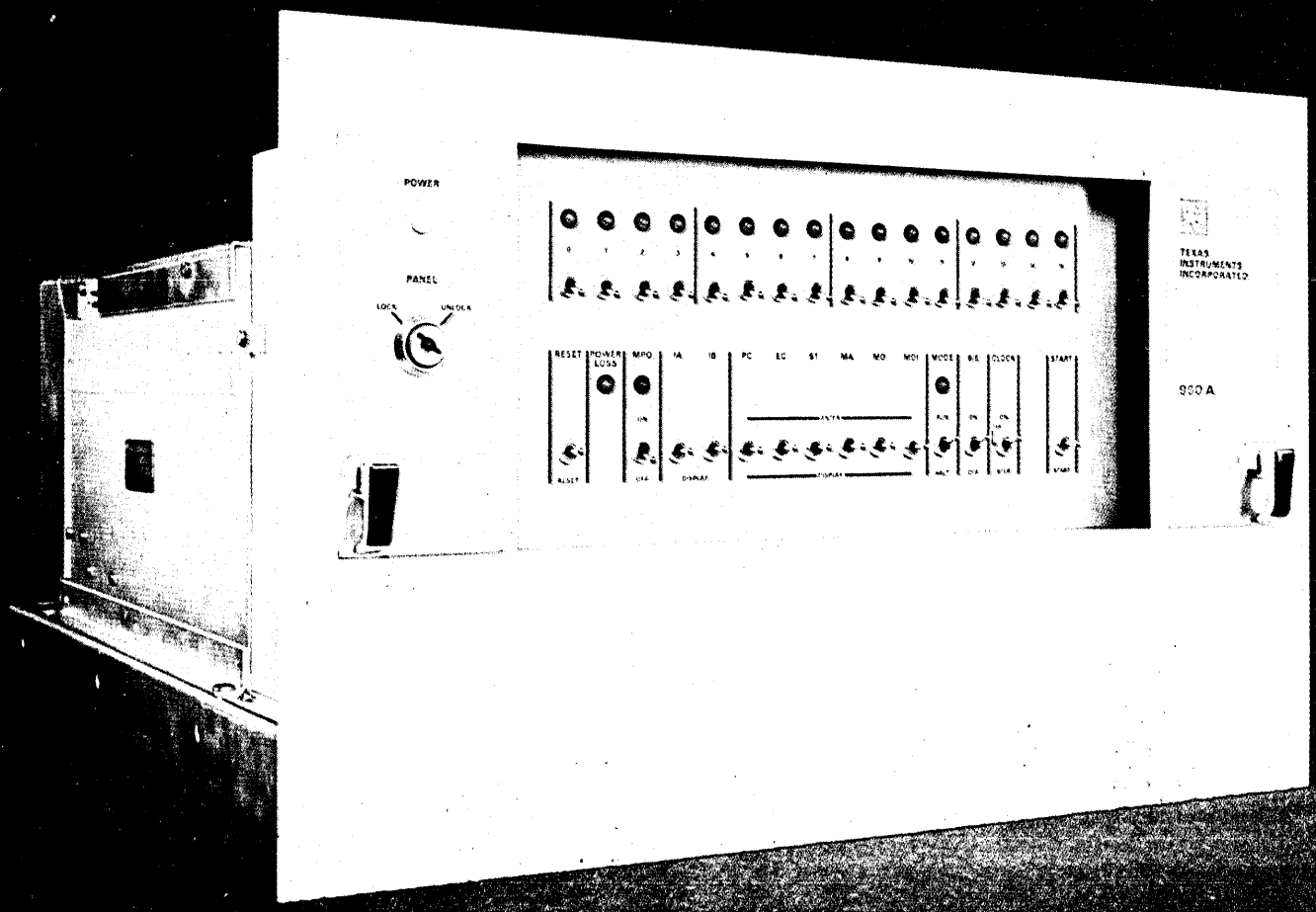

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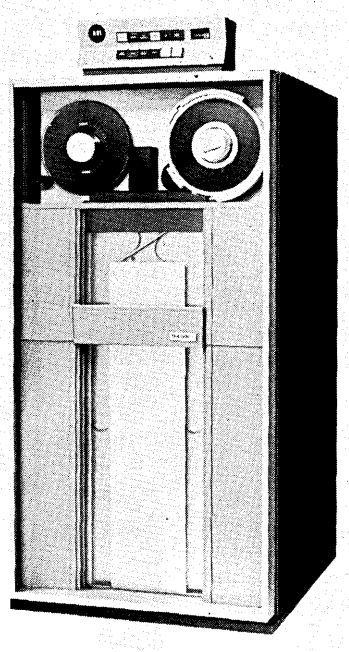


CIRCLE 557 ON READER CARD

CIPHER DATA PRODUCTS
San Diego, Calif. Booth 1736

The C-2000 is a cassette system that can be made up of from one to four cassettes and the necessary software and hardware interfacing for many minicomputers offered by Data General, DEC, Hewlett-Packard, Honeywell, and Varian Data Machines. The bidirectional read/write speed is typically 600 bytes/second for the ASCII and ECMA standard cassettes. Operation is at 6 or 24 ips, and backspacing and read-after-write error checking features are standard. Available 30-60 days ARO, the C-2000 system price starts at $2450 for a single unit. Four drives are priced at $5650. For information:

CIRCLE 558 ON READER CARD

CODEX CORP.
Newton, Mass. Booth 1128

The Codex 880 time division multiplexor, designed to handle synchronous data speeds for transmission on a single communications channel such as that provided by Bell 203 or 303 or equivalent modems, is offered in response to the recent tariff changes allowing such multiplexing of wideband circuits. Delivery is 30 days ARO for the model 880, and the pricing starts at $2K. For information:

CIRCLE 559 ON READER CARD

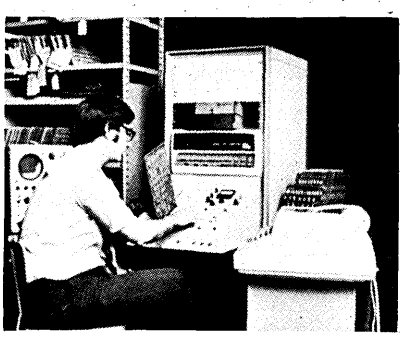
COMDATA CORP.
Niles, Ill. Booth 1742

The series 330 rack mounted modems for data communications systems will be introduced at the conference. Each 19-inch rack has space for up to 16 modems that can be Bell 103A, 103E, 113A, or 113B equivalents. Each modem has its own power supply and is priced at $195. The rack and cabinet are $465. For information:

CIRCLE 560 ON READER CARD

COMPUTER AUTOMATION INC.
Newport Beach, Calif.
Booth 1339-43

Three new software programs are available for this manufacturer's CAPABLE system for performing functional tests of digital logic cards. The Fault Detect Verification package ($1950) forces all possible faults of



the board components. The APG program ($4K) generates new tests for a particular card on a trial and error basis and saves only those tests that successfully detect specific faults. The Automatic Fault Isolation program uses a fault signature technique

to isolate faulty integrated circuits. It is also priced at $4K. For information:

CIRCLE 561 ON READER CARD

COMPUTER TERMINAL CORP.
San Antonio, Texas Booth 1148

The Datapoint 2200 (July 15, 1970, p. 135) intelligent terminal is gaining a family of peripherals to expand its applications potential. The first member is a 9-channel, IBM-compatible magnetic tape unit for remote data collection and pooling operations in a source data entry environment. Delivery is 4-5 weeks for the 2200-400 mtu, and it's priced at $8500.

The 2200-220 is a 135-lpm hard-copy printer that connects to the 2200 I/O bus. The character set is printed in 5x7 dot matrices, and up to 6-part forms can be used. This unit is priced at $8300 and available 10 weeks ARO.

And the 2200 is no longer limited to asynchronous communications. The model 2200-404 synchronous communications adapter handles ASCII or EBCDIC codes at program-controlled speeds in excess of 9600 baud, and is compatible with bi-synchronous communication protocol. It's priced at $910, and is also available 10 weeks ARO. For information:

CIRCLE 562 ON READER CARD

COMPUTER TRANSCEIVER SYSTEMS INC.
Paramus, N.J. Booth 1613, 15

The EXECUPORT 1200 serial matrix impact printer prints asynchronously at up to 120 cps from either computer or normal keyboard input. Versions are offered for use as a communications printer, billing printer for small computers, computer output printer, or hard copy unit for terminals. The standard 96-character ASCII set is printed at 1.3 seconds for a full 132-character line, with return from that point listed at 400 msec. Prices start at approximately $3K, and deliveries begin early next year. For information:

CIRCLE 521 ON READER CARD

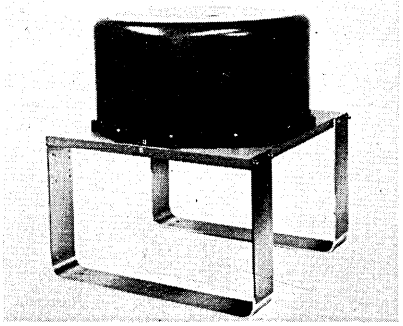
DIABLO SYSTEMS, INC.
Hayward, Calif. Booth 1248, 50

The successful series 30 disc units is about to be augmented by the series 40, which uses IBM 5440-type cartridges and is offered to oem's in several different model numbers for building System/3-type devices. The average seek time for all models is 35 msec, while the latency time is 12.5 msec for 2400-rpm versions, or 20 msec for 1500-rpm models. The model 41 has a single cartridge with a capacity of 24 million bits recorded on 203 cylinders at 2200 bpi. The model 43 has a removable cartridge and a fixed disc, and its capacity is 48 million bits. Prices start at something under $5K per unit for orders of 100, and deliveries are scheduled for early next year. For information:

CIRCLE 522 ON READER CARD

DIGITAL DEVELOPMENT CORP.
San Diego, Calif. Booth 1230

More and more this manufacturer is entering the end-user market, as in the case of the series 6000 head-per-track disc units. Two configurations are available: the model 6100 with capacities from 1 to 4 megabits stored on 16 to 64 tracks, and the model 6200 with capacities from 1 to 8 megabits. The units have average access times of 8.7 msec and are ex-

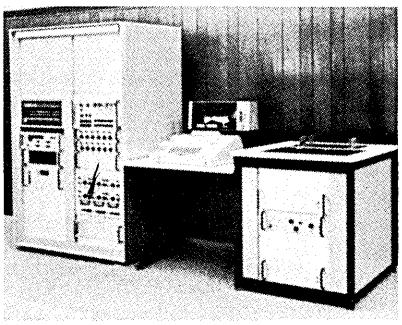


pandable in 16-track increments. The 6000 series is offered to users of the DEC PDP-8 and PDP-11 minicomputers at a price in the $10-12K bracket, including controller, interfacing, and everything needed to run. Oem's can obtain the basic 6000 units, less power supply, at prices under $5K. Deliveries are scheduled 60 days ARO. For information:

CIRCLE 523 ON READER CARD

E-H RESEARCH LABORATORIES
Oakland, Calif. Booth 1007, 09

Testing of ferrite core memory planes and stacks is the role of the model 8400. The computer-controlled 8400 tests for peak amplitude, peaking, and switching time, and can also show the drive current waveforms. The controller is a 1-usec minicomputer said to have enough power for economically testing cores in production environments. Delivery is 30



days ARO, and systems are priced at about $130K. For information:

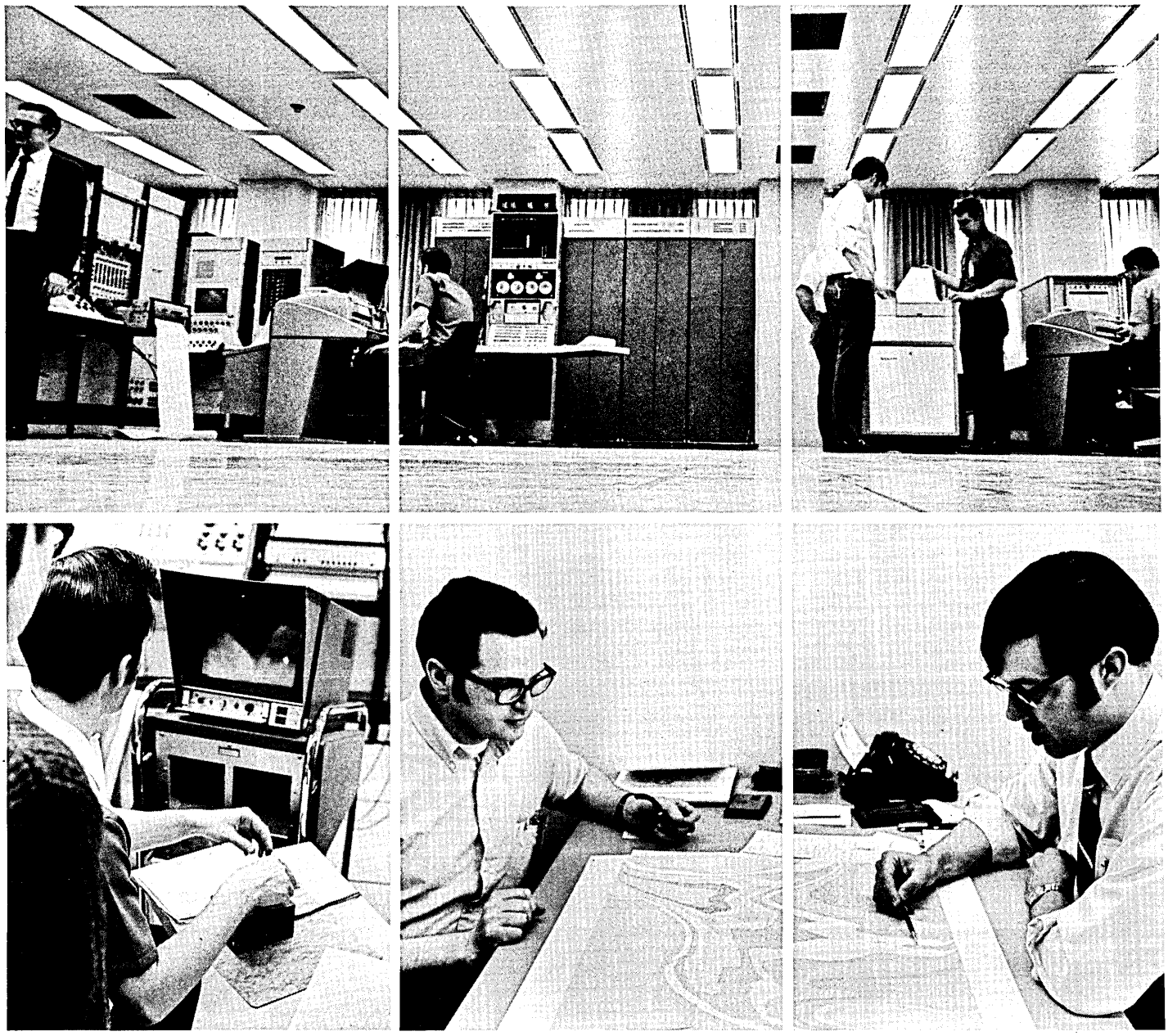
CIRCLE 524 ON READER CARD

GRUMMAN DATA SYSTEMS
Garden City, N.Y. Booth 1434

If everything goes as planned, this booth might contain the biggest attraction of the show—a trillion-bit

memory system called the MASSTAPE. It consists of a control unit and multiple storage cabinets containing packs of cartridges that store information at 8000 bpi. The transfer rate is 150 KB, and less than one second is required to rotate the pack of cartridges and load the desired cartridge. The system will be marketed and serviced by the manufacturer nationwide, and the price of approximately $1 million is competitive with other terabit memories. Deliveries are scheduled for the second quarter of next year with interfacing to the selector channel of 360s and 370s. For information:

CIRCLE 526 ON READER CARD



The Gould 4800 helps Battelle-Northwest analyze thermal discharges.

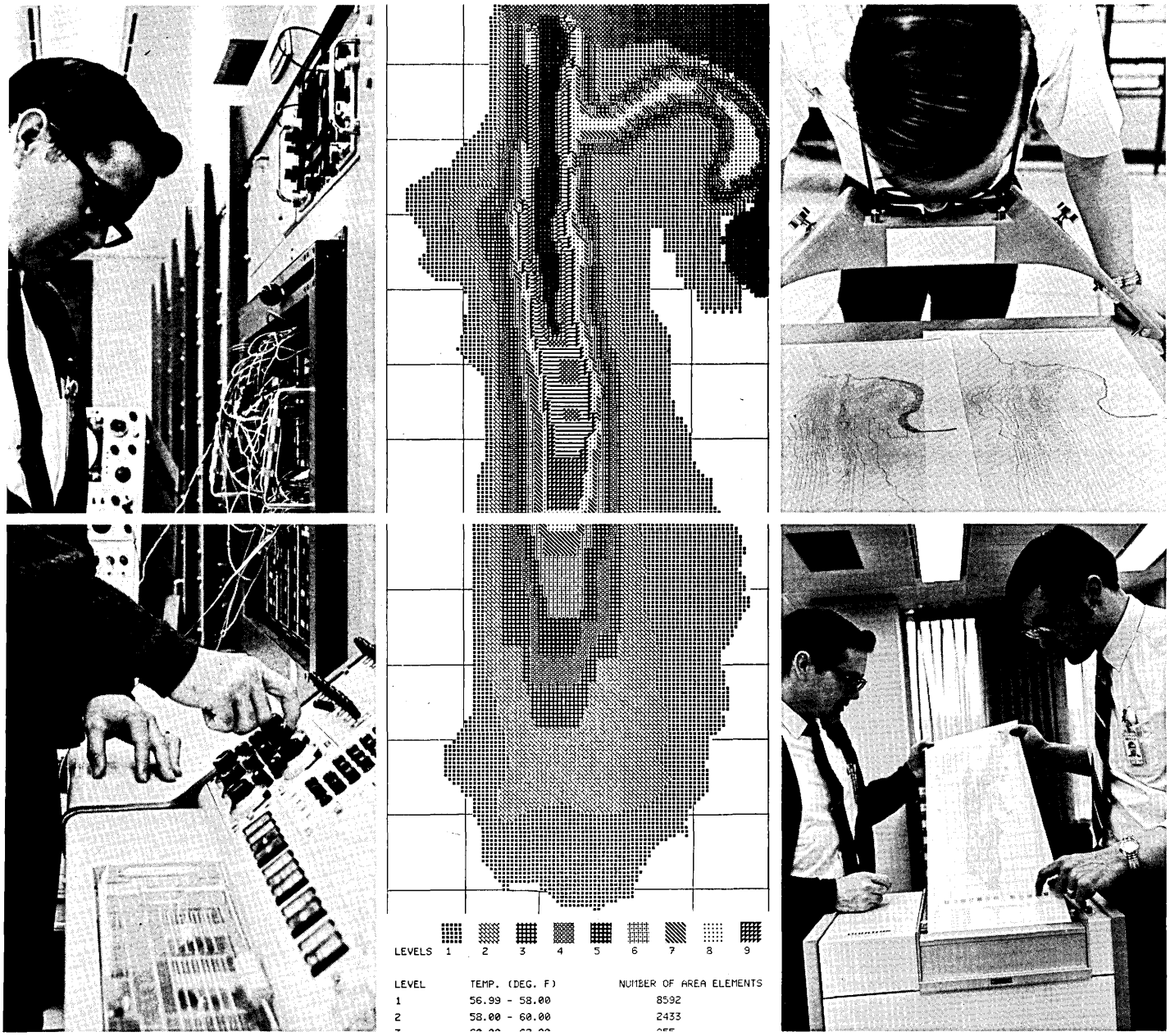
The Gould 4800 high-speed printer is playing a big part in the thermal pollution research being conducted at Battelle-Northwest.

Battelle Memorial Institute, established over 40 years ago, is a not-for-profit research corporation with four major labs and offices around the world. Battelle handles many projects on a contract basis, with heavy emphasis on applied research.

Projects currently underway at Battelle-Northwest in Richland, Washington, include studies that determine patterns of wastewater discharges from industrial and municipal operations and to evaluate their effects on surrounding waters. The research technique, developed by Battelle, consists of collecting aerial infrared and tracer dye imagery of surface water discharges.

Data recorded from the infrared imager is processed by Battelle's computer system, a unique hybrid facility. A Beckman EASE 2133 analog computer is coupled to a DEC PDP 7 digital computer.

The Gould 4800 then prints out isothermal plots, density plots, and contour plots. The contour plots provide two different views.



COMPUTER PRODUCTS

GOULD

Used with a stereoscope, these two views provide simulated three-dimensional temperature contours.

Researchers depend heavily on the Gould 4800's graphics capabilities for output of the simulation and modeling projects. And even with their small computer, they get high speed alphanumerics and graphics.

The Gould 4800 operates with the hybrid system in many other projects at Battelle, ranging from physics to social sciences. In addition, by means of a time sharing system, the 4800 operates simultaneously with an SEL 840 computer for basic math and science calculations.

Battelle's initial investment in the Gould 4800 was less than the cost of impact printer and plotter equipment, and they developed their own interfaces and software for it. Since the 4800 has few moving parts, as well as solid-state electronics, there is also a minimum of maintenance and servicing.

The Gould 4800 high-speed printer. Put it to work for you. Write Computer Products, Brush Division, Gould Inc., 3631 Perkins Ave., Cleveland, Ohio 44114.

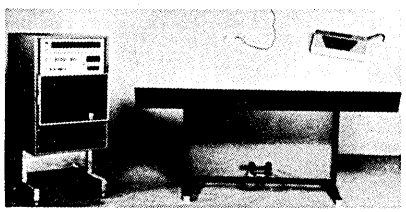
GTE SYLVANIA, INC.
Waltham, Mass. Booth 1704, 06

The two-color model 14VSP5110 crt tube is offered to oem crt and information display product builders requiring higher resolution than standard tv screens. The 14-inch diagonal tube provides more than 118 square inches of area for displaying 2,000 characters, 80 characters to a line. Contributing to the higher resolution are finer electron beams, improved drying circuits, and a shadow mask containing almost double the number of holes in previous masks. Engineering samples are available eight weeks ARO, and prices are $120 each for orders ranging from 100 to 999. For information:

CIRCLE 525 ON READER CARD

INSTRONICS LIMITED
Stittsville, Ontario Booth 2730

The GRADICON is a digitizer system consisting of the drawing table, a readout conversion console, and an optional output device. Various cursors are available for different appli-

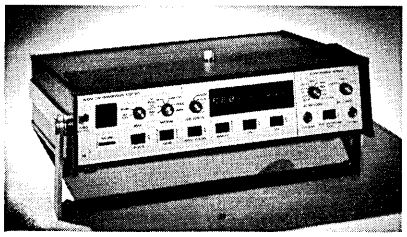


cations, and the system has a resolution of .001 inches and an accuracy near .004 inches. There are four recording modes—time, point, incremental, and grid—and input is at speeds up to 16 ips. Format changes are done with a patch panel, and the basic software for the GRADICON is FORTRAN. Systems start at $16K and are available 60 days ARO. For information:

CIRCLE 527 ON READER CARD

I.C.C., A MILGO CO.
Miami, Fla. Booth 2404

The model 220 data transmission test set permits users to isolate problems in nearly all types of data communication systems. It is a portable unit



that can operate at rates up to 330,000 baud with either synchronous or asynchronous modems. Error counts are displayed with a light-emitting diode readout, and another feature of the 220 is that it offers 103-type modem users a capability for line loopback testing of a single modem. Deliveries begin in February, and the basic unit is priced at $1650. For information:

CIRCLE 528 ON READER CARD

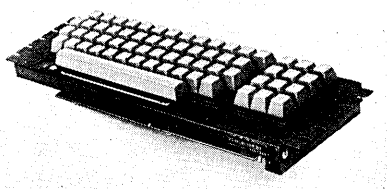
INTERNATIONAL TELEPRINTER CORP.
Closter, N.J. Booth 2518

An impact page teleprinter that prints at 10, 15, and 30 cps will represent this firm at the show. Called the series 30, the unit is available in KSR, ASR, and RO models, and has a 64-character ASCII set to work from for producing 5 x 7 wire-matrix characters. Sprocket- or friction-feed mechanisms for roll or fan-fold paper use can be specified, and the model 30 can be operated in half- or full-duplex mode as required. Deliveries begin in April, and prices start at $1K. For information:

CIRCLE 529 ON READER CARD

LICON DIV., I.T.W.
Chicago, Ill. Booth 1357, 59

A great deal of thought seems to have gone into the design of the series 550/551 solid state keyboards. For example, the buttons act as umbrellas above the ultrasonically weld-



ed thermoplastic housings to shield the electronics from sugar-content beverages, hairpins, and paperclips. The circuitry is contained in an ic card to facilitate coding changes, and the noncontacting switches are mounted on a low-profile assembly. The design is available in either two-key rollover or optionally N-key rollover models. Also available optionally are shift, shift lock, parity, repeat, and special coding. Prices dip under the $100/unit point for orders of 1,000, and availability ranges from six to eight weeks ARO. For information:

CIRCLE 530 ON READER CARD

LIPPS, INC.
Santa Monica, Calif. Booth 1101

Heads for building IBM-compatible magnetic tape drives are featured here. The dual-gap heads are said to be manufactured completely in-house using unique tooling techniques and passing rigid quality assurance testing. The average price of the units is $247, with delivery in 3-4 weeks. For information:

CIRCLE 531 ON READER CARD

For magnetic drum builders, the flying magnetic drum recording head will be shown. A single-channel unit, it utilizes a high-density barium titinate pad material, and is priced as low as $7 each, with delivery schedules reading 3-4 weeks. For information:

CIRCLE 532 ON READER CARD

A 9-channel flying disc recording head assembly will also be exhibited. These units also make use of barium titinate pads and are priced averaging $6 per track. For information:

CIRCLE 533 ON READER CARD

MICRO SWITCH DIV., HONEYWELL, INC.
Freeport, Ill. Booth 2822, 24

Components will be shown. The series 4 lighted pushbutton switches feature a choice of single- or double-pole circuitry, momentary or alternate actuation, and a variety of colors and legends for approximately $2 each in orders of 1,000 pieces. For information:

CIRCLE 534 ON READER CARD

A dc motor said to be economical enough for 75-ips tape drive builders and powerful enough for 200-ips designs, the 4VM accelerates to 3,480 rpm in .0023 seconds. A companion accelerates to 3,550 in .0038. Prices drop under the $150 mark for orders between 500 and 1,000. For information:

CIRCLE 535 ON READER CARD

The 2ss series of solid-state switches extends the capabilities of the Hall-effect keyboard chip introduced by the vendor in 1968 into a general-purpose switch line. The flux concentrators in the switches allow the switch to operate at a greater distance with a given magnet. The pricing is $3.75 each for orders of 100 pieces. For information:

CIRCLE 536 ON READER CARD

NORTRONICS CO., INC.
Minneapolis, Minn. Booth 1203

Manufacturers preparing to invade the point-of-sale market should be apprised of the DigiWand—a pencil-size, azimuth-independent magnetic

Freedom Now!

The new high performance Caelus CMCX pack for 3330 drives is here. One hundred percent compatible with IBM 3336 packs, it provides 800 megabits of storage, 4040 bits per inch. Most important, CMCX frees you from being dependent on one supplier. Freedom you can exercise with absolute confidence. Confidence that you can depend on Caelus for trouble-free quality—and service in depth. Celebrate your freedom. For price and delivery information, call (408)-298-7080 or write, Caelus Memories, Inc., P.O. Box 6297, San Jose, California 95133.

Caelus CMCX 3330 Pack

Caelus Memories, Inc. is a subsidiary of Electronic Memories & Magnetics Corporation

CIRCLE 45 ON READER CARD

reader for handling IATA and American Bankers Association formats. One feature that would seem to be invaluable to such manufacturers is the claim that the DigiWand can be tilted approximately 20° without affecting the accuracy of the recording. The bandwidth is 10 KHZ, the recording density is 250 bpi, and the wiping speed is 15 ips. Prototypes exist now for $300, and it is expected that an order of 5,000 DigiWands would drop the price to $50 each. For information:

CIRCLE 537 ON READER CARD

OPTICAL BUSINESS MACHINES
Melbourne, Fla. Booth 1161

An ocr page reader called the System One will check into Las Vegas. The unit accepts documents ranging in size from 3¼ x 3¼ to 8½ x 14 inches at rates up to 350 cps, depending on size. Initially the machine will only understand OCR-A alphanumerics and 20 control characters, but other field-replaceable fonts are promised for the future. Handwritten numerics are accommodated by the unit as an option. The standard code is ASCII, but other codes, including BCD and EBCDIC are available. Output devices can range from magnetic tape to computers, and the System One price schedule starts out at $30K. For information:

CIRCLE 538 ON READER CARD

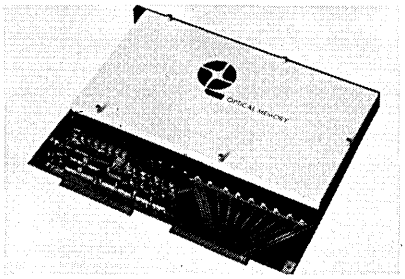
PRINCETON ELECTRONIC PRODUCTS, INC.
North Brunswick, N.J.
Booth 2625, 27

The GS designation appended to this manufacturer's 801 graphics terminal stands for gray scale—32 gray scale values to be precise. A 14-inch diagonal storage tube uses a raster scan to display 1Kx1K points, or up to 64 128-character lines. The 801GS communicates in full- or half-duplex modes at 110, 150, 300, and 1200 baud, and RS-232 interface specs are standard. The basic 801 without the gray scale option is priced at $7200, and $4K more buys the gray matter. Deliveries are scheduled for January. For information:

CIRCLE 539 ON READER CARD

QUADRI CORP.
Phoenix, Ariz. Booth 1648

The EANDRO is an electrically alterable nondestructive readout memory that uses two cores to store each bit of information in sizes up to 25K bits per pcb. The access time is 90 nsec, with a read-only cycle time of 150 nsec. Individual words can be altered, and the unit can be divided into a ROM and a read/write unit. Orders of

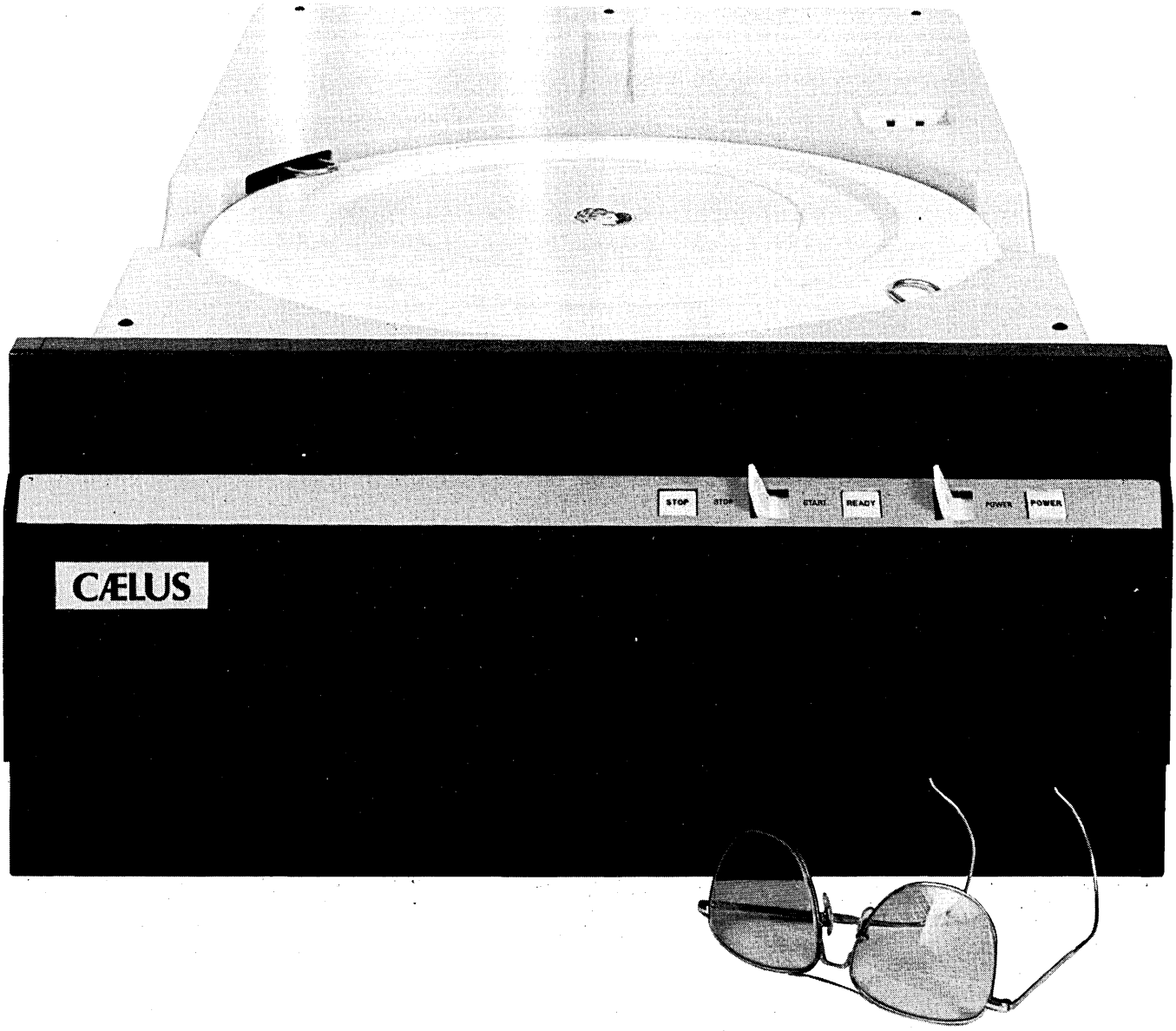


100 pcb's bring the price to 5¢/bit. A second version, without write circuitry and using 1¼ cores per bit, is priced at 1.5¢/bit for an order of 100. For information:

CIRCLE 540 ON READER CARD

Fiber optics are used in the 401-22, rather than complex lens systems

Desk Drive



Meet your first micro-mini disk memory system. The CD 348 from Caelus. Random access to 48 megabits in a package 8¾ inches high. Put four in a desk if you like. Two disks. One fixed, the other removable (top loads just like a big system). Sixty millisecond average access time. Contains its own power supply and 0.3 micron air filtration system. Can be configured to any OEM requirement. And the price is right. For a demo or specs, get to your desk and call (408)-298-7080 or write, Caelus Memories, Inc., P.O. Box 6297, San Jose, California 95133.

Caelus CD 348 Drive

Caelus Memories, Inc. is a subsidiary of Electronic Memories & Magnetics Corporation

CIRCLE 92 ON READER CARD

seen in most optical memories, to try to cut down on the cross-talk between lenses. The 401-22 has an access time of 100 nsec and a cycle time of 200 nsec. Block sizes of the TTL-compatible memory currently go up to 64K bits; and an order of 100 or more such blocks, set up for 32-bit words and including everything but timing and interface electronics, runs between 2 and 3¢/bit. For information:

CIRCLE 541 ON READER CARD

REMEX
Santa Ana, Calif. Booth 1347-51

The model 3075 punch tape reader/perforator is available in either fanfold or roll type versions, with prices $2045 and $2145, respectively. The read side of the unit operates at up to 300 cps synchronously or asynchronously, with stop-on-character capability. The punch rate goes up to 75 cps for 8-channel ASCII characters. Users of PDP-8 and 11 minis are offered interfaces for their machines, and the 3075 will also be sold to oem's. For information:

CIRCLE 542 ON READER CARD

SANGAMO ELECTRIC CO.
Springfield, Ill. Booth 1114

Modems for both end-user and oem applications will be displayed. For end users, the T4800 is currently available for 4800-baud transmission and includes user tests, error checking, and a modulation technique said to be unique. Single unit prices start at $3750. For information:

CIRCLE 543 ON READER CARD

Several pc card modems for oem's will also be shown. The C202CSC is a 1200-baud asynchronous unit on a single card and featuring EIA or TTL interfacing logic. It operates on the DDD network via Bell data couplers CBS or CBT. A reverse channel version is priced at $380, and a standard version at $270. For information:

CIRCLE 544 ON READER CARD

Finally, the T103GSB is designed for 300-baud, full-duplex, DDD applications via the Bell Data Coupler CBT and is equivalent to the Bell series 103. Prices start at $500, and the units are available now. For information.

CIRCLE 545 ON READER CARD

SIGNAL GALAXIES, INC.
Van Nuys, Calif. Booth 1609, 11

Some interesting things will be learned by stopping at this booth. For instance, while the semiconductor industry has been busy turning out chips and boards, very few have been turning out systems—complete with the coding, decoding, and refresh circuitry—like the SC418 MOSRAMS on display here. The 72K bits to each card can be factored into 4Kx16, 4Kx18, 8Kx8, or 8Kx9 bits at a price of $1859 before quantity discounts are taken into consideration. The maximum access time is 500 nsec, with a cycle time of 650 nsec.

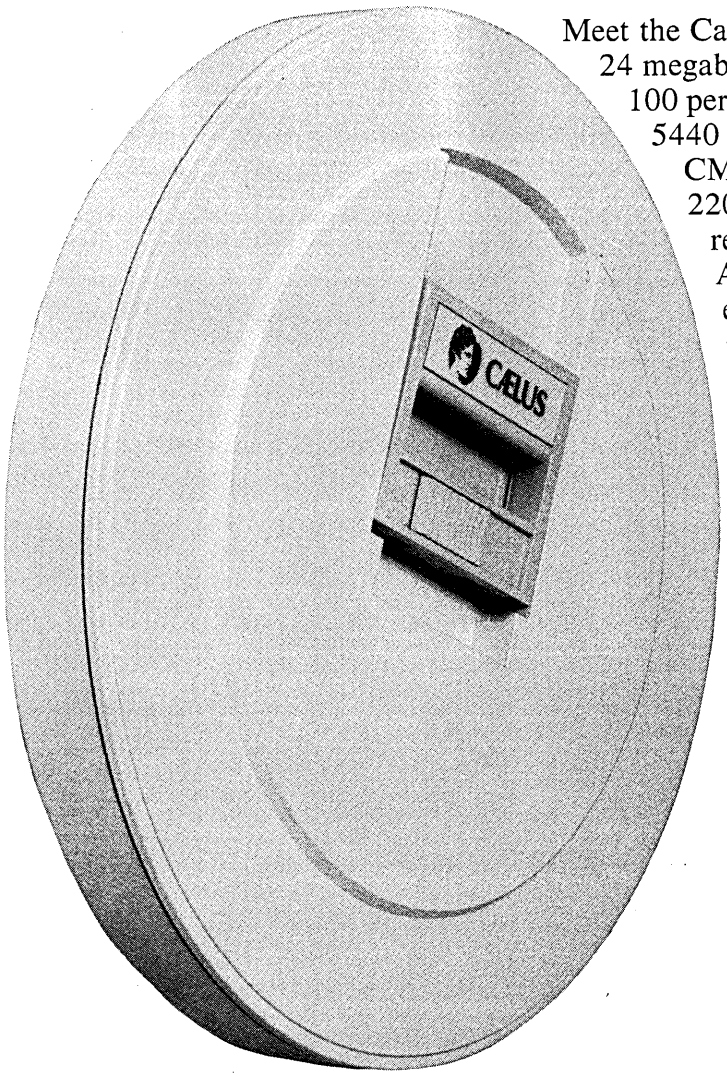
Any customer who takes delivery of 200 or more SC418 cards gets the artwork, manufacturing drawings, test procedures, and vendor parts lists at no additional cost. Deliveries are quoted as 30 days ARO. For information:

CIRCLE 546 ON READER CARD

SINGER-LIBRASCOPE
Glendale, Calif. Booth 1714

Several different versions of the L107

Source/2



Meet the Caelus CM III. A new 24 megabit disk cartridge that's 100 percent compatible with IBM 5440 cartridges for System/3. CM III top loads—records 2200 bits per inch. Has 200 recording tracks plus 3 alternates. An outstanding performer on either System/3 or the new Caelus CD 348 Micro Mini-Disk Memory System. Be resourceful. For exciting price and delivery information, call (408)-298-7080 or write, Caelus Memories, Inc., P.O. Box 6297, San Jose, California 95133.

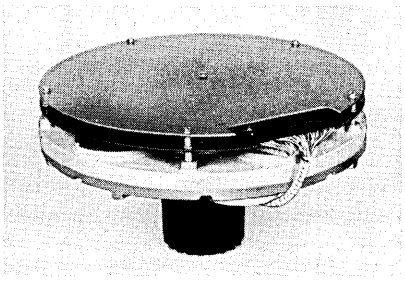
Caelus

CM III Cartridge

Caelus Memories, Inc. is a subsidiary of Electronic Memories & Magnetics Corporation

CIRCLE 6 ON READER CARD

series of head-per-track disc storage systems are available, including militarized ones. The storage capacity can range from 5 to 18 megabits, with a choice of 8.5 or 17 msec aver-

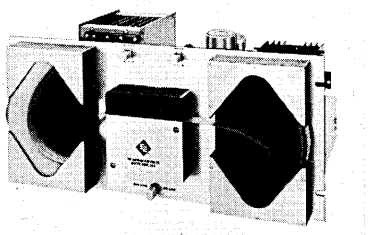


age access times. The transfer rate is 2 MHZ. TTL NRZI logic specifications should ease interface considerations for oem builders, and the L107 pricing starts at $7450 for single units, with 90 day ARO delivery. For information:

CIRCLE 547 ON READER CARD

SUPERIOR ELECTRIC CO.
Bristol, Conn. Booth 2720, 22

Paper tape gear manufacturers seem to be in about the same position competing with cassette builders as core makers are vis à vis the semiconductor industry—the handwriting may be on the wall that more advanced products will eventually replace them, but there's still a ready market for the more familiar technology. The Slo-Syn photoelectric tape reader type TRP500 is a TTL/RTL/DTL-compatible unit that can be specified to read at any synchronous rate up to 500 cps. It uses 1-inch, 8-channel tape



in either loop or fanfold form, and has trays for up to 200 feet of tape. The unit is available 30 days ARO for $980. For information:

CIRCLE 549 ON READER CARD

SYSTEM DEVELOPMENT CORP.
Santa Monica, Calif.
Booth 1710, 12

Primarily known for its software achievements in the past, this large firm has decided to invade the intelligent terminal market, offering the terminal and lots of supporting software. It (tentatively called System/One) has an 8K minicomputer, a crt, keyboard, two cassettes for storage, and a modem; and if that isn't enough, there are optional disc, tape,

and card units. Initially the System/One will be sold only on the West Coast so that the builders can keep tabs on its development, but there are already plans for nationwide marketing, custom hardware and software design, etc. System/One pricing starts in the $40K range, with deliveries in quantity slated 90 days ARO. For information:

CIRCLE 550 ON READER CARD

TALLY CORP.
Seattle, Wash.
Booth 1333-1337, 1520-26

Users whose tty can no longer handle their increasing data volumes, but who don't want to spend the money for a 600-lpm line printer, might take a look at this product. It's a 100-lpm, 80- or 132-column multicopy printer that uses only two moving parts to print its 64-character ASCII set in dot-matrix fashion. It operates at 1200 baud over Bell 202C or equivalent modems, and includes error control routines. A one-year lease for the 80-column model is $195/month. For information:

CIRCLE 551 ON READER CARD

TELEX CORP.
Minneapolis, Minn. Booth 2026

Cassettes are the main attraction at this booth. The Termi-400 is a dual-deck cassette that provides users of terminals having RS-232-C or current loop interface specifications with editing, sorting, and merging capability. The 250-cps units are priced at $3200 and available 30 days ARO.

The Termi-200 is a 250-cps incremental cassette for duty as a data terminal buffer memory. It has serial recording, automatic load point advance, backspace, search, and file protect features, and is priced at $1775. Delivery is 30 days ARO, and the interface specs are the same as the Termi-400 above.

The Termi-300 is a parallel interface cassette tape memory with 250-cps incremental read/write, and 9-bit, TTL-level interface characteristics. Termi-300s are priced at $1460 and are also available 30 days ARO. For information:

CIRCLE 552 ON READER CARD

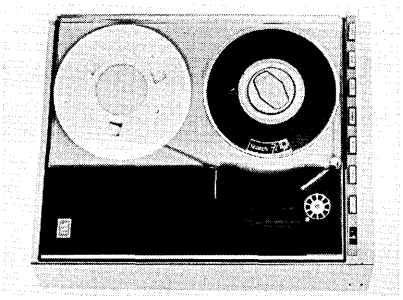
THOMSON-CSF ELECTRON TUBES
New York, N.Y. Booth 1766

Whereas vidicon storage tubes have optical input and electrical output, these tubes—the silicon storage tube models TME 1238 and TME 1239—have electricity as both their input and output. Greater resolution is claimed for the TMEs, also, with better than 1,000 tv lines/diameter. And the units have nondestructive readout, which might clinch their being used by crt equipment builders. Prices start at $610 for the TME 1238 and $875 for the TME 1239. For information:

CIRCLE 553 ON READER CARD

WANG COMPUTER PRODUCTS
Los Angeles, Calif. Booth 2425, 27

The Mod 1075 is a 75-ips, vacuum-column, single-capstan unit for reading and writing IBM-compatible 7- or



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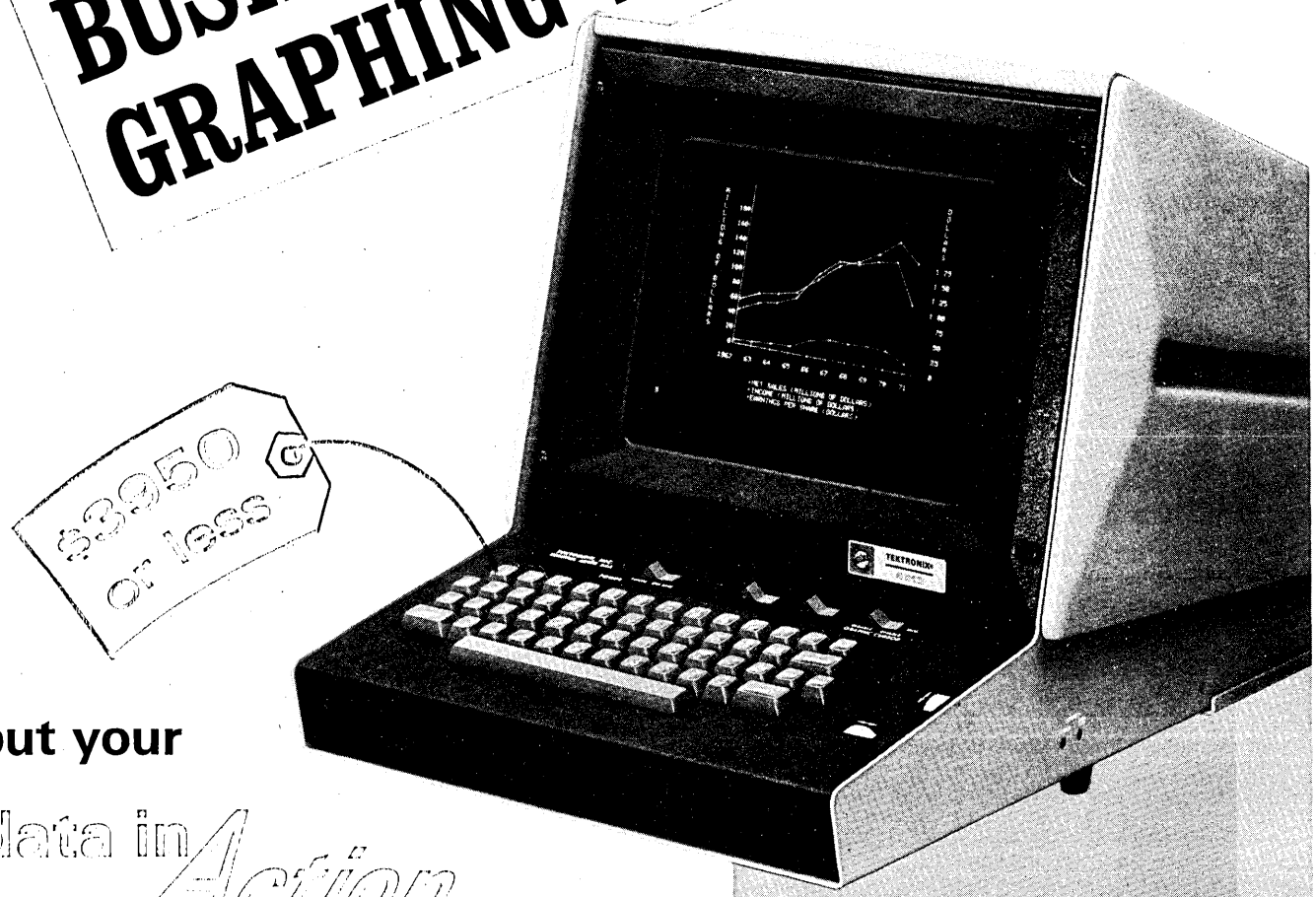

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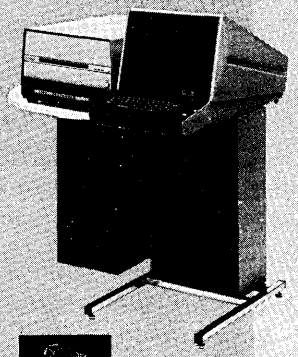

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PERSPECTIVE

an interpretive review of significant developments

House Examines Perot Medicare Take, Wonders If Bargains Were Too Small

H. Ross Perot's amazing climb to fortune and fame got attention in Congress recently, when a House Government Operations subcommittee spent two days looking at the relationship between Perot's company, Electronic Data Systems, and the Texas Blue Shield organization.

Perot, who founded EDS in 1962, was apparently just another dp services salesman until 1966, when he won two contracts to process Texas Medicare claims. Testimony given to the House hearing alleges that the Blue Shield organization, in awarding these contracts to Perot, violated its contract with the federal government, and that Perot was personally guilty of a conflict of interest by undertaking the job.

In its 1971 fiscal year, EDS reported total revenues of $75.2 million, versus $47.6 million the previous year, and $3.7 million in 1967. For the five years, '67-'71, the company earned $150.6 million, more than half from nine Blue Shield organizations.

The left-wing *Ramparts Magazine,* in a story published shortly before the House hearing, said Perot's personal fortune is estimated "as high as $1 billion." It said he was earning $20,000/year in 1965. The *Ramparts* article accuses Perot of milking exorbitant profits from the Medicare program, and of hiring a key official of the California Blue Shield organization — Carel Mulder — shortly after EDS won a lucrative contract to process California MediCal claims. Mulder allegedly was the official most responsible for awarding this contract.

The article swats at Perot as "an absolute dictator and petty martinet" because he allegedly enforces company dress and behavior patterns "so rigidly that outside of Dallas . . . EDS executives are known as 'the southern fascists.' "

Questions From a Cubbyhole

The House subcommittee hearings were conducted by Rep. L. H. Fountain, the North Carolina Democrat. Many of the questions came from James Naughton, the subcommittee's general counsel. Naughton, who works out of an impossibly cluttered cubbyhole in one corner of the newest House office building, and looks far more like a college professor than a grand inquisitor, helped put Billy Sol Estes behind bars several years ago.

Most of the answers to the subcommittee's questions were provided by Thomas Tierney, director of the Bureau of Health Insurance, a part of the Social Security Administration. SSA manages the Medicare program through intermediaries located, basically, in each state. In Texas, as in many other states, the intermediary is a Blue Shield organization.

The testimony showed that in 1965, just before Perot became a dp subcontractor to Texas Blue Shield, he was serving part-time as head of the agency's dp department. Tierney, in answer to a question from Naughton, said "we would not knowingly permit intermediaries to sign subcontracts with their own employees."

Meanwhile *Ramparts* claims that James Aston was "a very influential director" of Texas Blue Shield when Perot won his contract. It alleged that Aston also headed the Republic National Bank of Dallas, to which Perot allegedly repaired as soon as he had the contract. In return for stock in EDS, Republic National, according to the article, gave Perot a loan. (Another source says the loan was obtained in 1968, not 1966. He doesn't know whether any stock was involved.)

Much of the discussion at the hearing concerned the question of why SSA reimbursed Texas Blue Shield for its payments to Perot in '66 and '67 even though the contracts didn't permit federal auditors to check EDS's books; program regulations in force at the time clearly required inclusion of an "examination of records" clause. They also required prior SSA approval of any sizeable subcontract negotiated by an intermediary if the related services or equipment were used "primarily" to administer the Medicare program.

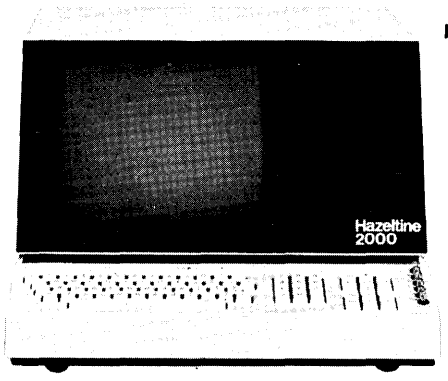
Texas Blue Shield awarded EDS a total of three contracts in '66, each lasting two years. One involved processing of "Part B" claims (Medicare bills submitted by physicians); another covered "Part A" claims (Medicare bills submitted by hospitals), while the third encompassed the state's commercial Blue Shield claims processing. Officials of the organization argued that since the commercial workload processed by EDS under the third contract was larger than the Medicare load processed under the first two, the "prior approval" regulation didn't apply and therefore, no examination of records clause was needed either.

SSA never went along with this reasoning, and never approved the '66-67 contracts, but ultimately reimbursed Texas Blue Shield for its payments to EDS anyway. In 1968, EDS was awarded *another* contract which wasn't approved by SSA beforehand and lacked the examination of records provision. Although Tierney's office, in June 1968, said EDS's charges under this contract were "exoribitant," the feds paid up in full the following October — possibly because, in the meantime, Texas Blue Shield officials applied pressure through the office of Carl Veneman, Under Secretary of Health, Education, and Welfare.

How much EDS made in 1966 and '67 from its Medicare contracts still isn't known; but according to a 1968 estimate by SSA systems analysts, the company's annual costs during this period couldn't have exceeded $750K. EDS collected at least $1.5 million/year for its labor, Tierney reported, so its profit was at least 100%. Data supplied by a subcommittee source suggests that in calendar '68, EDS profits from federally reimbursed health services contracts were considerably higher than 100%.

Part of this windfall was due to a provision in the Texas Blue Shield contracts for '66-'67 which hiked machine time charges. EDS allowed a reduced rate for usage beyond 176 hours per month, but specified that this minimum applied to the three contracts individually, not collectively. In other words, no discount was granted until the claims processed under one

The Hazeltine 2000 System



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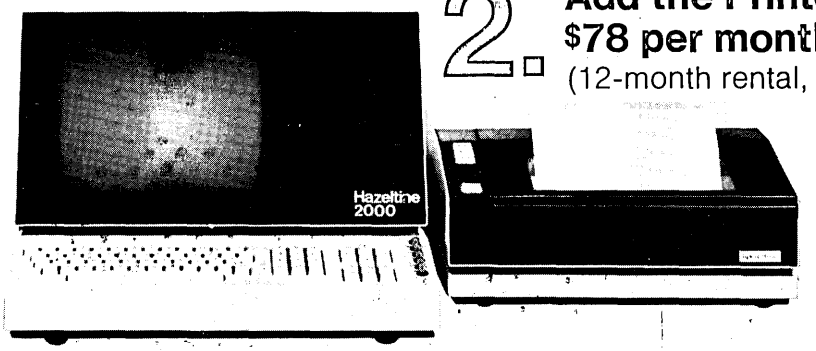

2. Add the Printer Unit for silent hard copy. $78 per month

(12-month rental, including maintenance)

Provides users of the Hazeltine 2000 with a choice of modes —Conversational or Page (regardless of whether or not the terminal is on-line to a computer or communications system). Operating mode may be switch-selectable by the operator, or selected by the CPU under program control.

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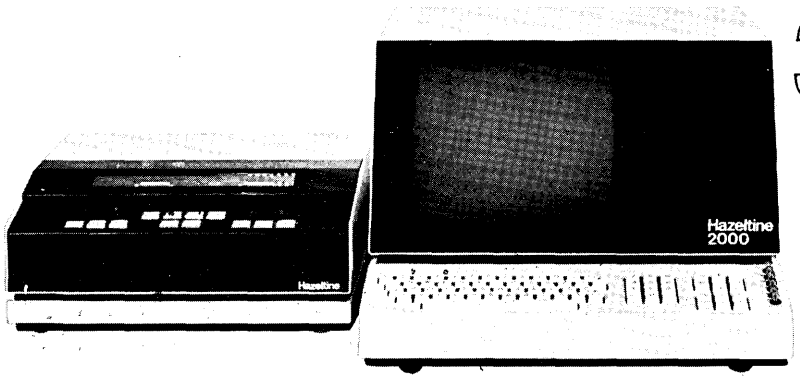
Page Mode—Prints only on command from the operator or CPU when meaningful data is on the screen. Using the powerful buffering capabilities of the Hazeltine 2000, printing occurs directly from the terminal's 2000-character core memory, permitting the screen to be filled, edited and then printed at 30 cps, regardless of the baud rate set for the terminal-computer network.



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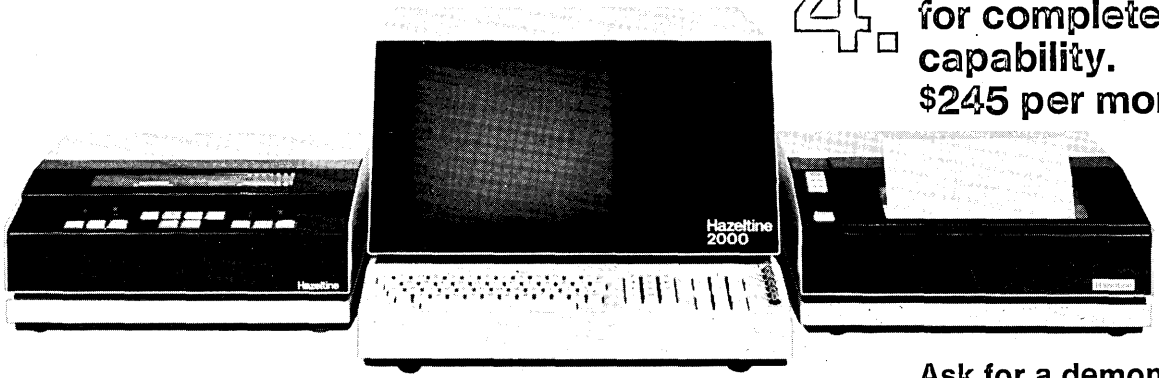
Page Mode—Pages (screensful) of data are recorded by the operator, who may edit before recording. Pages may be retrieved by the operator for review or transmission to the CPU. Additionally, either cassette may be selected, by CPU under program control, for recording or playback through the terminal.



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of the contracts consumed more than 176 hours of machine time in a month. The same computer system supported all three contracts, however.

SSA ultimately reimbursed Texas Blue Shield for the money paid to EDS because, said Tierney, they incurred the expense "and we have not been able to substantiate that the charges were unreasonable." At one point, Naughton asked whether SSA was "taking the position that it did not matter whether the dp costs were unreasonable so long as the overall costs compared favorably with those (reported by other Medicare) plans."

Tierney stressed that EDS's unit charges for processing Medicare claims, in Texas and elsewhere, have been consistently lower than the national average. But he later admitted that evaluations based solely on cost aren't relevant because they don't necessarily reflect the quality of the job done. And a General Accounting Office study, published in December 1970, suggests strongly that EDS's performance in Texas has left something to be desired.

Basing its findings on a sample analysis of claims submitted during three months of 1967, GAO said Texas Blue Shield may have made duplicate payments on about 35,000 claims that year because of coding errors. The cost of these errors was estimated at $1 million.

Postscript: *Datamation* asked EDS to comment on the House subcommittee hearings. President Milledge A. Hart III issued the following statement:

"We're very pleased that the hearings disclosed the performance of EDS and its customers who are Medicare Part B carriers. The overall operating costs per claim of Medicare carriers who employ EDS are significantly lower than those incurred by other carriers of comparable size which do not use EDS. Among this latter group are carriers using a model system developed at a cost of $3.6 million in federal funds. The dp costs of this model system group are 11 cents per claim higher than comparable costs of carriers employing EDS, and this differential does not reflect model system development costs. Our system, which required an investment of more than $2 million of our own money, is more extensively automated than any other and performs significantly more effectively in key areas. For example, it does an excellent job of detecting unreasonable and excessive charges billed by participating physicians. It

For California — Efficiency's the Thing

A couple of Californians went to Texas late last month to look into Electronic Data Systems' activities in health care services data processing.

But their interest differed somewhat from that of the federal House Government Operations subcommittee (see Perspective, p. 87). "If there's anything dirty going on, the feds'll ferret it out," said Assemblyman Mike Cullen; "we're interested in efficiency." Cullen, who's chairman of the California Assembly Committee on Efficiency and Cost Control, went to Dallas with John Billet, a consultant to the committee,

also provides comprehensive protection against duplicate payment of claims."

Hart declined to comment on GAO's charges that coding errors in the Texas Blue Shield system may have resulted in duplicate payouts of $1 million in 1967.

Regarding the charge that EDS refused to allow federal auditors to look at its books, Hart said the company assumed, until 1969, that this examination wasn't required, that "doing business with the federal government was the same, in that regard, as doing business with a commercial customer." In 1969, he reported, the company set up a subsidiary, EDS Federal, to handle its Medicare business. "Federal auditors have been free to examine EDSF's records whenever they want to," Hart added.

—Phil Hirsch

to learn how EDS was processing claims in the state-administered Medi-Cal program and to determine if this processing was the most efficient way of getting the job done. EDS has been processing MediCal claims under subcontract to Blue Shield, one of three fiscal intermediaries handling the claims under contract to the state Dept. of Health Care Services.

Last spring the state's Auditor General questioned the propriety of EDS doing this work (May 15, p. 87). An AG report raised such questions as: should the state be liable for development costs (for a system which conceivably could be used by EDS for other medical services processing); should state welfare funds pass outside the state to a profit-oriented organization; should fiscal intermediaries such as Blue Shield be permitted to enter into subcontracts with profit-making companies without the prior knowledge or consent of the Dept. of Health Care Services and without putting the contract out for competitive bid. The state legislature has yet to take any action on the report.

As for Cullen, he feels some of the constraints on a fiscal intermediary implied in those questions "could make it impossible for them to buy erasers."

Cullen said in mid-October his trip would be strictly a fact-finding mission. From Dallas, he and Billet were to go to Springfield, Mich., and Albany, N.Y., to study data processing systems there in hopes of bringing back ideas to help streamline California's total dp operations, which have been the subject of considerable wrangling in the state capital over the past three years.

Cullen said he has been following closely the GovOps subcommittee's investigations into EDS, and "if anything conclusively damaging comes out of them, I'll certainly fire off a memo to the (state) Attorney General to that effect."

— E.M.

NEWS SCENE

IBM Dominates Issue Over Its Dominance

The increasing number of major failures in the industry — like GE and RCA — have poignantly underscored the questions of whether IBM is a monopoly and how its dominance is impacting competitive survival.

The legal answer will lie in the way the edp market is defined and how its shares are distributed. Two recent actions in the private antitrust cases against IBM support this view. (1) Under depositions issued by court order, 2,700 firms were asked to write replies to 10 extremely detailed questions about their edp business (see Nov. 1, p. 7). (2) IBM in October was forced to refile its second counterclaim against Control Data Corp., alleging that it attempted to monopolize the large-scale computer market.

This second counterclaim exemplifies the problem of market definition. When IBM first filed it, it said that, in effect, *Control Data* believed that there was a large-scale computer market and attempted to monopolize it. The court struck it on the grounds that the claimant, IBM, had to state its *own* belief. But IBM, in its arguments on its own behalf, has denied that the edp market can be broken down into several limited markets. Thus, when it refiled, it "plead in the alternative"; that is, if the court determines that there are limited markets or submarkets, CDC has attempted to monopolize one of them — the large or "supercomputer" market.

Trying to establish the great breadth and competition in the edp market, IBM initiated the questionnaire that went to the 2,700 firms. IBM lawyer John French, of Faegre and Benson, argued in court that "if we prove really we are in competition with 2,700 or 1,800 or 1,000 or even 500 or even 300 separate, significant entries in the data processing industry, we find it very difficult to conceive how a jury could conclude that we have monopolized anything, or that we are in a position to monopolize anything." He also said that IBM would assume the expense, answer all queries, and "take whatever steps are necessary to secure compliance."

And that means that companies that didn't answer by Oct. 20 would again be called on to do so, perhaps in court.

Plaintiff Greyhound Computer Corp. did not argue against taking the depositions, but Control Data did — at length. One complaint was that the list included companies "that are only remotely interested in data processing," such as firms selling excess time on their computers. The obvious inference was that IBM strategy was to reduce the appearance of its market share by introducing every conceivable product, service, and firm. (French countered that IBM has trimmed the list down from an original 8,000 firms and individuals it had found in various

publications and elsewhere.)

CDC also complained of the task for the firms. "IBM proposes to take all 2,700 companies back to 1952 to make them resurrect 20 years of records, analyze them, restructure them, put them into new formats to suit IBM's taste, and set forth the net assets employed by each company during each year for all of their (edp) business ... the gross revenues of each year." Then, the complaint continues, "they get to products and services, and ask for virtually every conceivable detail about them, the name of a product, the model number, its application, its functions, the offering dates, the revenues from it, quantity sold and so forth."

IBM is asking companies to do this time-consuming task, says CDC, despite its own repeated objections in the interrogatories that "answering certain questions would require the examination of millions of documents, thousands of cubic feet of documents."

The court, however, upheld IBM's right to show what they consider the market to be and further agreed to the "shortcut" of taking depositions in written rather than oral form. (About 20 or 30 follow-up oral depositions also will be taken.) Of course, all parties will have copies of the data to develop their own analyses and the industry can look forward to fierce battles over the interpretation.

Two more actions in the antitrust case occurred in September. Commercial Credit Corp., CDC's subsidiary, filed a counterclaim as an IBM customer against IBM alleging violation of Section 2 of the Sherman Antitrust Act. It said that CCC has paid IBM "purchase prices and rentals greatly in excess of what such purchase prices and rentals would have been had IBM not been guilty of the monopolization alleged herein."

"IBM," it adds, "has exercised the illegal power of controlling the prices and rentals ... notwithstanding the existence of any competition or attempted competition." Treble damages are asked.

Too, Control Data and CCC filed replies to IBM's first counterclaim against them, denying all allegations: reciprocity practices, participation in an international cartel, acquisition of firms to restrain trade and lessen competition, and deception in the financial relationship between CDC and CCC (see June 15, p. 53). The 66-page IBM counterclaim contained dozens of quotations taken from CDC and CCC documents available in the antitrust "discovery proceedings." But since it did not attach the documents, both firms made qualified admissions that the quotes may be in.

One of these quotes:Relating to reciprocity charges, R. D. Eisenhardt, Jr., a CDC sales official, said in a memo, "Over the past 15 months partners at F. I. DuPont; Paine, Webber, Jackson & Curtis; Hornblower, Weeks, Hempill and Noyes; and Goldman Sachs have made direct statements to us that if they received a substantial portion of Control Data business, there would be no question that Control Data would get their data processing systems orders ..."

Control Data said interpertation of quotes would be up to the court.

Germans to Make Up 75% of Munich Show Turnout

As far as computers are concerned, not only has there been a thaw in the cold war, it is just possible it has melted away. For instance, teams from the U.S. Dept. of Commerce have been moving in and out and around behind the so-called Iron Curtain as if it were made of Swiss cheese.

The objective of the teams — working with Commerce's Commercial Exhibitions Program — has been to drum up support among the seven Eastern European countries for Systems '71, which will be held in Munich, West Germany, Nov. 30-Dec.3. The agency is sponsoring the U.S. exhibit at Systems '71, and an official says the 100 firms that will be represented in the U.S. Pavilion should be enough to make it largest in the show.

"We're putting a lot of resources into promoting this show," said the official. "This is the biggest effort we've ever made in Europe. And we expect to get a good draw from Eastern Europe."

In addition to Commerce department representatives, U.S. economic aides attached to embassies in Eastern Europe have been visiting large computer users there to help spread the word of the fair. In addition, the "pitch" for the U.S. Pavilion was given to some 3,500 visitors at a Commerce department office that was set up at the IFIPS conference in Yugoslavia this summer. "The push reflects the relaxation in the controls and feelings that had existed between the U.S. and Eastern Europe," said the official. "We know there are still many handicaps, but it's a good start, I think. We're not looking for any immediate success, though."

One problem, of course, is export control — many U.S. computer products cannot be shipped to communist countries. However, the U.S. government is relaxing those restrictions. IBM World Trade has shipped a 145 to Yugoslavia, and Data General Corp. minicomputers are permitted to be shipped into mainland China from Japan. The goal of the Commerce department is to foster U.S. exports. Smaller computer and peripheral companies are receiving the most help from the agency because most of their manufacturing is done in the U.S. and sales in Europe will help the balance of payments position.

Although the push in Eastern Europe represents a new development, the majority of the attendance at Systems '71 is expected to come from Germany, the host country. Of the more than 20,000 expected, perhaps 5,000 may come from countries other than Germany.

"This is a user-oriented show," says Gerd Vom Hoevel, a Systems '71 official. "Everything is aimed at attracting the computer user — the exhibits, the seminars, the speeches." The other German show, in Hanover every spring, has more appeal to oem's than end users. The Systems exhibition — held every other year — will continue to stress the computer user.

Technical conferences at the four-day exhibition in Munich will begin with subjects of broad interest ranging from time-sharing and data banks to

data communications and data entry. Later, the attendees will split into more vertical users' groups covering banking, government, insurance, and medicine.

One reason exhibition officials feel the event will be successful is that Germany is the third largest computer user in the world behind the U.S. and Japan. Further, the German market is booming; its size was estimated at about $570 million in 1970, and that figure is expected to double by 1974.

Australian Growth Is at Top, Bottom

There's a trend away from the use of medium-scale computers in Australia, accompanied by greater demand for those at the top and bottom of the price scale. Interestingly, this is also a shift foreseen for the U.S. by A. D. Little Inc. in a recent study, which described a movement by users toward the establishment of larger centralized systems that feed satellite processors.

In Australia, a Commonwealth government study shows there were 1,231 general-purpose digital computers installed as of June 30. Of these, 513 (or 42%) were in the under-$100K price bracket, compared with 39% a year earlier. There were 80 in the $1 million or more class — or 6.5%, compared with 5% in 1970. An accelerated movement toward the use of larger computers is also evident in the on-order breakdown, with 34 valued at more than $1 million, compared with 23 one year earlier.

As in the U.S., the federal government there is the largest user, accounting for 39 of the 80 biggie mainframes installed. It has one more on order, as well as 23 of the under-$100K variety, but none in the three other price ranges in between.

Annual growth in the number of installations is evident from year-end figures for the years 1967 through '70. They are 608, 718, 869, and 1,124. A more dramatic increase, however, is shown by hybrid computers, installation figures for the same period being 5, 8, 21, and 40.

Australian Scene: Would Macaulay Do It Again?

Australia's first computer hardware manufacturing company was formed by an American, Malcolm Macaulay, a UCLA graduate who left the computer business in St. Paul in 1967 to move Down Under.

Looking back on the early days of

MALCOLM MACAULAY: A tariff will improve the short-term outlook.

his 2½-year-old Information Electronics Ltd., Canberra, Macaulay wonders why he ever bothered.

Business is better now. But in the early days Macaulay couldn't raise venture capital for the young firm, formed to manufacture crt display terminals. Macaulay's solution was to list the company, anyway, on the Australian stock exchange without benefit of underwriting. "If I had known how hard it is to set up a business in Australia, I don't think I'd have bothered," Macaulay said recently. "However, I think we obtained our first orders much more easily than we would have done in the United States."

In recent months he's been the sole supporter — against all the U.S. hardware manufacturers operating in Australia — of a 25% protective tariff for crt display terminal imports. The tariff has been imposed by the Special Advisory Authority of the Australian government. The protection is only temporary, since it must be reviewed by the Tariff Board in a full-scale inquiry; but this may take up to two years.

Macaulay first came to Australia Jan. 26, 1967, with a visiting fellowship at the Univ. of New South Wales in Sydney, to undertake post-graduate research into computer terminal development. As a result of this, he became a Master of Engineering in 1968. His original degree from UCLA was a B.Sc. in 1954.

One of his early jobs was as project supervisor with Univac in St. Paul. Here he worked on the Naval Tactical Data System (NTDS), a network of computers that Macaulay describes as "an on-line, real-time system that was operating in 1958 well in advance of any commercial application of time-sharing."

The work made him realize the need for display units. He launched his first computing venture — Data Display Inc., St. Paul — to make display units; but was acquired in 1963 by Control Data Corp., which kept him as director of display engineering and assistant director of engineering. He moved out in 1965 to become a consultant and by 1968 was investigating setting up his own company.

Several factors led him to his decision: There was an estimated $250-million computer market in the country in the next 10 years; no other company was fully involved in manufacturing, although there had been one or two contracts for specialized keyboard terminals; and design and engineering manpower is considerably cheaper in Australia than in North America.

IE's first order came from the computerized betting system known as Totalisator Agency Board (TAB) in the state of Victoria. The installation in Melbourne, based on dual CDC 3300s, has been considered the most technologically advanced in Australia. In 1969 some 100 new telephone betting terminals were supplied to TAB by Information Electronics and another 16 last year. CRT displays for these terminals are based on standard television receivers with the intermediate frequency amplifiers removed. Signals are sent to the tube as demodulated tv video, and no detection is required.

The firm has had contracts this

year from the Common User Data Network of the Australian Post Office, Australian Iron and Steel, and from Medicheck, an automated multiphase screening center about to open in Sydney. IE also has interfaced two mark sense card readers from Data Products and two Kennedy magnetic tape drives to speed up data preparation for the Australian census, taken last summer. Interposed between the card reader and the magnetic tape unit is the company's own standard production visual display unit — the IE33. If a card stops the card reader for any reason, the image can be brought up on the display unit to identify the cause.

In Australia's terminal market, IE is up against some formidable domestic opponents. One is Standard Telephone and Cables, the Australian electronics company which last summer said it was making a banking terminal aimed at Olivetti's TC349, of which some 1,000 are installed. Standard's machine, the TT 14, has a print speed of 33 characters per second. AWA, another major Australian company, introduced the VTE-6 in September, a crt terminal with a character display of up to 25 lines of 72 characters each. The firm also makes non-crt ticket-issuing terminals for the state betting system.

Control Data's 60-man manufacturing facility in Melbourne makes ticket-issuing terminals for the betting system in Victoria, and Time Share Systems makes a data entry system called MAK. It plans to triple its output of stations, which now amounts to 400 a year. Honeywell and Varian supply the MAK's controller, but the firm plans to make its own mini soon.

Of his own company, Macaulay says: "I am optimistic about the future, and our short-term position, for up to 18 months at least, will be improved," because of the 25% tariff.

— Fred Bland

Canadian Digital Network Ahead of Schedule

Installation of digital equipment for the Trans-Canada Telephone System digital data network, announced in March, is running slightly ahead of schedule, with equipment scheduled to be installed early next year now expected to be put in next month. Plans call for coast-to-coast service by the end of 1972. Eventually, Trans-Canada plans a buried, multi-tube coaxial cable for implementation during 1974-76 and a digital transmission system using existing microwave facilities in 1976.

TCTS also announced its intention to provide a service called Software Controlled Communications Services, utilizing Datagen (Canadian subsidiary of Data General) Supernova minicomputers for use as front ends and concentrators. The supply of such hardware by a common carrier is apparently a new idea, and TCTS argues that such equipment actually performs a communications, rather than computing function and could better be provided by the communications carrier. Front end units are now available, but the concentrators are still under development.

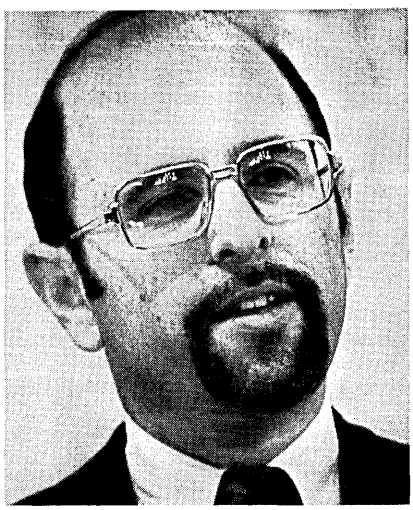
While TCTS has been working on

its digital network, the Science Council of Canada has produced a report to the government suggesting a coast-to-coast computer network be established, perhaps as a quasi-governmental organization like the Canadian Broadcasting Co. In response to that recommendation, Canadian Pacific Telecommunications suggested the network could be most cheaply implemented by using surplus capacity on the existing microwave network of Canadian Pacific - Canadian National Telecommunications.

We're Not in Computing or Software, Says C&S

"We're not computer people. We're credit people who know how to use computers to solve credit problems . . . collections people who know how to use computers to solve collections problems. You've got to understand the customer's problem."

This business stance was given a lot of credit by Dr. Norman E. Friedmann, president of Computing and Software, Inc., for the fact that a business historian in the next century, who had nothing more than his company's financial reports by which to judge the past few years, would never know there'd been bad times.



NORMAN E. FRIEDMANN: "We didn't do what we said we wouldn't do.

A former C&S executive who now heads up his own computer services firm gives another reason: "Norm Friedmann's just a darned good manager." Could be both reasons are valid.

Computing and Software, in a nine months' report for the period ended July 31, showed sales of $68,228,000, up from $64,282,000 in 1970, and earnings of $5,057,000, up from $4,758,000. And this was just the latest step up in a steady climb that dates back to 1965. For fiscal 1971 ended Oct. 31, the firm was, at this writing, anticipating revenues of some $100 million, up from $89,488,000 a year earlier.

Certainly Friedmann and company picked a good time to deemphasize the computer in their marketing efforts and to concentrate on selling results. Computer isn't considered a nice word in many business areas these days. Friedmann attributes this in part to "indiscriminate computer overkill" in both the sales efforts and services of many computer services companies. "They don't trust the customer

organization." And that, he says, results in their selling more computing power than is needed without ever really understanding the problems that need to be solved. "It leaves a bad taste."

Computing and Software at one time was considered one of the nation's leading software houses. Today they don't consider themselves a software company.

"As far as our software capability goes," says Friedmann, "we're our own largest customer. We won't sell software unless it's in an area where we have production expertise. We develop it first for our own use." Currently C&S is selling just two software packages, one for trust accounting and a small, general-purpose file management package called Extracto. "We have others in the wings."

The company, whose big push is in business information systems, contends it has no direct counterpart in terms of its overall activity, although it has competition from a variety of firms in specific segments. Of its three activities today, business information services accounts for 87% of revenues. The other two, educational and personnel services and the manufacture of printer drums for computer printers, account for 10½% and 2½%, respectively.

Roger Lee, vice president, said the educational and personnel services operations, which include International Tabulating Institute in the East, West Coast Trade Schools in the West, and a temporary help organization, probably will be sold off soon. The manufacturing arm, Troy Computer Products, is "a nice little operation. The sales have held up and so have the profits, and we'll definitely keep this even though we don't expect big growth in this area."

Selling off the educational and personnel services operations will be a reversal for C&S of an acquisition trend it actively has pursued for the past three years. "We've achieved as much diversification as we care for," said Lee. And now the trend is toward concentration and expansion in the areas in which they are strong.

One of these is the automated credit reporting field, which Lee says will account for some $5 million in revenues this year. C&S got into credit reporting by buying up four credit bureaus in the Los Angeles area. These were all manual operations which C&S immediately automated and consolidated. The operations have been fully automated for about a year now and still are limited to the Los Angeles area, but they will be expanded, says Friedmann, first within Southern California and eventually, nationally.

One way they'll expand is through a new "wholesaling" program they call their medallion program, something they say is similar to a practice in use for some time among New York City taxi cab operators. Their market for this is made up of credit bureaus outside of their immediate operational area who want to automate without a big capital outlay. In a given area they would grant one credit bureau a "medallion" representing its right to use C&S services in its area. These services would involve C&S converting the bureau's files to machine form and

maintaining the files. The bureau would obtain its own terminal. The medallion itself would become a saleable commodity which the bureau could sell if it didn't want to use the C&S services any more. C&S would charge the wholesale customer for storage and per inquiry. Sale of the medallion would be strictly between the user bureau and its customer, with the bureau setting its own price. Friedmann said in mid-October they had one group of bureaus signed up for the medallion program and "several others in negotiation."

Friedmann is proud of C&S' credit reporting service, which has TRW's CreditData as its major competitor in the L. A. area. He said his system can come up with the most complete "debt profile" of any company in the business. This is partially because they maintain current balance information, which most systems don't. This means, he explains, that a credit report on a given individual will show not only that he has an open account with the XYZ department store, but also what he owes that store and what his purchase and repayment habits have been.

Also, he pointed out, "we don't truncate information; every piece on a given individual or company is linked to every other piece so that mismatches are virtually impossible." A given John Jones, for example, would have to be linked to an address, a social security number, an employer and/or other specific information in the file before a report could be given out on him.

Friedmann says he's happy with the recent implementation of the Fair Credit Reporting Practices Act. "It marked the end of the era of the manual bureaus. They will have to sell out or go to one form of automation or another because it's impossible for them to comply with the law. They can't purge regularly, make their records easily available to the public, nor assure all their information is linked to sources." He feels this will help his wholesale business.

Friedmann said their security precautions for credit reporting activities are even stiffer than those for facilities management operations they have at government installations doing classified work. "There's a big criminal business, tampering with credit files; but our protection system makes it harder to tamper with ours than with manual files."

Besides credit reporting, C&S is concentrating hard now on market research, which includes things like media research, testing of response to direct mail, credit card use stimulation, foot traffic stimulation studies, and custom market research.

The important thing, said Friedmann, is "we're selling end items, not resources." He cited machine time as an example of a resource. "We're computer intensive, but we're not in the mainstream of the computer industry. Companies who sell their computer expertise and not what it can provide the customer find the customer converting to doing the computer work himself and doing it, in many cases, better and more effectively."

Another reason cited by Friedmann for C&S' growth in bad years is that "we didn't do the things we said

we weren't going to do back in 1967. We practice what we preach." Among the things avoided, he named commercial facilities management, leasing, and commercial time-sharing.

"All the things we said would happen back in '67 have come to pass. We said the general-purpose service bureau business wouldn't last, and it is clear today the general-purpose service bureau is passe. And, as we predicted, the era of the custom software company has passed."

Computing and Software has service bureaus in some 60-70 locations, but "they're as specialized as possible and many are dedicated to internal use." Even those that aren't look to the company for at least 50% of their business.

With the deemphasis of the computer and the emphatic claim they're not a software company come inevitable questions about their name, Computing and Software. It's not particularly descriptive, admits Lee, and "we'd like a new one, but so far nothing better has been suggested, and a name change is not a number one priority. However, we're open to suggestions."

But then, a rose by any other name is a rose is a rose is a rose.

IBM's 3330 Shoves Rival Memorex Out of Zayre

The marketing infighting at the Zayre Corp.'s computer installation in Framingham, Mass. — site of IBM's first 370 installation — is beginning to read like the computer industry's "Perils of Pauline."

First, Memorex knocked out two IBM 2314 disc drives with a 3660 disc file subsystem. Now, IBM has retaliated, replacing the Memorex equipment with one of its first 3330 disc drives to be delivered to customers.

For many months, Zayre had an IBM 370/145 on order, but then the nationwide store chain disclosed that it was considering installing an RCA virtual memory mainframe instead. RCA settled that issue itself, of course, when it fell on its sword, announcing that it was leaving the mainframe business forever. But as this is written, Zayre has no plans to take a 145.

The activities at the Zayre installation are considered by many to be particularly significant, not only because it is the location of IBM's first 370 installation, a model 155, but also because the site is something of a microcosm of several key issues currently facing the industry. It is felt that Zayre operates an unusually sophisticated installation and, as such, is often in the vanguard of new user developments.

One thing that has become evident at the Zayre installation is that what is Memorex and RCA's loss is not necessarily IBM's gain. For example: By pricing its new equipment so low, IBM has made competitive life miserable for the competition — perhaps unlivable in the case of RCA — but it is also causing problems for Number 1. There are indications that IBM's new equipment — largely a 155 and a 3330 — are bringing in monthly revenues that are sharply reduced from those that were coming into IBM from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It means you can put an extra measure of confidence in "Scotch" Brand computer supplies. All of them. Computer tape. Disk packs. Digital cassettes. Disk cartridges. And related accessories.

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CIRCLE 8 ON READER CARD

the equipment the 155 and the 3330 replaced.

"We've gone from three machines — models 30, 40, and 50 — to one machine (the 155), and we've got a lot of computing power left over," says Robert M. Bozeman, Zayre's assistant vice president of management information systems. "And I think that the same thing is happening all over at new 370 installations — not just at Zayre."

Bozeman, as might be expected, is delighted with the new developments. He says he has been able to cut his budget more than 25% because of the new IBM equipment. He declines, however, to give precise figures on the installation. And IBM, noted for its secrecy, has a standard policy of declining to discuss customer installations.

Informed observers, however, estimate that Zayre is saving about $250,000 a year on the new IBM equipment. Thus, it would follow that IBM is losing a similar amount. Zayre, which logs annual sales of about $800 million, has a data processing budget of about $4 million annually, the observers estimate.

The maneuvering over disc drives at the Zayre site has also been interesting. Memorex scored something of a coup when it displaced IBM's 2314s earlier this year, becoming in the process the first independent peripheral manufacturer to interface with a 370 machine. IBM, however, fought back with its 3330, which was installed in August. The two-controller configuration has 800 million bytes and eight spindles.

On another front, Zayre had been considering accepting an IBM 145 or an RCA virtual memory machine, primarily to meet the chain store's in-house time-sharing needs. RCA dropped out of the mainframe business, and Bozeman did not feel that the 145 could meet Zayre's needs, so he is going to use IBM's TSO on Zayre's 155. "We're going to see how it works," says Bozeman. "It looks like it might accommodate our needs for the next six to eight months."

As for the 155, Bozeman remains an extremely happy customer. "We run it solid all the time," he says. "We had high expectations for the 155 before we got it, and it's already exceeded the expectations."

Zayre has converted its installation from DOS to OS — a task that took about six months and represented 10 man-years of work. "It takes an investment to get the savings," Bozeman said. "We had to convert 1,200 programs and it cost us about $250,000." Now the installation is saving another $250,000 a year, largely because of reduced personnel. In all, the new IBM equipment should save Zayre an estimated $500,000 annually, and that is a substantial amount for an installation whose estimated budget is $4 million a year.

NEWS BRIEFS

Potter Eyes RCA Users

Inspired in part by an anticipation of a switch by RCA users to IBM 360s and 370s and a belief in the overall growth potential for 360 and 370 installations, Potter Instrument Co. increased the field sales force for its IBM plug-to-plug compatible peripherals by 40%, with a proportionate increase in its service organization. A Potter spokesman said each RCA user who switches to IBM "represents a potential sale for the company since Potter can help the user offset the higher IBM cpu cost by providing the peripherals at a lower price."

MAI Genesis One

The latest development in the genesis of a new and hopefully viable Management Assistance Inc. is a name change: MAI Equipment Corp., the firm's marketing arm, is now Genesis One Computer Corp. The word "genesis" is meant to signify "the beginning," while "one" derives from the leadership position MAI has had in innovating such concepts as purchase-leaseback of unit record equipment and "plug-to-plug compatible" peripherals, both claimed to be firsts.

Lessors Are Its Prospects

Fabri-Tek expects leasing companies to be a major market for its soon-to-be-announced LCM+ core memory add-on for the 360/65, making that machine competitive with the 370/155. The new unit will go up to two megabytes; but the first installation, scheduled for March, will be for one million bytes. Fabri-Tek will sell the one-megabyte configuration for $600K and lease it for $12K/month. The memory company also announced the signing of a Canadian maintenance agreement with MAI of Canada, Ltd., a move not unexpected after Fabri-Tek had contracted this spring with MAI subsidiary Sorbus Inc. for U.S. maintenance of its end-user memories. Canadian marketing will be done by Greyhound of Canada, Ltd., except for Alberta and British Columbia, which are handled by Computer Supplies of Seattle, who also has the northwestern U.S.

Before RCA's Black Friday

Computer professionals in northern California have been hardest hit by unemployment, says Source EDP, Inc., a firm which finds jobs for them. Its study shows 3.5% of all the computer professionals in San Francisco and Palo Alto were still looking for work late last summer. Next was Dallas where 3.1% were still unemployed, followed by Atlanta with 2.5%. In Los Angeles, only .5% of computer professionals were out of work, but this could be a lot of people since Los Angeles has the largest population of edp professionals, the firm noted. On a note of optimism, it found that Los Angeles and Dallas were the two most active employment markets in late summer; but scientific programmers and analysts from aerospace and electronics companies were still finding it hard to get work. The company also reported that the study was made before Sept. 17, when RCA folded its computer operations and shooed some 2,000 employees out onto the street.

Perot Makes His Point

Ross Perot has finally gotten permission to build Electronic Data Systems' new world headquarters on a 170-acre golf course he owns in the center of prime North Dallas residential neighborhoods. Could be some of the residents are relieved. Turned down by the Dallas City Council early this year on a request to have zoning for the tract changed from residential to commercial, Perot jokingly was said to have considered offering the land to the AEC for use as a waste disposal site. At a Dallas Press Club dinner last May at which he received the club's headliner award, Perot dead-

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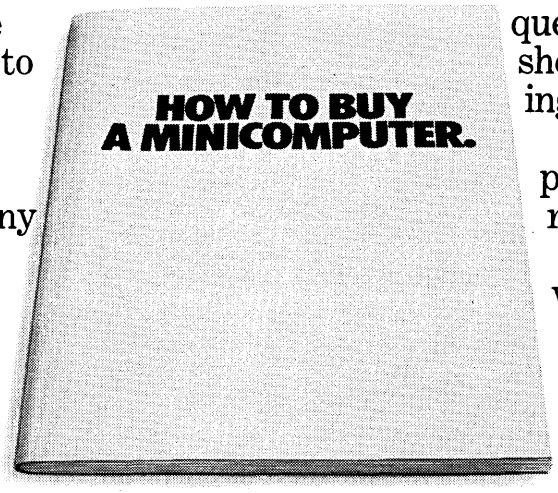
We think we're pretty well qualified to write the book on all these things.

After all, we're the number 2 company in the minicomputer business, and on our way to becoming number 2, we've installed over two thousand minicomputer systems in hundreds of applications.



Each of those two thousand systems is built around one of the Nova line of minicomputers — the broadest line of 16-bit computers available, offering the best price/performance in the business.

These systems use Data General's broad range of software, including Extended FORTRAN IV, Extended ALGOL, Disc Operating System, Time-Sharing BASIC, and assemblers, editors, and utility packages.

They also incorporate a long list of Data General peripherals, from discs to System 360 interfaces to line printers to mag tape units to A/D converters.

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Section I of our book has questions and answers you should think about before buying anybody's minicomputer.

Section II stacks our products against the questions raised in Section I.

After you've read the whole book, we think you'll be more likely to buy something from us.

That's how we plan to become the number 1 minicomputer company.

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You see, we have one fully integrated network. It has both "analog" and "digital" channels...and has had for many years. Signals travel as waves on one and as pulses on the other. Regardless of the original source or form of the signal, whether human voice or computer, we readily transform it to travel over either channel.

This flexibility makes virtually all of our network available for data transmission. It keeps charges low. And it gives us alternate routes should trouble arise.

Then why are we going heavily digital? Because with modern electronics, especially solid-state circuitry pio-

neered at Bell Labs, digital transmission is better not only for data but for many other services as well.

Digital transmission is better because it eliminates many kinds of noise, thereby getting more information over the same size cable with greater accuracy.

Digital is clearly technology's best answer to many of America's future communications needs. It will benefit everybody, not just our data customers.

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- For 1972, a new digital system that will operate at 6.3 megabits per second, four times the speed of our present all-digital lines.
- By the mid-'70's, initiation of private line service on an end-to-end, fully digital basis which will ultimately serve every major city in the country.
- By the late '70's, waveguide systems capable of thousands of megabits per second.
- By 1980, the Bell System's network will be four times its present size. A large proportion of it will be digital—enough to provide ample capacity to meet America's data-handling needs.

The American Telephone and Telegraph Company and your local Bell Company are continually working to improve service to business.

This time by increasing digital services to benefit all our customers.

pannedly laid this idea to rest with: "AEC disposal site problems have been solved; so I have no intention of inviting AEC to use my land for that purpose. But I understand there's a problem about disposing of nerve gas." Whatever the reason, the Dallas City Council changed zoning for the area from residential to planned development, which restricts buildings to two stories except for the administration building and requires maintenance of open space, which in this case will be a golf course for use by EDS employees.

Memory Market in '75

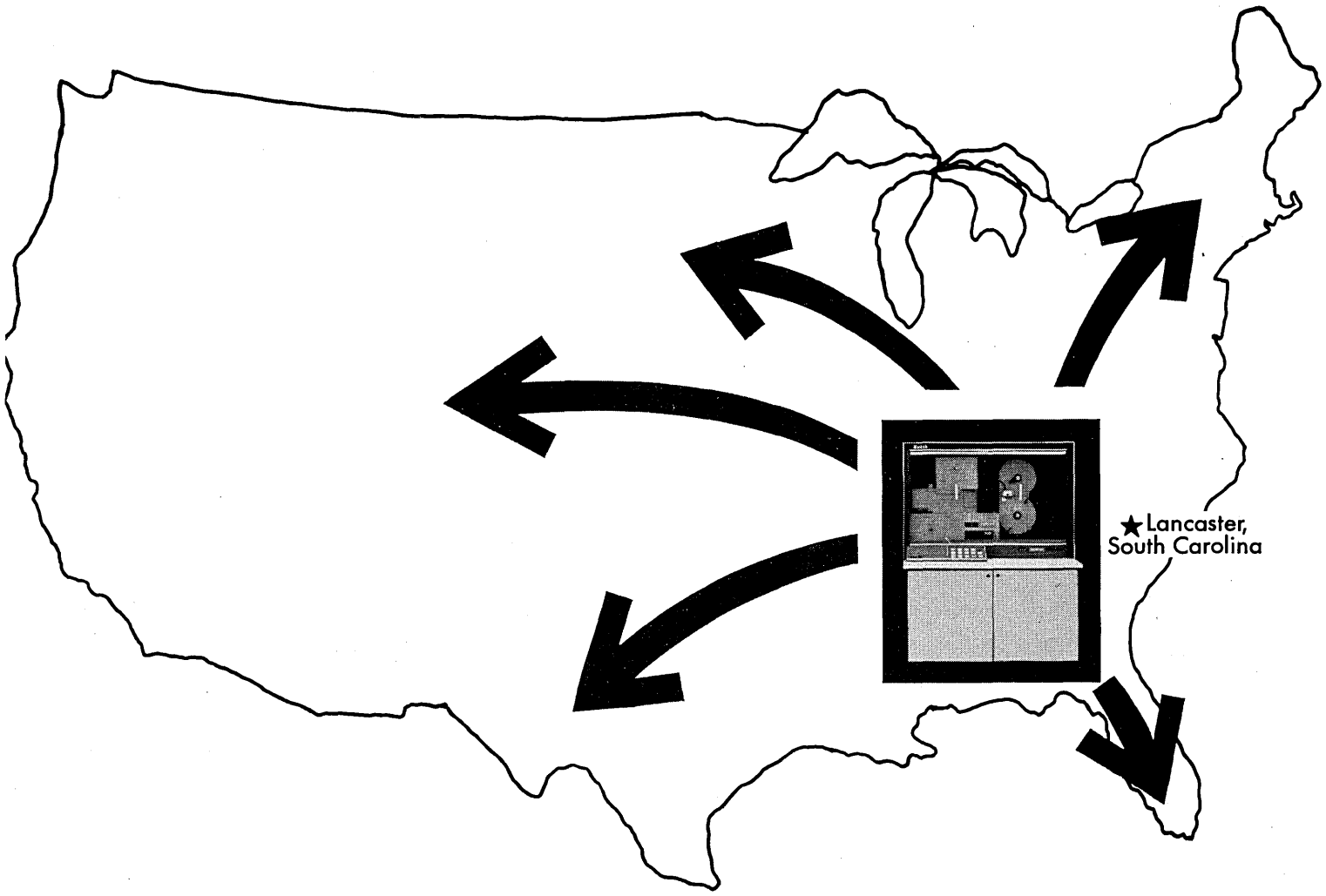
By 1975 the non-IBM semiconductor mainframe and add-on memory market will grow to 55 million bits and $124 million, says a report on the semiconductor memory industry published by Creative Strategies Inc. as part of its investment planning service, a monthly report series covering high-growth industries. And this dollar volume will be achieved, the report indicates, despite rapid drops in price for both semiconductor and core memory. It says core prices are droping by 20% a year and the prices of semiconductors for memories are going down even faster. New uses for memories, it states, will add another $63 million to the overall 1975 market.

More Digits than Chatter

A new Auerbach Technology Evaluation Service study, "Data Communications," says the day "is not far distant when the volume of digital data sent across telephone lines will surpass the volume of voice transmissions." The study predicts the data communications industry will grow to five times its present size by 1975. Major sections of the study cover facilities and services, market analysis and forecast, technical analysis and forecasts, and data communications outlook.

SHORTLINES

There's still some faith out there in RCA. NASA last month selected the company to develop a test model of a space computer that would be 100 times smaller and lighter than equivalent commercial systems ... A New York research firm, Frost & Sullivan, Inc., reported expenditures in 1971 of $7.19 billion on software and operations and predicted this amount will grow to more than $20 billion in 1980. In an analysis and forecast of the "Computer Facilities Management Market" the firm says facilities management operations will gross more than $300 million this year and will increase penetration to more than $800 million in 1975 ... A new Palo Alto company, SYSX (Systems Exchange Co.), hopes to bring suppliers and users of software together. The firm is compiling a software reference library on microfilm ... Digital Computer Controls, Fairfield, N.J., formed a Data Systems Group to develop computer systems and software ... Fairfield Communities Land Co., Little Rock, Ark., and Computer Property Corp., New York City, have agreed in principle to merge their businesses in recreational and retirement land development, computer sales, leasing and software development, and the maintenance and compiling of direct mail lists ... Applied Computer Technology Corp., Los Angeles, has been acquired by Johns-Manville Corp. and has become a JM subsidiary ... There are 39 shopping days left before Christmas, and four major retailers will be extra-ready, at least for the last 24 of them. TRW Data Systems this month is installing its System 4000 computerized credit approval system for Montgomery Ward, May Co., Rich's, and Burdine's. May Co. will get two systems. All are scheduled to be operational by Dec. 1 ... Another retail operation, Fox Grocery Co. Pittsburgh, has achieved automation of another sort. The firm has installed IBM's Vehicle Scheduling Program which equips its grocery truck drivers with computer-produced directions through traffic jams and bad weather ... There's a new computer game on the market called Beat-The-Computer. It is produced by the Quantra Development Corp., New Rochelle, N.Y., and familiarizes players with time-sharing, queues, discs, tapes, input, output, and sorting; and it can be played by people who have no idea what computers are all about ... The John Fluke Mfg. Co., Inc., Seattle, moved into the test system market with introduction of Terminal/10, a computer-controlled automatic test system designed to completely automate final production, verification, and calibration testing of electronic instrumentation and subassemblies . ■



Kodak's COM system makes data move faster for Springs Mills.

At the Springs Mills Customer Service Center in Lancaster, South Carolina, a vast five-computer data processing center stores information vital to the company's operations throughout the country.

To produce this data faster for those who need it, Springs Mills uses a Kodak KOM-90 microfilmer, which puts computer tape data directly on microfilm with incredible speed, and at a fraction of the paper cost.

The result: Big savings in time and mailing costs, faster information retrieval, better customer service, and far greater security. Fact is, Springs Mills is so pleased, they're investigating additional Kodak microfilm systems.

For fast details write Eastman Kodak Company, Business Systems Markets Division, Dept.DP588, Rochester, N.Y. 14650.

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CIRCLE 47 ON READER CARD

PRODUCT SPOTLIGHT

Off-line Card-to-tape

Building a hard-wired device like the model 8080 just for creating card-to-tape input files seems like a good idea. Not only does it unburden expensive cpu's from the I/O overhead associated in generating such files, but also offers other advantages: The system can prepare input tapes when machines are down or on maintenance, and it is simple enough to operate that control personnel might take over the input preparation function entirely.

The 8080 consists of a 300-cpm reader (600-cpm optional), an IBM-compatible tape drive, and a controller. The controller checks for invalid punch combinations in the input and proper parity generation on the output tape, which can be either 7- or 9-track. (The tape drive can be ordered for 556-, 800-, or 1600-bpi operation, and there is a choice of 12.5- or 25-ips speeds.) The controller also blocks the tape according to switches set by the user and indicates the number of cards and number of data blocks read at the end of processing. The basic model 8080 card-to-tape converter will be available during the first quarter of 1972 for $330/month on a one-year contract. COMPUTER MACHINERY CORP., Los Angeles, Calif. For information:

CIRCLE 598 ON READER CARD

360 Memories

From the latest firm to jump into the 360 memory add-on competition come MOS memories capable of 200-nsec operation. Advantages of the new memories include use of only half the floor space and one-third the power of comparable IBM units. Four models are available: the 7330, up to 128K; the 7340, up to 512K; the 7350, up to one megabyte; and the 7365 with up to two megabytes. These units are for the System/360 models 30, 40, 50, 65/67, respectively. Rental ranges from $1005 to $7200 per month, with a purchase range of $40,200 to $288,000, from the smallest 64K add-on for a model 30 to the largest 2048K chunk for the 67. Deliveries require 8-12 weeks. POTTER INSTRUMENT CO., INC., Melville, N.Y. For information:

CIRCLE 573 ON READER CARD

Disc Storage

The rapidly growing list of double-density disc storage upgrades for 2314-type equipment gains another member this month with the 5600 system. It consists of the model 5650 control unit for controlling from one to nine drive units, each storing 58 megabytes. The average access time is 29 msec, and the transfer rate is the same as the 2314 at 312KB. The modifications necessary to DOS and OS are provided at no charge by the vendor. Prices for peripherals have been fluctuating more and more lately, but as this is written, the 5650 rents for $1550/month, plus $455/month for each drive, including maintenance, on a one-year contract. TELEX COMPUTER PRODUCTS INC., Tulsa, Okla. For information:

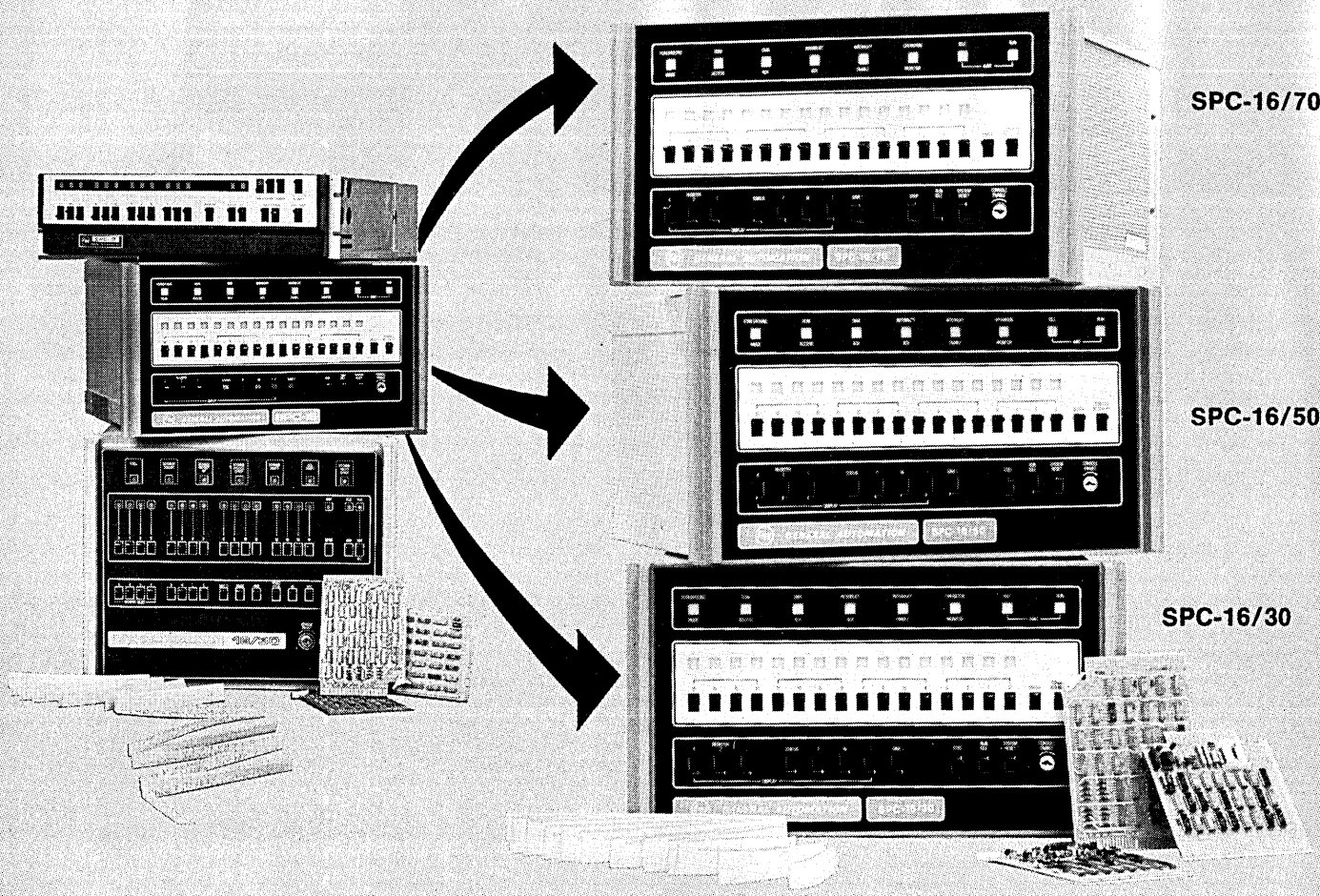
CIRCLE 574 ON READER CARD

Minicomputer

The Micro 1600/21 has a number of features that should insure a sizable number of orders from oem's. Among these are a two-hierarchy memory, 107 operation codes, stack processing, character/string manipulation, and extended arithmetic. The control memory of the 21 can be expanded from a minimum of 1K 16-bit, 200-nsec words, up to 16K. The 1-usec core memory comes in modules of 4 and 8K, and can be expanded up to 32K. The machine is byte addressable, and has 1-, 2-, 3-, and 4-byte commands. All arithmetic is done in the hardware.

Software includes BASIC, utilities, diagnostics, an assembler, and a bootstrap loader. The price for the 1600/21 is $6995, including 8K of memory, a tty, controller, and a system control panel. Deliveries begin this month. MICRODATA CORP., Santa Ana, Calif. For information:

CIRCLE 575 ON READER CARD



Prices Start at Under $3000 in Quantity — including 4K Memory

Announcing a new family of 'Industrial-Minis' from General Automation

PERFORMANCE LEADERSHIP AT COMPETITIVE PRICES

Welcome to General Automation's newest family: three new 16-bit *Industrial-Minis* that offer you a choice of price and performance you can't afford to overlook.

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INDUSTRIAL-MINIS FOR COMPUTER-BASED AUTOMATION

...HARDWARE

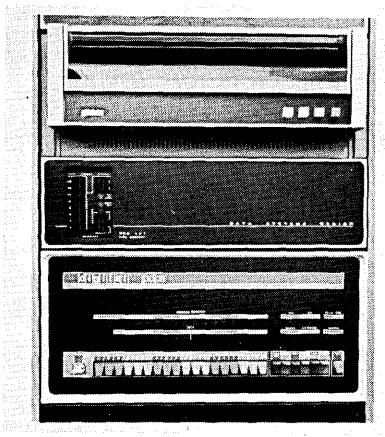
I/O Processor

The model 16 I/O processor is designed to service lines to remote concentrators, multiplexors, or terminals. It is based on the model 5 16-bit minicomputer (June '70, p. 214), but has a special ROM that contains an expanded I/O instruction set to handle data communications as well as data processing. The model 16 multiplexor bus can handle up to 256 lines with request/response I/O logic. Memory has a cycle time of 1 usec and is expandable from 8-64K bytes, directly addressable. An 8K machine is priced at $14,700, and delivery requires 60-90 days ARO. INTERDATA, Oceanport, N.J. For information:

CIRCLE 576 ON READER CARD

Disc System

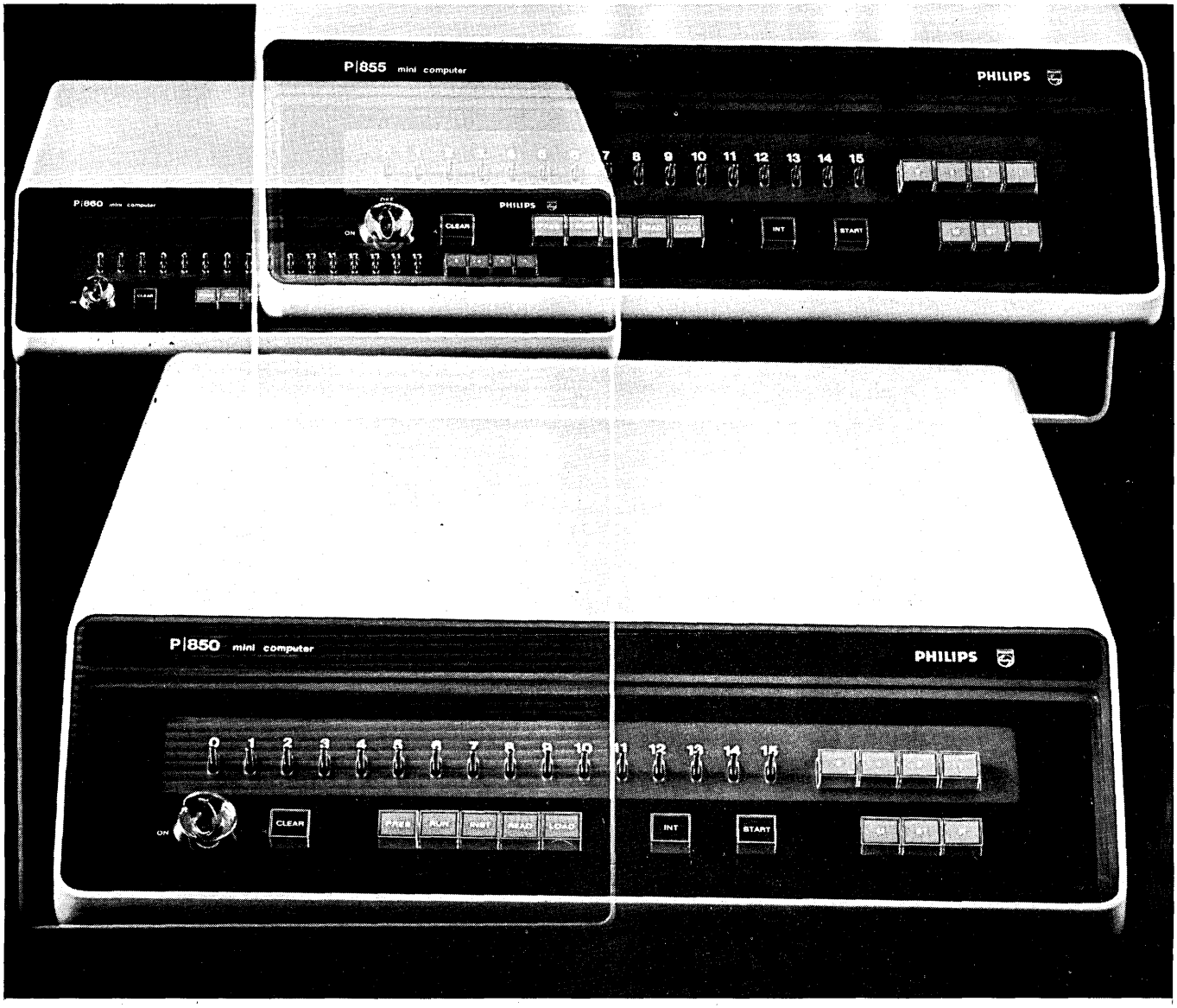
The 130 disc cartridge memory is based on the Diablo Systems model 30 disc (April '70, p. 218). The 130 attaches to the DEC PDP-8, 9, 11, 12, and 15 minicomputers, but stores data in the same format as IBM 1130 and 1800 disc cartridges. This might



be a real boon to installations running both makes of equipment because it would do away with the need for converting files created on the DEC equipment before they could be processed on the IBM gear. Two versions are available; a 1-megaword model with a 50-kiloword transfer rate, and a 2-megaword model that doubles the data rate. Common to both units are the access time of 75 msec and latency time of 20 msec. Prices start at $9845, including installation. Maintenance can be arranged, and delivery is 30 days ARO. DATA SYSTEMS DESIGN, Berkeley, Calif. For information:

CIRCLE 577 ON READER CARD

PHILIPS data systems



Announcing Philips mini computers

Philips. A household name for mass produced quality goods. Equally at home with small computers for OEM's.
That covers availability, and shows that prices are competitive, but what about performance?

P 850 – Philips smallest mini. Inexpensive. Easy to interface. 3.2 µs store cycle time. 16 bit word store. Complete instruction set. Wide range of controllers and interface cards. Rack mounted or table top versions.

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PHILIPS

CIRCLE 70 ON READER CARD

Disc Storage

Two disc drive subsystems for Series 200 mainframes are the type 276 for models 115 and 115/2, and the 277 for models 1015, 2015, 3200, 4200, and 8200. The minimum 276 configuration includes a control adapter and two drives, each of which stores 37.4 million characters. Up to four drives may be used on the 115, and up to eight on the 115/2. A two-drive system is $1295/month on a five-year lease, or $67,200 on purchase. Each additional drive is $445/month, or $23,040.

The minimum 277 system is also two drives, each storing 64 million characters. Up to eight drives can be used. The basic system is $1760/month, or $86,020 on purchase. Additional drives are $465/month or $22,660. Deliveries of the 277 begin in June. HONEYWELL INFORMATION SYSTEMS, Waltham, Mass. For information:

CIRCLE 578 ON READER CARD

Read-only Tape Drive

If we read the latest figures correctly, the COM business is picking up—meaning that COM equipment builders, as well as those building off-line printing systems and other data conversion systems, might be interested in the Mod 10-Read-Only series of tape drives. Speeds of 25, 37½, 45, and 75 ips can be specified by oem's, as can 7- or 9-track, IBM-compatible recording heads for writing at densities up to 800 bpi. The single-capstan, buffer arm units include electronic deskewing and come in four basic subassemblies, including the transport, transport electronics, data electronics, and power supply. Single-unit prices range from approximately $1800 for lesser capability models up to $5K for "fully equipped" 75-ips models. WANG COMPUTER PRODUCTS, INC., Santa Monica, Calif. For information:

CIRCLE 579 ON READER CARD

Cassette

The Datasette is a Philips-compatible cassette, but its plastic case is chrome plated to eliminate static buildup, and its tape is certified to 1600 bpi, after assembly in the cassette. Chrome plated surfaces are also used on all internal tape guides to prevent tape damage and misguidance due to worn guides. The cassette is available to end users at $525 per 200. AUDIO DEVICES, INC., Glenbrook, Conn. For information:

CIRCLE 580 ON READER CARD

If your world is punched full of holes, and limited to 3 1/4" x 7 3/8"...

Someday you will change the shape of things

SOMEDAY IS HERE. NOW.

Scan-Data Corporation makes it possible with OCR systems that give real meaning to the word flexibility.

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It all adds up to practically unlimited flexibility in data processing. And that means time and money savings for you.

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Portable Terminal

It's hard to imagine a more portable terminal than the 2002. It weighs only 7 pounds, it's battery powered (complete with a recharger), and though it fits in an attaché case, it includes a cassette recorder, the 64-character ASCII keyboard which can be removed from the case for desk-top operation, a strip printer, and optionally a communication module for providing half-duplex transmission at 40 cps. The basic price is $1135; add $550 for the strip printer and $240 for the communication unit. The 2002 is available 30 days ARO. MSI DATA CORP., Costa Mesa, Calif. For information:

CIRCLE 581 ON READER CARD

Non-Bell DAA

Fed up with the long wait for a Bell Data Access Arrangement coupler? Well, you can pressure your independent phone company—if that's who serves you—to get one from another source that claims delivery in one week. Or you could buy it yourself and try to get permission for its use. The new units, manufactured under license from Western Electric, are known as the EDC1001A, which is an automatic coupler with its own power supply, and the EDC1001D, which requires outside power. They are equivalent to WE units of the same nomenclature minus the EDC prefix. Both provide the DAA and network control signalling required by phone company tariffs. Single unit price of the model A is $207, and the D is $175. ELGIN ELECTRONICS INC., Waterford, Pa. For information:

CIRCLE 582 ON READER CARD

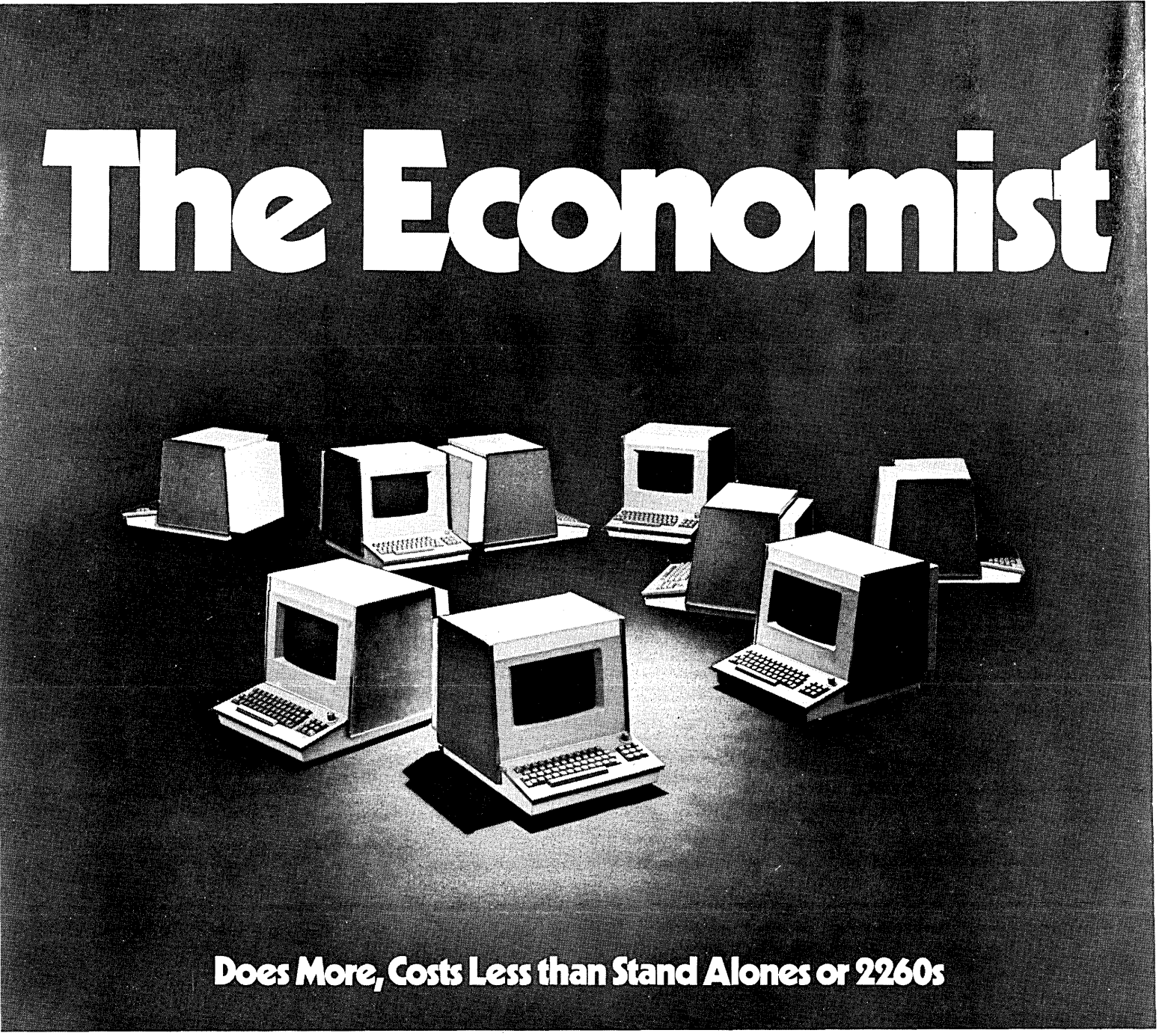
Nova Tape Cartridge

The MiniDek cartridge tape system is plug-compatible with Nova minicomputers. It consists of a transport, controller, I/O cables, and necessary software. Features include a four-track cartridge, ability to use the Nova program load switch for automatic program loading, and compatibility with the Nova editor and assembler for elimination of paper tape operations. It's priced at $2900 and requires 45 days ARO for delivery. TENNECOMP SYSTEMS, INC., Oak Ridge, Tenn. For information:

CIRCLE 583 ON READER CARD

For additional new products being introduced this month, please refer to the FJCC Product Preview section starting on page 74 of this issue. ■

The Economist



Does More, Costs Less than Stand Alones or 2260s

A 16-terminal Wyle CRT cluster costs between $30,000 and $40,000. An equivalent IBM 2260/2848 system checks in at from $80,000 to $100,000.

That's a savings of $50,000. Give or take a few thousand.

Which is a real break for end-users who are looking for a plug-to-plug and software compatible replacement for IBM systems. One that offers many more features for many less dollars.

It's also a great product for the independent peripheral supplier who can now provide a CRT cluster system without the time and expense of in-house development.

And it can be a boon to mainframe manufacturers who need a CRT system as part of their peripheral package, because our controller can be modified to interface with any computer.

And check these features. 960 or 480 character screen capacity, up to 9600 bps data rate, non-destructive cursor, colon-seeking tab, many special editing keys and general or specific terminal polling.

Plus columnar tab, character address, format protect, upper and lower case alphabet, hard copy printer and built-in data set options.

When it comes to dollars and sense, the Wyle 8000 beats the 2260/2848 hands down.

Our cluster also offers economic advantages over stand-alone CRT systems since the controller electronics is shared by up to 16 terminals. Also means fewer data interfaces, modems and communications lines. The end result is a lower cost CRT system with faster, more sophisticated polling capability.

First we introduced The Bookie, NYC's Off-Track-Betting terminal. Now The Economist, the do-more, cost-less cluster system. Our parent company, Wyle Laboratories, with $90 million annual sales and assets in excess of $60 million, gives us the financial muscle to tackle the big jobs. Send for our full color brochure.

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CIRCLE 12 ON READER CARD

DOS Job Accounting

The release 25 system generation option makes job accounting data available to DOS 360 users, and this package seeks to exploit it by providing automatic data collection and report generation. The reports can display all IBM DOS-provided data elements plus more than 25 computed elements at the job and job-step levels. Customized report formats are said to be easy to prepare. The system is written in BAL and COBOL and operates on models 25 and up with at least 24K available. The price is $950. JOHNSON SYSTEMS, INC., McLean, Va. For information:

CIRCLE 514 ON READER CARD

Document Referencing

The Library Retrieval System is a set of FORTRAN programs for maintaining a sequential list of documents and providing printouts containing the user-selected key-word cross-references for those documents. Typically, a user would save up information pertaining to the addition and deletion of manuals, journals, books, drawings, or even records, and run the program to update the files perhaps once a month. The Library Retrieval System uses standard IBM 360 sorts and utility print programs and comes complete with documentation for DOS 360s for a price of $500. J. TOELLNER & ASSOC., Los Angeles, Calif. For information:

CIRCLE 515 ON READER CARD

Bill of Materials

The Bill of Materials Processor is designed to organize, maintain, and retrieve product information for engineering and manufacturing information departments. It provides the user with current engineering and manufacturing product data, generation of detail part explosions, and information retrieval in the form desired. Written in COBOL, the present version requires 32K on System/360 cpu's. The price of $5500 includes 10 man-days of assistance. WESTINGHOUSE TELE-COMPUTER SYSTEMS CORP., Pittsburgh, Pa. For information:

CIRCLE 516 ON READER CARD

Inventory Control

Billed as the industry's first "complete inventory control" system, Evaluation Management using Past History Analysis for Scientific Inventory Simulation (EMPHASIS) is designed primarily for use in the food and hard goods distribution fields and by manufacturers. It provides an analysis of past demands and vendor discounts from which to create order models and forecasts; a four-week or monthly forecast determining the optimum reorder points and most economical conditions; periodic inventory reviews; estimates of future needs; and special reports. The system is written in NEAT/3 and FORTRAN for use on Century 100 or larger cpu's with at least 32K words plus dual disc units. It's bundled. NCR, Dayton, Ohio. For information:

CIRCLE 517 ON READER CARD

Correction

It seems we got everything correct in writing about the Pro/Test file generator (Sept. 15, p. 61) except the name of the company marketing it. It's Synergetics Corp., not Synergistics Corp., of Burlington, Mass.

Sort/Merge

The ever-increasing population of Data General Nova users is offered a generalized sort/merge program for sorting fixed-length, unblocked records in either binary or ASCII recording mode. Record size can go up to 256 words, and the output record length will be equal to the input record length. Files created by FORTRAN or assembly language routines are accommodated, and the program uses the ASCII collating sequence for alpha data. Fixed- and floating-point numbers are also handled. The program is supplied in pa-

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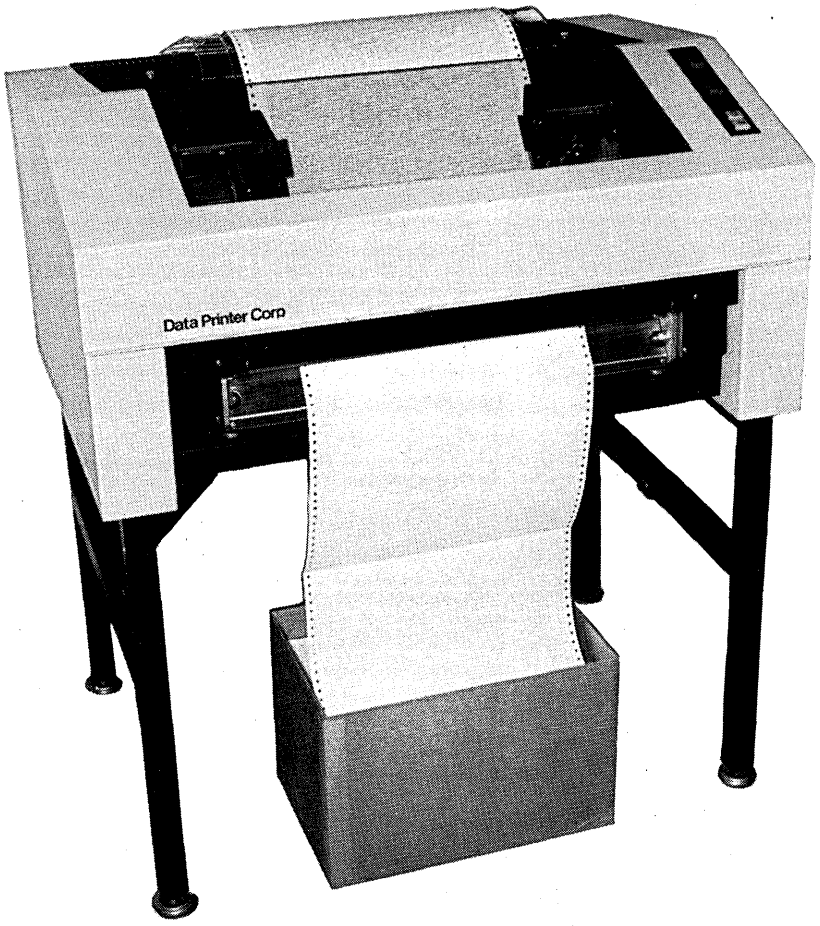
2 New Line Printers
OEM priced from $5,500.

Model 246
132 columns printout at 200 l.p.m.
96 columns printout at 400 l.p.m.
48 columns printout at 600 l.p.m.

Model 306
132 columns printout at 300 l.p.m.
72 columns printout at 600 l.p.m.



132 columns
64 characters
8 channel V.F.U.
3½" to 19½" paper width
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Most parts, assemblies and modules used in Model 246 and 306 are from our established product line with its proven reliability. They are both plug compatible with our 600 l.p.m. V-132-C printer.
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CIRCLE 21 ON READER CARD

per tape or cassette form, and will be modified for any three- or four-drive cassette system, any disc system, any three- or four-drive tape system, or even any other 16-bit computer at no charge, according to the firm. Hardware requirements for the program include 8K of memory, at least four cassette drives, and a console. Including documentation, the price for the program is $995. RHOMBIC RESEARCH, INC., Fort Worth, Texas. For information:

CIRCLE 518 ON READER CARD

Distribution

Management Information for Distributors, MI.DIS, is a series of programs offered free to wholesale distributors using Honeywell 200 series mainframes. Subsystems cover the functional areas of order processing, financial management, inventory management, purchasing, transportation, facilities and equipment maintenance, merchandising, warehouse control, customer services, and planning. Most of the programs are written in COBOL, with a few in Easycoder. Core requirements range from 8-64K. HONEYWELL INFORMATION SYSTEMS, Waltham, Mass. For information:

CIRCLE 519 ON READER CARD

Cobol D Precompiler

The Macro/Snap precompiler is said to provide users of COBOL D with the use of the DOS source statement library and a macro capability comparable to that of the DOS assembler. It also includes the Simplified Notation for Application Programming, which generates source programs with cross-referenced listings, and JCL cards without the extensive coding usually required. Macro/Snap output may be run through an IBM language conversion program for conversion to ANSI COBOL. Macro/Snap requires 24K of memory. Purchase price is $2750; rental is $90/month. MARK III SYSTEMS. Winston-Salem, N.C. For information:

CIRCLE 520 ON READER CARD ■

The Rime of the Ancient Programmer

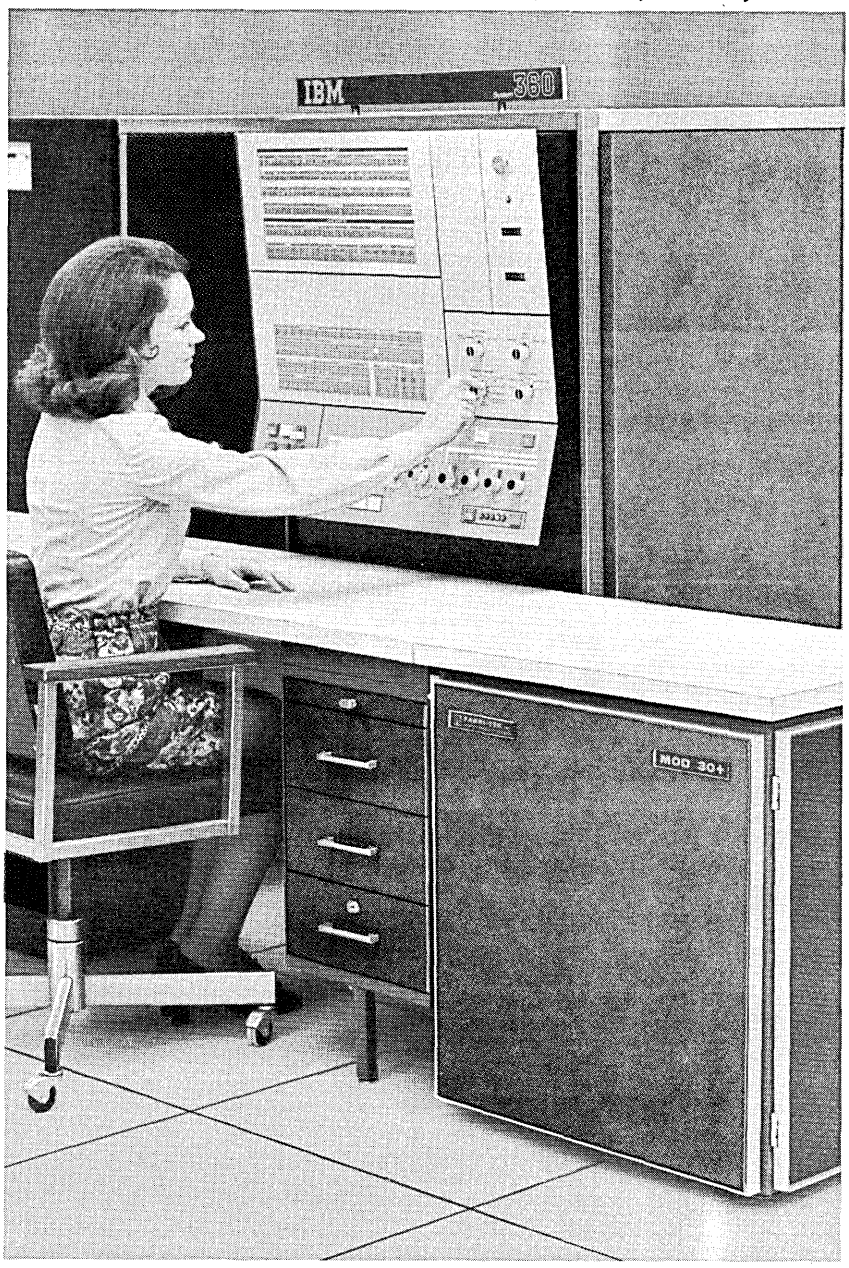
It is an ancient programmer;
He stoppeth one of three.
"By thy long printout, and error lights,
Now wherefor stopp'st thou me?
"My problem's set, conditions met;
It's my turn to get in.
"The 'ready' bell is tinkling loud;
May'st hear the merry din."
The programmer, he held him fast.
"There was a slip," quoth he,
"That made the program run awry;
It seemed it could not be.
"My mates and I for hours did try;
(Such torments few are given);
"Till in despair, I tore my hair,
And shot the algorithm.
"My mates said, 'Well, he's stopped the bell;
The error light's extinguished;
"And though there's insulation smell
His method's quite distinguished.'
"But suddenly, for programs weird,
Each sinner felt an urge;
"But though once and again they cleared,
The sums would not converge.
"So they dropped dead; at last I said,
'I hadn't oughter done it!
" 'I'm under curse, and what is worse,
There's no one left to run it!'
"An angel form at last appeared,
To answer my pained queries;
"And, though it seemed to me quite weird,
Said, 'Bless the Taylor series!'
"I blessed each term, and an angleworm,
As 'twere my heart's dear treasure,
"And Stieltjes integrals, in turn,
I threw in for good measure.
"Then up I rose, put on fresh clothes,
And tried to get an answer.
"How grand the sight! It worked just right
At each conditional transfer.

"He summeth best who loveth best
Remainders to grow small;
"But he for whom they won't converge
Can never sum at all!"

—H. W. Kaufmann

360 CORE
YOU CAN TRUST

MODELS 30+, 40+, 50+, 65+



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Hundreds of companies, including:

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Varian	Nixdorf (Germany)
NCR	Olivetti (Italy)
Collins	Marconi (Scotland)
H-P	ICL (England)
Bell Telephone	Honeywell-Bull (France)
IT & T	AEG-Telefunken (Germany)
Univac	English Electric (England)
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And yes — even IBM!

Now you can capitalize on this expertise, as this growing list of 360 customers and users are doing:

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MOD 30+ expands main memory of 360/30's to 128 K bytes.
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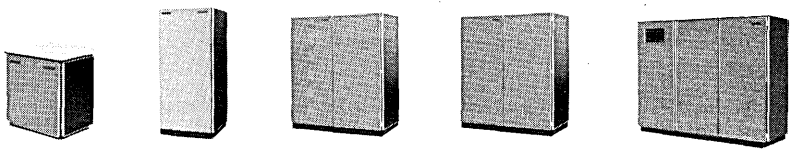

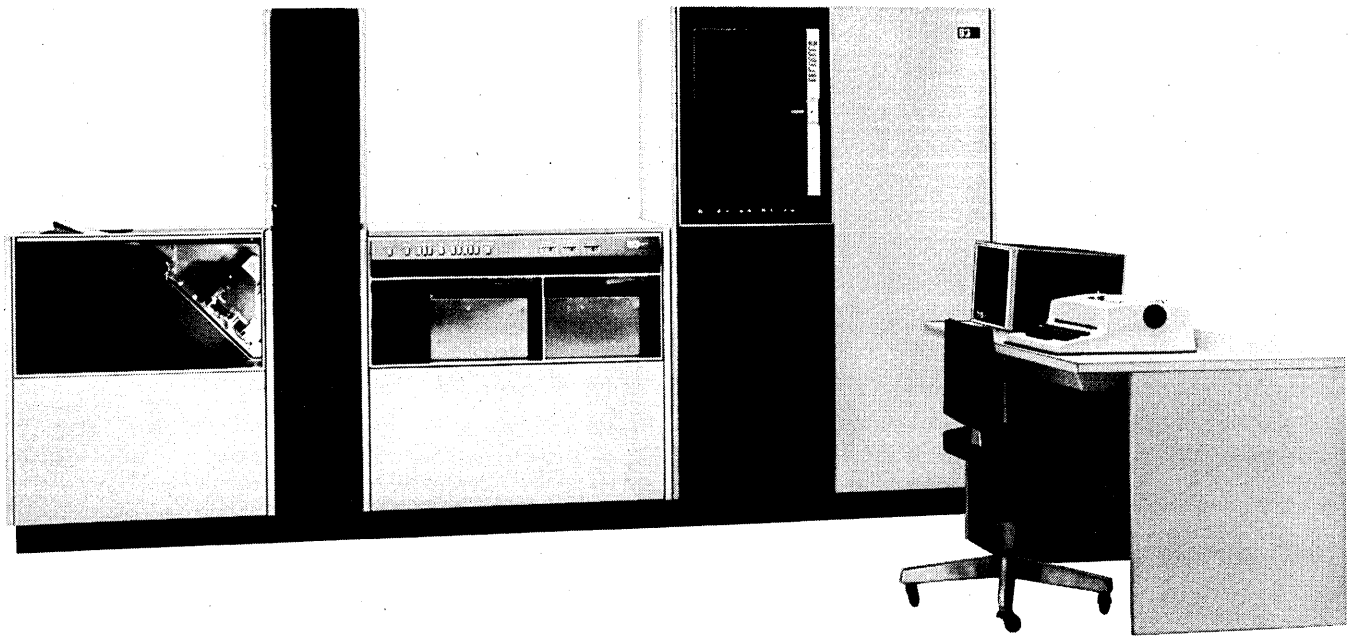

input?

Problem: At least 30% of your data processing dollar is spent on input. The key to solving your data input problem is not keypunch, or keydisk, or key verifier, or keytape, or key anything else. The real key is the Scan-Optics 20/20™, the versatile, high-thruput, low-cost Page/Document optical character reader.

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LITERATURE

Microfilm Catalog
Microfilm catalog for the 1971-72 academic year includes full listings and descriptive materials on newspapers (American and foreign), periodicals, and records for research on microfilm. Records for research include materials ranging in date from the 16th century through the present. A current price list is included. MICROFILMING CORP. OF AMERICA, Glen Rock, N.J. For copy:

CIRCLE 502 ON READER CARD

Book Catalog
Catalog of new books lists 22 covering data processing and computer sciences. Among them are books on alphanumeric display equipment, optical character recognition, computer output microfilm, advanced management information systems, designing computers, and a reference book introducing computer control standards for accountants. AUERBACH PUBLISHERS, INC., Princeton, N.J. For copy:

CIRCLE 507 ON READER CARD

Compatible Memories
Brochure describes a research report on the 360-compatible memory market, listing highlights and giving the table of contents. The report itself sells for $85 per copy. Topics covered include: pricing, IBM policies, service companies, compatible memory manufacturers, user reactions, and market potential. COMPUTER INTELLIGENCE CORP., San Diego, Calif. For copy of brochure:

CIRCLE 511 ON READER CARD

Optical Scanning Guide
"A Guide to Optical Scanning" includes information on scanning terms, examples of bar coding, mark and character reading systems plus readable ocr fonts. It also includes an explanation and diagrams of an optical scanning system and examples of a variety of "scannable" forms designed for use with present optical scanning equipment. GAF CORP., Shelby, Ohio. For copy:

CIRCLE 512 ON READER CARD

Commo Controller
Four-page brochure describes the REDECOM computer-based controller for telecommunication networks. It describes the hardware organization and the software operating package which enable the unit to control the flow of data between remote locations and a cpu. REDCOR CORP., Woodland Hills, Calif. For copy:

CIRCLE 510 ON READER CARD

Controlling Printing
Twelve-page brochure describes vendor's Model 36 DataPrint system which offers users a computer-controlled, off-line means of operating IBM 1403 Model N1 line printers. The system controls the transfer of data from magnetic tape to the 1403 for output. COMPUTER MACHINERY CORP., Los Angeles, Calif. For copy:

CIRCLE 508 ON READER CARD

General-Purpose Mini
Four-page bulletin describes vendor's Model 400 general-purpose minicomputer. It covers organization, system features, control console, input/output system, specifications, instruction repertoire and instruction/data formats. MICRODATA CORP., Santa Ana, Calif. For copy:

CIRCLE 501 ON READER CARD

In Support of Talk
Talk is cheap and more computers should be talking is the thesis of a brochure, "Someday Computers Will Talk," subtitled, "Welcome to Someday." It touches on the history of audio response and argues for its widespread use. PERIPHONICS CORP., Rocky Point, N.Y. For copy:

CIRCLE 503 ON READER CARD

Cassette Recorders
Six-page short-form catalog of continuous and incremental digital cassette recorders and accessories provides typical applications and gives advantages of bit-by-bit incremental recording over continuous buffered

LITERATURE...

incremental recording. MEMODYNE CORP., Newton Upper Falls, Mass. For copy:

CIRCLE 504 ON READER CARD

Printers and Plotters

Data sheet describes a new line of printers and printer/plotters priced from $3,385 in oem quantities. They operate at 135 or 300 lpm using 64 characters and up to 132 columns. Plotting speeds are 14,784 or 32,340 points per second. POTTER INSTRUMENT CO., Melville, N.Y. For copy:

CIRCLE 506 ON READER CARD

Sub-leasing Self Taught

Twelve-page booklet, "The TBI Guide to Computer Sub-Leases—A Self Teaching Study," takes the reader via a series of questions through the thought processes necessary to consideration of computer sub-leasing. TIME BROKERS, INC., Elmsford, N.Y. For copy:

CIRCLE 509 ON READER CARD

Seminar Proceedings

Proceedings of a one-day AFIPS sponsored seminar for members of Congress and their staffs titled "Information Systems: Current Developments and Future Expansion," covers such information system-related topics as: "Computer Applications in Political Science," "Communications and Future Information Systems," and "Understanding Information Systems." Copies are priced at $5. AFIPS PRESS, 210 Summit Ave., Montvale, N.J.

Front-End Processors

Twenty-two page feature report covers 49 stored-program communications controllers from 28 manufacturers. It tells how to select and apply the equipment, and includes detailed comparison charts summarizing characteristics. DATAPRO RESEARCH CORP., Philadelphia, Pa. For copy:

CIRCLE 513 ON READER CARD ■

YOU KEEP ORDERING. WE KEEP DELIVERING.

In early 1971 we started shipping Model 101 line printers to a few sophisticated users of peripheral devices. Now we are shipping many 101's to many sophisticated users. And for good reasons. The 101 is easy to build and maintain. It performs very reliably. Its matrix print quality is excellent, even on the fifth copy. It interfaces readily to almost any computer or terminal. And its low price is setting a new standard in the industry.

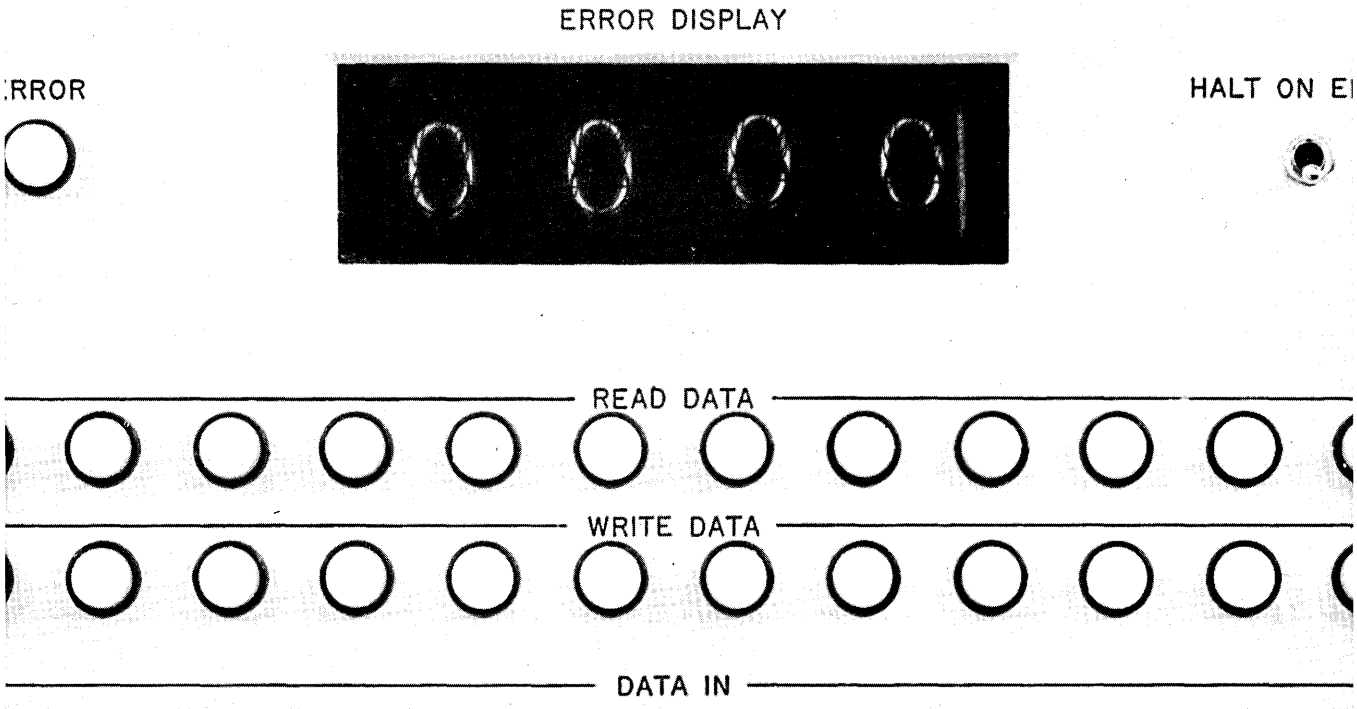
CENTRONICS

because you don't want to spend more than you have to.

Centronics Data Computer Corp., One Wall Street, Hudson, N.H. 03051
(603) 883-0111

CIRCLE 75 ON READER CARD

The most significant bit about the Datum drum minimemory is the one it has never lost.



We build reliable memories at DATUM. As long as we've been building drum memories we've never crashed a head. We started with an inherently most reliable memory device — a drum — and improved the other performance parameters like capacity, transfer rate, access time and cost. So the most reliable memories now look like this:

Storage capacities from 132,000 bits to 13,000,000 bits. Transfer rates from 1 MHz to over 2 MHz. Average access time from 8.3 ms. Prices from $895.

But reliability got to be a thing with us. So we designed head-per-track, flying heads; unique military-type read/write heads restricted to one degree of mechanical freedom. We nickel-cobalt plated all drum recording surfaces.

Our electronics package features self-clocked, peak-detecting circuits within the RETMA standard rack-mountable cast-aluminum housing.

Power supplies include voltage sensing, sequencing and all necessary memory-protect features to ensure data integrity during possible power loss.

System clocking, including master, index and track sectoring is standard.

We call these most reliable devices the DATUM Series 88 Rotating Drum Memories.

When you need the most reliable, low-cost core expansion you can find for mini-/midi-computers, or other storage applications requiring rapid-access economical data bases, call us.

DATUM CPD CALIFORNIA PERIPHERALS DIVISION

170 E. Liberty Avenue, Anaheim, California 92801. Telephone (714) 879-3070. TWX 910-592-1289.

Staran:

the world's fastest computer, from Goodyear

It's a new way of thinking

You no longer have to be satisfied with conventional sequential processing. The STARAN™ computer represents a new way of thinking. It's a better way to get higher performance at lower cost.

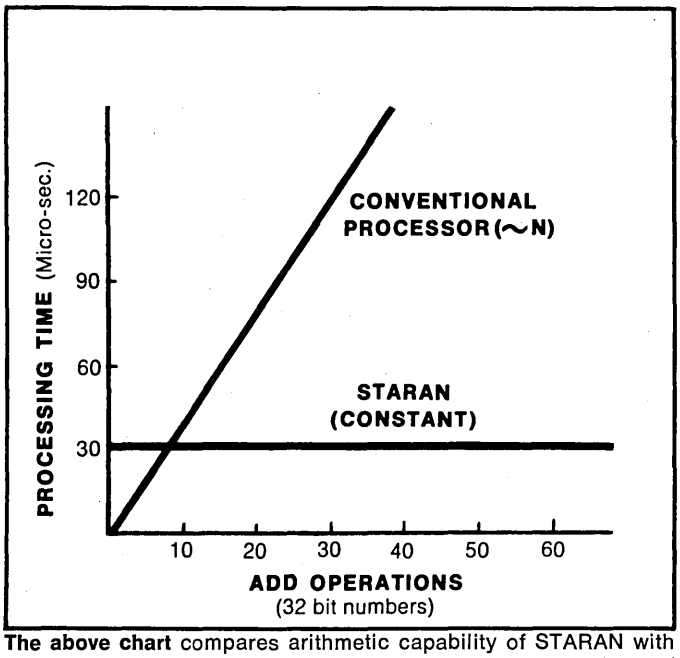
You now can think in terms of extremely fast parallel searches of solid state memories. You now can think of processing large arrays of data simultaneously.

Because now Goodyear Aerospace introduces the first standard associative array processor—the STARAN Series S. A true fourth generation computer, all solid state, providing content addressing, array arithmetic, and dramatic increases in input-output capability.

STARAN is on line now at the FAA's air-traffic control facility in Knoxville, Tennessee, where its performance has been outstanding. It can also break data jams in applications such as radar surveillance and control, electronic warfare, ballistic missile defense, geodetic surveys, transportation systems, world-wide weather forecasting, and data management.

STARAN is the product of 10 years of computer development at Goodyear Aerospace. If you have a near real time requirement, we'll be glad to show you how it can change your way of thinking.

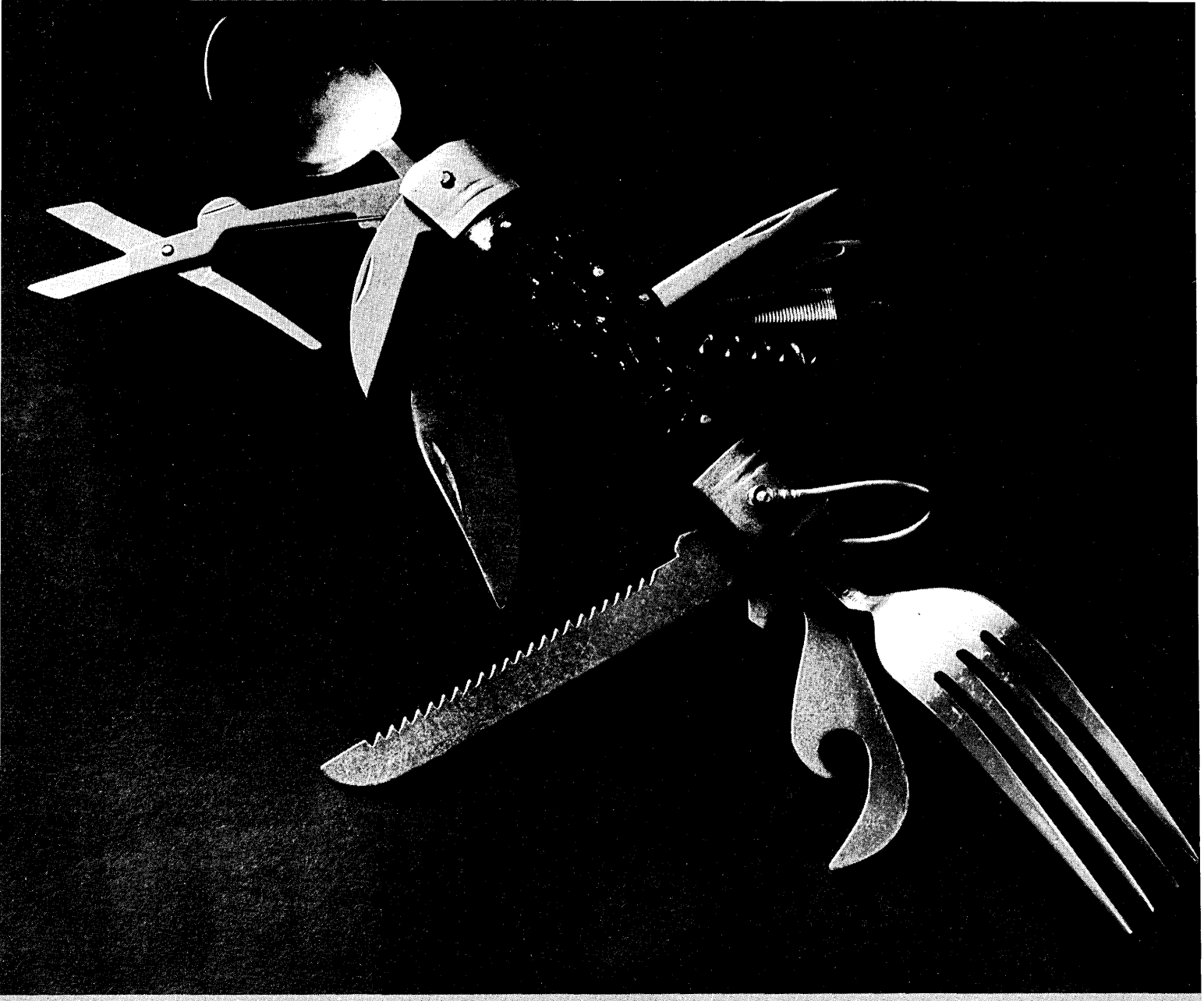
Write Goodyear Aerospace Corporation, Dept. 911PPK, Akron, Ohio 44315; or call Wayne Brubaker, Manager, Digital Systems Marketing, at (216) 794-3631.



The above chart compares arithmetic capability of STARAN with Model 50 of a common computer line. It shows that regardless of the number of operations, STARAN processing time remains constant. Processing time utilizing sequential techniques in the conventional computer requires increasing amounts of time . . . proportional to the number of items processed.

GOODYEAR AEROSPACE

CIRCLE 95 ON READER CARD



It's as versatile as a PDP-8.

As far as we can tell, there's a PDP-8 computer doing every job that's ever been done by a minicomputer.

We have them in steel mills. Nuclear reactors. Automotive plants. Hospitals. Laboratories. Newspapers. Businesses. All over the place. All over the world.

So it should come as no surprise to learn that the PDP-8 is the most popular minicomputer ever made. In fact, more PDP-8's are installed every month than all the other minis put together.

Of course, it takes more than versatility to make the PDP-8 so popular. Having more than sixty peripherals to pick and choose from helps, too. As does PDP-8's library of software. It's the biggest collection of minicomputer software in the world.

And all the big computer company backup we offer doesn't hurt either. Over fourteen hundred sales/servic engineers, for example.

But a lot of it must go back to what you learned as a kid: That there's nothing like something that'll do almost anything.

Digital Equipment Corporation, Maynard, Massachusetts 01754. (617) 897-5111.

digital

CIRCLE 64 ON READER CARD

BOOKS

***Future Develpments in Telecommunications*, by James Martin, Prentice-Hall, 1971. 413 pages, $14.**

James Martin, who predicts a vast increase in information exchange, is doing his part: this is his ninth title for Prentice-Hall. His books deal primarily with real-time systems and telecommunications, and his *Telecommunications and the Computer* (Prentice-Hall, 1969) is both competent and comprehensive. The present book, as the name indicates, is concerned with new and future technical developments and applications. The reader might do well to first browse through the earlier book.

Mr. Martin visualizes a substantial increase in our data transmission capacities resulting in many new applications such as real-time vehicle control, automated utilities meter reading, on-line banking and credit systems, and new forms of emergency communications and alarms. He expects that eventually every home will have an alarm system communicating on-line via telephone to a computer, and perhaps—also predicting an increasing rate of crime—remote alarm devices to be carried around by each individual.

The new applications arise from new telecommunication channels of enormous capacity. Most data processing personnel are aware of limitations to existing data communications using telephone lines with perhaps capacities of 2,000 bps. This may be adequate for some types of man-machine interaction, but is not adequate for many types of applications such as the on-line transmission of large amounts of data, or sophisticated computer graphics. A complete tv picture, for example, requires about 1,000 times the capacity of the telephone line. But such capacities —millions and hundreds of millions of bits per second—are becoming available through such techniques as coaxial cables, microwave links, and eventually—giving billions of bits per second—the use of lasers.

While business and government organizations will find many ways to provide themselves with increasing channel capacity, what is very interesting is the large capacities that are being introduced in the homes by cable tv. A typical cable tv installation provides 20 or more channels each with a capacity 1,000 times that of the telephone line. While a single channel is required for tv, a single channel can also be divided into 600 voice subchannels so that each could carry a separate continuous message on such subjects as the weather, time, stock market, sports, etc.

Mr. Martin also postulates the "music library." A single tv channel can be divided into 100 subchannels of hi-fi stereo music. The subscriber could do away with his record collection and instead select from any of one hundred different pieces. Similarly, channels could also be subdivided for transmitting still pictures, so that the subscriber could call for various slide presentations, perhaps a trip through the Grand Canyon.

Mr. Martin points out that in the

Bell System about 23% of the cost for making a call is associated with the terminals, but in the home this cost can be readily assumed by the installation of the Touchtone telephone. And while the home tv set might be used as a visual display, Mr. Martin expects that most likely the Touchtone telephone will be coupled with voice answerback from the computer. One could readily walk up to the telephone, dial the computer, key in 2 plus 2, and have the computer reply 4. It is not difficult to think of a great number of different applications which will become common when every home has direct and economical access to a computer.

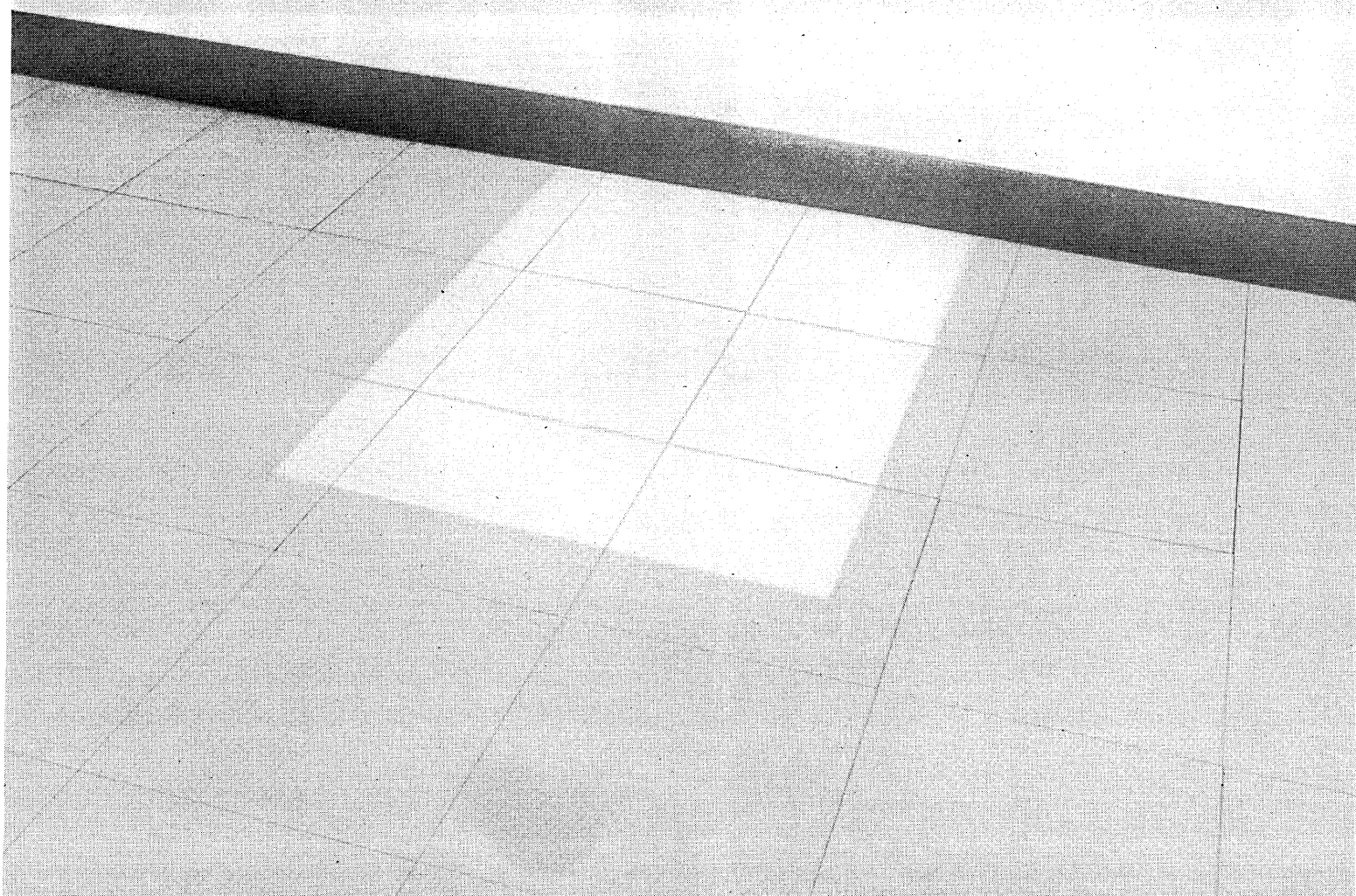
In addition to applications, Mr. Martin also discusses several technical developments, such as communication satellites, laser beams, large-scale integration (LSI), pulse code modulation, etc. He has attempted to divide his book into sections, so that Sections II and IV deal with applications while Section III deals with techniques. Unfortunately, Mr. Martin has an annoying way of intermixing technical and nontechnical topics, and also intermixing general concepts with details for specialists. For example, there is a very interesting chapter on AT&T's big push forward with Picturephone, which is being heralded as a major social innovation. But in the midst of this chapter there is a section on how to operate the equpment: "The # key is pressed prior to the keying of the telephone number. (The # key is the bottom right-hand one of the Touchtone keyboard.)" This will certainly be information worth having when one gets around to using a Picturephone, but for most of us that may be five or ten years from now.

Because of what might be called the "even" rather than "uneven" style of Mr. Martin's books, in which all topics seem to be given equal emphasis, I suggest that the best way to deal with them is to skip around here and there, munching on what looks savory. For example, it is fun to start on page 344 where begins a summary of what he calls "not so much a forecast as a statement of potential." We find—abstracting just a few items—that by late 1970s 65% of all homes will have cable tv offering a variety of services including hi-fi music distribution and computer-assisted instruction; Touchtone telephone with computer voice answerback will have spread rapidly; and the majority of high-income families will have Picturephone. By the late 1980s programming will be taught at an early age in schools; numerous persons will work at least part of the time at home; and the use of the computer as a hobby will become widespread. In the 1990s most people will carry a portable radio transceiver with a Touchtone keyboard, and among persons under 30 the inability to program will be regarded as a form of illiteracy.

Mr. Martin concludes with an extremely important chapter on the law and politics. He recalls AT&T's fight against foreign attachments, the vehement opposition from the existing tv companies to cable tv, etc., so that we might conclude that there are more than technical problems to be solved before every man and machine in the world can be in immediate communication with every other man and machine in the world, for better or for worse.

—Joel M. Kibbee

We want you to spend $80,000 for something your computer won't even see.



In fact, if your 360 even noticed our Tempo 270T communications controller, it wouldn't be worth buying.

The 270T will interface your computer with any terminal in existence (and a lot of new ones that will be coming into existence) and your 360 will continue to hum along, blissfully ignorant of any change. And you can hum along blissfully happy that you can change terminals without changing your whole 360.

That's because the 270T is programmable.

It takes care of all the dull, routine chores of converting codes and translating data into a form that your 360 understands. It doesn't ask the computer to handle details, the way ordinary communications controllers do.

That means more available capacity in the mainframe to do the work it was really intended for.

You don't have to revise programs for something like a 360, because as far as it's concerned, our 270T is nonexistent.

And after all, it's not every day that you can spend $80,000 to buy something just to fool your computer. But that $80,000 something could keep your 360 modern for the next decade.

And that's really something.

For further information on how you can keep an $80,000 secret and also to find out about our total data communications capability, call Gary Cadwallader at 714-523-9440. Or write Tempo Computers, 4005 West Artesia Avenue, Fullerton, California 92633.

Tempo Communications Processors

GTE INFORMATION SYSTEMS

CIRCLE 15 ON READER CARD

In all honesty, comparing System Development Corporation's new System/One intelligent terminal to competitive terminals is a little unfair.

Not because the competition doesn't have the very latest hardware available—they do. But because nobody else has the vast knowledge of software and systems that the people at SDC have.

SDC was the first computer software giant in the world. And a pioneer in time-sharing in the early sixties, with one of the first general purpose systems that could serve a variety of customers from remote terminal devices.

So, when we set out to create a remote terminal device, like the new System/One intelligent terminal, we didn't start the way most computer companies would start.

We started with the requirements analysis and then developed the software and hardware system to meet those requirements. Which, when you think about it, is the only logical way to go about solving any problem.

So, in effect, it would be fair to say that the new SDC System/One is the only truly intelligent, intelligent terminal on the market today.

(For a complete demonstration, visit the System Development Corporation booth at the Fall Joint Computer Conference in Las Vegas.)

Our new intelligent terminal has an unfair advantage over the competition.

System Development Corporation

Because form follows function.

2500 Colorado Avenue
Santa Monica
California 90406

CIRCLE 71 ON READER CARD

more than "equivalent to"

the CDS•214 dual disk drive

"200 tracks/surface, 20 surfaces/pack, 2.5-megabit transfer rate, 2400-rpm rotational speed . . ." Those are the specifications an independent must meet to be pack interchangeable with the IBM 2314. Meeting them wasn't difficult; several companies did. But only Century Data took the basic function and improved the technology across the board. For example:

The CDS-214 is a two-high unit that stores 466 megabits in half the floor space. It has a unique electromagnetic head-positioning system — without mechanical pawls, detents, or gears — that gives faster access time (65 msec compared to a competitor's 80 msec). All common logic is packaged on a common board, so the end result is one-third as many boards — and MTTR is reduced to a 1-hour maximum (compared to a competitor's 1.5 hours). And, an off-line checkout exerciser quickly isolates problems without tying up the controller.

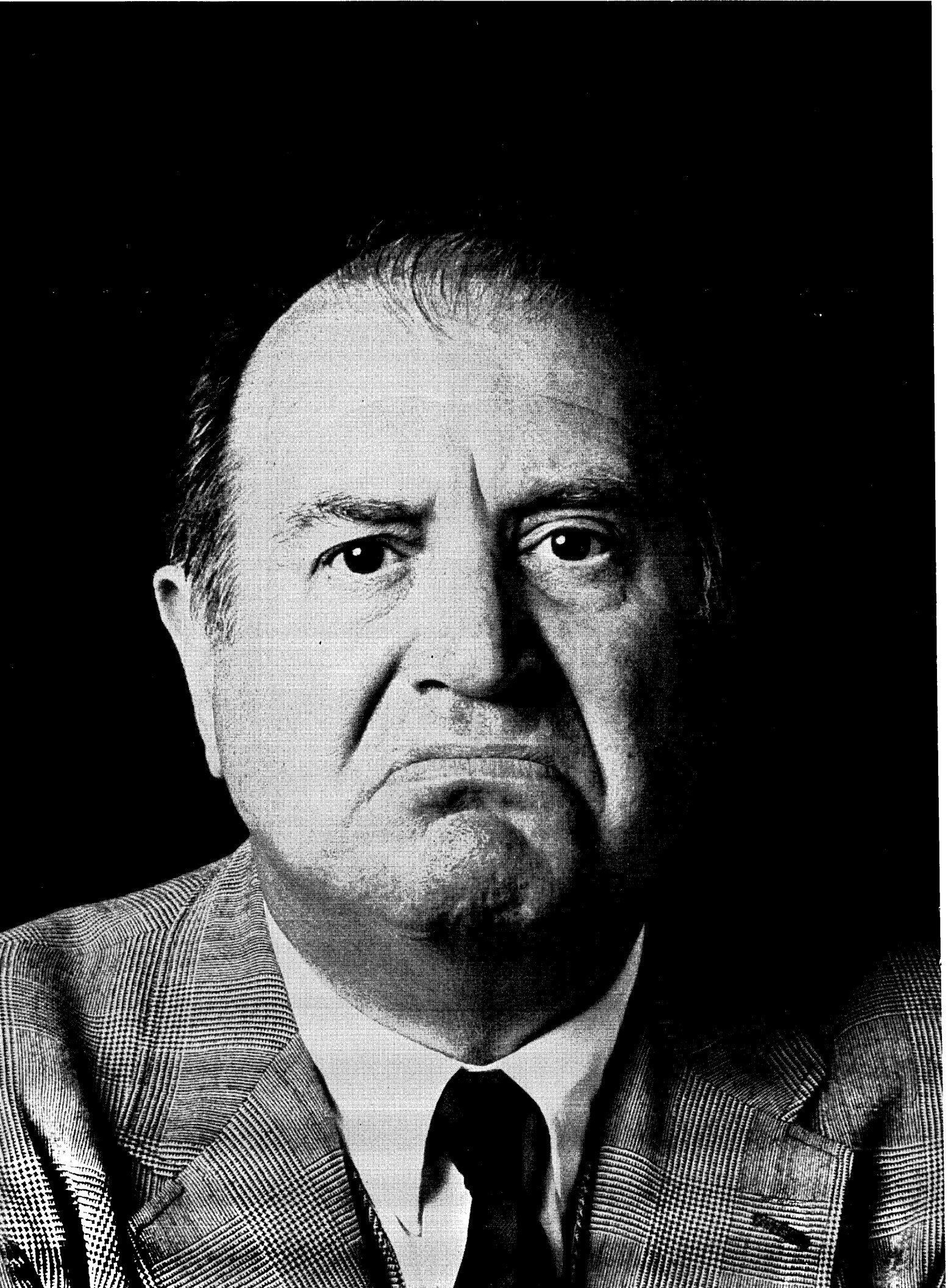
Other features also make the CDS-214 "more than just equivalent to": a cylinder difference calculator that simplifies OEM controller design, a variety of index and sector generation electronics for variable or fixed formatting, and interface options for virtually any industry standard logic. So that your system can be more than "just equivalent to," we'll be happy to send you full details.

Looking for an "incomparable"? The CDS-215 is a 400-track, two-high disk drive capable of storing up to 116 million 8-bit bytes, twice the capacity of the CDS-214. There's nothing like it . . . anywhere.

Century Data SYSTEMS, INC.

1270 North Kraemer Blvd., Anaheim, California 92806, (714) 632-7111

A subsidiary of CalComp



Who'd believe that garbage!

. . . 30% minimum reduction in run time . . . 25% reduction in core . . . 20% reduction in disc space—just by replacing ISAM with AMIGOS?

Why you guys from COMRESS must think I'm naive. I already speeded up my ISAM . . . put my cylinder index in core, added a binary search, pre-sorted my input and even included dummy records in my file!

You say 'so did others' . . . and they still realize these reductions . . . and more?

Aw! c'mon . . . who you kidding . . . who'd bite for a line like that?

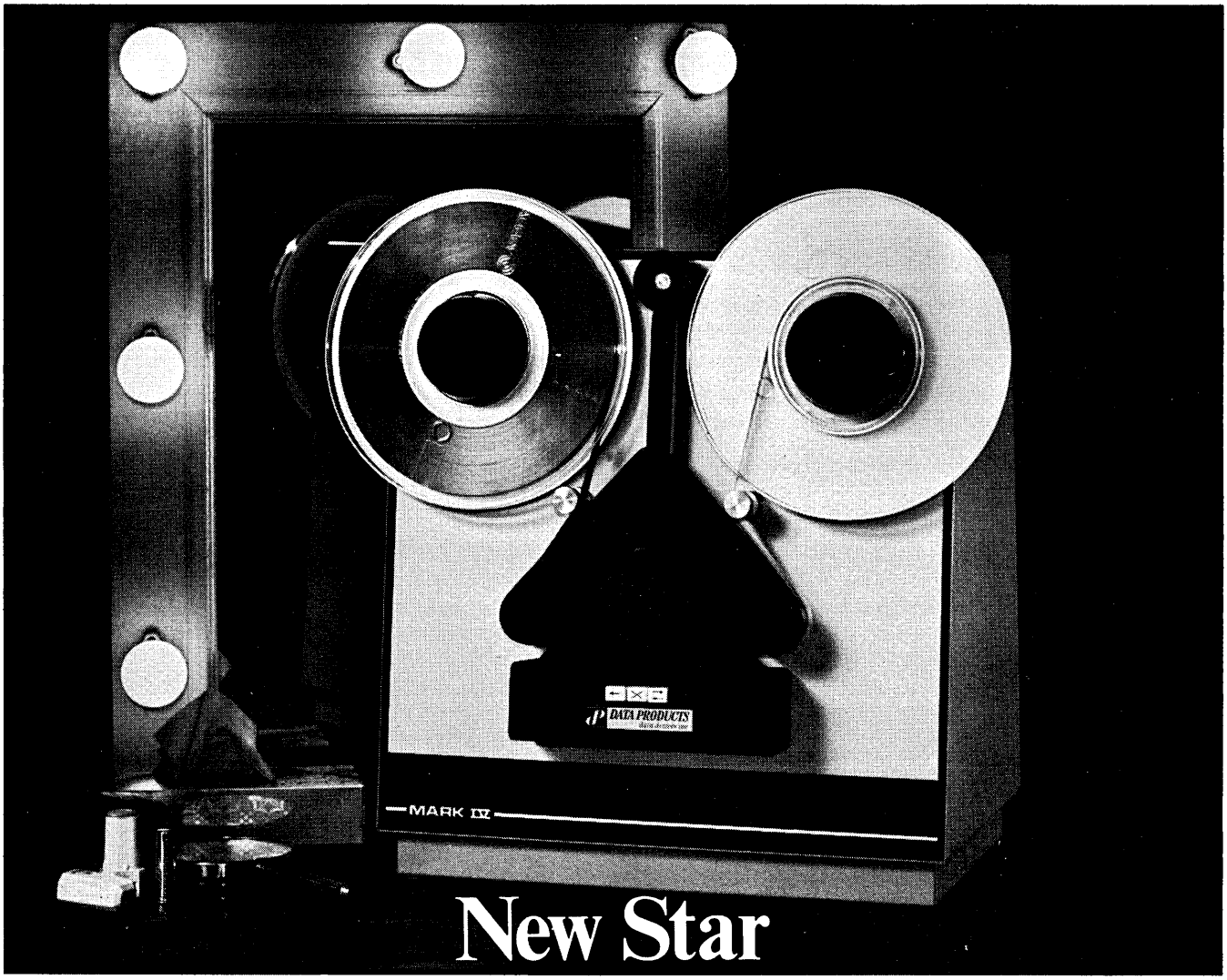
You say fifty of the largest EDP users in the States . . . banking, insurance, aerospace, manufacturing . . . stop! stop! I've heard anough!

Let's see that contract . . . is that all it costs? . . . now who do you think will believe that, buster?

COMRESS HEADQUARTERS

TWO RESEARCH COURT, ROCKVILLE, MARYLAND 20850. PHONE: (301) 948-8000

AMIGOS—Developed by DATA ART—Subsidiary of COMRESS



For best performance in a cost-cutting role: Our new Mark IV Tape Cleaner.

Every EDP center needs a magnetic tape cleaner. And this new star of ours makes all other cleaners old hat. See those controls? Three simple switches. Push one, and you have the fastest cleaner we've ever made going for you. Our famous patented self-sharpening slotted cylinder gently "shaves" dust and oxide clumps off at 180 ips. Meanwhile, a new screen cleaner is cleaning the Mylar side. All the debris is vacuumed away, never to appear on your tapes again. Mark IV has a new stacking wheel, too, that will wind and stack as good as any big tape drive will. Our patented hubs are an operator's dream; they're the fastest quick lock hubs in the industry. Our reliable reel brakes are solid state assurance against power failure, too. In fact, Mark IV is solid state throughout. The more impurities it cleans, the more you save in computer time. And Mark IV acts fast to clean them all out. At the flick of a switch. And at $2300. Which means that, in no time, Mark IV will pay for itself. From then on, it's clear profit. See for yourself how our star performer works. Call for a demonstration.

DATA PRODUCTS technology gives your computer the edge

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Chicago 312/654-0997; Dallas 214/231-8511; Los Angeles 213/474-9581; New York 212/532-9511; San Francisco 415/989-4191; Washington, D.C. 301/652-8120.

PEOPLE

Newly elected officers of the Society for Management Information Systems (SMIS) are **James C. Emery,** professor, Wharton School, president; **Richard E. Dooley,** vp and manager, information services group, The First National Bank of Chicago, vice president; **John C. Phillips,** vp and head of the planning and research department of Insurance Co. of North America, treasurer; and **Gerald M. Hoffman,** manager of operations research, Standard Oil (Indiana), secretary . . . Computer Consoles, Rochester, N.Y., has appointed **Herman A. Affel, Jr.,** president and chief executive officer. He has been on the company's board since it was founded in 1968. Affel replaces **Edward H. Nutter,** who resigned but will remain a consultant to the company . . . We're a bit late in reporting that **Dr. Andrej P. Ershov,** one of the USSR's top programming specialists, has been named to that nation's Academy of Sciences. He is at the computing center of the Siberian Branch of the Academy . . . **Robert A. Overton** has been appointed director of operations of Boothe Computer Corp., with responsibility for field administration and coordination of the company's re-leasing activity . . . **Dr. Barry W. Boehm,** a 12-year veteran at The Rand Corp., has been appointed head of the company's information sciences department to succeed **Dr. Willis H. Ware,** who has been serving for some time as deputy vice president for Project Rand. Most recently, Boehm was head of Rand's computer systems analysis group . . . Former director of marketing **Thomas J. Keffer, Jr.,** has been named president of Adtrol, Inc., Broomall, Pa., a subsidiary of KDI Corp., the financially troubled Cincinnati conglomerate whose Chapter XI plan was recently approved . . . EMR Computer's director of marketing has also moved up. **Arthur Mintz** has been appointed general manager of the Minneapolis OLRT computer systems manufacturer. Prior to joining EMR in 1970, Mintz held positions at Xerox Data Systems and IBM . . . Bonner & Moore chairman and executive vp **John S. Bonner** will receive the Professional Progress Award in Chemical Engineering at the American Institute of Chemical Engineers conference later this month for his work in computer simulation and the application of mathematical programming in the process industries. ■

Would you buy it without going inside?

If anybody offers you a price that looks better than ours, you'd better make sure you know exactly what you're getting.

We've just built a low-priced FDM data transmission system that's the best value on the market: the GTE Lenkurt model 25C. Go inside and take a look around . . . you'll find intermixable speeds from 110 to 600 baud. You'll find a built-in 20 mA local telegraph interface for on-premises printer applications. You'll find local/remote test features and a built-in carrier alarm lamp. You'll find it meets TTL, S-level and EIA/CCITT interface standards. And you'll find all the quality and precision we've been known for during 25 years of building data transmission systems.

The 25C comes as an attractive single-channel subset. Or the same duplex channel unit can be shelf mounted — up to 8 channels per shelf with a maximum of 18 channels (110 baud) on each VF line. So it lets you use just one voice channel rather than a lot of data lines. And it lets you do it at a very reasonable price. Add to that the 25C's economy of maintenance and you end up with a bundle of savings.

Write GTE Lenkurt Incorporated, Dept. C720, 1105 County Rd., San Carlos, CA 94070. We'll send you all the inside information.

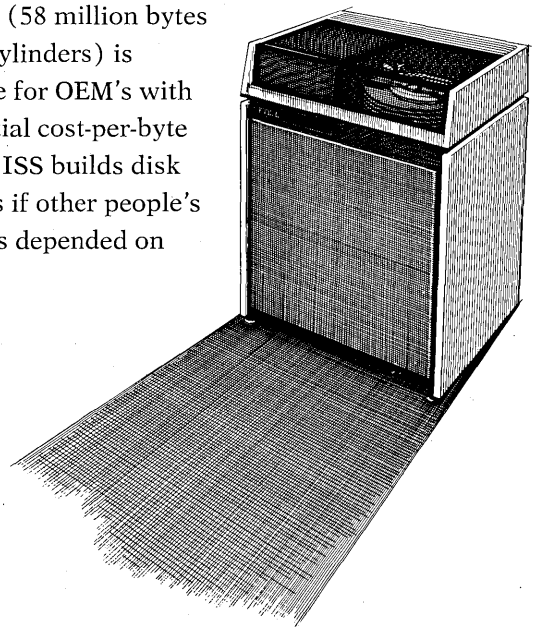
CIRCLE 87 ON READER CARD

GTE LENKURT

About Promises and Claims

A promise can be grounds for hope and expectation, or a promise can be a binding pledge of performance. There is a great measure of the former today and all too little of the latter. This is why OEM companies are so very careful in evaluating and selecting their suppliers. They know that overstatements and faulty claims about any part of their system will lower customer confidence. Which helps explain why you can count on a company that always exacts the pledge of performance from its suppliers.

Information Storage Systems is an OEM supplier with an unsurpassed record for delivering reliable disk drives that are compatible with most mainframe requirements. The 714 is setting new standards of performance for 11-high disk pack drives in thousands of installations. Now the 715, with double the storage capacity (58 million bytes on 400 cylinders) is available for OEM's with substantial cost-per-byte savings. ISS builds disk drives as if other people's promises depended on them.



ITEL CORPORATION
Information Storage Systems

Regional Offices *San Francisco:* 10435 North Tantau Avenue, Cupertino, Ca. 95014 (408)257-6220 *Dallas:* 2900 Turtle Creek Plaza, Dallas, Tex. 75219 (214)528-6990
Boston: 17 Church Street, Winchester, Mass. 01890 (617)729-2790 *Washington, D.C.:* Canal Square, 1054 Thirty-First Street, N.W., Wash. D.C. 20007 (202)333-7167

NOW

What are you waiting for? Right now, there is an *on-line* high performance, modular mass memory system that can access any one of up to 90,000 tape files (one trillion bits) in less than one second. ☐ We call it MASSTAPE. You'll call it the best business investment you ever made. ☐ Time is costly, so MASSTAPE puts your tape storage *on-line* where it's safe but easy to get at. Space is costly, too, so MASSTAPE reduces your tape storage requirements by as much as 90%. ☐ So why wait? Grumman didn't wait. It solved its own data base storage problems and now offers MASSTAPE to solve yours... now.

Write or call for further information. Do it now.

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Tel. 212-532-1122

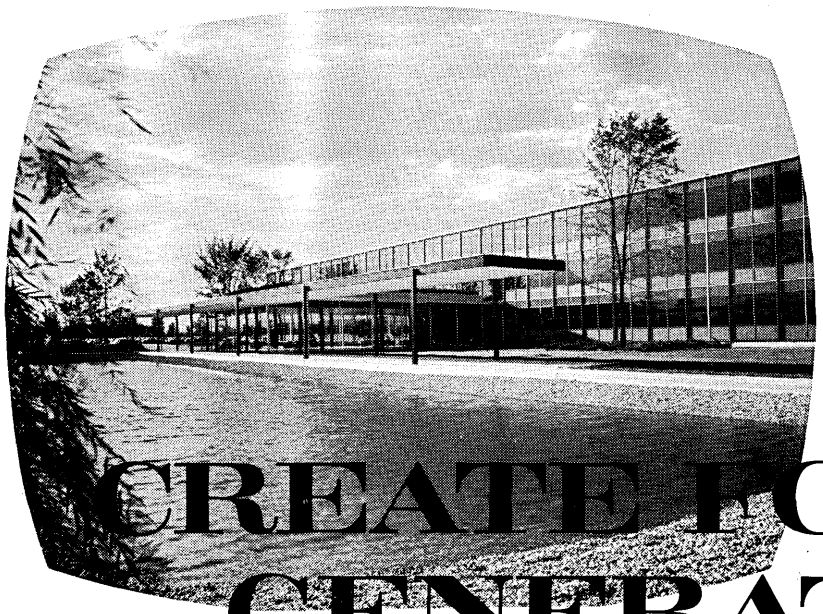
WASH., D. C. REGION
1117 North 19th Street
Roslyn, Virginia 22209
Tel. 703-525-8530

WESTERN REGION
999 No. Sepulveda Blvd.
El Segundo, Cal. 90245
Tel. 213-322-6990

GRUMMAN DATA SYSTEMS CORPORATION
GARDEN CITY, NEW YORK 11530
TELEPHONE 516-575-3034

SEE MASSTAPE AT F. J. C. C. BOOTH NO. 1434

CIRCLE 54 ON READER CARD



The planning of tomorrow's larger and more complex information systems has created challenging opportunities for computer professionals at the General Motors Research Laboratories. These professionally satisfying positions involve non-routine, in-depth work in the areas of software development and extensions to large scale computing systems.

CREATE FOURTH GENERATION SOFTWARE

with one of the leading teams in the game

• **CONVERSATIONAL GRAPHIC LANGUAGES**—Make computer graphic consoles more accessible to professional people not familiar with programming languages.

• **INFORMATION STRUCTURES**—Devise data base structures in conjunction with virtual memory management techniques to solve design problems.

• **TIME SHARING SYSTEMS**—Design and implement a large scale virtual memory time sharing system to run on a Control Data STAR-100 computer.

• **PL/I COMPILER** — Create a PL/I compiler, written in PL/I, for new computer hardware where parallel processing and arithmetic stream units are a way of life.

Our organization has been involved with projects on the forefront of computing technology for over fifteen years. We have always remained small in number and feel that the resultant ease of technical communication has been a substantial factor in our success. We are largely dependent on our own people to propose solutions to project problems and on the initiative of assigned teams to carry them out.

Requirements for joining our effort in any of the above areas include a master's degree or doctorate in computer science, engineering, or a related field, and a desire to cooperate with other computer professionals on some of the most challenging software problems that exist today. If you are interested please contact:

GM

Mr. J. B. Sparhawk

GENERAL MOTORS RESEARCH LABORATORIES

Warren, Michigan 48090 / An Equal Opportunity Employer

UNCLE SAM, MIDDLE MAN

A bill (HR 7248) authorizing a "National Institute of Education" that could "acquire...computing programs" and lease or sell them "to others" has been approved by the House Education Committee. Next major step is a final vote by the full House membership. The institute could also acquire dp hardware and communications networks and lease or sell this equipment to others. It could sponsor educational research, including developments on educational products and techniques, and disseminate research findings. The adp provisions are missing in a companion Senate bill (S 659), but House sources expect their measure to be accepted when the legislation goes to conference. The institute, a new agency within HEW, would take over most of the Office of Education's research activities.

NBS INTERFACE STUDY

A National Bureau of Standards report, still going through channels, proposes that systems suppliers be required to disclose channel and interface requirements whenever they offer new cpu's or I/O controllers to the federal government. One aim is to extend the life of already installed peripherals that were designed for earlier systems; another is to give independent peripheral makers more of a chance to compete for system contracts.

EIA APPARENTLY MOLLIFIED

EIA opposition to a bill authorizing U.S. participation in the Multipartite Accord and similar international standards activity apparently has been neutralized by a new draft, hammered out at an informal meeting of interested parties. The bill's proponents contend that its passage is needed to prevent European countries from erecting non-tariff barriers against American dp products. But Congressional sources doubt that the measure can be amended during this session--which could reduce the ultimate benefit.

TELPAK SHARING TO END

AT&T filed a tariff amendment last month that would end Telpak sharing beginning Dec. 12. The proposal represents Ma Bell's answer to an earlier FCC order which called for elimination of price discrimination in the present Telpak rate structure. Simultaneously, several Telpak users asked the commission to reconsider its order. These users--railroads, trucking companies, and motor bus operators--are now allowed to share Telpak pipes; they reap big savings in the process. The truckers, in their reconsideration request to FCC, implied they would be happy if AT&T allowed them to lease Telpak service through a centralized agency serving the entire industry. The truckers pointed out that the airlines can buy communications this way right now through Arinc. Support for such "single customer" arrangements seems to be growing--among Telpak sharers and non-sharers alike.

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The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

THE FORUM

Picturephone— Who Needs It?

In September I had the opportunity to listen to Mr. William M. Ellinghous, who had until a few days before been executive vice president of AT&T, as he addressed a group at the 1970 ACM National Conference. Mr. Ellinghous expounded on, among other things, the progress and desirability of Picturephone. His talk dredged up and focused for me several concerns I have harbored for some years. They are:

1. Does the public really want Picturephone as opposed to a vast array of other feasible and attractive communications services? AT&T takes on the appearance of a national resource, and it seems obvious that the public, who pays the R&D bill, should have a *very* strong say. Should we not expect the FCC to examine alternatives and, even if it does not have legal power, act to test public opinion, want, and need? Should we not expect AT&T to do the same—instead of attempting to shape public opinion in favor of the product they hope to sell?

2. Does Mr. Ellinghous really believe that the Picturephone will function as a display oriented remote terminal? If not, why was it not planned and designed so that it could be? As it is, the device has very little utility even as an ultra-simple terminal, and certainly it cannot be considered as an acceptable unit for advanced uses such as automated shopping, home CAI, etc. (All of these are admittedly years in the future — if, in fact, the public wants or will

tolerate them.) Whatever, it seems as though an exorbitant fraction of the phone-bill-payer's (e.g., taxpayer?) contribution to Ma Bell has been rather carelessly spent — or at least any further such expense can be considered careless.

3. How are the operating companies to supply circuits to Picturephone users when they are clearly not able to maintain the status quo at present? Picturephone service requires a large number of circuits, and the load increase would be enormous if the Picturephone were to become available in the near future. Here the FCC has a clear responsibility. At the very least they must protect the staticky, wobbly communications we already have to assure some marginally acceptable future level of service.

It behooves the computer community and the public in general to carefully question the policies and directions of AT&T, since these policies and directions generate future capability of the nation to maintain its "information system," and the effectiveness of it directly affects the future of the nation itself.

The FCC should immediately undertake a board of inquiry to isolate possible present and near-term alternatives to Picturephone and to examine the social costs and benefits of them. In addition, the commission should support investigation (via a series of Delphi examinations) into longer term options. And further, AT&T should be required to show clearly and unequivocally why it should be continually expending a "national resource" on development of Picturephone.

—Robert J. Robinson

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