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January

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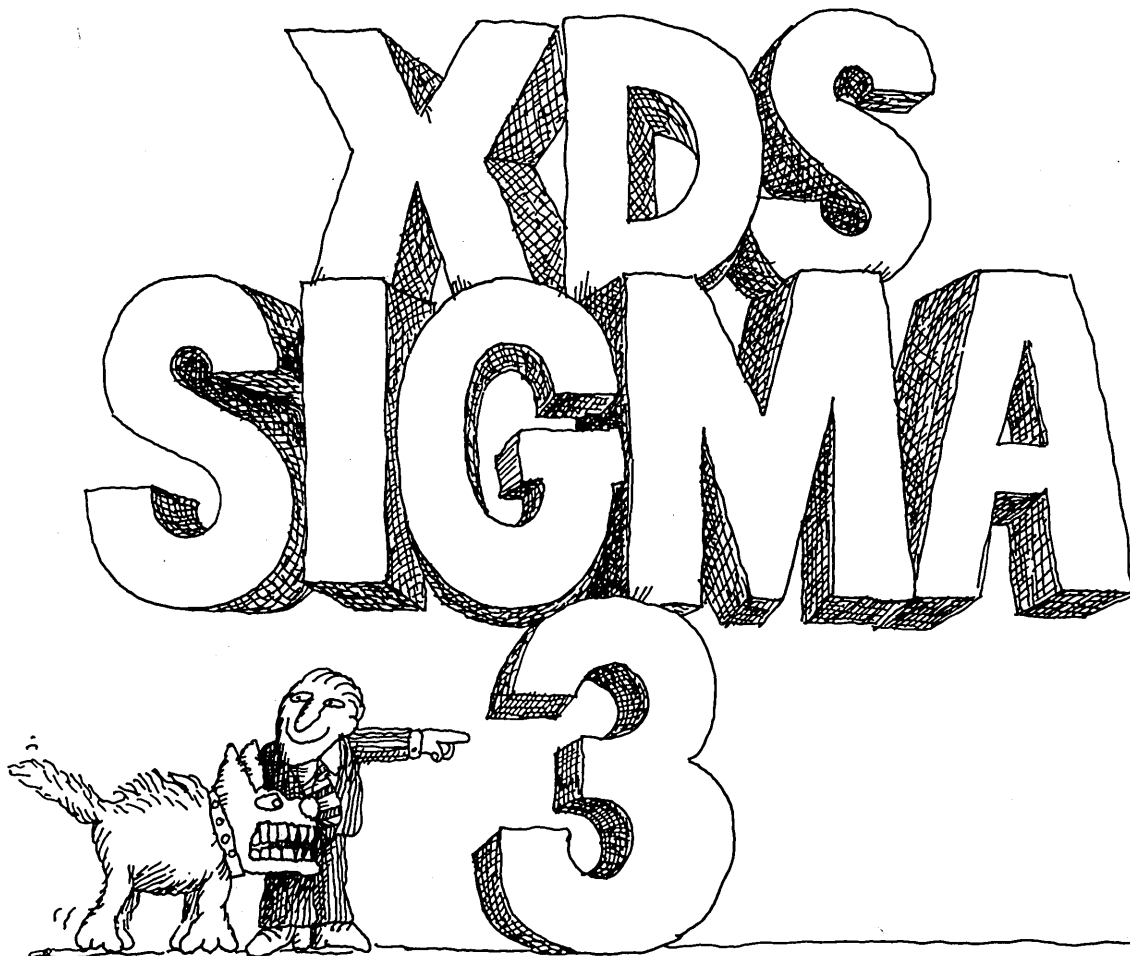
to their 6. Most important, we have complete file protection where they have none at all.

The number of access methods to rotating memory device shows us with 4. They, a mere 2. We have the advanced queued I/O while they are still working with chained.

When it comes down to specific real-time applications, you'll find that a VORTEX system goes to work faster and cheaper. It's the teeth in our argument.

Call or write today for complete information on the hows and whys of VORTEX vs. the XDS Sigma 3. Varian Data Machines, 2722 Michelson Drive, Irvine, California 92664. (714) 833-2400.

varian data machines



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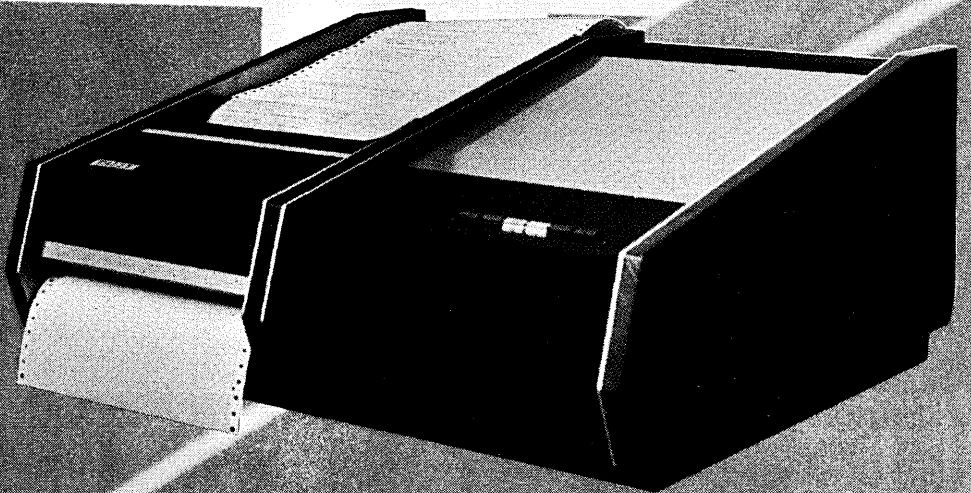
Line after line. Month after month. Copy after copy. Good environment or bad. The new Tally line printer consistently gives you crisp, multi-copy printout without downtime.

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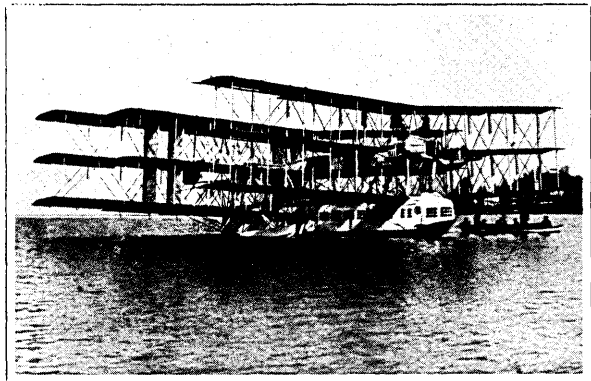
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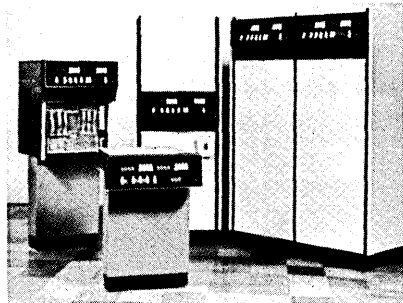
CIRCLE 4 ON READER CARD

To get the best fly Modular

This 1979 conception of the future stiller? Looks like anything but because the one wing eight engine airplane was designed using only those technologies familiar to folks back then. The basis for its basic design can be compared to obsolete computer installations where users have been supplied a particular computer that was quickly grounded by obsolescence and replaced by a larger but incompatible computer in an attempt to meet future requirements.



Today we're not Number 1 or 2 . . . we're flying ahead of them. We've got all competitors frustrated in the clouds announcing blue sky paper tigers. Why? Only Modular Computer Systems is delivering a family of 16-bit computers supported by family compatible software and I/O equipment that soar upward and downward from computer to computer. Instead of outdated patching, all elements of the MODCOMP family have been designed together to work together . . . specifically for real-time measurement, control, communications and on-line information processing requirements.



Here's the best:

- MODCOMP I taking off at \$2,500, climbing to the MODCOMP II and to the MODCOMP III with multiprocessor configurations up to \$300,000.
- Never been beaten by any 16-bit computer on a benchmark and always rated first in price/performance.
- Six language processors and three operating systems including a 'real' real-time monitor with foreground/middleground/background . . . and a re-entrant FORTRAN IV run-time package (and it's all been delivered).
- Unique ability to address and manipulate bits . . . bytes, words, doublewords and files.
- Architecture for the 1970's with 800 nanosecond full cycle time upgradable to 400 nanoseconds, 15 general purpose registers, 182 instructions, multi-port memory and user available microprogramming.
- 65K words of core directly addressable . . . standard software operates anywhere in memory.

- Fastest I/O throughput and most flexible interrupt structure.
- Hardware interfaces and software work interchangeably on all computers.
- Modular design enables use of lower-cost, higher-performance components as they become available . . . assuring continued low prices and high performance while extending customer investments in software development.

These are only a few of the reasons why repeat business to many of our industry's most sophisticated users has consistently averaged more than 40 percent of our order volume. Examples of why sophisticated users have turned to MODCOMP are almost as varied as the applications themselves.

Advanced Real-Time Software

A large, multi-computer user required all of his process control programs to be written in FORTRAN, operating under a real-time executive. His reasons: shortage of programmers having real-time assembly language experience; and attaining a level of machine independence. The manufacturer selected a MODCOMP III supported by the MAX III foreground/middleground/background software system. His extensive acceptance tests included the execution of multiple FORTRAN coded foreground tasks and concurrent background operations.



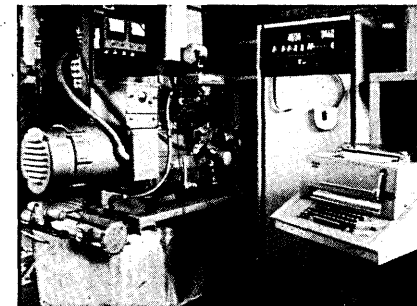
Measuring Capability

Another industrial customer was faced with two tough measuring problems. He had a wide range of analog signals, varying from millivolts full scale to volts full

scale. He also needed to resolve micro volt signals having common mode voltage of 500 volts. He chose a MODCOMP system with a Wide Range Analog Input Subsystem because it met his measurement and processing requirements.

Broad Range OEM

A large midwestern manufacturer needed inexpensive computers to function in smaller systems jobs and as remote processors. For medium and large jobs, more powerful CPU's were required. The manufacturer selected Modular because all these computer requirements could be supplied by one vendor. This earned them better OEM prices . . . their software and hardware interfacing people concentrated on learning only 'one' machine.



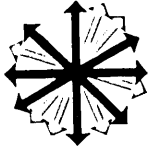
Custom Engineering and Programming

A MODCOMP II system was selected for an automated test application by a major engine manufacturer because Modular supplied the special control and display panels plus application programs for the test stands. This willingness to accept total system responsibility is a key difference between Modular and other mini-computer companies.

If you want the best, call Modular . . . or at least write today for our encompassing booklet on the MODCOMP family.



Modular Computer Systems, Inc. 2709 North Dixie Highway, Fort Lauderdale, Florida 33308 phone: 305/563-4392



JANUARY, 1972
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28 Where Go the Computer People— Up, Down, or Out?

MILT STONE. In this first article of a series, a DATAMATION contributing editor begins the interpretation of information gathered by the staff from thousands of questionnaires and hundreds of personal interviews—showing the personal attitudes that will shape the future of computer-based careers.

34 Modular Programs: Defining the Module

ALAN COHEN. That modularity is a useful tool is common knowledge, yet few seem to know how to use it. A new approach sheds light on the practical problems facing programmers who are attempting to develop modular programs.

39 The FJCC

Gone were the mainframers, software houses, and time-sharing outfits, while attendance was down substantially. Changes are in the wind.

45 1971: Anything Could Happen (and Did)

TOM MC CUSKER and W. DAVID GARDNER. As the year unfolded, IBM bared its teeth, RCA took a dive, and the world's fastest growth industry was stunted.

51 The Railroads: Salvation Through Computers?

Report on a conference concerned with falling profits and the threat of government intervention.

53 News In Perspective

RCA users generally were reassured when Univac agreed to buy the RCA customer base and industry observers were calling the buy a smart move on Univac's part. This month's individual Univac-user negotiations should give a good indication of just what it is that Univac has bought. User and industry reactions to the acquisition are examined.

107 The Forum: Exit—Without Flourishes

LOUIS B. MARIENTHAL. There must be a better way—even for going out of business—than the one RCA chose.

About the Cover

As we start the New Year with a look at where computer people are going, our art director's design reflects the fragmented image we see so far. Articles to come will pull the picture together.

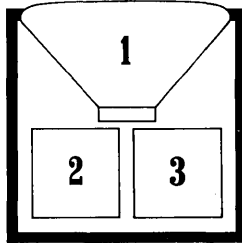
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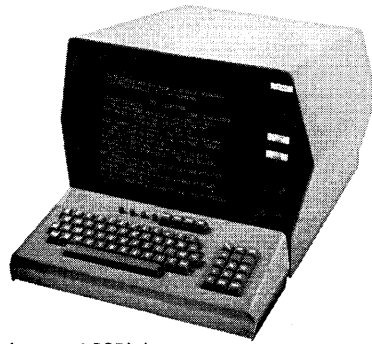
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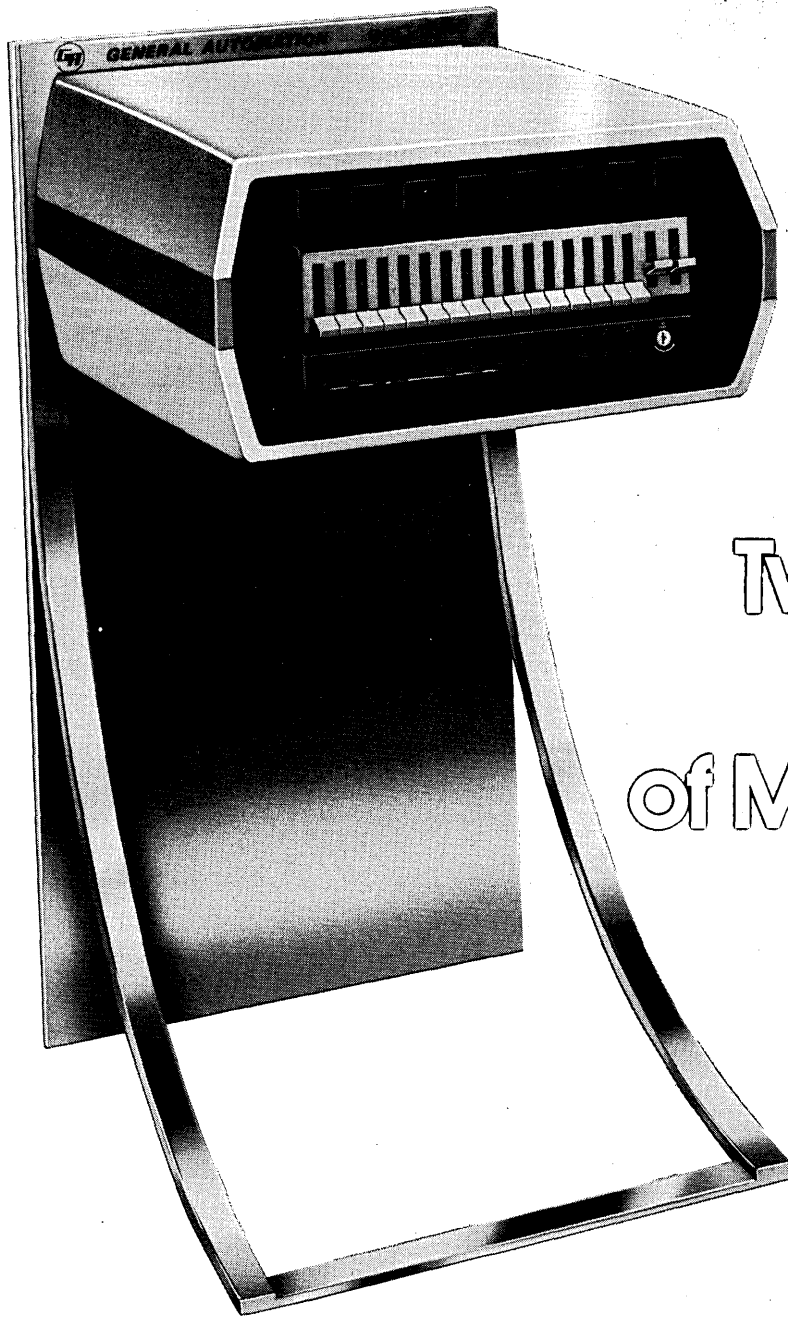


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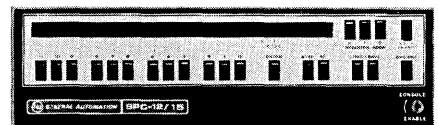
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October 11, 1971

Mr. James A. McCullough
Vice President and Group Executive
Burroughs Corporation
Burroughs Place
Detroit, Michigan 48232

Dear Mr. McCullough:

As one of the world's largest suppliers and installers of building automation and comfort control systems, we can certainly appreciate the value which the customer places on a timely and trouble-free installation. Our experience as recipients of the first B-4700 System merits our comment in that we were running production jobs just three working days after delivery.

Our experience would indicate that several firsts have been set in your industry. The B-4700 was delivered approximately one month ahead of schedule. Its performance meets or exceeds our expectations, and the hardware appears to be extremely solid. The speed with which it was installed certainly points to the fine job done by your Engineering and Manufacturing Staff, but a large amount of credit must also be given to the outstanding local Field Engineering Group.

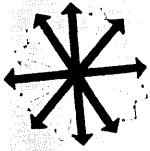
We offer you our congratulations on a superior new product that permits us to provide even better service to our customers.

Sincerely yours,

JOHNSON SERVICE COMPANY

Roger V. Resek
Roger V. Resek
Manager, Systems and Data Processing

RVR:lt



Look Ahead

UNIVAC PLANS SPECTRA EMULATOR

Univac's take-over of the RCA rental base (page 53) may be an even better deal for Univac than first met the eye. Its sales are said to be in the deep doldrums--still only five or six orders for the 1110, and the 9700 won't be delivered for many months. So, the RCA deal meets Univac's need for immediate growth. We know it wasn't planned that way, but the 9700 could have been designed to convert the RCA line. The 9700 has emulation capability, and we hear Univac has a team working on development of an emulator for the Spectra line.

UNIVAC HAS KEY/DISC BUSINESS PLANS TOO

Overshadowed by its big deal to acquire RCA's computer customers were Univac's quiet negotiations last month for the customer base of Redcor Corp., the ailing Canoga Park, Calif., data entry firm. Gould and Addressograph Multigraph were also in the running; but Redcor was said to favor a Univac offer under which it would manufacture KeyLogic key-to-disc systems for Univac and turn over the customer base and a sales and service staff of 75. Terms were under negotiation at press time. Despite the imminent demise of an activity that represented 80% of its sales, the company last month still answered the phone with a cheery "Merry Christmas, Redcor."

Elsewhere in data entry, we heard Mohawk Data Sciences will announce a numeric document reader in June. The plan is to hang it to the 2400 system. MDS' major interest in acquiring some of the RCA pieces, incidentally, is to get its hands on ocr equipment under development at RCA.

THE COMPUTER INDUSTRY'S PENTAGON PAPERS--ALMOST

In the private antitrust suits against IBM, the written depositions being taken from 2,700 firms have provoked controversy, confusion, and delay. In November eight of these firms--Burroughs, Honeywell, Digital Equipment Corp., NCR, Computer Design Corp., Memory Systems, Inc., Unicorn Systems, Inc., and Wyle Labs--requested a stricter protective order from the St. Paul Court. They contended that attorneys and some experts outside IBM and the other litigants would be the ones to analyze the data. But the court disagreed, saying if it is to have "meaningful significance" a limited number of IBM (15), Control Data (10), and Greyhound Computer (10) personnel should be permitted to evaluate it.

Presiding Judge Philip Neville didn't say anything about letting a reporter see the material. In December, a Business Week correspondent in routine search of data on the suits was inadvertently shown to the "protected" room where more than 1,500 depositions were filed. He wasn't aware of his treasure, so little harm was done, although at this writing his notes hadn't been subpoenaed. The fact that the room wasn't under lock and key has made corporations leery of the whole process. None contacted, however, had decided on any action.

In any case, the material being submitted is arriving in every form imaginable. With the court's refusal to authorize

Look Ahead

every form imaginable. With the court's refusal to authorize payment for preparing the questionnaires, one company has merely sent annual reports, saying, "It's all there. Find it." Undoubtedly, it will take months to sort and analyze the data. When the parties are through, everyone wonders what will become of the personnel that have been privy to it all. Quipped one computernik: "Well, they used to bury the Pharaoh's architect in the tomb."

USERS OF 165s PLEASSED WITH THE 3330

Users of 370/165s report that the IBM 3330 disc drive, just now going to customers, is working well with "no downtime to speak of" and that the change from 2314s to 3330s "is transparent." But its high speed (transfer rate of 800KB/second) is causing some problems for 155 users. One thinks the 155's HASP spooling module will have to be changed to keep up with the 3330 speed. Another user may have solved the problem by incorporating ASP (Attached Support Processor) into his OS, even though the machine is not running with another 370. ASP incorporates a spooling module and this user is happy with the result.

A CHRISTMAS PRESENT FOR INTRANET COMPUTING

It was a merry Christmas at Intranet Computing Corp., Los Angeles, and the firm's hopes for a happy new year are high. The company, which filed Chapter XI bankruptcy proceedings shortly before Christmas 1970, went into court last Dec. 15 with commitments for \$500,000 which more than funded a "plan of arrangement" that officially removed it from the bankruptcy roles. Actually, \$285,000 would have done it, but company principals said they felt more comfortable with the larger amount, the bulk of which came from S.A. King of D.H. Blair Co.; Robert Philip, Richland, Wash., publisher; Sam Volpenteste, head of the Tri-City Nuclear Industrial Council of Richland; and a large computer peripheral manufacturer which invested \$100,000 and also signed an exclusive worldwide marketing and maintenance agreement with Intranet. Once primarily a time-sharing company, the main business of Intranet-as-revived is the production of disc systems to replace Fastrand's.

RUMORS AND RAW RANDOM DATA

IBM's high purchase-to-lease ratio on the 370 line isn't deterring buys, it seems. We hear \$575 million worth of 370s were purchased in the second half, mostly by banks and insurance companies...Automatic Data Processing has been talking to Computer Sciences Corp. about Infonet, after breaking off talks to buy out ITT Data Services' service bureau operation. CSC isn't planning to can the service, but certainly would like to unload it, we hear...Some 15 time-sharing firms are bidding on a GSA contract to be let next April for remote dp services. The order possibly will be worth more than \$1 million a month...Jim Schallerer, industry savant and entrepreneur, has set up a consulting firm in Pebble Beach, Calif., to investigate the possibilities of trade with Red China. He has joined a trade mission planning a visit to the Peoples Republic this spring, and is signing up companies looking for markets there.

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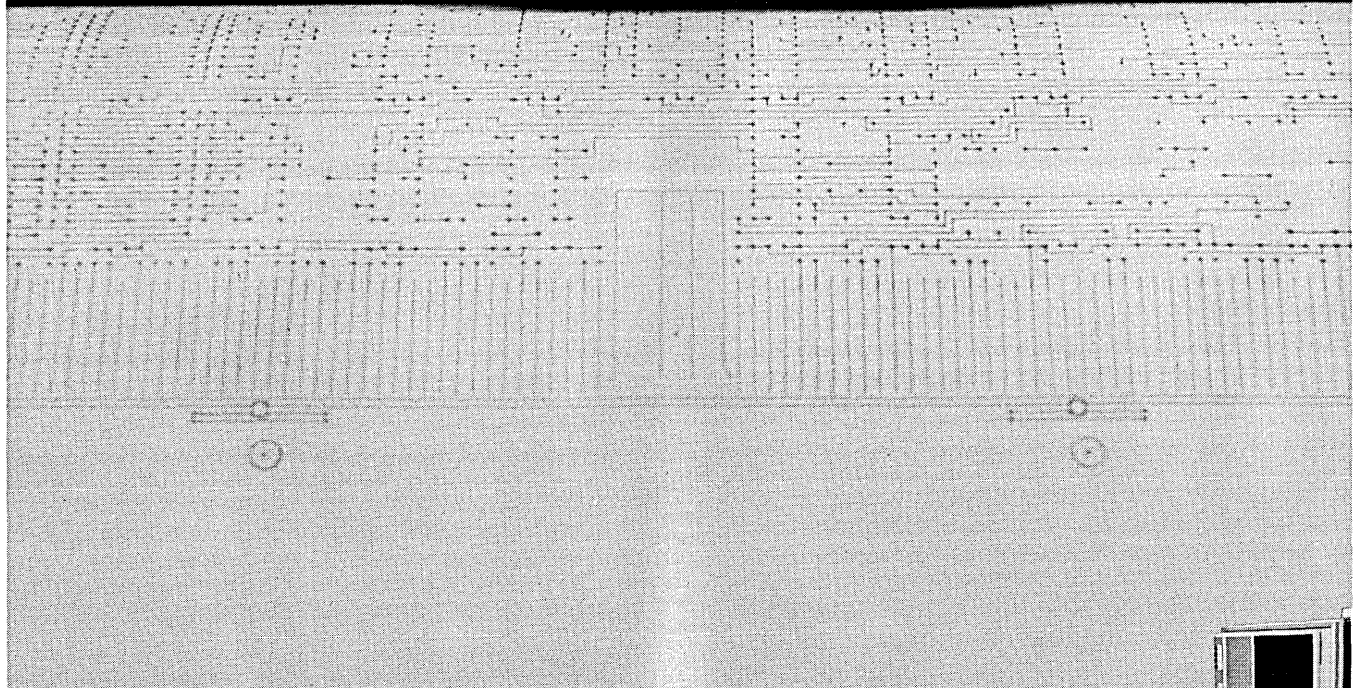
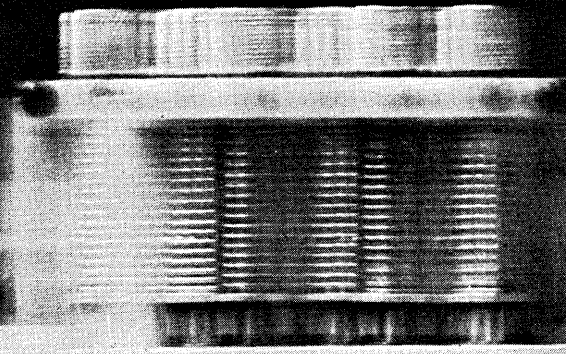
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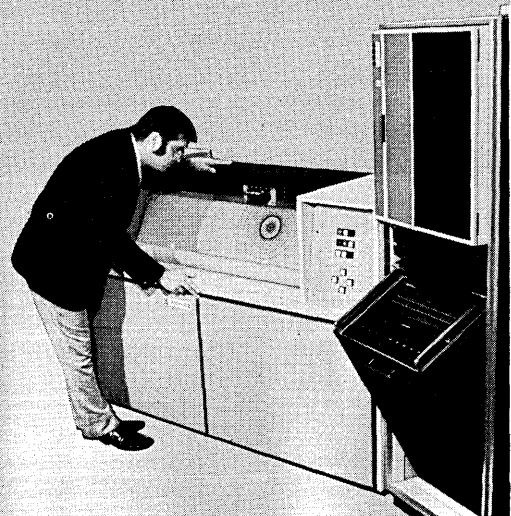
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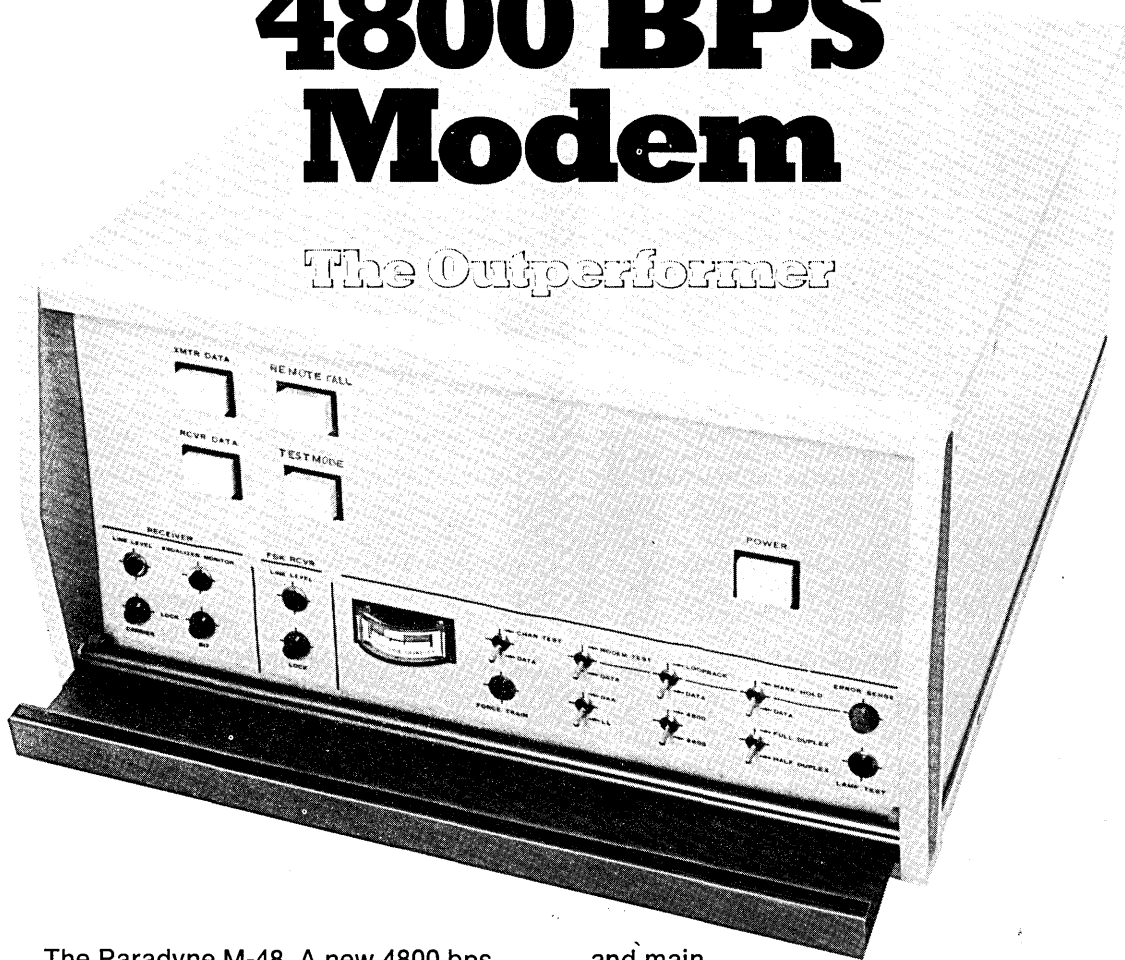
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and maintenance. All for less than most so-called competitive modems.

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Big computers. Middle size computers. And small computers.

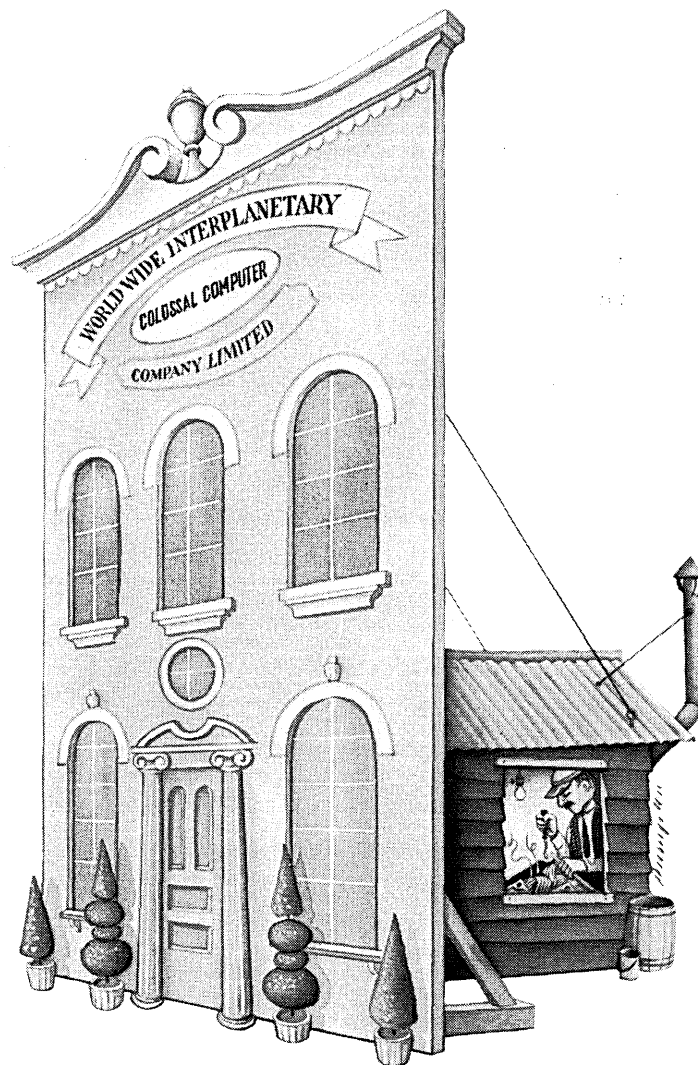
And our Logic Products Group can hook them up to anything you want them hooked up to (in the trade we call it "interfacing"), to do whatever job you want them to do.

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Better, faster card production begins with something basic: machine speed.

UNIVAC® 1700 Key punches are over 150% faster in punch and print speeds than their competition.

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+
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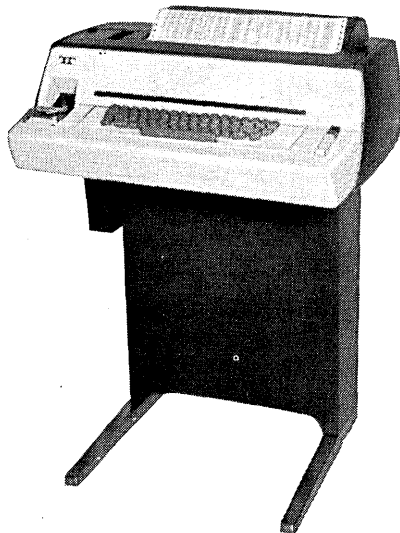
Calendar

EVENT/SPONSOR	DATE	LOCATION	CONTACT	COST
ADAPSO 34th Management Conference and 2nd Conference on Software	FEB. 17-18	Dallas	J. L. Dreyer ADAPSO 551 Fifth Ave. New York, NY 10017	\$80, members \$120, others
AMA 18th Annual Systems Management Conference	MARCH 6-8	New York City	Conf. Info. Coordinator American Management Assn. 135 W. 50th St. New York, NY 10020	\$150, members \$175, others
ACM SIGGRAPH Symposium on Computer Graphics in Medicine	7-10	Pittsburgh	Dr. John D. Canter Point Park College 201 Wood St. Pittsburgh, PA 15222	\$75 Students free
IEEE INTERCON	20-23	New York City	William J. Hilty IEEE 345 E. 47th St. New York, NY 10017	\$7, members \$10, others \$3, students
IIA 4th National Meeting	APRIL 10-12	New York City	Information Industry Assn. 1025 15th St., NW Washington, DC 20005	\$100, members \$150, others
NCS 9th Annual Meeting and Technical Conference	17-19	Chicago	Numerical Control Society 44 Nassau St. Princeton, NJ 08540	\$110, members \$140, others
Spring Joint Computer Conference	MAY 16-18	Atlantic City	AFIPS 210 Summit Ave. Montvale, NJ 07645	\$20, members \$50, others
ASM 25th International Systems Meeting	21-24	Miami Beach	Assn. for Systems Mgt. 24587 Bagley Rd. Cleveland, OH 44138	\$125, members \$175, others
Society for Information Display International Symposium	JUNE 6-8	San Francisco	Lewis Winner 152 W. 42nd St. New York, NY 10036	\$30, members \$40, others \$2, students
Conference on Computers in the Undergraduate Curricula	12-14	Atlanta	Dr. John W. Hamblen Southern Reg. Educ. Board 130 6th St., NW Atlanta, GA 30313	\$35, faculty \$75, others
Summer Simulation Conference of the Simulation Conf. Board	13-16	San Diego	O. P. Hall, Jr. TRW Systems, M/S 01/2060 One Space Park Redondo Beach, CA 90278	\$50, members \$55, others \$25, students
10th Annual Conf. of the ACM SIG on Computer Personnel Research	15-17	Toronto	Fred A. Gluckson EDP Systems Dept. National Bank of Detroit Detroit, MI 48226	\$45, members \$55, others



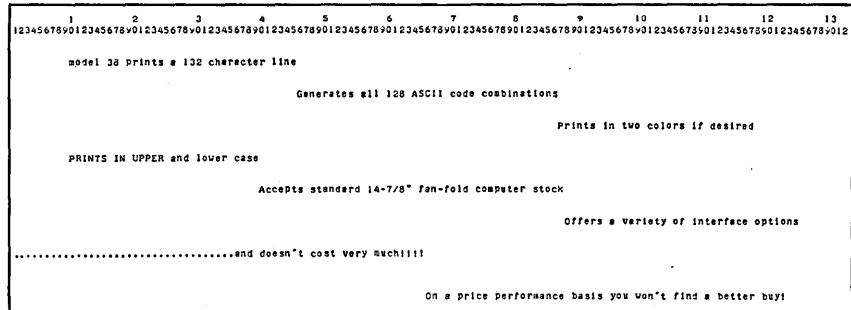
Right! It's a new
low-cost, wide-platen
 data terminal

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



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.

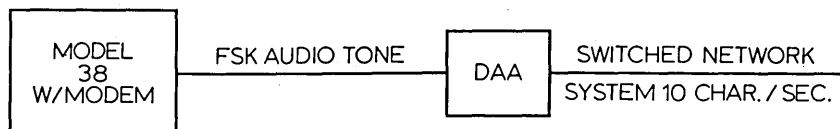
As you can see, the 38's format flexibility makes it easier to get your data in and out of the computer. And it broadens your on-line capabilities as well.

... 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

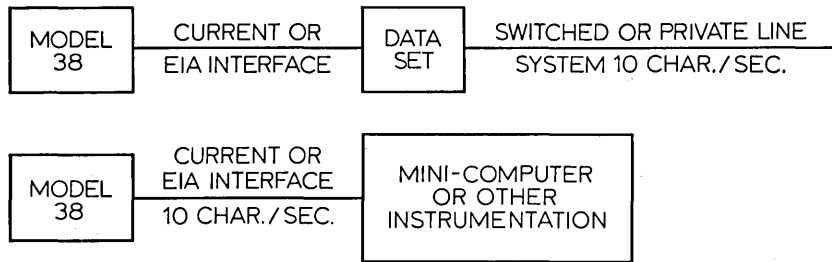
The model 38 is available with several interface options, operating at 10 characters per second (110 baud).



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.

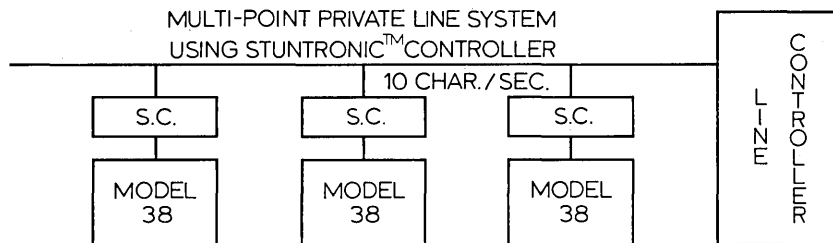
DATA COMMUNICATIONS

equipment for on-line, real-time processing



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 mini-computer at a realistic price.

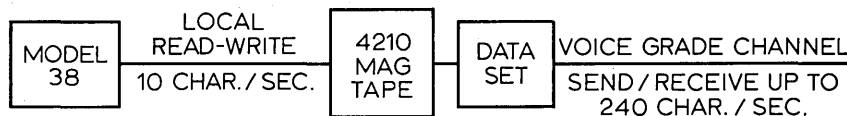


You can even use the model 38 in multi-point "selective calling" systems by adding a Teletype Stuntronic™ station controller.



... 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.

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DATAMATION

Letters

GIS terrible

Sir:

Thanks for the outstanding article in 15 October (p. 20) about "GIS."

We have been trying to use GIS since November 1969 in a TP mode, and it *still* does not work as sold!

Minimum 68K for *every* GIS job, horrendous QTAM-GIS interface problems, poor documentation from "Big Daddy," etc., etc., ad frustratum.

Many thanks to Kreger and Nathanson, and DATAMATION.

NAME WITHHELD
Atlanta, Georgia

Multics alive in Waltham

Sir:

As much as I am, as ever, titillated by his musings, I have to take issue with that peripatetic savant, the good Doctor Grosch (Forum, Nov. 1, p. 71), in one minor aspect at least.

In the process of berating unworkable systems born from tackling undable jobs, Herb has cast the Multics system into the same wallow where lie SAGE, BUICCS, and other dinosaurs; waiting to be pickled in tar.

This is a bad case of miscasting. Multics has proved in commercial use to be a practical, highly usable tool for systems programming—the primary activity for which it was designed. Here at the Honeywell Information Systems facility in Waltham, the Honeywell 645/Multics system is operational, in the full sense of the word, and is being further enhanced for production of advanced systems software. A second system is scheduled to be installed in the Honeywell Bull facility in Paris early next year—in the meantime, Paris programmers use the Waltham facility by long distance line.

By any definition today Multics is a workable system. In looking at its history, one has to recall that it was initially a research project, frankly intended to push the state of the art. There was no compromise with the ambitious objectives in order to meet schedule constraints. Under such circumstances it is not surprising that there were delays and periods of less than optimum performance. The fact remains that the resulting system, whatever its parentage and formative years, is maturing into an effective tool.

There are those today who believe that operating systems are too massive and incur too much overhead for the benefit received. Well, there *are* some efficient operating systems today; but there is room for substantial improvement, in general, both in performance

and in capability. And certainly if such systems are achieved, the work of developing Multics will have contributed many important influences.

RICHARD H. HILL
Waltham, Massachusetts

Rosin's bag

Sir:

As the first customer for the Nanodata Corp. QM-1 computer, I am pleased to see the recognition you are giving this machine (Nov. 1, p. 32). I support everything you said about QM-1, with one important exception.

My group and I have participated in the design of the machine only in the capacity of potential users. We are not interested in designing hardware systems; merely in using them. We submitted a set of requirements rather than "specifications," and the ideas realized in QM-1 have arisen in Nanodata, not in our university.

Furthermore, I have no connection with any company, including Nanodata, except as a customer. I am on neither the technical nor managerial staff of the firm, I do not consult for them, and I don't even own a single share of their stock.

Finally, I want to express publicly my gratitude to the National Science Foundation for supporting our work, which includes funding our acquisition of QM-1.

R. F. ROSIN
State University of New York
at Buffalo
Amherst, New York

Common error

Sir:

Dr. Siegel's article on the WATFOR compiler (Nov. 15, pp. 22-26) was most enjoyable (perhaps its title should have been "What for WATFOR"). It brought to mind a harrowing experience I had in conjunction with the debugging of a 4,000 FORTRAN statement nonlinear circuit analysis and optimization program (related to my PhD dissertation at UC Berkeley).

Briefly, an error in duplicating a COMMON card caused a variable (say N) to be undefined in some subroutine. N was used as a switch, and, depending on its sign, different code would be executed. Since memory was not initialized (CDC 6400), the program would run perfectly on some runs and bomb on others (with the same data!).

The experimental evidence clearly indicated the type of error to expect, but to pinpoint the bug in a 4,000-card program, where the error was not detected by the compiler, was something else again. After 10 days' work, several nightmares, mounds of computer print-

out, and much valuable cpu time lost, the problem was resolved.

WATFOR—where were you when I needed you?
PAUL M. RUSSO
Princeton, New Jersey

Garbage value

Sir:

I enjoyed reading Stan Siegel's article on the WATFOR compiler. In his discussion of the way that IBM System/360 FORTRAN compilers handle undefined variables (p. 23), it should be noted that none of these compilers sets an initial value for a variable.

In FORTRAN output under these compilers, a true zero reports as 0.0 regardless of format specification. Also note that in the example labeled H0, the value of Y is a negative zero. The garbage value of an unassigned variable is determined by whatever last occupied the storage location instructions in the compiler, data from the previous job, or whatever. In the case of large programs, this problem can create some particularly insidious bugs.

ANTHONY R. ABERNETHY
Tulsa, Oklahoma

Needed: new personnel

Sir:

In "Needed: A New Planning Framework" (Dec. 1, p. 37), Mr. Cosgrove states that any aggressive programming development group will need to find a way to use the talents of prima donna programmers. It is statements such as this which lower the quality of the programming profession.

What we need are professionals, not prima donnas. A professional finds out what has to be done, and does it to the best of his ability with consideration for the system environment and the overall corporate goals. He does not shift problems due to his personal idiosyncrasies onto his manager. He tends to be known for the quality of his work rather than his oddities.

A prima donna programmer is like a machine that can do everything, but cannot be found, cannot be started, is usually doing something else, and consumes exorbitant energy and resources. Who needs them!

JON A. MEADS
Beaverton, Oregon

What cut?

Sir:

Assuming the integrity of the author, Mr. Young's reference to data entry error rates (Oct. 15, p. 31) is sufficient to make the intended point that the error rate was cut to 4% of its original level.

However, Mr. Young, like the vast

DUO 360/370 shrinks OS manpower conversion costs up to 90%.

Going from DOS to OS is a battle. For one thing, programmer man-hours are monstrously inflated by the need to reprogram everything from DOS. With DUO 360/370 you get *OS results* without reprogramming.

For another, OS test time is an obstacle. DUO cuts it by as much as 90%.

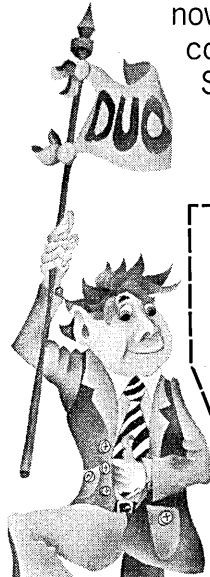
And in the conversion, departmental morale suffers heavily. DUO removes the pressure, by removing the need to reprogram everything at once.

What is DUO 360/370? Some kind of knight in shining armor?

If you're captured in the OS conversion process, it is. Because DUO permits most DOS object programs to fully access OS *facilities* without reprogramming. Your DOS

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It's been in operation at blue chip companies across the nation for over a year now. Try DUO 360/370 free, on your own computer, and prove it for yourself. Simply call me, Director of Special Products, (214) 638-7555, or write.



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- send me more information
 have someone call to set up my test

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letters

majority of authors touching on the subject of data entry error rates, uses such nebulous terminology that the cited data are of limited value to those readers who are interested in error rates per se. Statements such as ". . . we had about 5.0% reject rate . . ." prompt this reader to ask 5.0% of what? It is conceivable that the author is referring to keystrokes, columns, data fields, or logical records (e.g., card images). Also, what is the relationship of "reject rate" to total error rate?

There is so little information generally available on data entry error rates that authors would be doing their profession a service if they were more definitive in their references. Because of variations in the average number of keystrokes per logical record, maximum value would probably be achieved by limiting these references to per cent of either keystrokes or columns in error (a single omitted or added keystroke normally resulting in several succeeding columns being in error).

RALPH W. ZIMMER
Lafayette, Indiana

Read between the lines

Sir:

The statement made by Frank Cary in his interview with *DATAMATION* (Nov. 1, p. 26) regarding facilities management seems extraordinary. In 11 years as an IBM employee and customer, I have never heard of a situation in which IBM backed away from innovation because "it's difficult to justify to a board of directors."

Certainly Mr. Cary's memory is not so short as to forget the time when it was difficult to justify a "million dollar accounting machine" to a board of directors. We in the facilities management business fully recognize the difficulty in getting our message across.

We feel, as I am sure Mr. Cary would upon reflection, that innovative solutions to problems of efficient utilization of computer technology have been one of the strengths of our industry. The problem of how to best utilize the data processing dollar is frequently resolved through the facilities management concept.

KENNETH A. PARKER
Houston, Texas

Living legends

Sir:

After all these years it would seem that documentation would have come to be understood as the natural byproduct of every step in the system development

cycle. Although B. Menkus (Sept. 15, p. 30) and Thomas B. Sanborn (Nov. 15, p. 18) are to be commended in their belief that a "program is defective where documentation is lacking," the idea that "you haven't finished until you've done the paper work" is one reason why documentation is resisted.

Some of my colleagues and I have increased our effectiveness by harvesting the documentation at the milestone at which it most naturally occurs. Documentation is not an historical archive; originally it is active communication among users, analysts, management, and programmers. Each customary item of documentation has no validity unless it has served to communicate between two or more people. Our documentation is then processed by a very adept documentation section which is pleased to see it trickle in instead of deluging them, and they consequently do a better job.

I believe that if a project supervisor finds it necessary to have his programmer do much hated "back documentation," he has failed to adequately manage his project in the first place.

FRANK P. REYNOLDS, CDP
Occidental Life Insurance Company of
California
Los Angeles, California

Premeditated display

Sir:

Mr. Showalter's welcome article on display systems (Nov. 15, p. 28) listed prospective display users from the board of directors down to the foreman but made no explicit mention of the vitally important data analysis function. Data analysis is the discipline which extracts information from (usually multivariate) data and thus provides the objective basis for decision-making and prediction, whether models are involved or not.

The point missed by virtually everyone is that the display, in conjunction with appropriate software, is the *only* means by which complex data bases can be thoroughly explored and hence understood. Contemporary systems which partially enable such exploration are OLPARS (Rome Air Development Center) and PROMENADE (Stanford Research Institute).

Why does such an oversight persist? I believe that it is simply because specialists in display engineering, operations research, mathematical statistics, and management information are unconsciously bounded by the curricula, journals, etc., of their respective fields. In view of the powerful, computer-oriented methods published in the last few years, anyone who continues to use, for example, linear regression as the analytical tool for predicting has the burden of showing why a linear

method was chosen and why a global solution is preferred. By mapping the data onto a suitably chosen plane for display, he could decide by inspection whether a single linear regression solution were adequate. Extending from this example, data analysis research and exploration properly precede the choice of methods for management information systems, whether or not these systems make use of displays.

GEORGE A. BUTLER
Menlo Park, California

Tiny as zero

Sir:

I agree with Mr. Lafon (Nov. 15, p. 36) that dividing by zero is often "logical, desirable, and practical." I do it all the time.

Instead of putting up with the indignity of testing for a zero divisor and jumping around, I have a parameter called TINY, which I arbitrarily set to 8^{-24} . Relative to the other numbers, TINY is, for all practical purposes, zero. TINY is added to those denominators which can legitimately equal zero, in which case the numerator is merely divided by TINY.

If the denominator is not equal to zero, TINY is so tiny that it doesn't affect the result (assuming that the denominator does not equal minus TINY). In fact, TINY can initialize or be added to variables which are used as denominators, so that your program will never blow after division by zero—unless you want it to.

FRED FOLDVARY
Berkeley, California

Something for nothing

Sir:

It is late at night, and I just finished reading "The Fallacy in the Fallacy." It must be later than I think, because Mr. Lafon made sense.

In fact, my computer has been telling me this all the time. It keeps saying "+0, 0, and -0." I just never understood that the middle term in this pragadox is nothing, while the other two terms are zero.

Let's hear more from Mr. Lafon.
D. G. HAMLIN, CDP
Portland, Oregon

Impradox

Sir:

My praises to Mr. Lafon. His article was thoroughly delightful in both phrasing and philosophy.

I, too, have often instructed computers to divide by an expression whose value has sooner or later been zero. In 100% of these instances, the times when the denominator actually

(Continued on page 101)

Microprogramming is a great idea.

The 1600 makes it irresistible.



Microprogramming is on the move. The pace is fast, the result inevitable. It will soon become the dominant concept in the small computer market. And Microdata leads the way.

We put the concept to work in the Micro 1600, a new mini which gives you all the benefits of microprogramming. Greater speed. Better use of core. Programming simplicity. A broader application base. Architecture which can be changed.

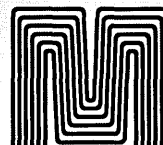
The 1600 also achieves a new dimension in modular expandability for mini computers. It accommodates up to 16K words of high-speed control memory, 65K bytes of core memory and several input/output interface modules.

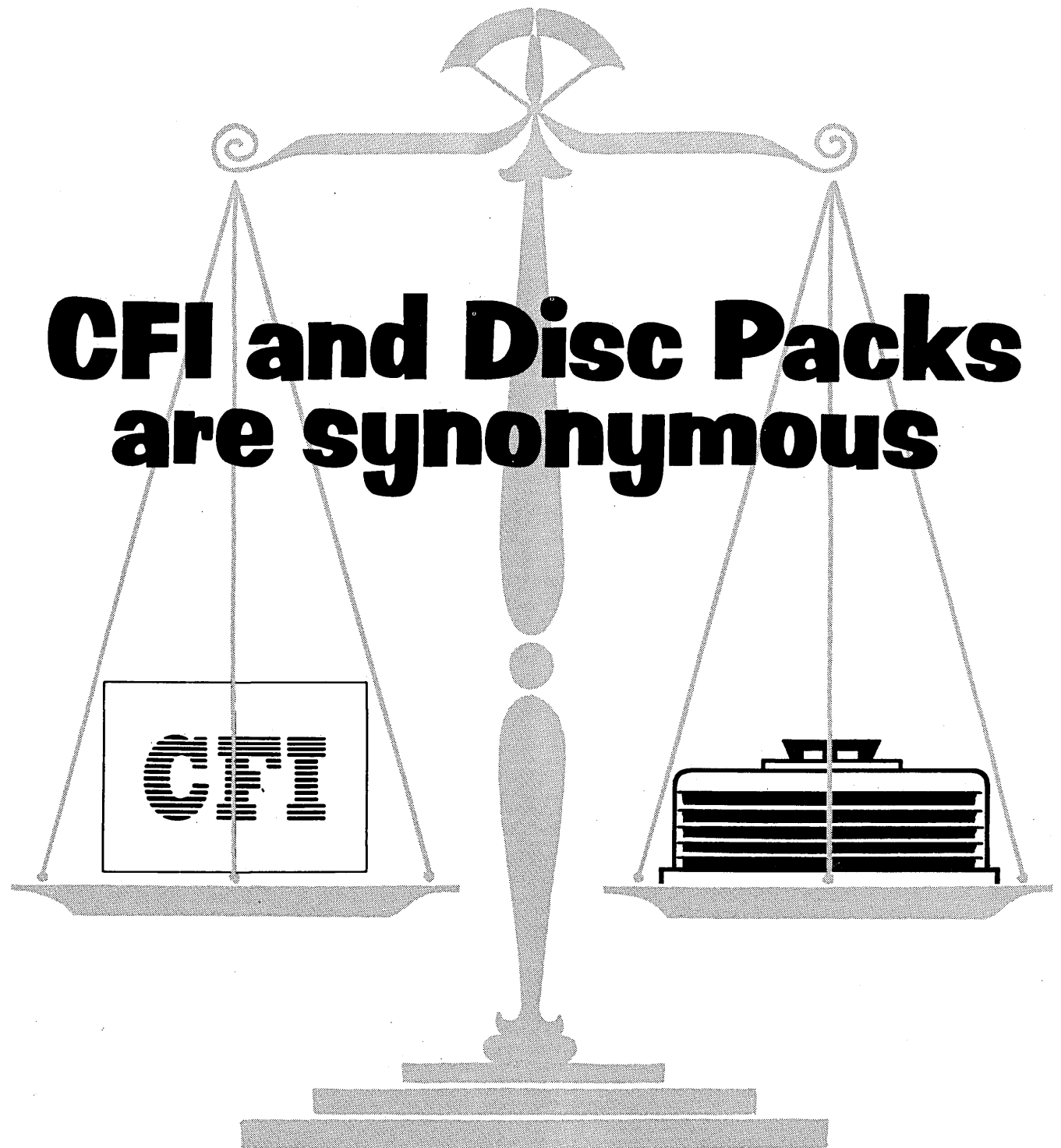
Just pick the combination of hardware, software and firmware that does the job best. Then expand as the need arises. Growth from the minimum configuration to the maximum takes place within a single 1600 enclosure.

Price for the Micro 1600, the mini on the move, starts under \$5,000. Send for a four-page bulletin and a copy of our new 352 page Microprogramming Handbook.

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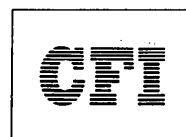
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Phase I

May 1969

**Inforex introduces 8 keystation
shared processor system for \$120
a month* per keystation.**

System 1301

- Lowest shared processor keystation cost
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- First totally integrated shared processor system

We also developed the most advanced data entry software available, including true background communications and printer support.

Shipments began in March, 1970. Today we have installed over 5000 System 1301 keystations, more than any other shared processor key-to-disc manufacturer. And shipments continue to grow.

*one year lease, including maintenance.



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Phase II

December 1971

Inforex introduces 16 keystation shared processor system for \$101 a month* per keystation.

System 1302

- Lowest shared processor keystation cost
- Improved data management capability
- Expandable capacity

Inforex Systems 1301 and 1302 are a completely compatible family. No operator retraining. System 1301 can be expanded to 1302 performance as growth requires. Choose either System 1301 or 1302 for your best price/performance/backup mix with rentals as low as \$101 a month per keystation.

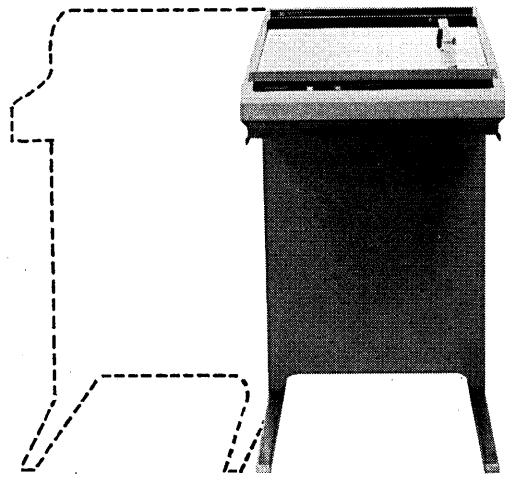
	System 1301 1-8 Keystations	System 1302 1-16 Keystations
Disc Capacity (user records)	5,000 @ 125 characters	18,000 @ 125 characters
	10,000 @ 61 characters	36,000 @ 61 characters
	20,000 @ 29 characters	72,000 @ 29 characters

Contact your local Inforex representative for full specifications and delivery. Offices in twenty-one U.S. cities, Canada, Germany, France, Switzerland, Netherlands and Italy. Distribution outlets in United Kingdom, Scandinavia, Israel, South America and Australia, with more to come.

*one year lease, including maintenance.



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At last, everybody can see their time-share data plotted in smooth, clear graphs. Hewlett-Packard's Model 7200 Graphic Plotter will add a new visual dimension to any terminal in the business. Now, even if you're partial to IBM's 2741, you can have instant graphic solutions to every type of engineering or mathematical problem.

There's no special operation or programming knowledge needed. You control the program. Plot numerical data in points, lines, curves, circles, ellipses, bar graphs or pie charts. Or, manipulate and expand computer data

and plot in finished graphic form. You get smooth lines—not the staircase drawn by the incremental recorder.

Use the HP 7200 simultaneously with your time-share terminal or silence the terminal and use the plotter alone. Because it goes to work when the data comes in, there's no time lag.

Simple manual controls allow you to set the graph limits to fit any pre-printed grid. HP's Autogrip electrostatic holddown firmly grips any graph paper up to 11x17 inches.

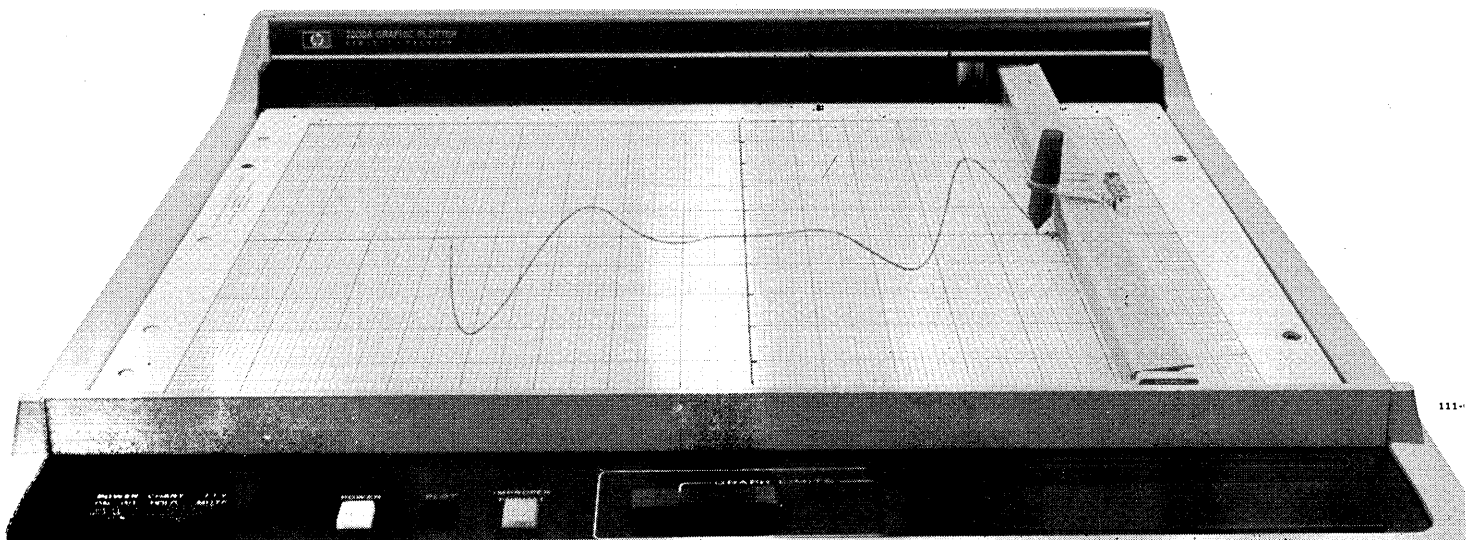
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Editor's Readout

One More Time

We want to make a belated apology for causing the gruesome recession that has had our industry by the throat now for 18 months.

You may not have known an apology was due. But it's pretty apparent that DATAMATION caused the fall-back by going semimonthly in August of 1970. You'll have to admit that since then things have been just awful.

However, we have good news: Beginning **now**, DATAMATION is a monthly magazine once more. And we've used the return to a friendly and familiar frequency as an excuse to make a few changes here and there.

We'll let you discover them for yourself, but here's a hint: we've tried to make DATAMATION easier to read, pleasanter to look at. We want to help you get more information faster, to grasp key points and concepts rapidly, to find what is interesting and/or useful to you sooner than before.

In the meantime, we plan to continue to offer timely, penetrating interpretation and analysis of important industry events.

It seems to us that analysis and interpretation is more important these days than the gosh-geewhiz-what's-happening-now approach. The industry **has** slowed down, after all.

More relevant perhaps, is that it is always more important to know why things happen and how they will affect us than merely to keep up-

dated.

But because the markets, the technology, the pace of our advancement is still relatively brisk, it's vital to be able to anticipate future direction as well as to understand what brought us to the current brink.

There's another angle: maybe it's more important to try to take advantage of the technology we have than to try to blindly race ahead. Perhaps we ought to spend more time perfecting current applications, improving our programs and projects . . . and our ability to predict how much time and money they will cost us.

Maybe we should spend more time trying to figure out just what it is we ought to do with computers instead of automating for the sake of automating, for the sake of progress, for the sake of God knows what.

Well, we didn't want to get too philosophical. But it does seem to us the industry has—until recently—moved a **bit** too swiftly. And maybe the slowdown gives us an excuse to think a little longer, harder, and smarter about what it is we are doing and why.

We hope so. And we hope that our new monthly format and its content will not only help you keep abreast of the technology (at whatever pace), but help you know how others around you are making do with the technology at hand. That's what we're going to try to do, at least. We figure you'll let us know if we let you down.

—Robert B. Forest

Whether you're thinking of getting into the computer business, advancing in it, or getting out of it, these are the strongly personal opinions and attitudes that offer you clues to the future

Where Go the Computer People.

The last 15 years have been great for us—for computer people.

That was yesterday. Today is something else. And tomorrow—will we be up, down, or out?

The answer to that question is so important to DATAMATION's readers—and to DATAMATION—that we've spent a year looking for it. This article—and those that will follow in the next five months—will tell you what we've concluded.

For those of you who earn a living by working with computers, we'll examine your hopes for the future, the obstacles you'll meet along the way, the possible rewards for you, and the likely shapes of your careers in the years to come.

And for those of you who have another job to do and are only secondarily a user of computers, we'll tell you what we've learned about the new ways of working with computer people to get better and more useful products from them.

The search for answers

When we started our search for answers, we had a suspicion that what the more publicized computer people had to say to and about each other is interesting—but not nearly as significant as it sounds.

This is the first of a series of six articles having to do with the future prospects for people who have bet heavily on "computer-based careers."

We set out to learn from the individuals outside the fraternity what their view was of computer people. Did others see Computerman in the same light as he saw himself? And how did Computerman view himself, his job, his future? In short, we wanted to find out if there was a difference between the expectations of Computerman and the reality he experienced—between his self-image and his projected image.

This month, we set the scene, describe the issues involved, the scope of our year-long investiga-

tion into these issues, and arrive at some early hypotheses. An important one is that maybe the most likely direction of travel for Computerman turns out to be "lateral."

In February:

About "grunts" and "honchos"—the quality of life in a computer-based career. Why and how do you get started? Is it fun? What will success look like? What will be the obstacles along the way?

In March:

The search for respectability and an identity. What's a professional? Who's a professional? To license or not? Are the societies, the "wise men," the "big men" and the cus-

Up, Down, or Out?

by Milt Stone, Contributing Editor

tomers talking about the same professional? What will finally happen to the professionalism crusade?

In April:

The insiders — onward and upward. How to succeed by staying close to the world of computers.

In May:

The spinoffs — onward and outward. How to use computerman-ship as a lever to pry open other doors.

In June:

Living happily ever after. Trends to expect and guidelines to follow for companies and individuals who are forced to deal with them.

So for the last year we've explored some hitherto private attitudes. We're convinced, now, that what is significant in any prophecy of the future for computer people is:

What most computer people (the silent majority?) expect from their jobs today and what hopes they have for the future.

What "customers" are thinking about the present and potential value of the people who today play the lead role in producing computer output.

How "big men" have type-cast computer people in assembling the actors for the feature picture.

To get our answers we checked with more than 9,000 individuals—by ourselves and in cooperation with AFIPS and the American Management Association. Our batting average was good. We received better than a 25% return of our questionnaires, which is statistically impressive. More impressive is the time spent with us by the hundreds who wrote long, thoughtful letters or who talked to us in personal interviews. (Just about every member of the DATAMATION staff has been and will continue to be on the interview circuit, collecting material for these articles.)

Who were the 9,000? We checked with a wide range of *customers*—vp's

and managers of engineering, finance, marketing, research, production. We asked blunt questions of the *big men*—board chairmen, presidents, executive vp's. We queried the *wise men*—professors, consultants, deans, "industry spokesmen," head hunters. Finally, we posed a different set of questions to the *honchos* (vp's, directors, managers, supervisors of computing, data processing, programming, operations, systems)—and to the *grunts* (programmers, systems analysts, computer operators).

Who are the computer people?

At this point, the reader might well ask, "But what about the circuit designers, the memory researchers, the thousands of lunch-time members of "the industry"?" They were not included in our investigations—and the reasons are simple.

The engineer, the researcher, the marketer working in the computer industry are just that—engineer, researcher, marketer. To the people who use computers and to the people who depend upon computers, "computer people" are the systems analysts, programmers and operators who produce the end product—information—and it is only those people whose careers will be directly influenced by the

"... the most likely direction of travel is lateral."

Where go the Computer People?

attitudes we have attempted to uncover.

Typically, these people can be working for users of computers, for manufacturers of computers, and for computer-based service organizations. How many of them are there? According to the Department of Labor:

	In 1968	By 1980
Programmers	175K	400K
Systems Analysts	150K	425K
Computer Operators	175K	400K

In a numerical sense, for a starter, the government says that the next 10 years will be "up" for computer people.

That picture of the future started with a forecast of the economy and was developed as a mechanistic projection. Our picture of the future started with a file of correspondence, interview reports and tape recordings sufficient to support—say an antitrust suit. To this uninhibited comment, we've added the results of our own fact-finding, we've analyzed, we've interpreted, we've summarized—wisely, we hope—and the result is this series of articles. We've made no attempt to produce a statistical report. We have produced the most revealing picture yet drawn of life in computing/data processing "like it is—and will be."

And, as the reader might suspect, the people in the picture didn't always agree on its appearance. For example, take the subject of professionalism as applied to computer operators:

"I manage a large computer operation . . . composed of 600 professionals. (I classify operators as professionals today.)"

William W. Shine
Vice President
The Chase Manhattan Bank

"Poker with the boys once a week and the topless bars also weekly seem to be the main road to the top."

Senior Computer Operator
Los Angeles

Or consider the effect perspective has on the view of success in the computer world:

"I am at the transition stage in my career where almost all companies require one to enter management in order to advance. I have resisted this as I feel my strength is more technical than managerial."

George E. Sauer
Senior Member Technical Staff
Computer Sciences Corp.

"I'm sure not every computer professional wants to be a general manager. Nor does every physicist at Bell Telephone Laboratories want to leave the career for which he has trained himself in order to move to the management side of the business. I do not believe that a professional should have to become a 'manager' (in the usual sense) in order to progress in business. But, as a rule, most of the computer people I've met have seemed bright, very interested in helping to solve real problems, hard workers and fast learners. With those qualities, a computer specialist—or anyone, for that matter—can go a long way in business, whichever path he chooses."

H. I. Romnes
Chairman of the Board
American Telephone and
Telegraph Co.

"Once you achieve the top edp slot in a company, that's probably the end of the line. This, of course, does not apply in organizations which are allied directly with the computer industry. I haven't heard of more than a handful of instances where an edp type moved up the line into a corporate position which gave him major responsibilities outside the edp sphere."

Edward M. Hackman
Manager, Data Services
Commonwealth Oil
Refining Co., Inc.

Even the joys (or the pain) of being "a computer people" seem open to question:

"Quite candidly, I can say that I really have not missed the world of computers. I enjoy spending at least part of each day out-of-doors, and I have not had a case of fanny fatigue since leaving the office routine."

Douglas W. Gaidry
Realtor
Ex-president of Enterprise Systems
Programming Co.

"I am excited, involved and overworked. I love every moment of it and feel that I am in the middle of what's happening."

Mrs. Peggy Knight
Manager, Computer Services
Winner Boats, Inc.

"I have worked for too many years too closely with altogether too many computer people to be able to generalize. They and I share too many bonds of horrendous experiences endured together. All of our failures were exposed to the world and universally derided. All of our triumphs were totally ignored by the generality and are almost secrets of the brotherhood."

Terrance Hanold
President
The Pillsbury Company

Notwithstanding the welter of con-

eagles flock
together . . . at
what altitude?

"The potential of a computer professional is directly dependent upon his interests, desires, capabilities and willingness to make the sacrifices to achieve his objectives."

Thomas J. Marquez
Vice President
Electronic Data Systems Corp.

"Unfortunately, all too few data processing people understand—and indeed even attempt to understand—the business in which their company is engaged as well as basic managerial techniques and procedures. In my view, this represents a major impediment to an effective information system within the company. With this narrow perspective, all too often the data processing department ar-

tradictory viewpoints, early in our investigation several generalizations—hypotheses—emerged as likely candidates for the roster of valid final conclusions.

To set the scene—and to provide a frame of reference for the detailed results of the complete study—we've distilled the mass of evidence into a list of propositions for future discussion. In some instances, the proposition is forcefully and vividly supported in this article by excerpts from the responses of the more articulate people to whom we talked.

Computerman is special

For one thing, successful computer people probably do have a special set of characteristics which, in turn, does make them somewhat special. Unfortunately, being special—and acting special—can be a hindrance:

"There is a natural tendency for people who pursue the same calling to adopt a vocabulary of their own, perhaps even mannerisms of their own, and to use these as a kind of societal password. Street gangs and outlaws do this, and so do the country club set and the astronauts. A university, differing from industry, has a great many subsets with their own passwords. Each discipline seems to develop its own—and to resist efforts that would seek to reduce the effect of these 'territorial imperatives.' Computer professionals are no different. They have their passwords and they seek to preserve

their group identity. I am not critical of the specialized vocabulary—I merely see it for what it is, the hallmark of a guild."

Francis H. Heller
Vice Chancellor
The University of Kansas

Not a passport

A second generalization is that many of the special characteristics that are required for success in the computer world are not necessarily useful in climbing the organizational totem pole. The day of the computer priest—one whose computermanship automatically qualified him for deeds in other fields—ended longer ago than we thought. Today, the resistance to the idea of the all-wise, all-purpose Computerman is outspoken:

"Computer people come in all sizes, shapes and varieties of opinions, attitudes, insights and competence. I might add that so do marketing people . . . (but) many computer people believe they can solve problems better than the user, when many times they do not understand the problem and the practical aspects involved in the solution."

George G. Joseph, C.L.U.
Executive Vice President, Marketing
New England Mutual
Life Insurance Co.

Computerman: pick your spot!

Another generalization is that the advancing technology of applying computers has made certain industries

the way it is . . . room for compromise?

"At the present time I feel that data processing is the most important department in the company . . . 'That's where it's happening.'"

Dick Kennedy
Business Systems Manager
Los Angeles Times

"In the business world, most problems associated with computers are very quickly attributed to the 'computer professional' . . . It's not the 'computer professional' who has caused these problems but the lack of management direction to these specialists. Corporate management must define the environment in which the computer people work. . . . Computers have a role in the business world but not one of replacing or second-guessing the judgment of line management. Our computer professionals are used where their work really pays off, primarily in engineering-oriented tasks."

Alan J. Grant
Executive Vice President
Aerojet-General Corporation

"Any manager who has grown up in the computer environment (and is worthy of the title of manager) will know how to deal with computers and computer professionals. A quick guide is whether the manager knows how to write a computer program. Today, any adult is illiterate if he does not know how to program a computer!"

Roger L. Sisson
Associate Director
Government Studies & Systems
A subsidiary of Mathematica

rives at the wrong answer to the wrong problem in a technically outstanding manner."

Richard Wand
Administrative Vice President
Bergstrom Paper Company

"I consider myself a 'corporate professional' who, because of his background, naturally gravitates toward edp applications for problem solving and management systems development. Being out of the formal corporate edp structure, I do not have any hang-ups about my career advancement potential. I simply do the best I can for anyone who comes to me for help and don't (at this stage, anyway) have to play politics. Being over-worked is my best indication of rec-

ognition, particularly since most of my work load comes from other corporate sections requesting my services."

Scientific Programmer
Connecticut

"Computer professionals tend to be highly specialized. They are frequently relatively inexperienced in practical business affairs and are thwarted by variables and exceptions not at first recognized. They also tend to "embrace the world" rather than reduce it to digestible pieces. The discipline required to develop expertise would mitigate against this becoming a career path to general management."

Frank H. Staub
Vice President Marketing
Shell Oil Company

Where go the Computer People?

extremely dependent upon computers—and upon computer people. These, then, become areas of bright career promise for members of the guild. For example, consider banking:

"The computer functions are such integral parts of our organization that the staff members assigned to these areas are very much a part of our overall operation."

Bland W. Worley
President
The Wachovia Corporation

"If this bank is to succeed, this area—my function—must succeed. I guess in many ways I've like got this bank by the balls—they'd be scared to death to get rid of me. But in order for me to capitalize on that, I've got to be successful. So the bank has like got me by the balls."

Data Processing Vice President
Large Bank

What is especially intriguing in this relationship of mutual dependency (which exists in some other industries as well) is the ethical problem faced by Computerman—to say nothing of the control problem faced by Bankman.

Prepare for change

The changing technology of computing will have a significant effect on the content of jobs in computing. For example, Ted Withington, of Arthur D. Little, Inc., sees new operating systems dramatically impacting the jobs in the machine room. And Computing and Software's Bob Leonard sees a coming polarization of jobs—room at the top and the bottom of the skill ladder and a sharp curtailment in the need for "bread and butter, fringe" programmer/analysts.

Jim Stringer, Los Angeles software man par excellence, puts it simply: "The biggest single obstacle to my career in the 1970s is the 'down' state of the economy." Shifts in the economy will, of course, control the numbers and types of computer people required. We'll have much more to say about this later.

The real management problem

Another generalization is easy to make. The management problem for those who must deal with Computerman is the same one raised by C. P. Snow (Science and Government) in 1960:

"One of the most bizarre features of any advanced industrial society in our time is that the cardinal choices have to be made by a handful of

men who cannot have a first-hand knowledge of what those choices depend upon or what their results may be."

An ex-IBMER made the same point to DATAMATION, saying what an IBM marketer could not say:

"The point is how one organizes to assure better communications, better understanding, and better control in a world where society and top management must keep specialists and technical prowess in bounds—yet do this in a world where it is unrealistic to expect society or general management to be as informed as they need to be really to exercise direct control and in a world where top management literally does not have time to ride herd on all the things that they have ultimate responsibility for.

Dr. William R. Dill
Dean
New York University
Graduate School of
Business Administration

Gut-level feelings are important

As we talked to more and more people, the evidence indicated more and more that the scope of computer-based career opportunities will not automatically enlarge just because computer-based systems are a steadily increasing factor in our daily affairs. To us it seems much more likely that the boundaries of a computer-based career will be set by very strong "gut-level" feelings—the subjective attitudes of the computer people, themselves, and the equally subjective attitudes of their peers and of their superiors outside the fraternity.

"In a broad sense a professional is a person who uses technical training to provide a service to others. Success or failure should be measured

from the quality of that service. Many so-called computer professionals feel that their clients are unworthy to evaluate the success or failure of the application and therefore they design and perform to suit their own standards."

Paul T. Sherwood
Former Vice President of Finance
Hunt-Wesson Foods, Inc.

"Computer people tend to think of their area as having a mystique all its own, somewhat like a castle with a moat around it, and the drawbridge is controlled by the manager of data processing. I suspect it is partly an ego factor because they feel the uninitiated cannot understand computers and, therefore, why bother explaining to them."

Dr. Sam R. Goodman
Controller
The Nestle Company, Inc.

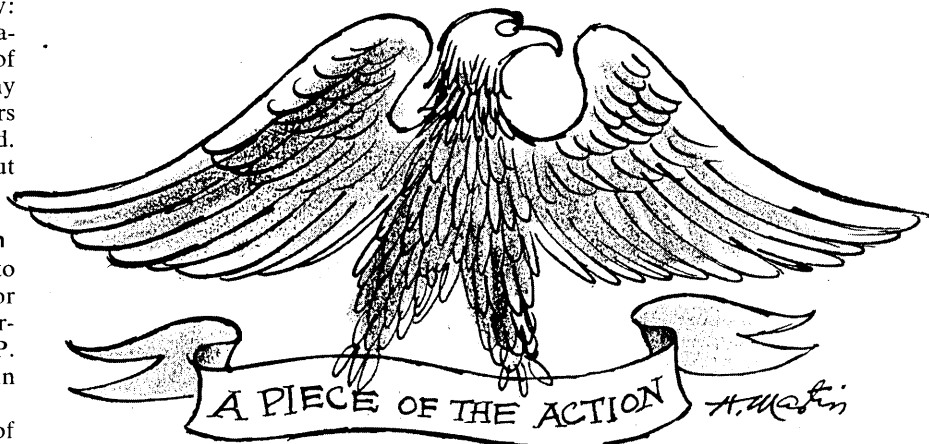
Is a lateral move the answer?

In spite of all of the criticism (implied as well as overt) leveled at Computerman, all is not lost if he can somehow fit his special talents into a newly acquired girdle (self-discipline and heightened perception of reality). The thing to avoid is lack of discipline, lack of worldliness.

The way to a better adjustment with the world around may be a more "engineered" approach to Computerman's job, a more compassionate view of his customers—or it may turn out to be a studied lateral move: out of the "technician" pigeon hole and into another channel of endeavor.

"On 'computer people' . . . I have no trouble with them, since I am one of them myself."

T. Vincent Learson
Chairman of the Board
International Business Machines Corp.



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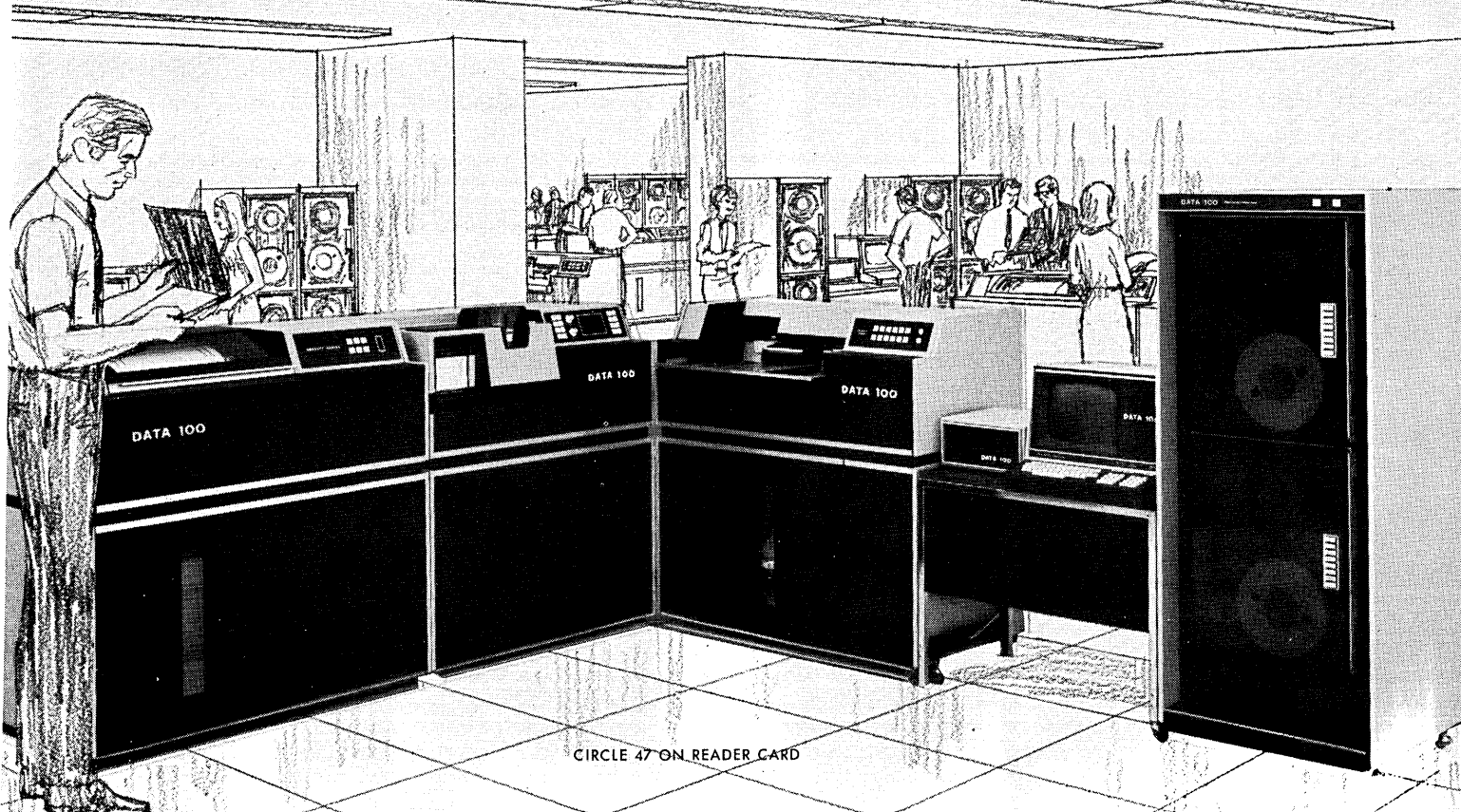
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CIRCLE 47 ON READER CARD

A fresh & practical look at the promise
(and problems) of modular programming

Modular Programs: Defining the Module

by Alan Cohen

Computer programmers and programming management now generally accept that modularity is a useful programming tool. The advantages of breaking a large program into several smaller self-contained programs (or modules) appear to be sufficiently self-evident as to require no additional justification. Yet few installations manage to do modular programming successfully, and the resulting modular programs are often no better than the monolithic programs they replace. In fact modular programs are often no more than monolithic programs broken into arbitrary modules, each of which exhibits the characteristics of the monolithic program it replaces.

Why does this happen? Why is modularization so difficult? How should a program be broken into modules to obtain the advantages we all so confidently expect?

This article assumes that modularity is the right approach, and that the trouble is that we do not yet understand how to modularize. In some sense it must be right to break a large program into smaller units, but exactly how is this to be done? To answer this, this article first summarizes the conventional approach to modularity, and then looks again at the same problem from a different angle. This turns out to be a more promising approach and one which can be more meaningfully related to the everyday problems facing programmers. Finally, an example is used to illustrate the approach.

Modularity. A modular program is a program which has a structure such as that shown in Figure One. A, B, C, D and E are the modules; their interrelationship is called a hierarchy; together A, B, C, D and E form a modular hierarchy or program.

The object of modular programming is to break a program down into such a hierarchy of modules. The advantage of doing this is that each module is simpler than the total program. Each module is therefore easier to code and test, and this advantage outweighs any core or running time overhead imposed by the module linkages. The modules fit together in a simple way; since each is already tested in isolation, program testing is reduced to testing the interfaces between modules.

Guidelines are generally given to programmers for the choice of program modules. These are usually along the following lines:

1. Each module performs some logical subset of total problem processing.
2. Each module is self-contained, and is neither too big nor too small (say the equivalent of 200 COBOL Procedure Division statements).
3. Each module is a program subroutine.

More detailed guidelines might add the following:

4. Each module should have one entry and one exit.

5. Each module should be a "black box" (i.e., the results of its execution should depend only on the input data and not on any remembered module states).

6. All input/output should be sub-routined.

7. There should be a "main-line" logic flow calling dependent processing subroutines.

Finally, if these guidelines are insufficient, a programmer is generally advised that modularity is a skill which "comes with experience" and "cannot be taught." Senior (or "good") programmers can do it, and this skill is communicated to those less skilled only

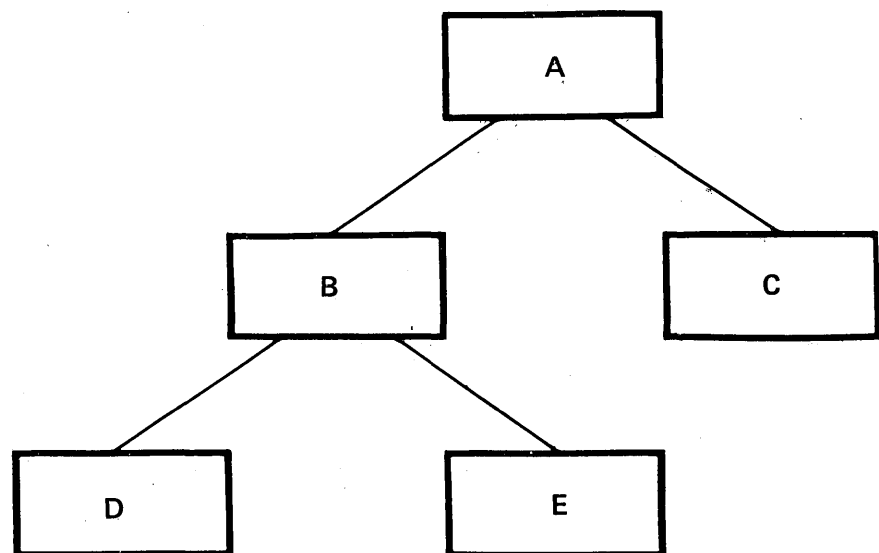


Fig. 1. A modular program.

by a process of exhortation or, failing that, by osmosis.

In practice this is little help to programmers. The guidelines laid down are certainly correct in that they characterize the finished product. But they are little help to the programmer faced with designing program modules in new instances. The fact that a well-designed or modularized program is instantly recognizable is evidence enough (to me) that modularization should not be as difficult as it seems to be.

To see this, let us go back to first principles and look at the nature of the program we are trying to modularize. It will turn out that modularity, as defined, has its place, but in specialized contexts. These are outlined in the section on program design below.

Program structures. A program takes data records on input files, processes them, and writes data records containing the processed data to output files. The input files raise two problems:

1. Not all records on file may be useful.
2. Not all combinations of records on the input files (if there is more than one) may be useful.

So, the job of reading the input files breaks down into: reading the physical file; checking that a record read is useful to the program; and setting up useful combinations of records on the various input files, ready for processing.

We refer to these functions respectively as input/output, exception checking, and file handling.

Processing the combinations of records set up by the file handler may require the use of auxiliary (e.g., direct access) files to provide additional information, and these may also require action on exception conditions (e.g., record not found). Processing then reorganizes the input data and calculates new data, to provide the information required for the output files or reports.

Writing to output files presents new problems because the data required to build up output records is scattered (it may come from any input record, or be calculated by the processing routines). Also, the sequence in which records are written may be affected by hardware dependent logic (typically the line printer).

All the program functions described above can be represented by the diagrammatic program structure shown in Figure Two. In this diagram each box represents a program function; no assumptions are made about the choice of program modules. But to make the discussion more familiar we shall refer to the "process records" function as the "processing routines," and so on.

In special cases a program may appear to perform additional functions.

This happens when logically separate programs are combined to optimize on file access, or core usage. (An example would be to update an auxiliary file in a program which is also using this file

for other processing. In this case, amendments to the auxiliary file would normally be output to a serial file, and run through a separate program to carry out the update.) Cases like this are

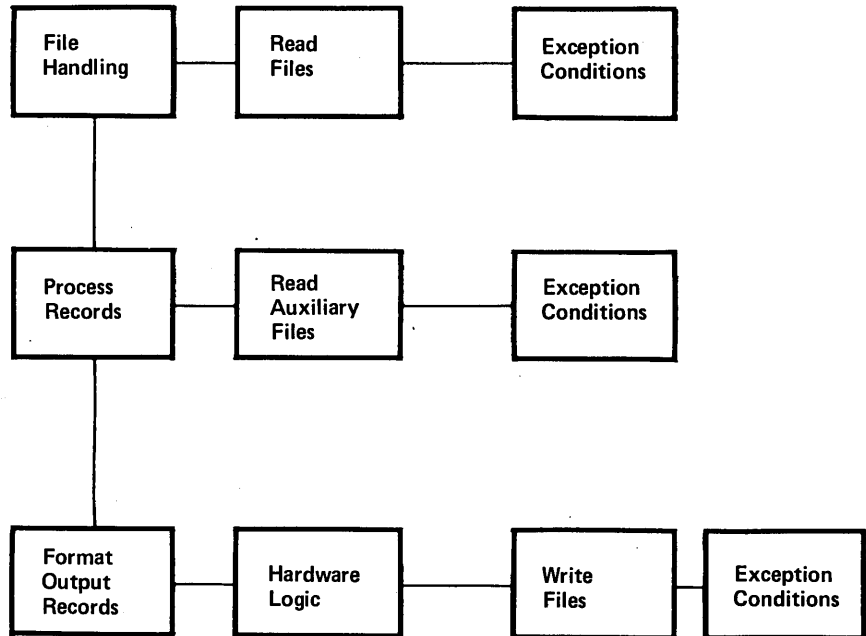
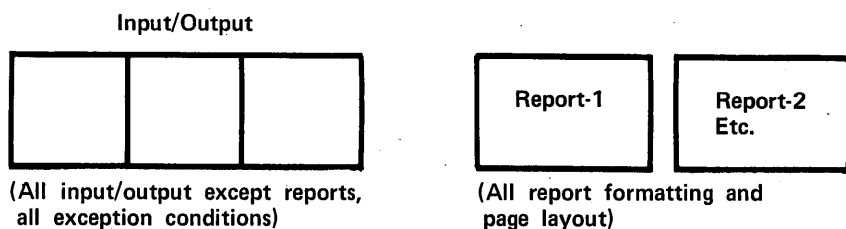
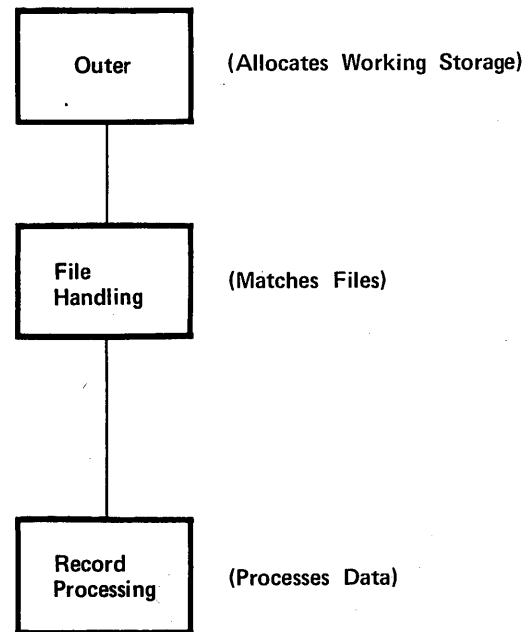


Fig. 2. Diagrammatic program structure.



(All input/output except reports, all exception conditions)

(All report formatting and page layout)

Fig. 3. Revised program structure.

Modular Programs

rare, and the optimization tends to disguise the underlying structures; but the additional functions can always be added to the main structure given.

Practicality. In order to ensure that a program works, it must be tested, and in order to ensure that testing is as thorough as possible, the program must be tested in pieces. To make a program testable:

1. It must be possible to (optional-

ly) simulate physical input/output, except possibly output direct to the line printer (in order to save using live files).

2. Working storage must be controlled separately from the object code (in order to monitor the results of tests).

3. Some unit of code is required to plug in to a module test bed (in order to test each program function independently).

To make a program testable then, the following structural changes are made (corresponding to the needs listed above):

1. All physical input/output (except printed reports) is grouped into one or more subprograms. These subprograms also handle file exception conditions.

2. All working storage is allocated in one contiguous area in a special subprogram (called an outer). (The final justification for this in terms of workstack and module re-enterability is beyond the scope of this article.)

3. All testable program units are made subprograms (COBOL/360). (From this point on, COBOL/360 is assumed whenever any language dependency is involved.)

These changes result in the program structure shown in Figure Three. In this diagram each box could be a COBOL/360 subprogram.

Program design. At this point we can return to the programmer faced with a program specification which he is trying to modularize. Given the general structure of Figure Three, the programmer is now able to relate this to his specification. To design a program means to design an outer, file handling routines, record processing routines, input/output routines, and printed reports.

The function of each is clear from the above discussion. Whatever the format of the program specifications, they will contain file and record layouts, reports, and processing rules. This enables the programmer to start design work on each program element.

As design proceeds, decisions are required about the precise boundaries between these elements. The most convenient order for design is outer, input/output, reports, file handling, and record processing.

The first two (outer and input/output) can be largely standardized—only the exception conditions vary. The report routines can be designed largely from the report layouts, and the file handling routines can be designed from the file structures (the logic for this is usually similar for each data edit/update/print program).

All this strips the processing routines of functions which do not properly belong to them, and which generally

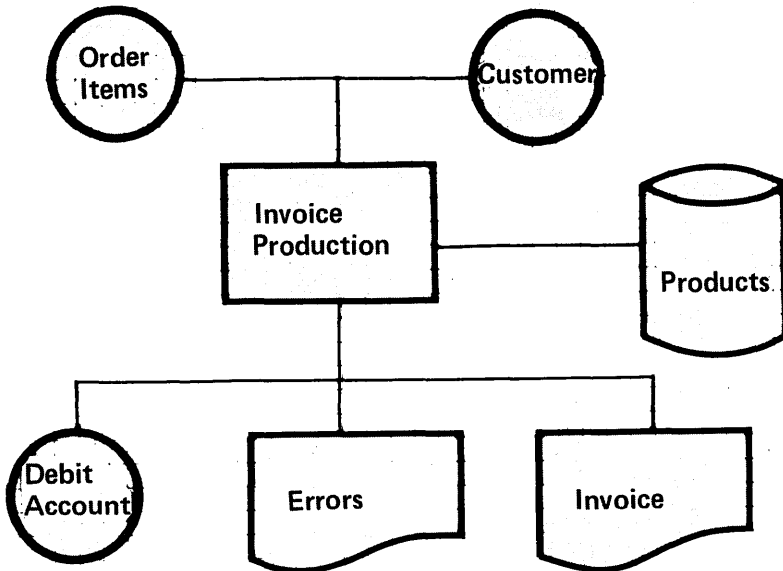
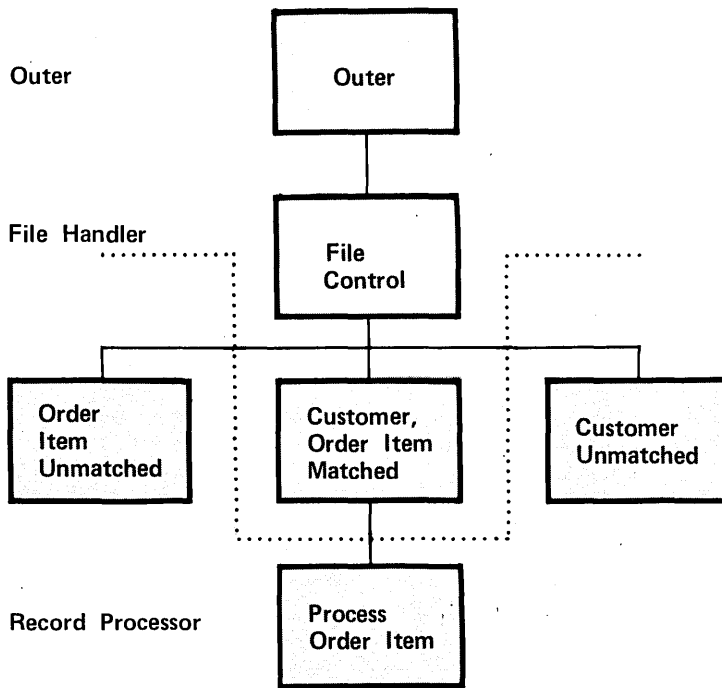


Fig. 4. Example program.



Input/Output

Customer	Order Items	Pricing	Debit Account
----------	-------------	---------	---------------

Reports

Invoice Format and Print

Fig. 5. Example program structure.

only serve to complicate their design. In fact, it is often easy to design and code processing routines, and programming problems arise largely from the way these are strung together (file handling) and the action taken on exception conditions.

Furthermore, each program function can be designed modularly along the lines given in the introduction to this article; the programmer now has the advantage that the content of each program function is much more homogeneous, and not confused by processing which does not properly belong to it. The choice of modules for each program element then turns out to be a much simpler exercise.

To show how this works in practice,

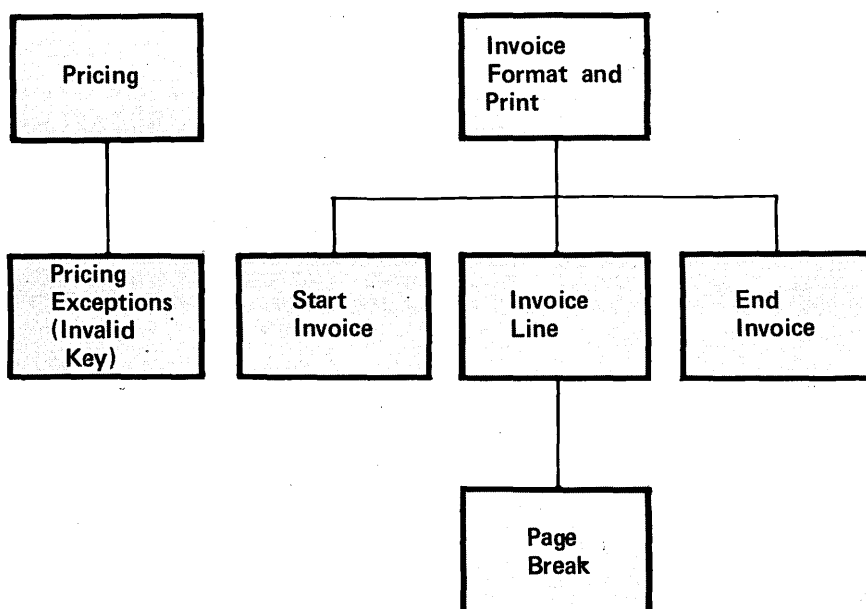


Fig. 6. Example exception processing.

consider a program producing invoices for customers using a master customer file and variable data on an order item file. The invoiceable amount is calculated using pricing records from a direct access pricing master file. For each invoice produced, a record of the amount due is written to a debit account file. Errors are written to the line printer. The input/output requirements are shown in Figure Four.

For each customer there may be more than one invoice. Each invoice consists of heading information, line information, and summary information. All this is taken from the input records—except for some line information which is taken from, and calculated using, the pricing file. Finally, if invalid key is specified on the pricing file, an error message is displayed and no calculation is made. This is the only exception processing required.

For this program a suitable breakdown of the program functions might be that shown in Figure Five. This

structure can be designed using only the ideas contained in the previous section of this article. In addition the pricing input/output and the invoice format and print routines can be further structured as shown in Figure Six.

These examples illustrate the points made in the previous sections:

1. The file handler sets up three conditions requiring processing ("Order Item Unmatched," "Process Order Item," "Customer Unmatched").
2. "Customer, Order Item Matched" would require two calls to the invoice report subprogram ("Start Invoice," "End Invoice").
3. "Process Order Item" would require one call to the invoice report subprogram ("Invoice Line").

4. Pricing records are read in the record processor, as an auxiliary file.

5. Exception conditions are processed in the input/output subprogram.

6. Invoice layout logic is contained in the invoice report subprogram.

The following additional points should also be noted:

7. No mention has been made of program subroutines, though each box in the diagram might naturally be one (or might be a hierarchy of subroutines).

8. The dotted line represents the boundary between file handler and record processor; each of these might be implemented as a subprogram even though they are then effectively multi-entry (this is just a COBOL/360 implementation problem).

9. The resulting program structure shows how the program could be ideally specified (i.e., to reflect this structure).

10. The program is testable.

The above discussion shows that programs should not be thought of as simple modular hierarchies. Rather, programs consist of well-defined program functions (file handling, etc.). These functions can be identified and structured in a way which relates clearly to a program specification, which makes the program testable and which relates more closely to the programmer's job (Figure Three). Each program function may then be considered as a module hierarchy; once the program functions are identified, the modules are easier to choose, and will have the characteristics desired of them (i.e., those described in the section on modularity above).

The next step is to carry this kind of analysis further. For example, the following questions have been left unanswered:

Is there a generalized layout for the working storage allocated in the program outer?

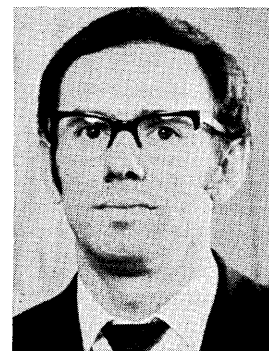
How should working storage be communicated between program modules?

What is the relationship of run controls to the overall structure?

What program code (e.g., for the outer) can be standardized?

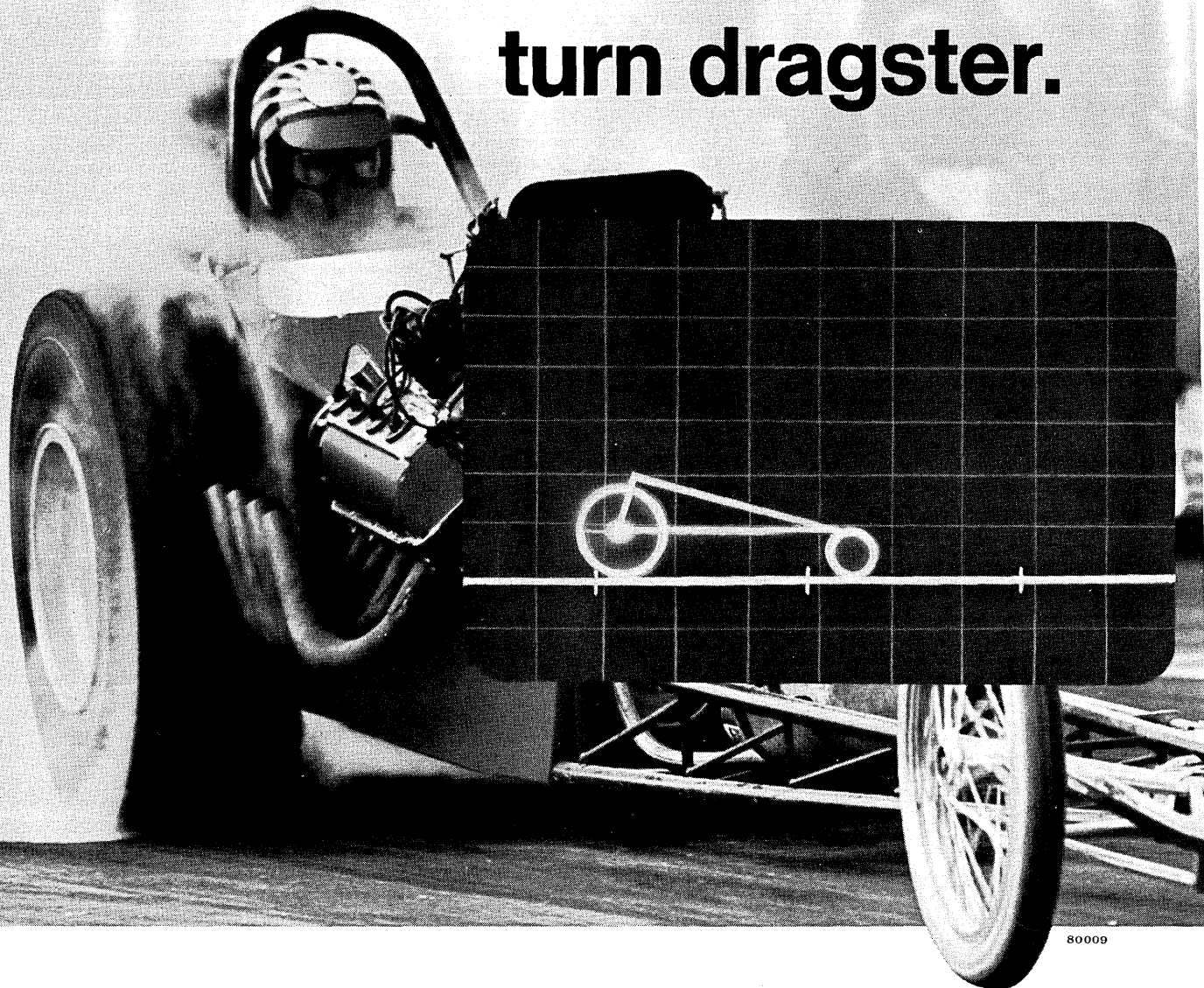
Can file handling logic be automated?

These questions all need precise answers, since the same general problems arise for every program. Only if general answers can be found will there be any consistency in program design. And only then can we look for software solutions to programming problems, or for standardized modules which are meaningfully reusable. After all, this is what modularity originally set out to do. □



Mr. Cohen until recently was a programming consultant with Hoskyns Systems Research in New York. He joined Hoskyns in 1969, after working for the British government and a British software house. His primary interest is in developing technology to improve the quality and productivity of commercial programming. During the last year his principal activity has been to promote Hoskyns software and to explore commercial programming techniques.

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The Las Vegas conference provoked the question. AFIPS has the dice—can it come up with the winning roll?

JCCs... Whither or Wither?

On its 20th anniversary, the Joint Computer Conference ran headlong into an identity crisis.

Out of a projected attendance of 20,000 plus, only 15,745 by final count attended the 1971 JCC in Las Vegas and a poll of these probably would find them equally divided on such questions as: was it a good show or a bad show, a computer show or a peripheral show, an oem show or an end-user show, relevant or irrelevant, worthwhile or a waste of time.

Some JCC veterans were throwing around terms like "funeral" and "lack-luster." Said one: "Other than the fact that it's a total disaster, I like it fine." Another suggested it ought to be called "the Fall Joint Peripheral Conference."

But there were among the booth manners those who were giving the show an A-plus rating. Bill Otterson, president of Cipher Data Products, called it "the busiest JCC for us in two years." He called the attendees and their inquiries "top quality." Al Aster of Computer Communications, Inc., said the size of the show was "better for us. People were coming to our booth with problems, problems which could lead to sales for us."

To budding Storage Technology Corp., the tape drive manufacturer, the show was better than the company had anticipated. Its three-man booth staff had to be boosted to five as the show opened and this traffic continued through Thursday morning.

STC president Jesse Aweida said introduction of the firm's 3480 tape drive with the world's highest speed of 250 ips or 400K bytes and its micro-programmed controller was what drew the traffic. The 3480's first customer is Neodata, Colorado Springs, which will get the drive in April.

A Digitronics Corp. booth staffer termed the show "excellent." He said "the demand has been overwhelming.

This show people are coming into the booth with firm requirements for products to be announced in early '72."

Other exhibitors happy with their traffic and inquiries included: Computer Automation, International Computer Products, Datapro, Dataram, Van San Associates, Hathaway, Kennedy Co., Signal Galaxies, Comtec Corp., Facit-Odhner, Tandberg of America, Kanematso-Gosho, and System Development Corp., whose first hardware offering, an intelligent terminal, was a big attention getter and produced 112 leads by the middle of the second day.

On the other hand . . .

Not so happy was Collins Radio. "My impression is that there are more exhibitors in here than customers," said a spokesman for the communications firm.

Equally unhappy was Century Data Systems, Inc., which exhibited in conjunction with its parent firm, California Computer Products. Said William J. Sewalk, vp-marketing for Century: "We are not going to the next show because the shows are not consistent with our objectives any more. The Las Vegas show was a very poor one."

Sewalk said his company received no new oem leads (they sell disc drives to Burroughs, CMC, and others) and did not "really see any significant number of leads from the end-user market." He said so many people are involved in making a buying decision at the end-user level that only shows with a mass audience can meet their marketing needs.

"We can't believe AFIPS when they tell us we're better off because the show attendance has been trimmed from 37,000 to 15,000," he added.

A number of attendees said the show had become primarily an oem show: "There's nothing here for the small user," said one veteran. One ex-

hibitor agreed his company hadn't helped much by quoting oem figures to confused end users.

But most booth manners tended to call it an end-user show, at least in terms of traffic. Cipher Data's Otterson estimated 70% of their traffic end user.

There were computers at the show but they were all minis. Finally and inevitably all the big mainframers have dropped out. And the time-sharing companies, which two years ago clobbered the Las Vegas phone system, weren't there either. Apparently the only strictly software house on the scene was International Mathematical & Statistical Libraries, Inc. SDC was present but pushing its terminal.

The peripheral makers seemed to be jockeying around for top position as the providers of the most complete line of gear outside the cpu. Potter Instrument was there, fresh from a cross-licensing agreement with IBM on tape and disc drives and printers—the result of a settlement of Potter's patent infringement suit against IBM. The immediate indication of Potter's new position was the 4330 disc drive on display.

A good sign at the show was the reappearance of Charlie West, missing at the last few JCCs. West founded Soroban in the early '50s and his white hair, red face, and pot belly were standard exhibit fare as he crumpled cards to show his reader's ability to handle abused documents.

Having sold Soroban to Mohawk, he retired and was urged by friends to get a boat, something in the Columbia class. "But, hell," says Charlie, "it takes them 15 minutes to get sails ready. What I wanted was a push-button boat. So I got one with an 85 watt radio so I can call for help." Next he tried to figure out how to use it and started exploring oyster beds, but he figured he'd covered them all so he started a new company called Optical Business Machines, Inc.

The company showed off its first product, the "first practical optical reader," that West says can be justified by companies with six keypunches. How was the show? "Best show we've ever been to," says Charlie. "We sold two units, and I've never sold anything at a show before." Welcome back, Charlie West!

Time to cut?

Even some of the exhibitors who shared West's enthusiasm felt JCCs should perhaps be curtailed in some way. Aster of Computer Communications, Inc., suggested one show a year "in a place like Chicago." More than one booth offered the comment that the JCC is always better than the SJCC and said they'll consider skipping the SJCC in favor of putting more into the

JCCs... Whither or Wither?

FJCC. Richard Bravo of Electronic Memories & Magnetics came up with the idea of shortening the shows to two days. "Attendance was so thin on Thursday we began asking ourselves what we were doing there."

And certainly this show's last day had more than its share of last-day gloom. People were stumbling over each other to get out of Las Vegas Wednesday night.

Bill Fordiani of EECO, who had been very enthusiastic about the show opening day, stopped a reporter in an almost deserted aisle on Thursday to demand, "Now ask me about the lousy show."

A booth staffer for Datapro Research Corp. had this comment on the future of the JCCs: "We hope the JCCs don't go away—well, they won't die. They'll change."

Plans for change

And change is what AFIPS is looking into. The Las Vegas show's attendance was some 10,000 less than that at the 1970 Fall Joint in Houston and was about 5,000 down from the 1971 Spring Joint. From being in a position of having to "manage" attendance to keep it down, the JCC sponsors have moved into a position of having to manage to build it up somehow.



GTE Information Systems offered a haven for weary visitors who like to sit in eggs.

Compucorp Calculators sorted its visitors; other signs read Financiers Only, Scientists Only, and Accountants Only.

Toward this end, AFIPS will establish an industry advisory panel to assist with conference planning. The first panel will be made up of appointed marketing men from different industry segments. Subsequent panels will be elected from and by exhibitors.

The JCC board, said an AFIPS spokesman, "is reevaluating all aspects of the conference to make sure we develop relevant programs and to seek active dialog with user industries."

At a press briefing during the show, one AFIPS official said they viewed the shows as horizontal in nature and saw a need to add more vertical interest. One way they'll try to do this is to invite an industry group to participate in a series of supplementary technical sessions on their industry. The first such vertical supplement will take place at the '72 FJCC and probably will be on the "cashless society." AFIPS officials emphasize that the vertical push will not change the basic nature of the show which "will be 80% general content still."

AFIPS did have some figures with which to console themselves. Although total attendance was down from the Spring Joint, paid attendance was up from 3,159 to 3,217, and while the booth total was down from 599 to 542, the number of exhibitors was up from 195 to 214.

An AFIPS spokesman credited the deflation of the JCCs "in large measure to the economy," a subject on which Fall Joint exhibitors expressed as mixed a set of feelings as they did on the nature of the show itself.

Any good news?

Ron O. Huch, vice president of marketing for Centronics Data Computer Corp., said he detected definite signs of an upturn in the economy in the several weeks preceding the show.

Centronics, headquartered in Hudson, N.H., manufactures low-cost printers.

A small terminal company reported that its sales are rising sharply, but—ironically—it hasn't detected any fundamental turnaround in the economic slowdown. "We doubled our sales in our last fiscal year," said Irving Schwartz of Computek Inc. of Cambridge, Mass. "But I think this is largely because our equipment is inexpensive and people are looking at the smaller companies as a way of saving money."

Another firm that attributed brisk business to users' attempts to economize was Computer Investors Group Inc., which markets Data Recall add-on core memories. Roger W. Goetz, vice president, said Data Recall has more than 200 add-on memories in the field, sold to users attempting to stretch the life of their 360 line. "I haven't seen any break in the economic squeeze yet," he said.

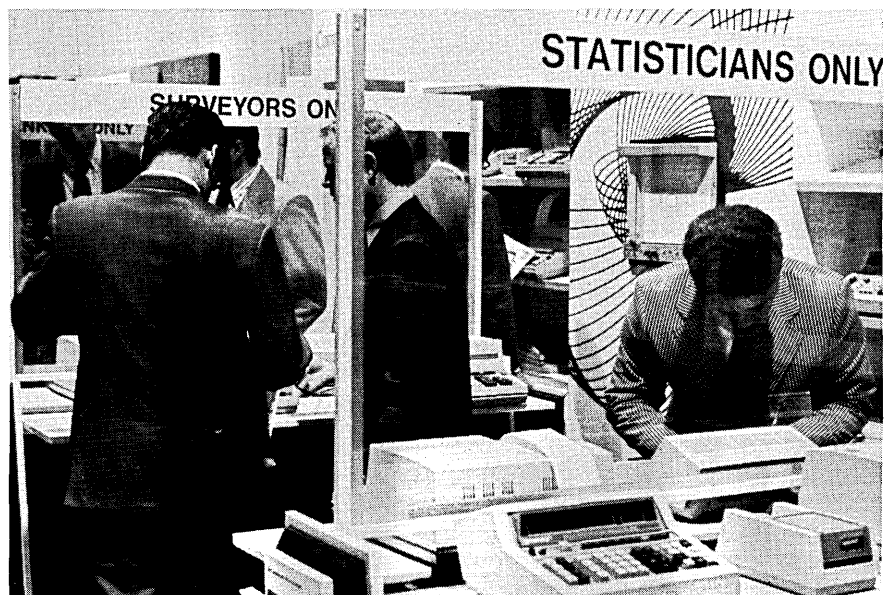
On a more positive note was the final admonition of FJCC keynoter, Dr. Arthur G. Anderson: "Don't be a pessimist."

Dr. Anderson, vice president and director of technical assessment for IBM, addressing the conference theme of "Computers and the Quality of Life," told his audience: "Even with our problems, we're members of one of the most dynamic industries the world has ever known."

At the sessions

Liston Tatum of KRCA Inc., had this to say on the conference theme at a panel session: "My big disappointment has been that computers haven't made a helluva lot of difference in our way of life. On the plus side, computers have improved the style of life—mostly of computer people."

Tatum was part of a session featur-



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ing speakers who participated in the first Joint Computer Conference 20 years ago. He charmed his audience and made the session memorable. "The computers of 1951," he said, "combined the best features of a chess game and an erector set . . . The question asked then was: Is IBM in this business for the long haul?" With a glance at session chairman W. King of IBM, he noted, "I guess that's still a relevant question."

An element of timeliness surfaced in this somewhat historically oriented session. In the introduction of one speaker, Brian Pollard, it was noted that he is with RCA . . . "until next Monday (Nov. 22)."

Pollard tossed a hot potato to the audience. He called for prohibiting of leasing (only sales) by manufacturers. The reasons:

"Competitive pressures would ensure that the users would be given the opportunity of using state-of-the-art equipment as soon as the technology permitted.

"A company's growth rate would be determined primarily by its sales success—cash flow problems would be similar to other capital goods industries.

"Selling prices should come down since they are now artificially set high to encourage leasing.

"Since for many reasons users might still prefer to lease, I am sure leasing companies would continue to be a vital segment of the industry, but they would no longer be in direct competition with the manufacturers."

Unfortunately, the audience was given no time to debate this highly controversial topic.

AFIPS officials are quick to point to session attendance as evidence of the success of the FJCC. They claim many offered standing room only.

One which did, in a room which seats 500, was on "The User Interface for Interactive Search." The underlying theme of the session was "how can the remote terminal designer better aid the relatively unsophisticated user in the accomplishment of his tasks" with the focus on what goes on in front of the terminal—how does the user do what he does.

Hospital problems

A well-attended panel session on computers in medicine focused on some homely truths of how a hospital functions. As panelist Dr. Charles Post put it: coronary care is not the mainstream of hospital activity, despite the attention it has from the computer people; information systems don't work; and computer experts turn out to be strictly problem solvers—not problem definers.

Therefore, the panel reminded the

audience, they should try harder to understand what a hospital really is. It supplies only facilities, in the form of plant, equipment, and services from nurses and technicians. It is the doctors that use these facilities, and the hospital can't tell the doctors what to use and how to use it. Thus any computer project must win the doctors' approval or it doesn't stand a chance; some have worked all right, then floundered when the doctors wouldn't use the new methods and equipment.

Some other serious obstacles cited: the medical field has no history of automated processing, such as the use of punched-card gear; until 1960, there were no medical records in machine-readable form; and, most important, you can't turn off a hospital to try a new system, since it runs 24 hours a day every day of the year.

A case of data processing inadequacy was discussed by conference luncheon speaker Dr. Frank Ryan, director of information systems for the U.S. House of Representatives. "Congress needs the ability to evaluate established programs," said the former Cleveland Browns quarterback. "It is here that the imbalance of information processing between the legislative and the executive branches is so sharply defined. For example, Congress must advise on budgetary matters offered by the executive—often supported by the enormous data processing capability—without the capability for equitable independent analysis."

Dr. Ryan said the work load facing members of Congress is staggering and that much of it could be automated, yet—by way of computer hardware—the Senate maintains just a 360/40 and the House a 360/50 and an NCR 100. He said that operational and political reasons prevent any joint data processing effort between the House and the Senate at the present time.

As a result, the House effort is proceeding on its own, Ryan said. "Our main short-term goal during the 92nd Congress is to bring on-line legislative support to all the standing committees of the House. Our long-range goal is to provide timely analytical support to the legislative process. The problems inherent in this goal are large; after all, since Congress does involve itself from time to time with almost all aspects of American life, the size of a data base supporting information queries in a timely fashion is almost beyond comprehension."

Technology which one day will reduce complications in storing such an incomprehensible data base was covered in a surprisingly well-attended session on Large Scale Integration. Perhaps the attention stemmed from the fact that the speaker panel was heavily IBM flavored and a lot of people would

like to know what IBM is thinking about LSI. Dr. C. K. Tang of IBM, Endicott, gave a hint. In describing his method for cutting down the number of storage cells currently required in designing monolithic array read-only store (ROS), he noted that ". . . since future computers will be 90% ROS, one can see the reason behind reducing ROS size."

An interesting point made during this session was that "a useful, programmable, sequential logic module can be implemented on a single LSI chip." INTEL Corp., Santa Clara, Calif., underscored the point the same day by leaving literature in strategic places at the show describing such a chip.

But the conference wasn't all chips and bits and circuitry and logic functions. As usual, it had its lighter side. Varian Data Machines had a mini-computer playing blackjack with a crt. Tally Corp. had a paper-tape reader playing a Bach fugue. Computer Communications had an on-line roulette game, and Data General came up with a game that allowed a player to become the lord of a small European kingdom possessing the richest 1,500 acres of farming soil on the continent. The player was given planting and selling decisions to make which could make or break his kingdom. A DATAMATION reporter who tried it lost 98 of the 100 people in his kingdom in his first move.

International Communications Corp. had a vivacious young lady in red conducting a crowd-stopping modem comparison; her graceful movements and lively line of patter seemed pleasing to everyone except some "gentlemen with bells on their jackets."

And, of course, there was Las Vegas itself. The hospitality suites got a good play, probably because they were the only places in Vegas where one could sit quietly and chat. One computernik barged into the Landmark, looked at the forest of money-grabbing machines, and asked, "Is there a hotel around here?"

Of the many and varied evaluations of the FJCC, one of the most down-to-earth came from a Las Vegas cabbie who remembered the good old days of the '69 show when he hauled home \$75-80 a day. This time \$30-35. Another cabbie complained because the city had been promised 30,000 attendance and had gotten "only 10,000."

Everyone had his own yardstick, including a boy of about 13 who toured the show with a friend on the final day. "There's one thing about this show," he said. "Some of the people are really nice, explaining things and everything, and the rest are awfully mean."

It's the old story of the good guys and the bad guys. —Edith Myers

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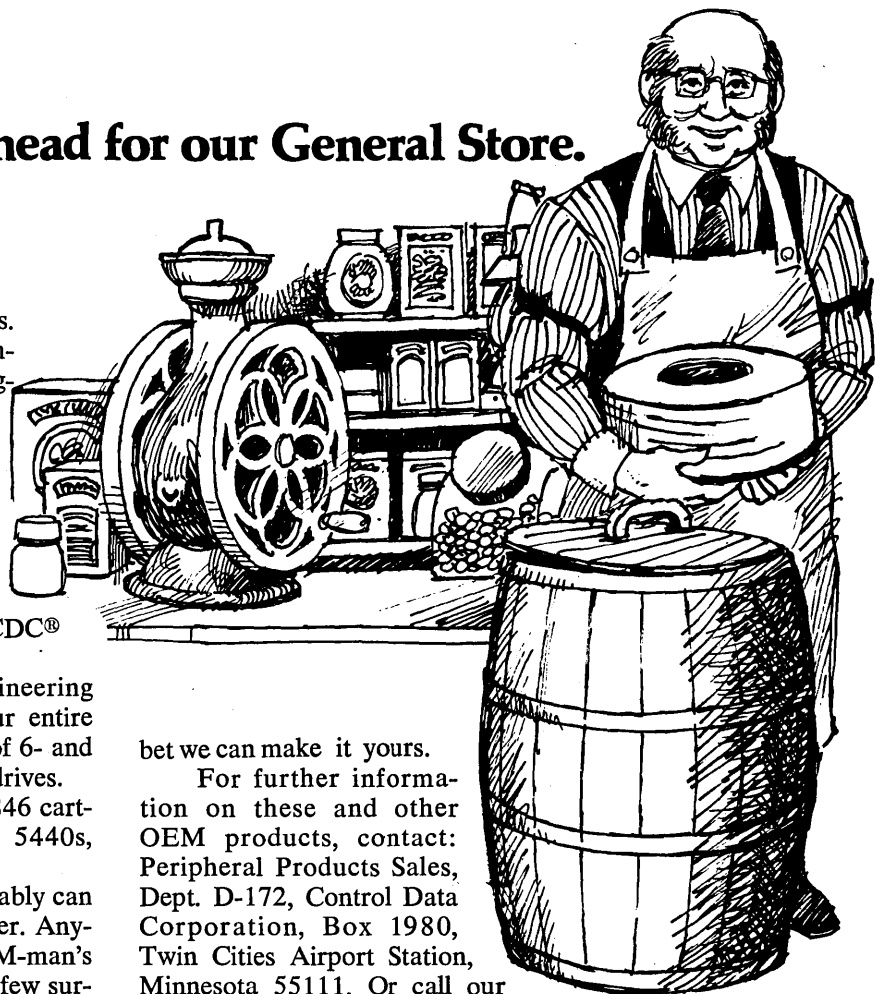
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1971: Anything Could Happen—and Did

by Tom McCusker, Senior Associate Editor,
and W. David Gardner, New England Editor

Even IBM was nervous last year.

Orders for the new 370 line were below expectations and IBM offered bonuses to entice older employees to retire early. Its technical and marketing strategy to unplug independent makers of auxiliary memory products wasn't working, so it made a drastic price cut in May, only to see the competition counter with price adjustments of their own. In Santa Clara, Calif., disc drive memory maker Memorex Corp. in a countersuit denied IBM charges that it violated the law in hiring away employees from IBM in San Jose, and asked \$1.5 billion. In Minneapolis federal court, where Control Data filed its antitrust suit against IBM, Armonk's lawyers filed a counterclaim which charged that CDC was a monopoly. But what may have shaken the serenity of Armonk most last year was the announcement of that bleak Friday, Sept. 17 — the day its self-styled arch rival RCA capitulated.

Although many within RCA were quick to explain that it was a suicide, not a murder, IBM nevertheless fired off a memo to salesmen: leave RCA users alone, or face a grand inquisition. The RCA systems had been as far away from IBM as many dared to tread, and if a parade back to IBM didn't make the computer colossus look like a monopoly, what would?

In the uproar that would follow such a move, who would blame the Justice Dept. if it decided to stop dragging its feet in the IBM antitrust suit that had been filed on the last day of the Democratic Administration? In Armonk, the new IBM president, Frank Cary, may have recalled with second thoughts his comments to a DATAMATION interviewer that he doesn't have "any nightmares" when asked if he worries about wiping out the competition.

So it must have been comforting to IBM when Univac said it was interested in taking over RCA's customer base. In the public eye, Univac was where this business all started, and old No. 1 of the early 50s was now back in No. 2 spot, heavily committed (about \$70 million)

to keeping RCA users away from IBM. Univac's 9700 computer, probably the first of many that will be compatible with IBM and RCA programs, was an indication of this commitment. It was announced shortly before the agreement in principle was reached last fall.

Despite Univac's reassurance, many wondered about the future of the remaining dwarfs. If such industrial giants as General Electric and RCA couldn't make it in the computer business, how could the rest of the competition survive? But at year-end the prospects for some were good. Honeywell, with a giant order for the Worldwide Military Command and Control System and a large backlog for the 6000 line, appeared healthy. So did Univac, which has been in the black, as well as remarkably profitable Burroughs. Control Data's mid-year profits had been wiped out in the third quarter, but head man Bill Norris' computer savvy and a plan by the company to trim overhead would keep CDC alive. Xerox and NCR were expected to

keep their computer operations afloat, perhaps integrating them with their already sizeable customer base in related products.

So perhaps, in this coming year, little will change. The positions of the mainframers would stabilize. Independent peripherals manufacturers would continue to attract the sophisticated user, whose numbers would continue to grow. New companies would arise as surely as some would fall.

Tiny Berkeley Computer disappeared in 1971 along with its big time-sharing machine designed to serve 500 users at the same time. In nearby Sunnysvale, Tenet, Inc., struggled for survival in bankruptcy court to save its TENET 210 time-sharing machine. KLH Assoc., which publishes computer user directories, said the number of computer installations in southern California dropped 10% last year. And an investment counselor who specializes in high technology companies said, when asked if the good old high flying days of 1967-68



Early in the year, IBM announced with fanfare its first delivery of a 370 machine (a 155) to Zayre Corp., the retail chain. But no sooner was the machine operational than Zayre had sent back two IBM 2314 disc drives and replaced them with 3660 disc drives from rival Memorex Corp. But last fall, IBM struck again with an early delivery of its 3330 disc drive, thus replacing the Memorex equipment. That was the kind of year it was.

Anything Could Happen

will return, "I'm not so sure those days were so good . . . for example, the formation of time-sharing companies got out of hand."

There was *some* good news. In Dallas, mystery man Richard Kelly came through with the money to get Scientific Control Corp. back on its feet in more modest quarters. In San Diego, an obscure little terminal maker, Typagraph Corp., emerged from bankruptcy to announce a new teleprinter terminal.

There were bright spots too for the minicomputer companies. That industry subsection surged and some experts estimated growth of minis last year at 30%

in both dollar sales and units shipped.

In the minicomputer oem market, Digital Equipment Corp., Maynard, Mass., and its rival, neighboring Data General Corp. of Southboro, squared off in a marketing battle that promised to heat up in 1972. DEC began deliveries of its new 16-bit family, the PDP-11, and introduced a full line of machines. Data General moved into the No. 2 position behind DEC in number of units shipped and at the end of the year introduced a new line. Data General appeared to be shipping 16-biters at a higher rate than DEC, although the latter firm held the edge in over-all industry shipments.

Last year also saw the entry of Texas Instruments into the mini business. TI came into the market in the fall with a low-cost semiconductor memory ma-

chine and served notice it would wage an aggressive marketing campaign. Other major manufacturers in the mini business — Varian, Honeywell, and Hewlett-Packard — tended to place more emphasis on larger systems at the expense of the oem business. Business picked up sharply for two other mini manufacturers, Interdata and General Automation, who both announced new machines.

Those who study computer markets were high on the growth prospects for a new breed of data entry products which use noiseless keyboards, computers and disc drives to prepare data for rapid entry to computers. The key-to-disc market, as it was called, had outstanding short-term growth prospects, according to these market experts, but in a leasing environment the industry was faring

1972 Computer Almanac

A summary of past news, as in the accompanying story, is useful — but even better is a summary of *future* news. So here are some brief items our New England Editor foresees during the coming year . . .

january

Viatron Computer Systems emerges from bankruptcy proceedings and Dr. Edward Bennett makes a triumphant return as president. "We're somewhat behind schedule on overhauling IBM," says a Viatron spokesman, "but by 1975 we expect to have delivered more digital machines than any other firm, including IBM." The spokesman notes that deliveries on the firm's \$39-a-month terminal will begin soon. Wall Street responds by driving Viatron stock from 10 cents to \$5 a share.

february

IBM chops prices 40% on disc drives, tape drives, and a host of other plug-to-plug peripherals. At the same time, the computer colossus increases prices 25% on 370 mainframes. IBM says it is just a coincidence that it tends to cut prices where it experiences its most intense competition and tends to increase prices where the competition is weak. "IBM remains dedicated to serving its customers," says an IBM spokesman.

march

RCA corporate headquarters announces that it is placing major emphasis on its Data Communications Div. "Just as color television represented the great growth industry for RCA in the 1960s, so will data communications be the great growth industry for RCA in the 1970s," says a top company executive.

april

Viatron announces plans to offer a low-

cost trillion-bit MOS memory, to enter the office copier business with a brace of machines, and to sweep the ocr business with a revolutionary new product line. The firm says deliveries on its \$39-a-month terminal will begin soon. Wall Street drives Viatron stock from \$5 to \$10.

may

The Spring Joint Computer Conference opens in Atlantic City with NCR proclaiming NCR means computers, Honeywell saying that it is "The Computer Company," Univac announcing that it is number two in computers, Xerox claiming that it is growing faster than anyone else in computers, Control Data observing that it makes the biggest computers, and Burroughs saying that it makes the best computers. "Hogwash," says Dr. Herbert R. J. Grosch. "NCR makes cash registers; Honeywell, thermostats; Univac, oscilloscopes; Xerox, copiers; Control Data sells insurance; and nobody knows what Burroughs really does."

june

RCA denies that it is talking merger of its Data Communications Div. with any other company or that it has any intention of withdrawing from the business. The company points out that it has just built a huge multimillion-dollar Data Communications headquarters and that it has embarked upon an extensive hiring campaign.

july

The Justice department wins a major

victory in its antitrust case against IBM: the feds wangle an admission from IBM that it makes computers.

august

Viatron announces the formation of a fast-food franchise subsidiary, Viatron Fried Chicken. In addition, the company says deliveries of its \$39-a-month terminal will begin soon. Wall Street drives Viatron stock from \$10 to \$20.

september

RCA's Data Communications Div. unveils a new line of processors and modems, says they are the best and least expensive in the business, and begins a hard-nosed frontal assault on IBM and ITT. "We're in this business for keeps," says an RCA top executive.

october

Viatron announces that it will manufacture an electronic Spiro Agnew wristwatch. In addition, the company reports that it will begin deliveries of its \$39-a-month terminal soon. Wall Street shoots Viatron stock up another 20 points to \$40.

november

The Fall Joint Computer Conference opens in Las Vegas with IBM returning as an exhibitor. The keynote address is dropped in favor of a barbershop quartet featuring T. Vincent Learson of IBM, William C. Norris of Control Data, D. James Guzy of Memorex, and — with a nod to Women's Lib — Joan M. Van Horn. Their rendition of "Side by Side" is the hit of the FJCC.

december

RCA announces that it will discontinue operations of its Data Communications Div.

— W. David Gardner

with only mediocre success in the money markets.

One reason for this was a problem all of the independent (non-IBM) sector of the computer industry faced. It appeared last year from the Accounting Principles Board of the American Institute of Certified Public Accountants. The board's insistence on new accounting requirements for computer firms that lease equipment tended to stifle competition in the industry and slow down venture capital for new company start-ups.

At the heart of the issue was the board's moves to require that leasing transactions be recorded under the "operating method" of accounting, rather than the "financing method." Under the operating method, revenue from the contract for equipment is income only as received. Under the financing method, the equipment is considered as a sale at the time of the financing transaction, although payments for the equipment may continue for an extended period of time. Therefore, as computer firms were forced to abandon the financing method for the operating method, they had to delay reporting sales and earnings into the future. As is often the case, the measure had little effect on IBM, which already was reporting on the operating method.

But for others the stringent requirements were disastrous — notably to Consolidated Computer, the data entry firm that was forced to delay a public offering of its stock because of it, and subsequently went into receivership.

Once again the way IBM does business was imposed on the rest of the industry, although it had no direct hand in deliberations of the board. But the tough line of the board appeared to be taking its toll in the venture capital market. "It's harder than ever now to find investors willing to back computer start-ups that need lease financing," explains Barry Weinberg, of the financial consulting firm of Channing and Weinberg. "They see that profits are just too far away under the new system."

No one would accuse the board of not having the highest motives. The goal of the new accounting measure is to help protect stockholders and the public by bringing about a clearer, more comprehensible and more unified financing reporting method. The irony is that the measure may well retard competition in the computer industry.

Bunker Ramo's NASDAQ over-the-counter stock quotation system went on the air in 1971. When a number of Big Board stocks were added experimentally to the system, a national magazine predicted that soon Wall Street would be just a nickname for a computer through which all stock trades were made. Fletcher Jones of Computer Sciences Corp. finally got his computer system to

Perhaps the most significant technological development of 1971 was the cpu on a chip carried elsewhere in this issue (p.75) by Intel Corp. of Santa Clara, Calif. The metal oxide semiconductor chip, measuring approximately $\frac{3}{4}$ x $\frac{1}{4}$ inches contains a 4-bit adder, a 48-bit program counter and stack, an address incrementer, an 8-bit instruction register and decoder, control logic, and 45 instructions. It is supplied as a building block component of the MCS-4 "Micro Computer Set" and is complemented by random access memory chips, ROM chips, and shift register chips. The price of \$66 per set in quantities of 100-999, plus a \$600 charge for creating each individual customer's ROM mask, clearly portends the computer in each home — or car — perhaps later this decade.

Something that should benefit users in the near term came in the form of the 960A 16-bit minicomputer announced by Texas Instruments toward year end. Data General, DEC, Varian Data Machines, and other principally oem-oriented companies must be weighing courses of action should TI decide to make its weight felt in the market. The 960A uses semiconductor memory that operates at 750 nsec, and is priced at \$2850 including 4K of memory, power supply, a direct memory access channel, automatic parity checking, and a lockable front panel. By way of contrast, the Data General Nova 1200, a 1.2-usec machine similarly equipped, is

work last fall at the Off Track Betting Corp. in NYC, thus bringing automation into the world of Damon Runyon. Ampex Corp. promised to start deliveries in late 1972 of a terabit memory which could store up to 3 trillion bits. An Ampex neighbor in northern California, Precision Instrument Corp., delivered its trillion bit laser memory system (a read-only system) to NASA in Ames, Calif. Frank Marchuk of Irvine, Calif., continued to warn the industry his 10 trillion bit laser computer was on the way. And in Los Angeles, Ovonic Memories, Inc., was formed to make a disc drive with all the characteristics of IBM's 3330, but with ten times the storage capacity — a feat that is due to its use of glass-coated discs on which you write, read or erase with laser beams. It said a prototype would be out this March.

And, of course, 1971 was the first year IBM operated without a Watson at

priced at \$5450. Varian's 620/1 (for low cost) goes for \$50 less than that, with each additional 4K of memory priced at \$2300. An additional 4K on the TI machine is only \$1500.

Optical character recognition technology saw some interesting developments during the year. At the exotic end of the spectrum was the Graphix I system developed by Information International (April 1, p. 60). Despite the system's starting price of \$1.2 million, more than 200 reader responses were received for it — an unusually high number for any ocr device. At the low-cost end of the scale was the System One page reader from Optical Business Machines of Melbourne, Fla. The \$30K price for 350-cps speed would seem to be a new price/performance standard for such products.

The many benefits to be derived from microprogramming were offered up to users of the QM-1 computer from Nanodata Corp. of Buffalo, N.Y. A lot will be learned about what actually happens when users are permitted to use the "innermost secrets" of the computer — creating new instructions, modifying others, etc., which may well dictate what users will demand in future machines.

As good as 1971 was, technologically speaking, 1972 promises to be much better. Research and planning on some exciting new products has been going on quietly during the recession, and many of these developments will see the light of day this year. Hopefully the economy will, too.

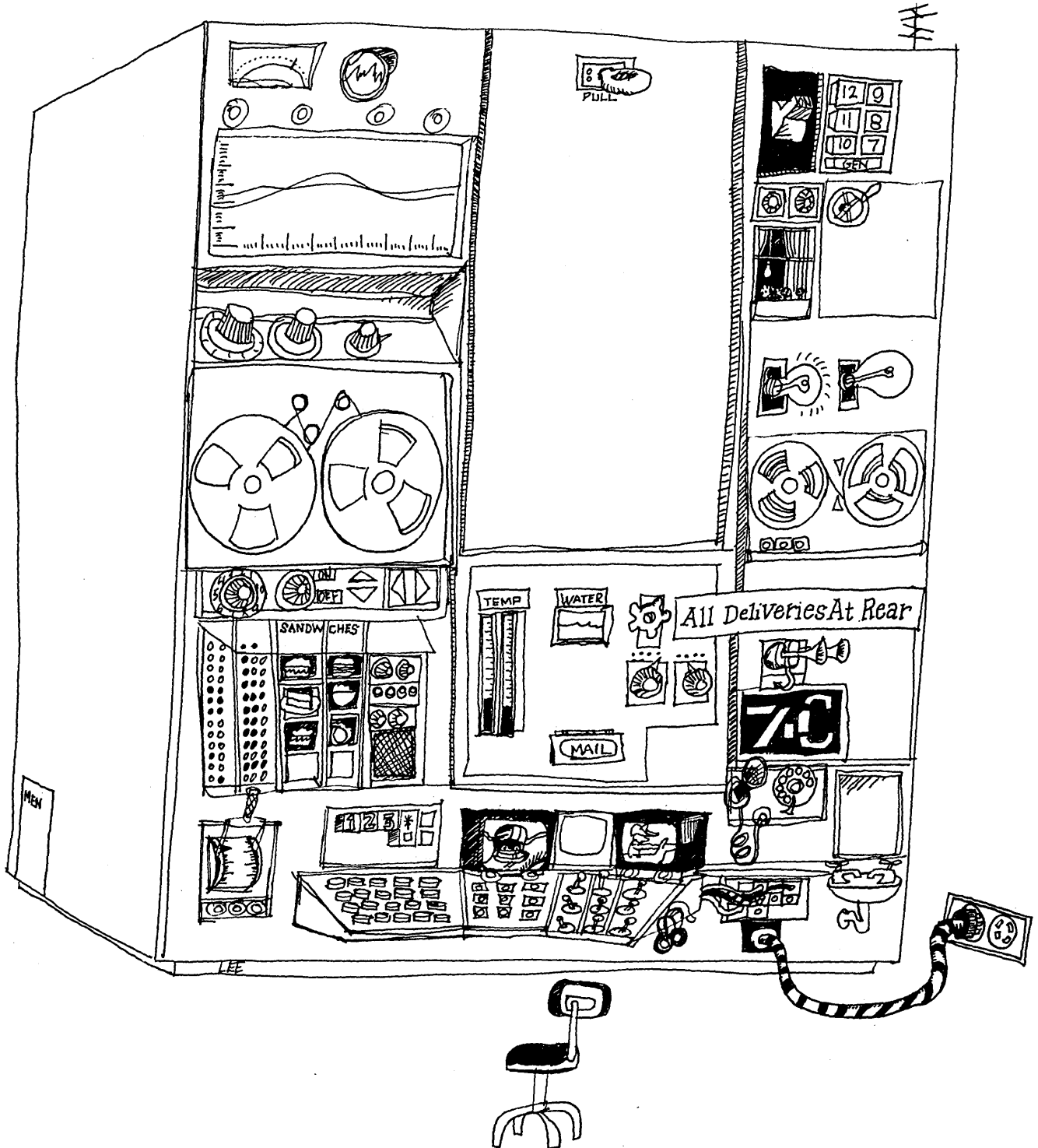
— M. W. Cashman

the helm. Thomas Watson, Jr., resigned as IBM chairman in June at 57, after suffering a heart attack the previous fall. President T. Vincent Learson, who had been running the show during Watson's illness, succeeded him. But the Watson influence still will be felt at IBM, as the retired chairman is now head of the executive committee and a member of the company's management review committee.

The turnaround that failed to happen in 1971 may very well materialize in '72. And when the purse strings are loosened, a larger portion of computer business may be available to the independents. A new breed of user has emerged from the recession — educated to having to make do with less, and sensitive to the needs of his financial management. This user isn't going to feel all that lonely turning away from IBM, if the result is better price and performance.

It may be the year of the Hard Sell. ■

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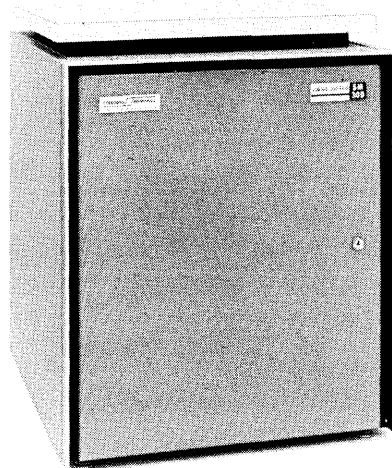
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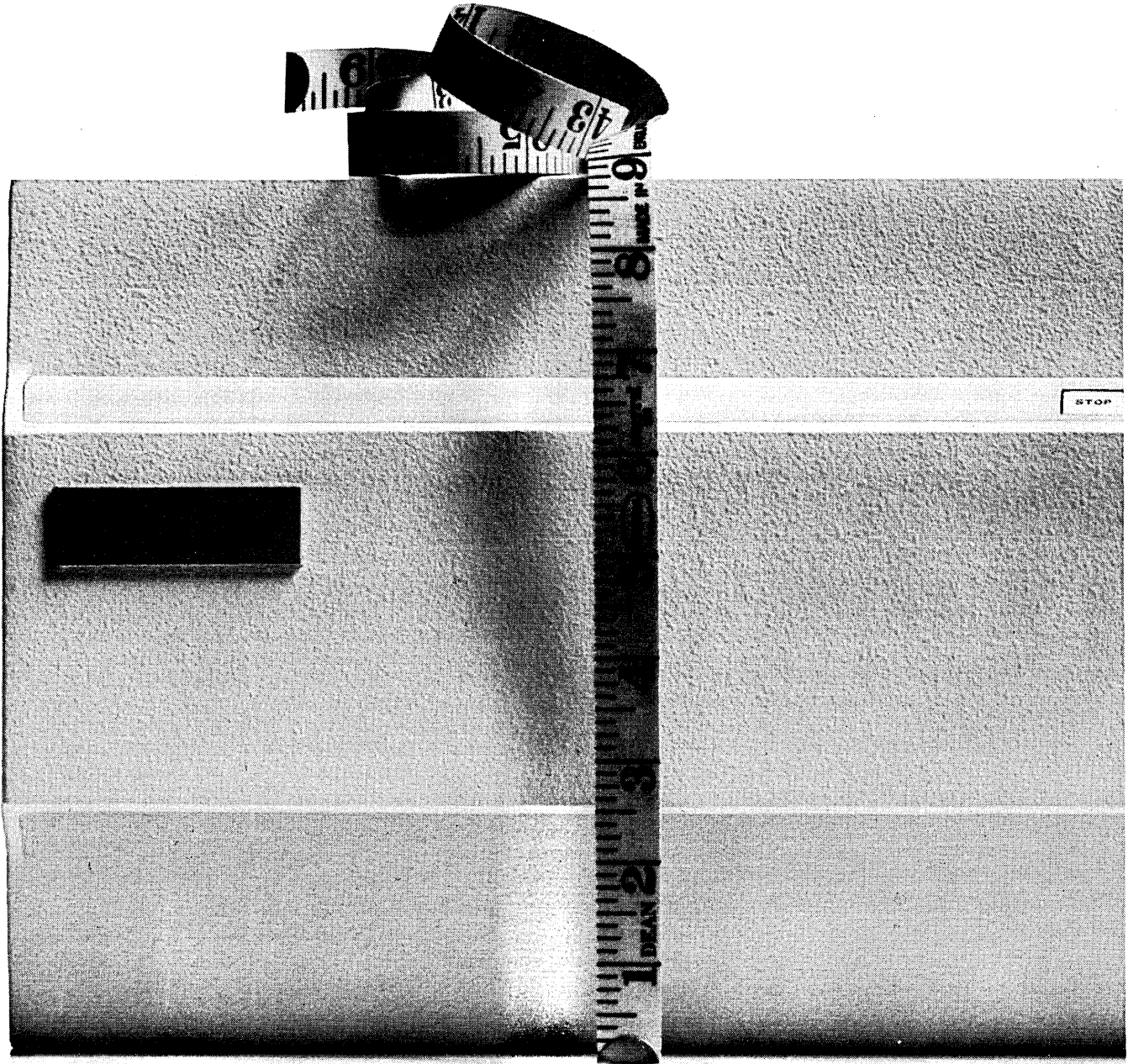
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The Railroads: Salvation Through Computers?

"Exploiting our data systems" was the theme of the '71 meeting of the Association of American Railroads' Data Systems Div. meeting in New Orleans. And the theme was well chosen, for the railroad computer men have a sense of urgency and destiny: many consider their data systems to be the salvation of the railroads in an era when falling profits have brought the threat of nationalization, or at least government intervention, almost to fruition.

Clearly the problem is to exploit existing computer capability, as the roads already have a lot of raw material to work with: hardware to the tune of 246 computers in service as of June 1, 1971, as reported in *Railway System Controls*. Yet just having lots of computer power is no guarantee of success, as shown by the fact that the railroad with the most computers is Penn Central.

Keynote speaker Alan S. Boyd, president of the Illinois Central, actually set the keynote of the two-day meeting with his speech, which seemed a mixture of pep talk and foreboding. He said that proper use of computers could result in an impact as great as the gains from dieselization in the fifties and sixties. But the payoff isn't likely to be realized until there is full computerization, just as the cost savings of diesels weren't fully gleaned until all the steam engines were gone and the necessary coal bins, water towers, and roundhouses were abandoned.

What computers can do in the seventies is "create the effective capacity control railroads need if they are to become super common carriers." Further, "computers may well be the instrument whereby the railroads ultimately recover from the competitive decline that began when the automotive age resulted in a national highway network."

A national freight car control and information system would be the "quickest and cheapest way" to get more usage from existing capacity and require as little of what the government "has to give us" as possible.

But that's all conjecture. In today's reality, automatic car identification (ACI)—basic to freight car control—remains largely a dream. Few railroads

make any use of the brightly colored labels that adorn nearly all interchange cars and many piggy-back trailers.

The effort to launch ACI lags so much that some railroaders wonder if the present labels will last until such time as a national system becomes a reality, according to Boyd. A reflection of the lack of impact of ACI thus far was the extreme attentiveness of the audience for a talk by L. I. Dillenbeck, director of management information systems for the Peoria & Pekin Union Railway. His road was certainly the most obscure to provide a speaker, and Dillenbeck himself appeared youthful, thin, and nervous.

But what he described was unquestionably a successful application of ACI, and that was enough to put most attendees on the edge of their chairs. It seems the P&PU terminal railroad, which serves 11 lines, has actually increased freight car throughput and reduced personnel as a result of a nine-scanner configuration implemented by

Proper use of computers could result in an impact as great as the gains from dieselization . . .

ACI Systems Corp. According to Dillenbeck, ACI was approached as though it were a process control problem, and the resultant system worked.

And while the problems of the P&PU are certainly smaller and more easily defined than those of the major carriers, all railroads have yards and terminals, so perhaps there is much the giants could learn from this tiny success.

At the opening luncheon, AAR president Stephen Ailes cited statistics in support of the need for a nationwide car-locating system: 52% of all shipments involve interchange with other railroads and an average trip covers 2.6 railroads. It's hardly a problem an individual line can solve.

The workshop on ACI was jammed, as usual. I. Gitlin of the AAR reported that a study conducted on the Chicago Belt Rail Road found 91.4% of the cars labeled, but only 94% of those labels accurate, which isn't good enough. Labels were missing from some cars that

had previously been labeled, while others had labels obscured by chalk, paint, dirt, and dented surfaces.

This situation may not be as serious as it appears, however, in that correct information can still often be obtained from incomplete label input, according to L. L. Scheibal, a Missouri Pacific programmer. His road has developed an ACI data enhancement program that operates in batch mode, matching train consists with ACI lists in order to verify and correct ACI information.

Speaking at a workshop on improved equipment utilization using existing data bases, William Jewett of the Illinois Central stated that most lines already have most of the input needed to control car utilization. But this information and control must be centralized, and cars classified by type. Using such data, the IC has been successful in offering excess cars to other roads and has—less successfully—solicited for cars from other lines to ease IC shortages. Further, repair priorities have been set not only on the basis of the cost of the repair, but in consideration of the revenue potential of the individual car.

In the panel discussion on data exchange, J. W. "Pete" Germany of the Southern Pacific said that an investigation of the trucking and airline industries revealed there is no real data exchange except in the case of the seating information maintained by the airlines' ARINC operation, which is jointly owned. But no actual flight information is exchanged nor is air cargo data exchanged. So the railroads apparently have no good model to imitate.

Discussing common codes in data exchange, Data Systems Div. executive director R. A. Pettrash smashed a glass on the floor, remarking that "we're going to be in the same position as [that] glass" unless we take the initiative.

When the meeting was over, the 476 attendees headed home by air. Some flew as far as Canada, Holland, Germany, and Switzerland. Even newly elected Data Systems Div. chairman Jack L. Jones of the Southern Railway was forced to fly on the firm's jet to a meeting in Washington the next day, although he and some other Southern personnel had made the trip from Atlanta aboard a private business car on the Southern Crescent.

Two weeks after the meeting the AAR announced it had organized a task force to design a national car information and control system, as so often advocated, under the leadership of R. P. DeCamara, vice president of administration for the Illinois Central. So there should be more than ACI to report on next year. Hopefully, progress will be more rapid.

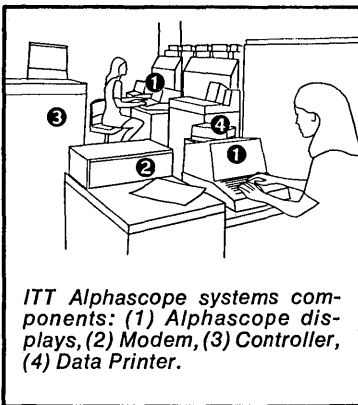
—F. Barry Nelson

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News in Perspective

Univac executives spent most of last month with big users of RCA computers, and now the company feels the \$70 million it paid for the RCA customer base is justified. There'll be no wholesale retreat to IBM—at least not for a while. The story starts on this page . . .

Page 55, Roger Brown switched from a Spectra 70/45 to a PDP-10 and he's happy. The head of Copley Computer Services, Inc., says DEC's first release of PDP-10 COBOL is better than RCA's 14th release for the Spectra . . .

Page 58, IBM's R. F. Elfant predicts more widespread use of monolithic memories, and thinks they'll even push their way into the main memories of IBM's 370/155 and 165 . . .

Page 60, The FCC says you need a special device (data access arrangement) to attach non-Bell-made devices, such as terminals, to the telephone network. But the way Ma Bell has delayed in supplying the devices, it just could be that the rule will be relaxed maybe within six months . . .

Page 61, Immediately after getting out of the advertising business, pioneer software company, Informatics, jumped into the insurance business . . .

Page 64, The world's most automated hotel goes on-line in Paris next month . . .

Page 68, How about \$100 million a year for r&d? That's what a British parliamentary committee has recommended the U.K. government provide to ICL to keep them competitive in the computer business.

Companies

Yes RCA Users, There Is a Santa Claus

As 1971 was slipping to its hoary death, Univac's G. G. Probst and his helpers sped around the nation telling abandoned children of RCA that if they would only believe, their investment was not lost. Apparently Univac found enough believers to justify paying \$70 million for the RCA customer base. That's 1,000 purchased and rented systems used by 500 customers.

To a man, industry observers and experts thought it was a smart move, a plus. But whether Univac is buying temporary income or a big new set of Univac users depends on what it does in the next two years. January 1972 is the most critical month of that period.

Univac made general assurances of support to big RCA revenue-producing customers in December. Its executives were "impressive, sincere, intelligent, understanding," said the users who talked to them. Most were pleased or satisfied that it was Univac taking over. (One who was uncertain was a Spectra 70/45 user who had completed his conversion from a Univac 9200 by the end of December and still found himself a Univac user.)

Carte Blanche operations manager, George Clark, whose firm after the RCA demise was furious and considered suit and other severe actions, said, "it's a new ballgame," and Univac is "a company with credibility." But whether the firm keeps its 70/55 depends on Univac answers to queries about a new operating system RCA promised, about

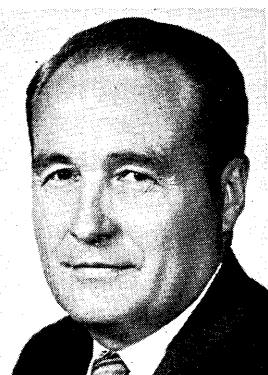
the availability of products, with support, to extend the machines, and about improvement of reliability of the 55, now plagued by parity error troubles.

Walt Disney Productions, which has two Spectras, planned for an RCA-6, and definitely needs that capability this year. But the decision won't be made until after this month's negotiation with Univac. The major issue to dp manager Jack Cornwall: "We're going to stay on the (IBM) compatible track . . . we don't want to get too far away from what big brother is doing. If Univac gets on that track and stays there, well . . ." Of course, big brother is hustling the account hard, too.

Another model 6 order hangs in the balance at Orange County, Calif. Robert Farmer, county dp director, is "relieved" by the take-over and welcomes the chance to negotiate. He feels that Univac's two goals assure the user of better service than ever before: 1) to keep RCA equipment operationally useful as long as possible; 2) to convince users to move to Univac gear when it becomes necessary to convert.

Univac would like to see the rented RCA gear stay in through 1980. But two to four years would give the firm time to complete the packages and set up centers for RCA-to-Univac conversion. That conversion hasn't been defined yet, but we're told it will be implemented through both hardware and software.

One of the planned migrations will be to the new 9700, already promised



news in perspective

to include IBM 1400 and 360 emulation by 1973. Another possibility is that Univac will announce a follow-on to the 1110 that will have RCA and IBM emulation.

In the meantime, Univac is trying to determine what RCA operating system it should continue developing. Univac has been looking at the operating system being developed by RCA licensee, Hitachi. But, at writing, the best bet seemed RMS, a system developed for the Navy and said to be an improvement over the IBM 360 disc operating system. It's unclear what'll happen to RCA's big investment, the Virtual Memory Operating System, outside of continued maintenance.

Univac will provide hardware maintenance for all rented and purchased equipment for new systems and upgrades. At mid-year, Univac will make its final order for this gear, and RCA is expected to continue some manufacturing until year-end.

RCA users are worried about the special software and support commitments that RCA had made to them. But, says Sperry Rand's exec vp, Robert E. McDonald, "it's up to us to keep users satisfied within normal economic bounds." Reportedly most of the legal contracts are "innocuous," and the big promises were verbal. (Hardware maintenance, however, is legally spelled out.) Before Univac agreed to take over, many users were ready to go to court over both the verbal and written commitments. This perhaps is why RCA chose to take the Univac offer rather than the one made by Mohawk Data Sciences. Mohawk wanted the base and several plants and offered \$10 million more than Univac. But that \$10 million wouldn't have begun to cover the suits that would have landed back in RCA's lap if Mohawk failed.

RCA still faces a \$110 million lawsuit by Marketime Corp., New York lessor of its systems. Herb Rothstein, president, considers his systems devalued despite the take-over because of "the brutal method" RCA chose to announce its demise.

The weeks following Nov. 19 were understandably confused. Not only were Univac executives courting the users, they also were trying to figure out the who and how of hiring RCA personnel. The first returns on what Univac and RCA were offering personnel to make the move were described as "a pittance" and "niggardly" by outraged staffers. Apparently RCA at first

planned no severance pay for people who were offered a Univac job, and those who went would go without their seniority and retirement accruals. Employees balked, and rumors spread that the customer engineers, having both companies over a barrel, were discussing joining a national union.

The purchase agreement was in danger. If Univac couldn't get the right RCA force together, the users might defect in large numbers. But RCA made what is becoming its most famous move, a complete about-face. On Dec. 3, it decided to offer "one sweetheart of a package," said a relieved staffer. And Univac did its part, too. Employees moving over would get from RCA sever-

Before You Analyze This Chart . . .

It's not what it appears to be at first — an equivalence of the computing features and (roughly) power of RCA, Univac, and IBM computers. Rather, the Univac and IBM columns have been shifted up one "buy" in an attempt to show what machines current RCA customers might be looking at when they outgrow present computing capacity. Customers may be able to acquire larger RCA computers handed down by defectors and forestall conversion problems for a while.

It would seem that there is a good choice of moves for the very small Spectra user — both within what Univac offers in the byte-oriented 9000 series gear, and without (read IBM). But at the upper end of the Spectra line, and for the few users of the models 6 and 7 in the year-old "RCA" series, the Univac 9000 series gets thin (shown by the shaded portion on the chart). The recently announced 9700 might handle

work loads through about the Spectra 70/55 or RCA-3 level. But beyond that, Univac doesn't currently offer anything for, say, an RCA-6 user to grow to. The Univac 1100 series of 36-bit machines, despite COBOL capability, are really scientifically oriented, and users might not be willing to go through the conversion to this line when the 370/155 is there and waiting.

But some people in the industry feel that the most likely path for the RCA user "in trouble" isn't shown on this chart. There are some hungry leasing companies out there with good stocks of 360s that can be discounted to some very attractive levels in an attempt to get those current RCA users. How well Univac manages to stave off these firms — and IBM — until it can provide a growth path for their newly adopted customers is something we'll have to watch during the coming 12 months. ■

RCA COMPUTERS			UNIVAC 9000 SERIES			IBM 360/370 SERIES		
Model (estimated installations)	Monthly Rental Range \$K or (typical)	Memory (KB) Languages	Model	Mthly Rtl Rge \$K or (typical)	Memory (KB) Languages	Model	Mthly Rtl Rge \$K or (typical)	Memory (KB) Languages
Spectra 70/15 (150)	2.8-6.7 (4.3)	4.8K COBOL, ASSEM.	9400	(5.9)	24-128 COBOL, ASSEM. FORTRAN	360/22 (5)		24,32 COBOL, RPG. FORTRAN, BAL.
Spectra 70/25 (100)	6-12 (7.0)	16-64K COBOL, ASSEM.				370/135 (9.9)		96-240 COBOL, RPG. FORTRAN, BAL.
Spectra 70/35 (140)	7-25 (9.2)	16-64K COBOL, ASSEM. FORTRAN						
Spectra 70/45 (135)	8.5-30 (18) 70/46 24-50 (32)	16-256 256 COBOL, ASSEM. FORTRAN	9700	14-42	64-1024 COBOL, ASSEM. FORTRAN, RPG	370/145 (23.3)		112-512 BAL, PL/1, COBOL, FORTRAN
RCA-2 (60?)	(15.4)	64-256 128-256 COBOL, ASSEM. FORTRAN						
Spectra 70/55 (15)	15-60 (30)	64-512 COBOL, ASSEM. FORTRAN				370/155 (45)		256-2048 BAL, PL/1, COBOL, FORTRAN
Spectra 70/60 (20)	17-60 (40) Spectra 70/61 30-60 (45)	128-1024 128-1024 COBOL, ASSEM. FORTRAN	Univac might fill this space with additional 9000 series models, but more likely with emulation capability on machines as fast as the 1110 to cut the cost of developing a whole new machine.					
RCA-6 (107?)	(29.3)	128-2048						
RCA-7 (107?)	(36.3)	128-2048 COBOL, ASSEM. FORTRAN						

ance pay of one week's salary for every year of service, unused vacation pay for 1971, and full vacation pay for '72. Retirement benefits would carry over, RCA paying its part and Univac picking up from there under its own plan. Salaries would be according to seniority and position; Univac would either match RCA's or make it equal to what similar Univac people make. McDonald said RCAers are not being hired "just until RCA revenue deteriorates." In fact, some RCA and Univac personnel will be cross-trained to know both vendors' gear.

Last reports were that 90-95% of the offers were being accepted and Univac was on its way to getting a majority of the 2,500 people it intended to hire.

And what does Univac stand to gain from the buy? Reportedly there are 700 rented and 300 purchased systems installed domestically, worth \$1 billion. This brings Univac's total base to \$4.2 billion. But the RCA base bears dissection. If our RCA source is correct, 30% of the RCA base is owned outright, and is not revenue-producing except for maintenance. About 29%, mostly Spectra 70s, have been purchased on an installment basis. Most of those installment contracts are for 5-7 years, with some 10-year government contracts.

This means that Univac stands to collect the remaining installments of these contracts. (They are difficult to cancel, coming with stiff penalties.) Thus Univac will not own 59% (in value) of the RCA base. The remaining 41% is on rent or a six-year accrued equity contract toward purchase (4%); most of the latter are likely to be converted to rent by the user since the contracts are relatively easy to cancel.

The rental base represents \$7-8 million a month in revenue, which comes to a tidy \$96 million a year. It sounds good for Univac, but it also is up for grabs. A source says that inside-RCA estimates of Univac revenues from rental and maintenance are \$90 million for 1972, \$60 million for '73, and \$30 million for '74. Add to that undetermined tens of millions for the installment purchases. Estimates of the total have ranged from \$140 to \$175 million, but \$140 million is what the RCA sources are saying.

Besides the \$70 million cash to be paid by Jan. 6, Univac has agreed to pay RCA \$30-60 million over the next five years, depending on future revenues.

Various sources at Univac have said the erosion, or loss of RCA installations

to other vendors, probably will be 30-50%. The question is when. Many users have their orders in for IBM replacements.

Asked what RCA markets would help Univac, McDonald said RCA was stronger in state and local government and banking. According to our sources, the RCA base as a percentage of the value breaks down the following way: banking, insurance, and brokerages, 14.5%; state and local government, 17%; education, 8.1%; medical, 1.3%; manufacturers, 20.2%; distribution, 3.2%; federal government, 16.5%; telephone companies, 8.5%; and others, 10.7%

Univac itself has almost 8,700 installations worldwide, one of the best reputations for on-line and real-time systems, and a claimed profitability. In 1970, Univac and other Sperry operations in information handling and retrieval grossed \$639 million. About 40% of the 8,700 are abroad. Certainly since Univac has no relationship with RCA's licensees, Siemens and Hitachi, it may opt to market its returned RCA systems abroad.

The Sperry Rand division is led by new president Probst, who has gradually moved from manufacturing through the executive ranks — a Univac tradition. As of a 1970 reorganization, worldwide marketing and services have been put under one man, George Geick.

Univac has the time-honored reputa-

tion of being the technological pioneer — Eniac, Binac, Univac 1, Larc, etc. — but being unable to parley it. It is the object of the great quote, "snatching defeat from the jaws of victory." Its first big miss was the chance of being number one in the industry.

Generally, organizational troubles and marketing cacophony have been credited with drowning out Univac's technical genius. The reputation, if not the problem, lingers on.

For sure, Univac has not been afraid to change to find its "truth," having gone through several reorganizations and restructurings in the last five years. It does have a large base, profitability, and a reputation for doing many good things, so observers give it a good chance of making the RCA buy a big plus.

— Angeline Pantages

Conversion

Spectra 45 Dumped for a PDP-10

One user who made a startling switch from a batch-oriented Spectra 70/45 to a PDP-10 says he'd rather fight than switch back.

The user is Roger Brown, president of Copley Computer Services, Inc., which started in late February 1971 to



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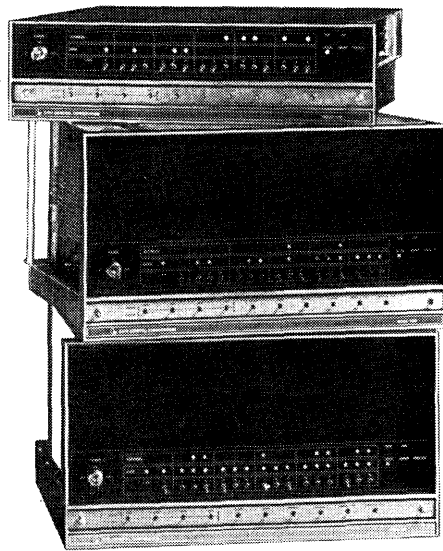
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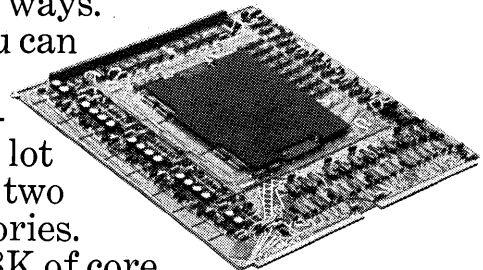
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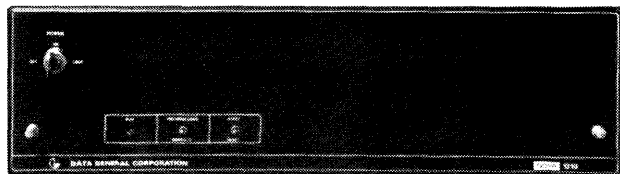
Second, 8K of core



*Price includes central processor, 4K 16-bit words of core memory, programmer's console, Teletype interface, direct memory access (DMA) channel, automatic interrupt source identification, and rack-mount slides or table-top enclosure.

on a single board means you can fit more memory into a smaller, less expensive computer.

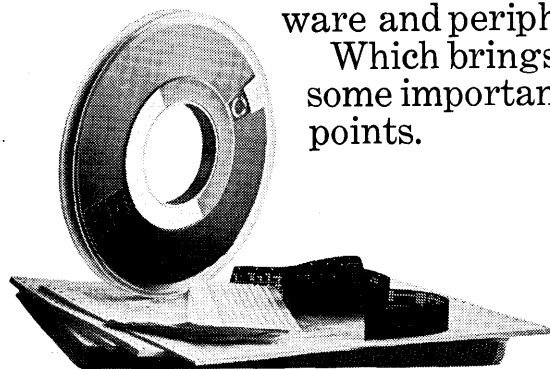
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news in perspective

convert to the Digital Equipment Corp. gear. By September a staff of 10 people had every system (approximately 350 programs) running in parallel on the two machines at the installation near San Diego where the firm provides dp services for the Copley newspaper chain and some other customers.

The team consisted on an administrator, two lead men, four programmers, and three systems analysts. Primary reason for the speedy conversion, according to Brown, was on-line programming, which he says can offer up to 10 times improvement in production speeds over off-line batch. All programs were written in COBOL.

And although Brown says he's not in the business of praising DEC, he will admit that the PDP-10 COBOL compiler is better than RCA's. "They're a funny company," says Brown of the firm that made its fame as a minimaker. "They take an engineering approach. Once they make up their minds to do something, they do it." As a result, he feels the first release of the PDP-10 COBOL compiler is better than the 14th release for the Spectra. And, he points out, total monitor/compiler overhead is 40-60K

(words), depending on job mix.

The Copley configuration includes six 16K modules of main core, a 1.7-million character swapping drum (representing the limit on memory available to on-line users), one-third of a billion characters of on-line disc, and four 120KC tape units, plus a line printer. No card gear.

A DC 75 — a special PDP-11 — will link the system to eight high-speed (9600 baud) synchronous lines. There are also 64 low-speed asynchronous lines assigned to production programmers, time-sharing customers, and to remote corporate program development people.

The key to the system, Brown feels, will be the front-end DC 75. But late delivery of the 75 is delaying complete system implementation. In the meantime, special interfaces are allowing CCSI to limp ahead on two ports for remote batch.

The conversion to the PDP-10 itself has not been completely trouble-free. The longest downtime so far has been 11 days. A maintenance snafu damaged 18 cables that since have been replaced at no cost to CCSI.

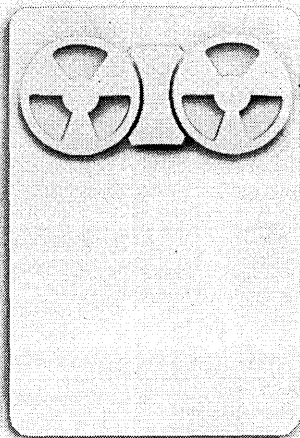
Other than that and the lateness of the 75, support has been satisfactory, says Brown. And the costs of the system may ease those pains. Brown says that the current configuration costs out at about the same as the Spectra would have in 1972. But over a five-year amortization period, costs are calculated to come down 5% per year.

A detailed description of the system and the conversion will be offered in the February issue of Dick Canning's *EDP Analyzer* (925 Anza Ave., Vista, Calif. 92083).

Memories

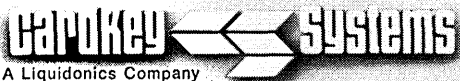
Debate Gives Peek at IBM's Direction

The great computer memory debate was held in Boston recently, and the consensus was that computer memories in the not-too-distant future will be organized into hierarchies that will embrace different memory technologies. In short, the hierarchies will probably consist of a variety of memory technologies, including core, semiconductor, bubble, and DOT.



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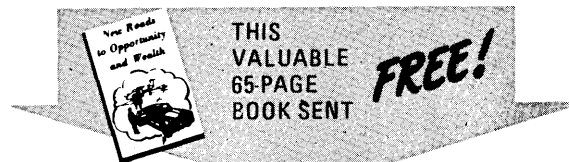
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That, at any rate, was one conclusion that could be drawn from a panel of memory experts who spoke at the Northeast Electronics Research and Engineering Meeting (NEREM). The meeting had special significance because one of the speakers represented IBM and presented a revealing glimpse into the memory technologies of the normally secretive industry giant. IBM, of course, is the number one manufacturer of computer memories.

R. F. Elfant of IBM's Components Div. presented a paper that he prepared with an IBM associate, W. L. Shevel. Other speakers were R. J. Spain and H. I. Jauvtis of Cambridge Memories; A. H. Bobeck of Bell Telephone Laboratories; and C. V. Ramamoorthy of the Univ. of Texas. Chairman of the session was Joseph Kruey, president of Cambridge Memories.

It was IBM's Elfant — with his candid comments — who drew the most attention. Elfant's predictions — he indicated he was thinking to about 1975 — included:

Monolithic memories will increasingly push their way into newer and larger computers, perhaps even into main memories of IBM's 370/155 and 165.

Monolithic memories will be manufactured with 64,000 bits on a chip.

IBM probably will be using a fairly elaborate memory hierarchy that will include several memory technologies.

In addition, Elfant said IBM has been unable to develop meaningful statistics on the reliability of metal oxide semiconductor (MOS) memories. One undercurrent at the meeting was the feeling that core memories will suffer at the expense of bubble, DOT, and semiconductor memories.

Elfant's paper was entitled "Semiconductor Memory — Status and Expectations," and one of his basic themes was that semiconductor memories would grow rapidly. There seemed to be agreement among the session participants that semiconductor memories would continue to push core memories out because of the increasingly higher speeds and lower costs of semiconductors. In addition, many expect the moving magnetic memories to cut into the use of core, largely due to anticipated low prices of the moving magnetic memories.

And what does Elfant think future memories — presumably IBM's — will look like? First of all, he believes that density will increase substantially. El-

fant predicted that linear dimensions will decrease by a factor of two to three and that circuit design improvements will decrease the number of devices by a factor of three to six. All of this should result in an increase in chip density of from 12 to 54 times the current dimensions. Elfant indicated that IBM is projecting 64,000 bits per chip in early 1975, and that would be in excess of one million bits per quarter inch of linear density.

"In order to make those kinds of densities happen, we need to have consistent and very rapid improvements in other pieces of semiconductor technology," Elfant said. "We see going right towards very, very large, very reliable low-power monolithic memories." Elfant added that IBM is working on ways to decrease power requirements on chips that would be such that total chip power would actually remain constant or decrease with the new high densities.

As for reliability, Elfant indicated that progress here is such that chip reliability — with the very high densities he spoke of — will also remain constant or improve, "netting a per-bit reliability improvement of a factor of 12 to 54."

As for the new memory hierarchies,

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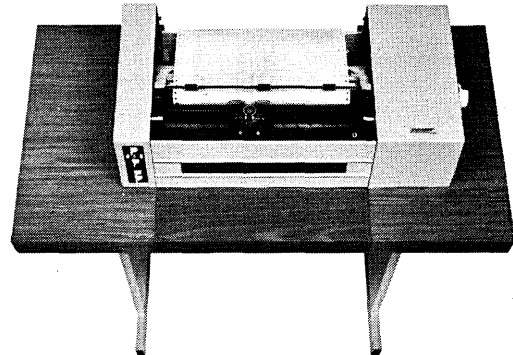
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Elfant indicated they would look something like this: At the heart would be an ALU (arithmetic and logic unit) surrounded by control stores, surrounded by buffers and local stores, surrounded by main memory, surrounded by backing stores, surrounded by mechanical stores which would be the interface with the user.

Elfant said the bipolar monolithic memories used in IBM machines — like the 145 and the Model 7 — were determined by IBM to be extremely reliable. IBM, said Elfant, was able to extrapolate reliability statistics on bipolar memories by using IBM's data base from its SLT memory technology. On the other hand, Elfant said IBM was not able to prepare accurate projections on the reliability of MOS memories. On the subject of MOS reliability, Elfant said: "Everybody and his brother is now trying to collect enough data to project what the reliability will really be."

— W. David Gardner

Communications

A Helping Hand from FCC

Independent terminal makers and users who want Ma Bell's foreign attachment restrictions lifted were hitting the old lady where it hurts last month. There is a possibility — small but growing — that within the next six months, interstate tariffs will be modified to permit much greater use of independently made equipment.

The attackers are in an unassailable position. They're willing to abide by present foreign attachment restrictions but can't because AT&T is unable (some say unwilling) to provide a sufficient quantity of connecting arrangements — the protective devices that, under the present tariff, must be interposed between every foreign attachment and the dial-up telephone network.

One apparent victim of this situation is Arcata Communications, Inc. Last July, Arcata installed a Nippon Electric PABX at Chemtex, Inc., New York City. New York Bell was asked for a connecting arrangement, but couldn't supply it because of a communication workers' strike. So, Arcata connected the Chemtex system directly to New York Bell's lines. Soon afterward, the telephone company threatened to cut off service. New York Bell insisted that the Nippon

Electric switchboard couldn't be allowed to violate the tariff. However, it couldn't say when Chemtex might receive the device needed to make the installation comply. Whereupon, Arcata complained to the FCC.

Before the feds could act, New York Tel managed to find a connecting arrangement for Chemtex to use. This solved the immediate problem, but Arcata still wasn't satisfied.

To prevent similar episodes, it said the FCC should require the carriers to permit direct connection of foreign attachments when they can't supply connecting arrangements in a reasonable time and when the attachment has already proven that it won't endanger the telephone network. (Perhaps the most galling part of the Chemtex incident was that, according to Arcata, the same Nippon Electric PABX being used there is also offered to the public "by at least one Bell company" without a connecting arrangement.)

FCC's Common Carrier Bureau subsequently announced plans to sit down with officials of New York Bell and the New York Public Service Commission, in hopes of helping foreign attachment users get better service.

A key FCC official was asked whether this new commitment will extend to emergencies in states other than New York, where users have also had to wait months for delivery of connecting arrangements; he indicated that the bureau will get involved if the complainants produce sufficiently convincing evidence.

Arcata has announced its intention of submitting a second complaint to the commission which will discuss the shortage of connecting arrangements in New York "and a number of other states," according to the company's attorney, Jay Ricks.

Our FCC source emphasizes that the Common Carrier Bureau can push Ma Bell only so far. If she won't "voluntarily" ease current restrictions on foreign attachments, the bureau is stymied until its boss, the commission, orders a change. But recent history suggests that the bureau, even with this limited clout, can be extremely persuasive. "They don't exactly have a mailed fist inside a velvet glove," says one observer; "it's more like a rubber fist that gets harder or softer depending on the climate."

At the moment, the climate seems to be encouraging hardness.

The staff of the New York Public

Service Commission (NYPSC) has recommended adoption of Rochester Telephone Co.'s recent proposal, which calls for certifying foreign attachments and then allowing them to be connected to the dial-up network through a simple interface. This interface would cost the user far less than the Bell connecting arrangement and give him a far greater choice of independently made terminal equipment.

The "Rochester Plan" may never be adopted because the company also wants to charge foreign attachment users substantially higher rates, and the NYPSC staff says this is illegal. But even if the plan is stillborn, AT&T's position on foreign attachments has been undermined; for the Rochester company's action has shown that Ma Bell can relinquish much of her present control over the dial-up network without endangering the service.

Meanwhile, the California Public Utility Commission has told Phonetele, Inc., that it can connect directly, on a limited basis, to the dial-up facilities of General Tel and Pacific Tel (see Dec. 15, p. 58). And there is growing evidence that some foreign attachment users are connecting directly regardless of what the tariff says.

According to a June 10, 1971, letter written by Robert Carr, president of Telephonic Equipment Corp., a California terminal maker, to Pacific Northwest Bell, telephone answering services in that carrier's territory have been connecting directly "for the past two years." (TEC, as reported last month, has asked the California commission to permit a direct linkage with Pacific Tel dial-up facilities.)

Recently, another foreign attachment maker said, at an informal meeting with FCC officials, that "hundreds of thousands" of telephone answering and recording sets have been linked directly to the telephone system in violation of the tariff. New York City has a lot of them, he added, partly because New York Bell doesn't offer such equipment on its own and can't keep up with the demand for connecting arrangements.

The estimate may be exaggerated, but even so it seems pretty clear that if Ma Bell doesn't lift the restrictions soon she will find them being ignored by a significant number of foreign attachment users. Locating these culprits will be tremendously expensive. Allowing violations to continue will pose a real threat to the integrity of the telephone network. It would appear to be far cheaper, and safer, to give foreign attachment makers and users at least

some of the concessions they are demanding.

Related developments:

Telpak sharing officially died last month, but sharing in some form seems likely to rise, Phoenix-like, from the ashes of the old tariff (as predicted in Washington Report, Sept. 15, 1971, p. 67). William A. Bresnahan, president of the American Trucking Assn., recently complained to the FCC that, despite the demise of sharing, Arinc can continue leasing Telpak circuits at bulk rates and then divvy them up among its member airlines. This is because Arinc enjoys a special "single customer" status under the tariff. Bresnahan wants "regulated land transportation industries" to be given similar status. Subsequent comments by the commission and AT&T suggest he may be able to get what he wants.

The advisory committee established by FCC several months ago to develop standards, certification, and inspection procedures permitting direct connection of independently made PBX equipment to the dial-up network plans to have a program ready for FCC approval by April 1. It will be limited to voice-only PBX connecting arrangements.

— Phil Hirsch

AT&T Promising Data Under Voice

"Technically, DUV is nothing new; essentially the same technique has been used by the military for years, but DUV does give AT&T a real boost competing with Datran."

So says a communications consultant, referring to the Bell System's recently announced "data under voice" microwave transmission system which is scheduled to go into operation "in some parts of the country" by 1974. Field trials of the terminal equipment needed to access DUV channels are scheduled for "early this year."

Few technical details have been released, but apparently DUV consists of a series of 1.544-megabit channels, each inserted within the base band of a microwave channel. In a TDTH system, explained a phone company spokesman, there is room for about 25 megabits of DUV data transmission capacity. A TDTH system consists of up to 16 channels. Depending on the kind of frequency division multiplexing used, the spectrum space to be occupied by each DUV channel is either unoccupied at present or contains 120 voice channels.

"The key point," says the consultant, "is that DUV can be added to Bell's existing facilities at very little incremental cost and will reduce the existing transmission capacity very little, if at all. This means that the price of DUV service can be extremely low, even if Bell is required by the FCC to include a fair share of the overhead costs of the associated microwave towers and transmission equipment. Because the technology is well known, the system promises to generate few start-up problems. And because of the low investment required, Bell should be able to get DUV up and running in minimum time. I would bet that the investment required for DUV is 10% of what AT&T would have to spend if it built a separate digital transmission network from the ground up."

A spokesman for Datran, the University Computing Co. subsidiary which plans to offer a switched data transmission network, disputes some of this analysis. "Less than 30% for our plant investment will be in long-haul facilities, the rest is in switching and in local distribution," he explained. "Since DUV is restricted to the long-haul portion of the communications path, we don't consider it a major threat."

Services

Informatics: This Time Insurance

When Dr. Walter Bauer decided in late 1961 to form an independent software company, it was because "I looked around at what others were doing and decided I and my associates could do just as well or better."

So Bauer, with two of his associates, Werner Frank and Dick Hill, formed Informatics in the spring of 1962; and it would seem they have done well, growing from 14 people at the end of their first year to some 800 people today, among whom only Bauer of the founding trio still remains with the parent company. Hill left Informatics in late '70 to join Honeywell Information Systems. Frank has, in a sense, been spun off in the software firm's latest vertical thrust, a move into the insurance business through formation of Equimatics — a joint venture with Equitable Life Insurance Co. — of which Frank is president. The company was formed to "offer a wide range of computer services to customers in the insurance, health care, and other industries utilizing industry know-how and advanced technology."

In earlier, unsuccessful attempts to corner specific industry markets for software and services, Informatics aimed at the airlines reservations field and the advertising business.

Their bid for the airline market failed when the Civil Aeronautics Board shot down a contract that affiliate Atar Computer Systems, Inc., had with 12



WERNER FRANK: Hopefully as well or better.

domestic airlines to provide a joint automated reservation system. Atar was "put in mothballs" early last year.

A more recent attempt to get into the advertising business almost led Informatics into court. The software firm agreed to buy a controlling interest in Dataplan, a service bureau for the Interpublic Group of advertising agencies. The sale never was consummated. Informatics sued Interpublic for misrepresentation in connection with the sale, and Interpublic sued Informatics for nonpayment. Court was by-passed when Interpublic bought back Informatics' interest in Dataplan.

In its latest venture, Informatics has a substantial partner in Equitable, which has more than 20,000 employees and agents and more than \$77 billion of life insurance in force. Equitable will provide most of the new company's initial capital through the purchase of \$6.2 million of convertible preferred stock. David H. Harris, senior vice president of Equitable, is chairman of the Equimatics board of directors.

J. Henry Smith, president of Equitable, has estimated that life insurance companies today "spend a quarter million dollars annually for the development and operation of individually designed data processing systems, many of which represent a wasteful and costly industry duplication of effort."

An early effort of the new firm will be development of a nationwide data communications network to improve the coordination of administrative and

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Chances are, most of your information processing problems can be handled by standard computers, using standard software.

But, traditionally, there are always a few applications that get swept under the proverbial rug. At least until they become critical enough to warrant a good deal of pressure to get them solved.

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CIRCLE 7 ON READER CARD

news in perspective

policyholder service functions between insurance company home offices and their field organizations.

Smith looks for an annual expenditure by life insurance companies on edp of \$1.5 billion in 10 years. Frank predicted that Equimatics' sales will be "modest in the first year—about \$600,000."

"Already we have a new contract to design and write specifications for a consolidated system of individual life insurance policyholder record administration for Home Life Insurance Co. This contract is just under \$500,000."

Founders said formation of Equimatics followed several months of joint studies and negotiations between Equitable and Informatics. It's hoped they took as realistic a look around at what's being done as Walter Bauer did back in 1961 and that they will turn out to be as right.

TRW's Canadian Caper on Schedule

TRW's ambitious plan to form a joint dp services venture in Canada is on schedule, despite the defection of one major partner.

Last month, Ontario's Prime Minister William G. Davis showed up to take part in ceremonies opening a \$6 million building in the Toronto suburb of Mississauga where The Canada Systems Group, Ltd., is housed. The company is a consortium of TRW, Inc., Cleveland; The Steel Company of Canada; and T. Eaton Co., Ltd., the big Canadian department store chain. It will perform the data processing work for Steel Company and Eaton and later offer data processing services to other companies. It calls itself "the largest, most advanced data processing operation in Canada."

It would have been even larger had not a would-be fourth partner, giant London Life Insurance Co., of nearby London, Ont., dropped out last March because of "political problems inherent in any organization whose members are equal partners." A spokesman for the insurance company explained what he meant: "For starters, at their first meeting they wanted to have four chairmen of the board."

Canada Systems Group president William B. Boggs is confident the new company has a good future. It has a staff of 120 recruited from the three companies and will boost this to 255 by

the end of March. In Los Angeles, a TRW spokesman said the goal is to have 500-800 persons eventually and to take on the first large customer this spring. It began doing the data processing for Steel Company on an IBM 370/155 in December and was scheduled to have a second 155 operating by the middle of this month to begin handling Eaton's work. TRW, meanwhile, had about \$100,000 in contracts for services in land development, transportation planning, and hospital information systems, according to Boggs. He said there was no immediate plan to provide the new company with the credit reporting facilities of TRW's Credit Data division.

A spokesman at London Life said it might have stayed if the joint venture had included a credit reporting capability. Another deficiency, according to the spokesman, was that the partners weren't contributing their systems analysts to the company, thus impeding its ability to seek outside customers.

Boggs admits the plan calls for the partners to keep "some" analysts on their own payrolls, but he has been assured the present staff "will be supplemented as needed." He claims London Life dropped out primarily because of a morale problem in transferring 120 dp employees 110 miles from London to Toronto.

Whatever the reason, the insurance company isn't all the way out. It holds the mortgage on the \$6 million dp building.

Hotels

The Next Time You See Paris

If everything works, the world's most automated hotel will go on-line in Paris next month.

"Everything" includes an IBM 1800 computer and more than 1,660 terminals which run the gamut from cash registers to automatic bars. The hotel is the PLM Saint Jacques. PLM stands for Paris-Lyon-Mediterranee, formerly a railroad and now a hotel and restaurant chain. When the PLM Saint Jacques opens next month in Paris, it will be the chain's sixth hotel.

The computer system for the Saint Jacques was conceived and executed by a team composed of hotel and computer technicians from PLM; the Societe de Conseillers de Direction

(SCOD), a consultant firm specializing in computerized management; Societe Francaise de Gestion Mecanographique (SOFRAGEM), the computer subsidiary of the Rothschild group; and technicians from the various suppliers to the system, including IBM, Friden, and Sealectro.

It was PLM technical managers who developed the first concept and managed every stage of the system's development, a contrast to many hotel automation projects in which the hotels have called in outside experts and said, "do it for us."

The IBM 1800 is generally considered a process control computer, and while the Saint Jacques' guests might not like to think of it that way, they will be undergoing processing throughout their stay; but if all things go as planned, they should like the results.

When a potential guest telephones to reserve a room, a simple glance at a crt should enable the reservation clerk to reply without chance of error, for the computer should be able to furnish room availability data day by day for 18 months. Upon arrival at the Saint Jacques, the guest, going to the front desk, should get away pretty fast. The clerk (as planned) will strike a single number on a typewriter which automatically should set in motion: the output of the reservation specifications stored in the computer in order that they may be rechecked or completed if necessary; the perforation of a hotel charge-plate specifically for the guest; the printing of baggage labels to assure proper disposition of the guest's baggage; and, most important, the opening of the guest's computer account.

When he leaves the front desk with his hotel charge-plate, the guest literally will be on-line. In his room he can get a drink or a snack by inserting his card into an automatic bar which is an input device to the computer. Same with his telephone . . . no operator problems . . . time and charges will be input directly. In public areas like restaurants, terminals in the form of cash registers and charge card readers input his charges directly.

And when he leaves, all the guest has to do is present his charge plate, and the terminal cashier can trigger the printing of his bill on one of four printers in less than 20 seconds . . . and it will be up to the minute (if everything works).

But that's just what it should mean to hotel guests. The same system is designed to handle management control, accounting, payroll, inventory control, and purchasing. That's what it all will



Meet System/3000: HP's new adaptive computer.

Until now you'd have to pay a half million dollars or more for the capabilities built into the new HP System/3000. Now our adaptive computer handles batch, real-time and time-sharing simultaneously. And for a third the price of a good alternative.

That's because System/3000's advanced architecture joins unique software and hardware features for really big system performance. But it offers true dynamic allocation of resources. Plus a huge microprogrammed instruction set to slash overhead. And virtual memory to ensure available core for every program in any mode.

System/3000 also comes with a full line of peripherals, including disc drives from cartridge size up to 50 megabytes, swapping drum, CRT, tape drives, card punches and printers.

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But, perhaps the most important feature is our Multiprogramming Executive. This operating system lets you mix languages, use them in different modes, develop your program in time-sharing and execute it in batch. In other

words, it ties everything together.

That's just a glimpse of our new adaptive computer. For more information write to Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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Terrific. Until you realize they're talking about a processor so stripped down it won't even hum by itself. Its assembly may be your next do-it-yourself project. Except for the tic-tac-toe game, the software won't work without 16 KB more memory and enough peripheral gear to triple your costs. And the discount they used was based on a 1000 unit-per-month schedule.

No question about it. When it comes to minicomputers, some guys really know how to play price. And there's a big difference in how they price their basic processors and how they price everything else.

We ought to know. We've lost our knickers in the trick-pricing game often enough to be experts.

Promise them anything.

We've learned that you can make a lot of promises.

About delivery, for example. "For a customer as important as you, we'll cut our 9-month shipping schedule in half." About documentation. "We don't have all the manuals yet, but we'll work that out together." And about customer engineering. "Of course we'll assign a full-time man to the Isle of Wight."

But what we've really learned is we don't have to make promises we can't keep. We don't do business that way. We just don't have the stomach.



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Like our Universal Clock Module. And our teletypewriter controller built into our basic processor.

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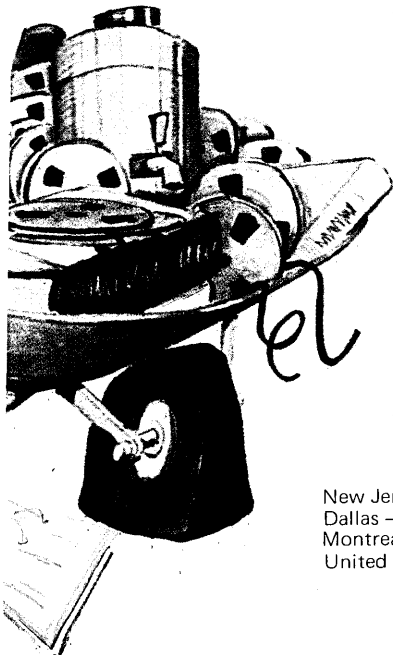
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CIRCLE 70 ON READER CARD



news in perspective

mean to management and employees.

And what does it mean in terms of equipment?

In the computer room it's the 32K 1800; three disc drives with a capacity of 512K words each; two 30KC tape drives; one 300-cpm card reader; one 80-cpm card perforator; two slow printers; one system printer; one telephone charge printer; and one electronic charge meter.

Connected on-line throughout the hotel are: in guest rooms — 812 telephones and 812 automatic bars (Bell Captain by brand); at the front desk — two conversational typewriters, two charge-plate perforators, one slow printer to produce labels, and two charge-plate readers; in the billing department — two conversational typewriters, four slow printers, and two charge-plate readers; in bars, restaurants and other public areas — 10 cash registers (Friden) and 10 charge plate readers (Sealectro).

That's a lot of hospitality.

International

Will Britain Pay for ICL's R&D?

The British government is being asked to pour at least \$100 million a year into ICL to finance the U.K. computer company's research and development. The recommendation is the result of an all-party Parliamentary inquiry into the prospects of the U.K. computer industry in the '70s. It asks for a total of \$120 million a year — but the bulk of it would go to Britain's biggest computer maker. Another recommendation calls on the government to alter the rules on procurement for central agencies. At present, ICL gets favored treatment in most proposals for contracts and in some cases is the only manufacturer invited to bid.

The government received an elaborate package of proposals from the inquiry, but observers still wonder if they are enough to build an industry that could compete with U.S.-based international giants of the data processing world. There certainly was no shortage of opinions offered to the politicians in the year-long inquiry from IBM, Honeywell, Univac, and Digital Equipment, to name but a few.

Evidence in the three-volume report can be separated into (1) the needs of

the British industry as reflected by the various proposals; (2) a guide to market prospects over the next five to six years; and (3) the chances for Euro-

pean and Euro-American collaboration.

The committee said that in spite of the dominance of the U.S.-based suppliers, a strong, independent, indigenous hardware and software industry was necessary to contribute to home

British Post Office Computer Expenditure Plans: 1971-76

Hardware

Purchases of systems	\$70,000,000
Purchases of terminals	6,800,000
Purchase of terminals not supplied as part of total systems	1,200,000

Software

In-house growth forecast for wages and salaries	\$78,000,000
Software consultancy support	240,000
Use of external bureaus	
a. purchase of machine time	1,000,000
b. purchase of data preparation capacity	120,000

Forecast for Data Terminals Required Through 1983

	slow (up to 200 bps)	medium (up to 10,000 bps)	fast (over 10,000 bps)	total
1973	27,000	24,000	108	51,000
1978	169,000	65,000	390	234,000
1983	316,000	117,000	637	434,000



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and export economic policies. On this basis, they recommended abandoning the practice of the "single tender contract." Nevertheless, purchases by central government agencies should carry a degree of preference, but also take into account the contributions made by foreign companies in providing employment and technological advancements. They've recommended the following criteria be applied to all companies supplying equipment and services to the government:

Contribution made by the supplier to the U.K. balance of payments.

Measure of R&D carried out in the U.K.

Degree to which the U.K. company is able to influence its parent board and to control its own affairs in the U.K.

Shareholding by U.K. nationals of the company operating in the U.K.

Long-term effect on the U.K. industry from the award of a particular contract.

Assessment of other benefits to the economy, such as the cooperation offered by a foreign company in starting to manufacture in science-based industries needed to offset declining traditional ones.

Procurement would be done by a

new agency to be called the Computer Purchasing Board. It would buy all computers and services, including those for scientific and defense — with the possible exception of computers that become a physically integral part of weapons systems. The group also would set up a system to monitor and review the development of computer installations.

A Computer Research and Development Board with five full-time members (established professionals who would serve three-year terms of office) would advise how the \$120 million would be allocated for R&D efforts, after examining all sections of the industry. This would include mainframe, software, peripherals, and component suppliers, and the users and computer education sectors.

Until last year, total deliveries of machines in the U.K. had shown a steady growth of around 40%. In 1969, deliveries were valued at \$500 million, of which \$134 million was imported. The following year deliveries accelerated to \$710 million, with imports worth \$175 million. But in the year just ended, the boom was not sustained. Final figures should be a bit below those for the previous 12 months. Nevertheless, not

all is gloom. Forecasts of central government needs contained in evidence collected in the inquiry show plenty of prospects to hardware and software companies. One of the most interesting is from the Post Office (see table), which between 1971 and 1976 will acquire some \$70 million worth of computers and some \$8 million in terminals. Its software bill will equal this.

In 1969 the number of terminals installed in the Post Office was 4,000; and this has been increasing at 100% a year. Unlike the slowdown in cpu deliveries, the terminal requirements continue to rise. The forecast for 1973 is now expected to be 64,000. That's 13,000 in excess of assessments made for the Post Office. In addition, the Post Office faces collaboration in a European project under discussion at the intergovernment level. It would involve the prototype of a computer-to-computer communications network involving some 10 countries.

Since it is the remaining U.K. mainframe house, the question of ICL's survival potential is one of the most important aspects of the report. Among the hundreds of persons and organizations who were examined in the year-long hearing was that seasoned profes-



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sional from the U.S. National Bureau of Standards, Herb Grosch. In fact, one of the dialogues involving Grosch points directly to the idea for the \$120 million figure for R&D. Dr. Grosch was asked about ICL's spending on research. He digressed first to emphasize that in time more and more of the total cost to a company like ICL would go to software — and software writing was all development — so the amount of money for R&D for the whole company would increase to a very sizeable percentage of the whole operation. He said he thought ICL's turnover was in the region of \$400 million gross a year. They probably needed to spend about \$100 million, or 25% of their gross costs, on R&D, he said.

Among the millions of words of evidence given during the inquiry, one passage might be awarded the fickle finger of perfidy. It is in a memorandum from the British Aircraft Corp., a major computer user and the British half of the Anglo-French Concorde supersonic airliner joint venture.

"Referring specifically to ICL," their

testimony said, "we see them suffering from the popular denigration of British products, the overcoming of which will be their biggest problem in the '70s. We are in no doubt that a strong native computer industry is very much to the benefit of the U.K. . . . With regards to international collaboration, the benefits it gives in securing a wider market are clear, but the problems and inefficiencies in so doing are not so clear. Any such collaboration should, therefore, be undertaken from a position of superior technical strength with U.K. initiative, and there should be no question of selling this U.K. computer birthright. The main competition for the U.K. computer industry comes not so much on a technical front, but on a marketing one. It is BAC's policy, other things being equal, to purchase its computers from ICL. We are keen to develop a credible competitor to IBM's near monopoly . . . In spite of this policy, the present position is that some 80% of BAC current equipment is IBM, and there are no immediate plans to replace this with British equipment."

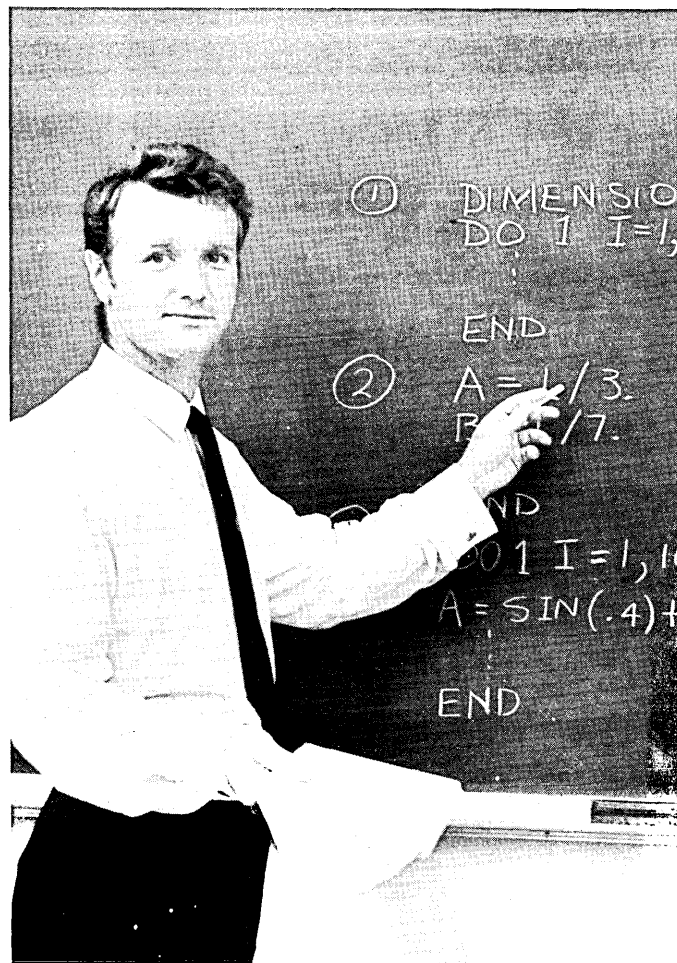
— Pearce Wright

Japan Users Focus on Applications

Computer users in Japan say that in the next three years they will place increasing emphasis on developing applications in business forecasting and planning. Specifically, they hope to provide this capability for such functions as sales, accounting and finance, production, personnel and labor, and stock control.

This is one of the findings reported in the English-language "Computer White Paper," a 98-page condensation of the original published by the Japan Computer Usage Development Institute. While the document was only recently made available in the U.S., its coverage unfortunately is for the most part only through 1970. Nevertheless, it provides a picture of computer usage there, notes trends, and reports on such activities as standards, education, and legislation affecting the industry.

Looking at some representative industries, for example, it finds that the steel industry has the highest edp operating expenses as a percentage of sales, but that figure is only 1.08%. By



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I'm Jim Dixon. I work with a group of professionals who are concerned with the software for the 6024 family of Datacraft computers.

We built certain features into Datacraft computers that make them particularly attractive for scientific, real-time applications. Our customers are smart data pros who are experts in their special fields.

These professionals know that benchmarks give a tangible means to make intelligent judgments about how much machine is really required for a specific application. They will run a benchmark, and then look at the crossover point where it's not worth spending more money because you're just not getting the performance out of the machine.

Each model in the Datacraft 6024 computer family is a 24-bit machine. We know from analysis of user applications that 24 bits is the optimum word size for scientific, real-time problems.

contrast, it's only 0.03% in the insurance industry and in the wholesale, retail and trade industries.

The organization also surveyed users to see when they thought the nation's educational system would use computers and television in some combination. The greatest percentage (42.9%) placed this in the 1974-76 era, although 25.4% foresaw this in 1977-80. When will the shortage of computer specialists become severe? Most said between 1971-73, but a few placed this dilemma between 1974-76.

It's been some 15 years since the first computer was introduced to Japan, but that nation is now second in terms of the number installed. Perhaps indicative of the lessons they've learned in that time is the response elicited from users. Asked what advice they would give someone considering the acquisition of a small- or medium-scale machine, they overwhelmingly favored "buying a computer capable of handling from double to three times your present volume of work."

The study is available for \$10 from Japan Computer Usage Development Institute, Kasumigaseki Bldg., 3-2-5 Kasumigaseki, Chiyoda-ku, Tokyo, Japan.

Shortlines

"It has become increasingly clear that the auxiliary memory market, especially the oem portion, is becoming limited in growth potential," stated Digital Development Corp., San Diego, as it announced its acquisition of Sun Valley Systems. The Menlo Park, Calif., peripheral manufacturer currently is readying three new products: a mark sense card reader, a mark sense sorter, and a communications multiplexor . . . DATA-PET, which surprisingly enough stands for Data Phone Equipment and Terminals, is California's newest data communications company. It's an off-shoot of Sharp Corp., Japan, which will start out by offering autodialers, low-speed modems and high-speed adaptive modems, and special processors, displays, and terminals for inventory data entry, point of sale, purchasing and billing equipment . . . Boothe Computer Corp. has retired Boothe Resources International, writing down its investment in the unprofitable operation to net realizable value resulting in an extraordinary loss net of taxes of approximately \$1,200,000 . . . Pertec Corp., Los Angeles, formed Pertec Business Sys-

tems, a division combining its Peripheral Business Equipment (PBE) and Peripheral Technology Inc. (PTI) subsidiaries . . . Computer Technology Inc., Dallas, a subsidiary of University Computing Co., received a three-year facilities management contract from The Michigan Automobile Insurance Placement Facility . . . Control Data Corp. and Programming Methods, Inc., agreed to the marketing of PMI's proprietary software package SCORE through the CDC sales organization . . . Microdata Corp., Santa Ana, Calif., minimaker, and Intertechnique of Paris have extended a licensing agreement permitting Intertechnique to manufacture Microdata's 800 computers in Europe to include permission for manufacture of the California firm's 1600 series. ■



FREE Benchmarks for Price/Performance Comparisons
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 P. O. Box 23550, Fort Lauderdale, Florida 33307

Jim, please send me a deck of benchmarks so I can run my own price/performance comparisons. I understand the DC 6024 digital computer is ideally suited for applications requiring real-time control and/or complex calculations. My application is one of the following which I have circled:

- | | |
|-----------------------------|--------------------------------|
| Simulation systems | Communications systems |
| Wind tunnel testing | Medical analysis & monitoring |
| Process control | Training devices |
| Scientific experiments | Pollution analysis and control |
| Data acquisition | Optical character recognition |
| Nuclear experiments | Computer output to microfilm |
| Chemical analysis | Satellite processing |
| Engineering problem solving | Other _____ |

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Datacraft has a major advantage in price/performance comparisons — we are more powerful than the 16-bit computers and there are only a few cases where we are not toe-to-toe competitive with the larger and much more expensive 32-bit machines.

But these are only generalities.

Prove your own price/performance comparison. Write to me for a free deck of benchmarks. You'll have no problem running them. They're universal benchmarks designed for a FORTRAN IV compiler.

With the deck of 26 cards I will also send you a memo on the advantages we have with our 24 bit word length. Our family of Datacraft 6024 computers may not be a "machine for all seasons," but if you run these benchmarks then you'll see why we think we can give you a very favorable price/performance for the experienced user.

The DC 6024 series is a family of 24-bit, high speed, digital computers addressable at byte, word, and double word level. The family consists of:

MODEL	FULL CYCLE TIME	PRICE
DC 6024/1	600 nanoseconds	\$51,400
DC 6024/3	1.0 microsecond	\$32,800
DC 6024/5	1.0 microsecond	\$10,900

The DC 6024/5 is expandable in 4K memory modules up to a 65K word maximum. Models DC 6024/3 and DC 6024/1 are expandable in 8K memory modules up to a 65K word maximum. All models are software and I/O compatible.

Datacraft

Hardware

Product Notes . . .

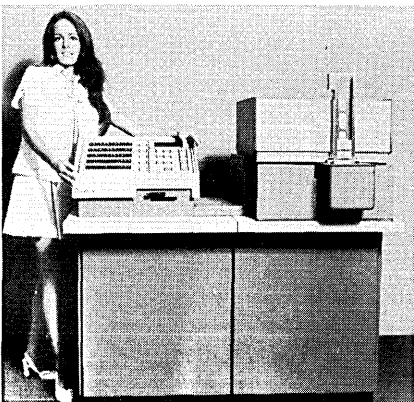
Five years of marketing effort by GE sold approximately eighty 600 series computers. We hear that HIS has already (11 months since announcement) sold more than 100 of the follow-on 6000 series. Maybe "word machines" aren't dead after all.

A San Francisco area buyer who chooses to remain nameless has bought an Omnis-1/C 16-bit minicomputer (July 15, 1970, p. 140) to front-end 32 half-duplex lines running at 2400 baud into, of all things, another minicomputer!

Retail Data Acquisition

From a firm famous for its merchandise tickets comes the Meritag Data System, a complete merchandise sale data acquisition system based on a ticket with information encoded on two circular magnetic tracks—a ticket originally used on the ill-fated GE TRADAR system. The ticket accommodates up to 48 characters, which are printed as well as magnetically encoded.

The system includes a ticket maker, ticket reader, and a Honeywell 316 minicomputer. The ticket reader can



be used in conjunction with point-of-sale equipment, or ticket stubs can be sent to the user's data processing center

for reading. Under minicomputer control, the information is formatted and recorded on standard magnetic tape or transmitted to a central computer.

The system is available on lease, with charges on a usage basis that ranges from .5 to 1¢ per transaction, depending on volume. An annual volume of about 3 million transactions per year should result in a charge of 1¢ per transaction, about equal the cost of manual systems. Delivery requires three months. DENNISON MANUFACTURING CO., Framingham, Mass. For information:

CIRCLE 228 ON READER CARD

Add-on Memory

The ExpandaCore 11 is a plug-compatible add-on core memory system that enables PDP-11 users to expand in 4 and 8K increments. The plug-in card modules feature memory interleaving, permitting users to address memory as if it were a continuous 8K block. An 8K expansion module sells for \$5600, and a 24K unit goes for \$15K. CAMBRIDGE MEMORIES, INC., Newton, Mass. For information:

CIRCLE 227 ON READER CARD

Medium-scale Computer

The 9700 is the largest 9000 series machine yet announced by this manufacturer, and it's a very interesting machine indeed. It emulates IBM 1401, 1440, and 1460 computers; it's com-



patible with all the other 9000 series gear; and when equipped with the OS-7 monitor currently under development, the 9700 will also offer compatibility with programs originally written in BAL, COBOL, FORTRAN, and RPG for running under IBM DOS. OS-7 can handle up to 14 user programs concurrently, and has multitasking capability. One is tempted to think that it was because this machine was in the wings that Univac acquired the RCA customer base—some of this information just has to make good reading for RCA users.

The hardware of the 9700 sticks with plated wire memory with a 600-nsec cycle time for four bytes. Memory starts at 64K bytes, expandable to a megabyte. Performance estimates put the 9700 in the 360/65 class. The rest of the mainframe consists of a 175 KB/second multiplexor channel and an 833 KB/second selector channel. A programmable communications processor called the CIC for controlling up to 128 communication lines also was announced, as was a three-megabyte disc storage unit, called the OSSF, to be used for system support. Basic system prices start at \$508K, or \$14K/month, including maintenance. Deliveries begin in August. UNIVAC, Blue Bell, Pa. For information:

CIRCLE 229 ON READER CARD

Key-to-disc

Most of the some 700 Intelligent Key Entry Systems already installed are potential candidates for this souped-up version of the original key-to-disc system. Essentially, the new hardware features include a more sophisticated control unit and increased disc storage capacity.

The new system—called the 1302—was not intended to be a price cut, but arithmetic shows that is one thing the new system represents: With the original system—the 1301—individual key stations could cost as low as \$120 a month; the new system brings the cost down to \$101 per station on a 16-station configuration.

The new configuration: A control unit, a disc with user capacity of 2.25 million bytes, an adaptor, and up to 16 key stations. Cost is \$1610 per month including maintenance. For some, the new system will simply be an upgrade—the vendor will retrofit existing 1301 systems. INFOREX, Burlington, Mass. For information:

CIRCLE 241 ON READER CARD

Digitizer

The model 185 graphic digitizer, selling for under \$14K, is the lowest priced digitizer this firm has ever offered. The tracing bed measures 48 x 60 inches, and the accuracy is .001 inches. The operator is guided by three digital displays, x axis, y axis, and event; and the output from the model 185 is internally formatted for either punch card or paper tape form. Scaling for each axis can get down to 31:1 ratios. CALMA CO., Sunnyvale, Calif. For information:

CIRCLE 240 ON READER CARD

CIRCLE 22 ON READER CARD →

DATAMATION

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**From a company
who's come of age.**

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Then mail it to us by January 31, 1972.

You'll then be eligible to win a free, all-expense-paid, round-trip to Rome. For two.

Your name goes into a drum with the other names we receive. On February 4, 1972, we're having a drawing. The name drawn wins first prize -- the trip to Rome.*

If you're wondering why we chose Rome, it's obvious you haven't been there for a while. It's a city (just as we're a company) that's come of age.

Why we're celebrating.

We used to be called MAI Equipment Corporation. But we've outgrown that name. That was fine when we were a company with a single idea -- purchase leaseback of unit record equipment.

But now we're GENESIS ONE -- a sophisticated computer-oriented company with a whole line of products, like those shown, that can cut customers' costs. Because we carefully select manufacturers with superior products, designed to reduce the cost of data processing. Either by direct savings. Or by giving customers better equipment for their money.

MAI Equipment Corporation was a fine name when we were smaller. But now we've developed one of the largest independent marketing organizations in the U.S., with over 40 offices.

And MAI Equipment Corporation was perfectly suitable when we had only a few customers. But now we do business with 300 of the Fortune 500 companies. As well as more than 2700 other leaders in the American business community.

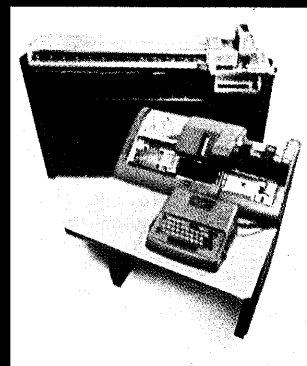
So you see, we do have something to celebrate. We have come of age. We've changed our name. And, as GENESIS ONE implies, we've begun a new era.

We intend to step up our efforts to bring to the data processing industry the high-technology engineering benefits of smaller companies, backed by our own technical know-how. And we intend to continue our efforts to lower our customers' costs of data processing.

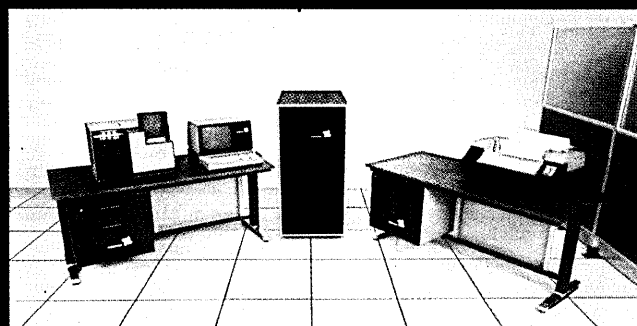
All of which means you have something to celebrate, too.



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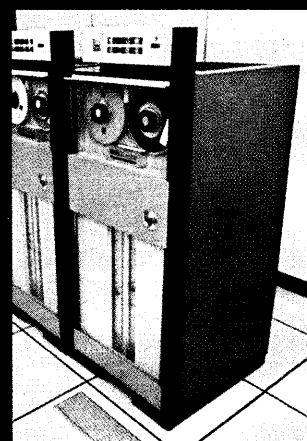
MAI Unit Record Equipment
buy equipment like this and save.



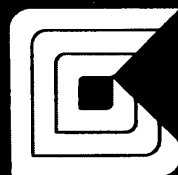
Basic/Four -- complete on-line system with a common data base.



ATC-2000 Data Display Terminal
superb clarity, large capacity.



MAI-2403 Magnetic Tape Unit
costs less to rent or buy.



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Computer on a Chip

It finally happened—the predicted computer on a chip has arrived. In this case, however, the computer is on at least two MOS chips, and might be on a larger number, depending on oem requirements.

The computer is called the MCS-4. (The letters stand for Micro Computer Set, and the numeral designates the number of chips in the "set.") Chip model 4004 is a 4-bit parallel cpu with a relatively slow 10.8-usec instruction cycle time, but still suitable for the computer's probable applications, which include test systems, peripherals, terminals, billing machines, measuring systems, and process control. There are 45 instructions: 16 machine instructions (five of which are double length), 14 accumulator group instructions, and 15 i/o and random memory instructions.

The minimum machine consists of one 4004 chip, and one 4001 control memory/4-bit i/o port, organized in 256 8-bit words. The other chips are the model 4002, a 320-bit RAM and 4-bit output port; and the 4003, a 10-bit shift register. The computer set is supplied in the form of 16-pin dual in-line packages to oem's for \$63 each (orders of 100-999 quantity), plus \$600 for the custom ROM mask. The system can be expanded up to 32K of ROM and up to 5,120 bits of RAM. INTEL CORP., Santa Clara, Calif. For information:

CIRCLE 233 ON READER CARD

Add-on Memory

A three-month trial period is offered to renters of IBM's 360 model 22 for an additional 32K of memory—bringing the system up to 64K. The rental on the 32K chunk of 1.5-usec core is \$997 a month for those three months, including maintenance. A one-year contract drops the rental to \$870/month. DATA RECALL CORP., El Segundo, Calif. For information:

CIRCLE 231 ON READER CARD

Auxiliary Processor

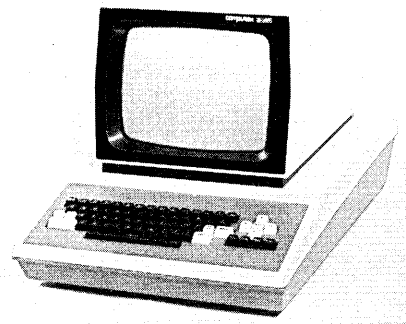
The DPAE double-precision arithmetic element buttons up to the UNIBUS of the PDP-11 16-bit computer for doing such operations as signed integer multiply (32 x 32 bit), signed integer divide (64 bit/32 bit), signed normalize and bidirection multiple shifts (arithmetic and logical) of 64-bit words. The execution times for multiply and divide are said to be approximately 8 usec, with the other two operations 4 usec and 8 usec, respectively. Included in the \$3600 price is the supporting

product spotlight

Graphics Terminal

There should be soup-to-nuts applications, ranging from financial to process control, for this graphics terminal that uses MOS memories and a tv-raster crt. The display—which has interfaces for most standard computers—can mix vector graphics, alphanumeric data, and television images. In addition, an unlimited number of vectors to full screen capacity and more than 1,000 characters can be generated and displayed flicker-free on the 256 x 256 grid.

Vectors and characters can be edited individually and rapidly with no need to erase and rewrite the entire screen. Each display comes with complete



software, which is FORTRAN based. The package automatically generates formatted graphical and alphanumeric display lists from user-level commands; for example, move beam to location x-y, draw line, display text, translate, rotate, and zoom.

The 40-pound display has a 12-inch tv raster with 525 lines. The cursor in alphanumeric mode is bar with gap at addressed point; in graphics mode, crosshairs, full screen size. The speed is up to 1200 baud, asynchronous; and 120 characters/second, and 60 vectors/second, synchronous. The price is \$3900. COMPUTEK INC., Cambridge, Mass. For information:

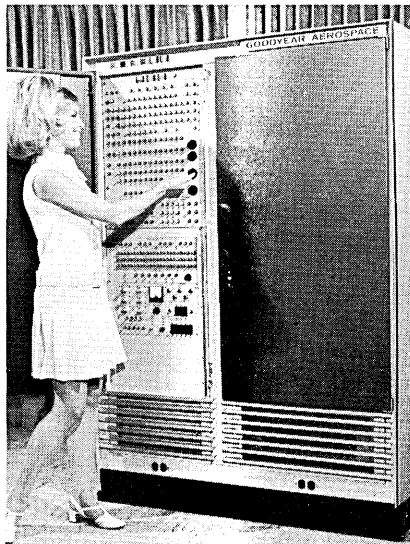
CIRCLE 238 ON READER CARD

software which allows fixed- and floating-point double-precision arithmetic. AUTOMATED HEALTH SYSTEMS, INC., Burlingame, Calif. For information:

CIRCLE 235 ON READER CARD

Parallel Processor

This may come as a surprise to many people, but this firm has done as much (or more) research into the design of parallel data stream computers than anybody else we can think of—



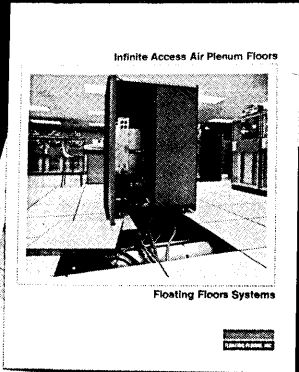
enough, in fact, to offer them for the first time as commercial products. The first application that comes to mind for the STARAN IV would be to use it as an auxiliary processor for special high-speed parallel problems such as real-time weather simulation. It's fast—the 850-nsec add time is misleading—its true performance is closer to 15.8 mips (million instructions/second) per array, each array consisting of 256 processing elements. If you could get the 32-array system configuration running at top speed, you would be processing about 500 mips. Software, test, diagnosis, and debugging is included in the system price, which starts at \$1 million. GOODYEAR AEROSPACE CORP., Akron, Ohio. For information:

CIRCLE 234 ON READER CARD

Minicomputer

The PDP-11/03 is a scaled-down version of the PDP-11/05, limited to 16K bytes of 1.2-usec memory, and packaged in a 3½-inch case. It is compatible with all other members of the PDP-11 line and sells for \$3995 with 1K of 16-bit memory. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 226 ON READER CARD



Get this brochure before you buy or specify a raised floor system.

Data processing installations deserve the best in unlimited access floors for the support of expensive equipment and for maximum flexibility. The answer . . . The Floating Floors® System.

Choice of Panels—Aluminum for highest quality, steel for economy.

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CIRCLE 26 ON READER CARD

hardware

Small-scale System

It's still the exception and not the rule when the software development people sit down with the engineers to design a totally new system; and this computer, the System/3000, is the result of such desirable collaboration. The architectural concept—resembling Burroughs' large-scale designs more than anything else—has been implemented with the intent of providing an efficient multi-programming machine. The 16-bit words of memory cycle at 980 nsec,



and are meted out in 8K chunks above the minimum 16K up to the system maximum of 64K. The stack-oriented cpu provides 170 instructions working with the 175-nsec microprocessor.

The MPE/300 monitor handles multiprogramming for time-sharing, realtime, and general-purpose batch processing and supports the BASIC and FORTRAN languages, as well as SPL/3000, a high-level language that is the basic code for the System/3000 and is said to have all the flexibility of assembly language. A comprehensive program library supplies most anything else needed in the way of programs. A typical configuration, consisting of 32K of memory, a 600-cpm reader, a 200-lpm printer, a 5-megabyte cartridge disc, and a 30-cps console, sells for approximately \$148K and rents for something above \$3K/month. Deliveries are scheduled for this fall. HEWLETT PACKARD, Palo Alto, Calif. For information:

CIRCLE 232 ON READER CARD

Memory Extensions

The Mark 6000 main memory expansion system is available for System/360 models 30 and 40, providing 16-112K in 8K increments. Units for model 50s will be available soon. The memories are electronically and logically compatible with equivalent IBM memories, although they are claimed to be capable of higher cycle speeds, allowing later adaption for use on System/370s. A 32K add-on is \$960/month on a two-year lease. De-

livery time is from stock to 90 days. FERROXCUBE CORP., Saugerties, N.Y. For information:

CIRCLE 257 ON READER CARD

Real-time System

IRAS (Immediate Response Application System) is a turnkey hardware/software system for order processing, inventory management, production scheduling, and various reservation, costing, and forecasting operations. The application programs are customized to the user's requirements. A basic system with five crt terminals, a 48-byte cpu, 22 megabytes of disc storage, and software support rents for \$2800/month. COMPUTER CONVENANT CORP., Ridgewood, N.J. For information:

CIRCLE 225 ON READER CARD

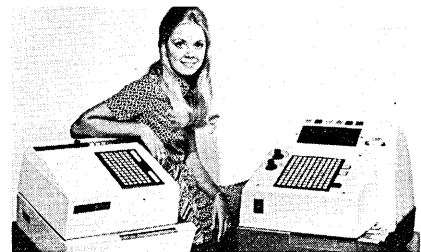
Minicomputer

This firm's announcement of a 16-bit minicomputer, complete with power supply, a Direct Memory Access channel, automatic parity checking, a lockable front panel, and 4K of 750-nsec memory for only \$2850, really puts the pressure on other manufacturers to remain competitive. Each additional 4K increment is \$1500, and that's low, too. Software includes FORTRAN, a translator for developing applications-oriented languages, several operating systems, assemblers, cross-assemblers, and utility programs. First units of the 960A have been delivered. TEXAS INSTRUMENTS, INC., Houston, Texas. For information:

CIRCLE 242 ON READER CARD

Terminal

The initial applications for the LCT series of terminals will be in manufacturing plants and hospitals, but customers will find other uses for them, too. All units (there are five different models)



accept information from the 10-column keyboard, internal slide switches, and from punched cards, and operate either off-line or on-line to ASCII-based systems over twisted pair or telephone lines. Pricing starts at \$3200, and the LCT series can also be rented. THE STANDARD REGISTER CO., Dayton, Ohio. For information:

CIRCLE 239 ON READER CARD

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CIRCLE 15 ON READER CARD

January, 1972

Large-scale Computers

The five models of the B 4700 computer are code-compatible with B 2500 and 3500 series machines, allowing step-up into the 700 series. The B 4700 systems start with a single-cpu configuration with 8-20 I/O channels, extending to larger models with additional I/O, and two, three, and even four cpus for parallel multiprogramming. The largest model has up to 80 I/O channels arranged in independent subsystems for greater assurance of continuous system availability. Each cpu operates at 4 MHz, twice as fast as the B 3500. Software includes the MCP monitor, the FORTRAN and BASIC languages, and remote job entry capability. Virtual memory is standard on all 4700 systems. Memory cycle time is 500 nsec per two-byte word and can be expanded from the starting ration of 56K up to two megabytes in the four-cpu configuration.

Peripherals announced concurrently with the B 4700 include a disc pack drive that stores 242 megabytes on each dual-pack module, with up to eight units accommodated per subsystem (1.9 billion bytes!); a series of 1600-bpi tape units with transfer rates of 320 or 400 KC; a communications preprocessor that handles 16 lines, expandable to 64; and an operator display console intended to help the oper-



ator keep tabs on things in a heavy-usage multiprogramming environment.

Purchase prices for the B 4700 line range from \$650K for a typical system with a single cpu, to \$4.5 million for a four-cpu version. Rentals on these would be \$14 and \$90K/month, respectively. Delivery is 90 days ARO. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 236 ON READER CARD

Disc-based Computers

Five disc-oriented computers have been added to this manufacturer's 9000 line-up. Known as the 9000 series D, the machines have cycle times ranging from 1.2 usec to 600 nsec and main storage of 16, 24, or 32K (6-bit) bytes. Disc storage capacities range from 3.2 to 58.4 megabytes. COBOL, RPG, and assembly languages are supported on the series D, and the larger 24 and 32K models handle MOS, NCOS, COS, and OS 500 operating systems. Rental on three-year leases runs from \$1600 to \$3450/month (\$52,320 to \$131,040 on purchase) for basic systems. Some

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CIRCLE 56 ON READER CARD

hardware

models are available for delivery this month. UNIVAC, Blue Bell, Pa. For information:

CIRCLE 255 ON READER CARD

Media

The model T300 data cassette conforms to ECMA and ANSI standards, has permanently attached write-lockout tabs, and is single quantity priced at \$8.50. INFORMATION TERMINALS, Mountain View, Calif.
CIRCLE 243 ON READER CARD

Minicomputer

The PDP-11/45 is a 16-bit general-purpose minicomputer compatible with the other members of the series. Up to 124K words of memory can be made up from combinations of 300-nsec bipolar, 450-nsec MOS, and

850-nsec core. Monitors include a DOS for stand-alone application, and RSTS (Resource Time Sharing) supporting BASIC. Prices start at \$15K. DIGITAL EQUIPMENT CORP., Maynard, Mass.
CIRCLE 244 ON READER CARD

Fixed Media Disc

The model 1709 is for Hewlett-Packard 2114/2115/2116 models not equipped with direct memory access. It stores up to 512K 16-bit words. Access time is 16.7 msec; transfer rate is 15K words/second. Prices start at \$5500. DATA DISC, INC., Sunnyvale, Calif.
CIRCLE 245 ON READER CARD

Optical Reader

Model 420-3 reads cash register, adding machine, and accounting machine tapes at 7.2 ips. It can be coupled with the model 739-102 tape unit for use as an optical-to-magnetic-tape conversion system. Price starts at \$55,760, leases available. THE NATIONAL CASH REGISTER CO., Dayton, Ohio.
CIRCLE 246 ON READER CARD

Modem

A Bell 103-type, user-installable modem for tty's is available in dial originate (\$199), automatic answer (\$199), and both (\$299). Options include Touch-tone dial, acoustic coupler, and a handset. CHANNEL DATA COMMUNICATIONS, Beaverton, Ore.
CIRCLE 247 ON READER CARD

Standard Tape Transport

The 5000 series of synchronous tape drives is available in 7- and 9-track versions, with choices in speeds (12.5 to 37.5 ips), and densities (800 or 1600 bpi). In quantities of 100, the price is \$2380 for the read-after-write version. PERTEC, Los Angeles, Calif.
CIRCLE 248 ON READER CARD

Buffered Tape Transport

At the heart of the 1700 series asynchronous tape drives is an MOS memory ranging in size from 512 to 2K characters, allowing burst rate recording at rates up to 250 KC. Reel sizes can be 8½ or 10½ inches; recording densities can be 200, 556, or 800 bpi. Prices start at \$4300, single quantity. KENNEDY CO., Altadena, Calif.
CIRCLE 249 ON READER CARD

Standard Tape Transport

The 7000 series of 7-inch mtu's includes all data electronics, bring to load point logic, and tape motion control electronics. Speeds go up to 25 ips, densities to 1600 bpi, and the 7000 units can be obtained with 7- or 9-track heads. Primarily for oem's interested in building data entry or data terminal products, the 7000s are priced at \$2630 each (read/write) in quantities of 100. PERTEC, Los Angeles, Calif.
CIRCLE 250 ON READER CARD

Communications Switching

The ACAU (Automatic Calling and Answering Unit) can control from 5 to 25 communications lines unattended, normally at 300 baud rates. Higher speeds are available. A five-line model is typically priced under \$10K. TELEPROCESSING INDUSTRIES, INC., Mahwah, N.J.
CIRCLE 251 ON READER CARD

Image Sensing

A monolithic chip containing 256 individual photosensors is offered to oem's for building high resolution equipment such as ocr systems, page readers, facsimile devices, etc. The TTL-compatible RL-256 is priced at \$250 in oem quantities. RETICON CORP., Mountain View, Calif.
CIRCLE 252 ON READER CARD

Disc Pack Inspection

The PACKOMETER 16 is designed to measure the amount of warp on IBM 1316 or 2316-type disc packs before they are installed on the discs. Installations might save some grief by identifying packs that are warping in time to transfer the contents to other packs. The price is \$750. DISCHECK CORP., Indianapolis, Ind.
CIRCLE 253 ON READER CARD

Media

The CMCX is an IBM 3330-type disc pack that stores 100 megabytes on its 19 recording surfaces. There are 404 recording tracks per surface, plus 7 additional tracks for alternate locations. The CMCX is priced at \$850. CAELUS MEMORIES, INC., San Jose, Calif.
CIRCLE 254 ON READER CARD

Disc Pack Cleaner

The model 235 cleans IBM 1316- and 2316-type disc packs by scrubbing them in a filtered solution during a five-minute cycle. The unit is priced at \$2195, and the cost-per-pack cleaned is said to be .10¢/each. RANDOMEX INC., Palos Verdes, Calif.
CIRCLE 260 ON READER CARD □

Cambridge Memories is delivering more and more 360/CORE.

Why? 360/CORE is the new add-on and replacement main memory for System/360. Up to 40% less costly. Installs in less than an hour. Highly reliable, with over 100,000 operating hours. Full maintenance throughout U.S. And it comes in a variety of models, including:

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Model 40	To 448K
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CIRCLE 11 ON READER CARD

As portable data recorders go, the three you see below leave all the others behind.

Surprisingly versatile for their size, they're yours for the taking whenever and wherever there's a need to record or reproduce analog signals.

Part of the broad line of TEAC instrumentation products, which have come a long way in worldwide business and industry over the past ten years, these portable systems are now set to go places in this country.

The smallest of our get-up-and-go trio is the low-priced R-70 Series using Philips-type instrumentation cassettes.

You can select direct or FM on any one of its four channels with a flip of a switch, or add any spoken data needed. And a light

goes on to tell you when you've come to the end of your tape.

Rugged and reliable, the R-70 will operate on self-contained batteries, or on external AC or DC.

The R-200 Series Direct/FM recorder is another fine idea that you can never carry too far. In the field or laboratory, it gives you four independent record/reproduce channels, built-in calibration source, input/output level meters and a direct-drive closed-loop capstan. It performs well under mobile conditions on AC or DC and takes voice messages on one channel when desired.

It'll even follow your directions via a remote control unit. Which guarantees your always having everything well in hand.

The mightiest of our lightweights, (only 67 pounds), the

R-250 Series, is made to IRIG standards. Using an FM system, it will record and reproduce analog signals from DC to 5kHz, on its 1/2" tape.

You can take your choice of using one or more of its seven independent channels plus one edge-track voice channel.

While a bit heftier than the R-70 and R-200, it's worth its weight in dependability, whether you're on the move or not.

For additional details on these portable recorders and other TEAC systems, write or call Ken Williamson, Director of Marketing, Technical Products, TEAC Corporation of America, 7733 Telegraph Rd., Montebello, CA 90640. Telephone (213) 726-0303.

You'll see why there's a good reason to go TEAC.

Take your TEAC[®] and go.



R-250 SERIES

R-70 SERIES

R-200 SERIES

CIRCLE 28 ON READER CARD



CURRENT BATCH STATISTICS...
BATCH NAME: PAPPOL
NUMBER OF RECORDS: 0000
NUMBER OF DELETIONS: 00
NUMBER OF INSERTS: 000



**All you ever
asked for
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And then some.

In fact, quite some. The new MDS Key-Display System can be anything you want it to be.

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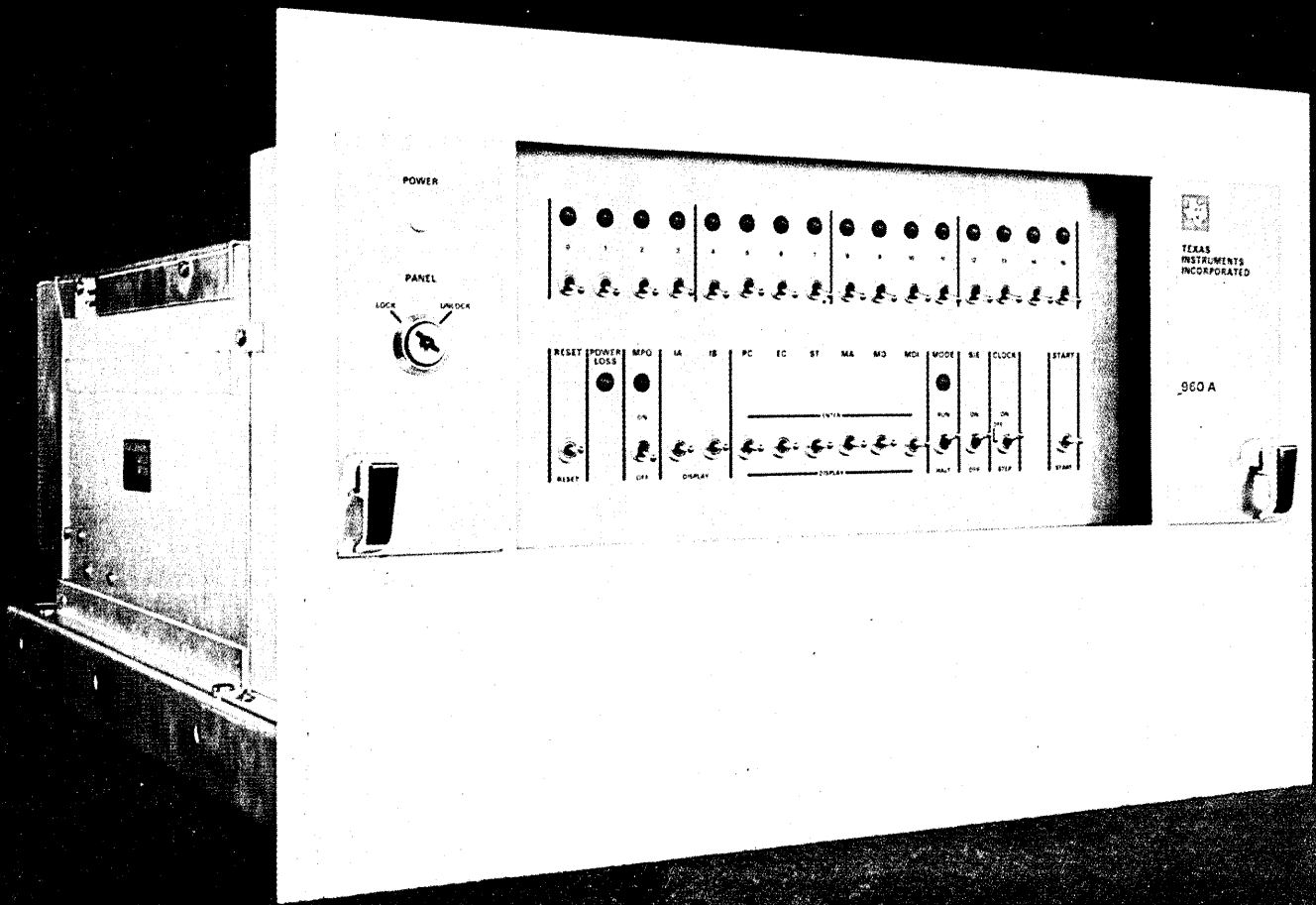
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Model 960A

\$2,850

Quantities 1 to 100

CPU with 4K memory \$2,850

CPU with 8K memory \$4,350

CPU with 16K memory \$7,350

The 960A is the newest addition to the proven family of TI computers used to solve the problems of industrial automation.

With the capability of using single bits of standard 16-bit words to perform sensing and control functions directly, and the easy-to-use "shop language" software, the 960A is especially cost effective in manufacturing automation, process control and data collection systems applications.

The basic price of the 960A includes the power supply, a Direct Memory Access (DMA) channel, automatic parity checking, and a full, lockable front panel. The new 750-nanosecond semiconductor memory is expandable to 32K in the basic chassis at \$1500 for each 4K increment. Also provided in the basic chassis is space for 512

input/output lines that are expandable to 8,192 I/O lines.

Options include hardware multiply and divide, memory write protect, power fail with auto restart, a battery pack good for two weeks of memory refresh, and a 65K memory.

Extensive software backup for the 960A includes:

- FORTRAN with extensions to permit direct I/O interfacing, to produce re-entrant code, and to allow logical operations and bit manipulations.
- General Purpose Language Translator which allows the creation of applications-oriented program languages.
- Operating systems ranging from a small batch processor to a full disc operating system with background/foreground processing.

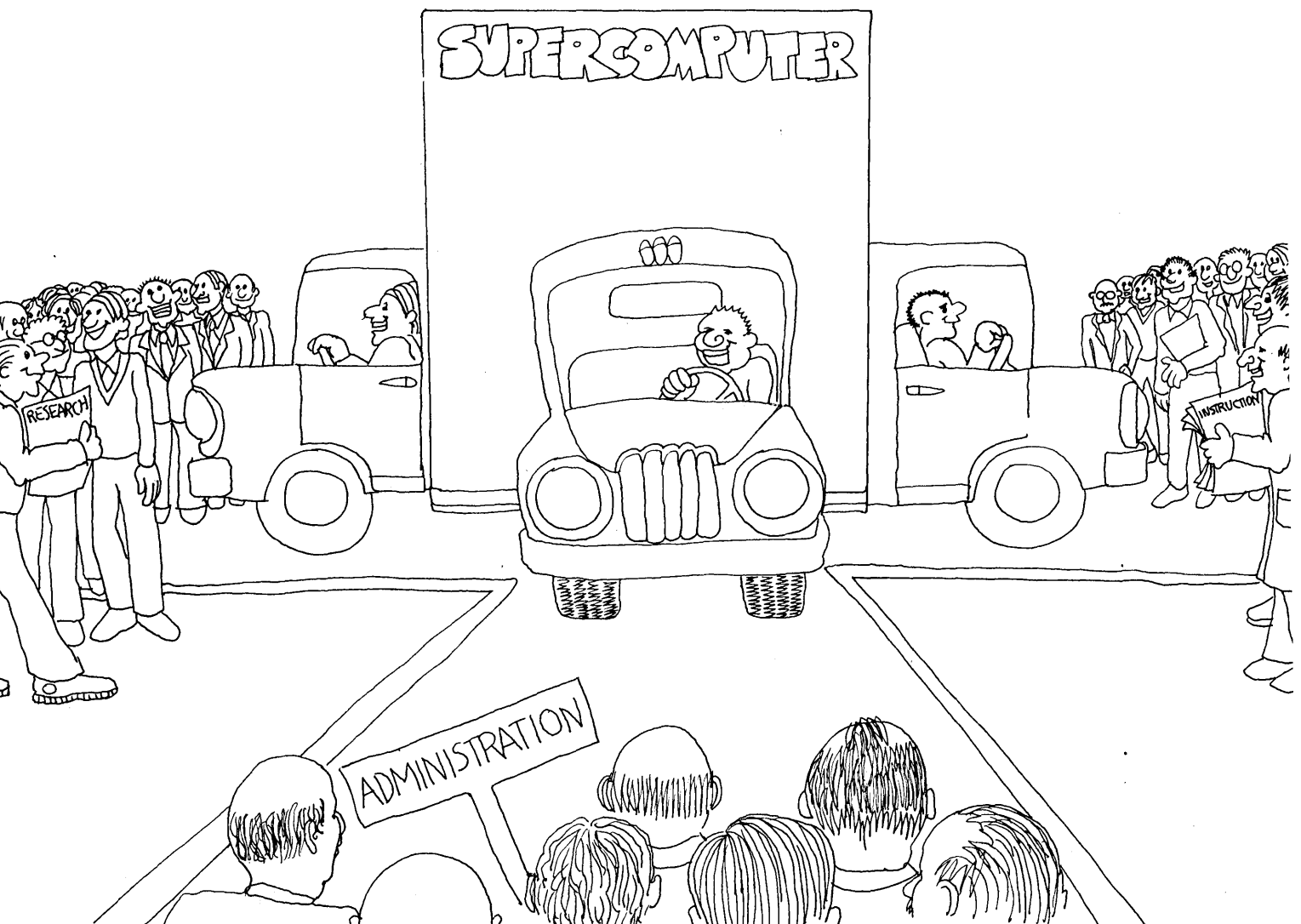
- Assemblers and Linking Relocating Loaders.
- Cross-Assemblers for large computers.
- Source maintenance, debugging and utility programs.

For applications support TI offers the resources of its experienced Applications Engineering group. Also, training courses on 960A software and hardware are scheduled regularly, and TI service facilities are located throughout the United States and abroad.

Would you like to know more about the new 960A price/performance leader? Write to Computer Products Marketing Manager, Texas Instruments Incorporated, P.O. Box 1444, Houston, Texas 77001. Or call (713) 494-5115, extension 2745.



TEXAS INSTRUMENTS
INCORPORATED



Supercomputer can go in three directions at once.

Some computers do a great job on administrative work. Others are just fine for instruction. Still others come into their own on research.

But one computer can do all three at once. In a batch mode. Timesharing. And real time. All at the same time.

Supercomputer.

Our DECsystem-10.

Supercomputer has all the power and flexibility you need to keep everybody happy.

And everybody gets their favorite languages: Interactive COBOL. FORTRAN IV. Extended BASIC. ALGOL. TECO. AID. SCHOLAR/TEACH. You name it.

A lot of schools are looking to replace two or three existing systems with a DECsystem-10. But you should take a look at one even if you don't have that many.

Because any way you slice it —

lease or buy — DECsystem-10 costs half as much as equivalent systems.

Get the literature that describes DECsystem-10 and some of the 60-plus schools that have one. It reads like a Who's Who. Write Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754. (617) 897-5111.

digital

Software & Services

Software Notes . . .

Attention all Bell Picturephone users (10?)! Pittsburgh-based Alcoa is offering a PL/1 and BAL program called APRIS that lets you use the Picturephone as a computer terminal.

What might turn out to be one of the last software patents awarded (see Nov. 1, 1971, p. 54) has been received by Dr. James Sweeney, director of Univ. of Oklahoma's computing center, for his information retrieval system called GIPSY.

Phase 2 Aid

President Nixon may not be the best friend of the data processing set with all that additional reporting he is requiring in Phase 2. To the rescue is the Personnel EDP Reporter, which can be used by both nonprogrammers and programmers and which is priced at \$5,000 for a two-year period, including source programs, installation, three days of training, instruction manuals, and life-of-lease warranty and support. The new system is based on the CULPRIT output processor and can generate information required by some aspects of Phase 2 like productivity increases and reports on the labor market, to name just two. CULLINANE CORP., Boston, Mass. For information:

CIRCLE 222 ON READER CARD

ATS/DMS Combination

Several "plug-to-plug" compatible software modules that can be added to IBM's Administrative Terminal System almost transform it into a new type of package altogether—an ATS with pretty good data management capability. The modules are Super Find and Replace, for selecting records per multiple search criteria, including conditional test using Boolean operators (which can be linked), and supplying replace, erase, count, or sum specific column capabilities (\$2500); On-Line Sort, for doing just that (\$2K); On-Line Format, for reformatting records by blanking out fields, sequencing records, moving data fields, right-justify-

ing columns, or changing from lower to upper case (\$1K); and Continuous Print, for printing multiple-page documents on continuous forms (\$500). PROPRIETARY COMPUTER SYSTEMS, INC., Van Nuys, Calif. For information:

CIRCLE 214 ON READER CARD

Accounts Payable

Actually, this A/P program, which is available in ANSI and COBOL "D" for OS and DOS 360 model 30s and up, does more than just A/P reporting. It also provides forecasting of future cash requirements, general ledger cross-referencing to accounts payable, automatic payment discounts, and posting of expenditures to specific job cost responsibility centers. The A/P portion of the package does all the common functions of input validation, file maintenance, and report preparation in one pass of the master file, and can print checks two-up and labels four-up. Requiring 55K bytes of memory, the package is priced at \$15K and can also be rented. Supplied are the source language tapes, documentation, and four man-days of installation assistance. GTE DATA SERVICES INC., Tampa, Fla. For information:

CIRCLE 220 ON READER CARD

Accounts Receivable

This A/R package contains the financial management module described in the product above, sells for the same price, and comes in the same form. It is designed to handle multiple division or company receivables accounting, and processes data by either open-item or balance-forward accounting procedures. Also featured are invoice generation, repeat invoicing, and variable heading or trailing messages on statements. A minimum of 55K of memory is required for this program, too. GTE DATA SERVICES INC., Tampa, Fla. For information:

CIRCLE 219 ON READER CARD

Computer Scheduling

Four modules comprise the Computer Scheduling and Control System for calculating long-range machine loading, daily or shift throughput optimization, and automated job and cost accounting. The program creates a work load control file from information taken from the SMF or other job logger. CSCS is available for DOS, MFT, and MVT, and requires a 70K partition. The ANSI COBOL program is supplied in ob-

ject deck form with a users' manual for approximately \$7K (but might run as high as \$12K depending on the installation), excluding installation. VALUE COMPUTING INC., Cherry Hill, N.J. For information:

CIRCLE 224 ON READER CARD

Graphics Program

This laboratory distributes a number of student-developed graphics programs, the latest of which is called SYMVU. It generates three-dimensional drawings of continuous surfaces for plotting on a crt or standard plotter. Among SYMVU's capabilities are horizontal and vertical rotation, user definition of image size, and hidden line removal. It's written in FORTRAN, runs in about 220K bytes on 360s, and is supplied in source deck form for several hundred dollars, including documentation. GRADUATE SCHOOL OF DESIGN, HARVARD UNIV., Cambridge, Mass. For information:

CIRCLE 215 ON READER CARD

1401 Sorting

There are still several hundred IBM 1401 computers left in the U.S., and the machine is popular in India, too, where this sorting package was developed. It's said to be "plug-compatible" with the IBM Sort-7 but offers run time reductions ranging from 10-30% and improved error checking features. CASH-SORT checks for correct record length, dropped or duplicate blocks, and for correct sequence between passes and at the conclusion of the sort. The 800-card deck is supplied for \$750 for the first cpu, with a 25% discount for each additional machine. Prices include supporting documentation. COMPUTER AIDS & SYSTEMS HELP, Richmond, Va. For information:

CIRCLE 216 ON READER CARD

Commo Monitor

The BI-TRAN system provides binary synchronous communications between System/360 cpu's with minimum use of core. BI-TRAN I is essentially a BTAM replacement, yet it requires only 6K, compared to 12K for BTAM. It operates under OS or DOS and can be used on a system with as little as 16K of memory. The price is \$10K for OS or DOS versions, and \$12,500 for both purchased concurrently. BI-TRAN II includes its own supervisor so that it becomes a stand-alone system. It operates in 12K of memory and

software & services

sells for \$15K. Both packages provide double buffering, verification of block numbers, deletion and subsequent reinsertion of blanks, and checkpoint/restart facilities. CYBERNETICS & SYSTEMS, INC., Louisville, Ky. For information:

CIRCLE 258 ON READER CARD

services . . .

On Contracts

This service, called the Contract Advisory Service, is another sign of the hard times our industry has experienced during the last two years. Basically, the firm offers services such as proposal analysis, standard and non-standard contract design, contract analysis, negotiation, risk evaluation, and contract review, oriented toward hardware and software products. A standard contract usually can be reviewed for \$2K—which would seem like a bargain since installations stand to lose much more than that if a contract has “holes” in it. UNICORN SYSTEMS CO., Los Angeles, Calif. For information:

CIRCLE 217 ON READER CARD

Efficiency Analysis

Users contemplating the switch from current 360 equipment to the newest offerings have available to them a service called Evaluate: 360. It consists of a three-stage study program for analysis of the current work load; recommends specific changes in equipment, software, and procedures; and then provides detailed estimates of the performance improvement that will result from these changes. While improvements in the range of 25-35% have been realized, the vendor “assures” its customers a minimum 5% performance increase. The fee for conducting the study varies from installation to installation, but general costs range from 1-2% of the customer's annual hardware budget. From four to six weeks are required for the analysis. ADL SYSTEMS, INC., Cambridge, Mass. For information:

CIRCLE 221 ON READER CARD

Financial Reporting

A financial reporting system called FIRES is available to financial officers, marketing managers, production heads, and others not necessarily familiar with dp on this firm's INFONET sys-

tem. FIRES asks the user to input such items as report title, column and row headings, and the calculations that are to be performed; and FIRES does the rest. For those not familiar with INFONET pricing, it's 50¢/cpu second, plus \$11/hour connect time. COMPUTER SCIENCES CORP., Los Angeles, Calif. For information:

CIRCLE 223 ON READER CARD

Researching Aid

The entire 75,000-item data base of current literature on educational research and practices compiled by the U.S. Office of Education's Educational Resources Information Center has been indexed and is on-line nationwide from this vendor. No knowledge of programming or computer science is said to be necessary to use SDC/ERIC, and the system reportedly makes searches for relevant items of educational literature possible that could not normally be attempted. The search is conducted in English. For large listings the researcher can have his output generated off-line and mailed to him.

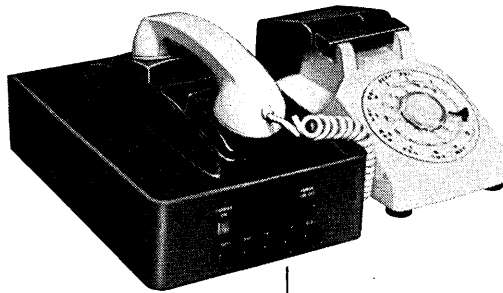
There is a minimum monthly charge of \$380 for 10 hours' use. SYSTEM DEVELOPMENT CORP., Santa Monica, Calif. For information:

CIRCLE 218 ON READER CARD

AUTO ANSWER

Omnitec couplers answer the need for unattended terminal operations

Let the Omnitec model 703A acoustic couplers with fully automatic answer capability handle your data transmission. Now you can have 24 hour terminal to computer communications without the need for an attendant. This unique unit not only answers the telephone automatically, but also determines that it is a data call, turns on the terminal, establishes communications and releases the line after transmission.



The Omnitec model 703A combines the best in operating features — Originate, answer and auto-answer operating modes • fully automatic • data rates in excess of 300 Baud

(30 cps ASC11) high sensitivity: greater than -40 dBm in acoustic mode
• simultaneous TTY and EIA (RS232) terminal outputs • half-duplex and full-duplex operation (switchable)
• acoustic or hard wire (DAA) line coupling.

CIRCLE 39 ON READER CARD

For complete technical information on the model 703A or any of the Omnitec acoustic couplers use this publication's reader service card or phone or write directly to Omnitec, Phoenix, Arizona.



OMNITEC
CORPORATION

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Phoenix, Arizona 85004
Telephone (602) 258-8246

Bell & Howell & Kiss the Girls Good-bye

Sorry. But cute as they are, key punch girls are a thing of the past. You don't need them anymore. Thanks (or no, depending on how you look at it) to MDR. The Mark Document Reader.

It's a remarkable machine.

What it does, as we said, is knock out the need for key punching. It reads simple pencil marks. Nothing fancy, and anybody can make it work. (Incidentally, it also reads pre-print and key punch. But the nice thing about it is it's set up to be simple.)

Reads tab cards (standard, long or short), snap sets or page formats.

Has over 200 combinations of character speeds, bit rates and languages.

With several interfaces. It's compatible with incremental recorders, modems, etc.

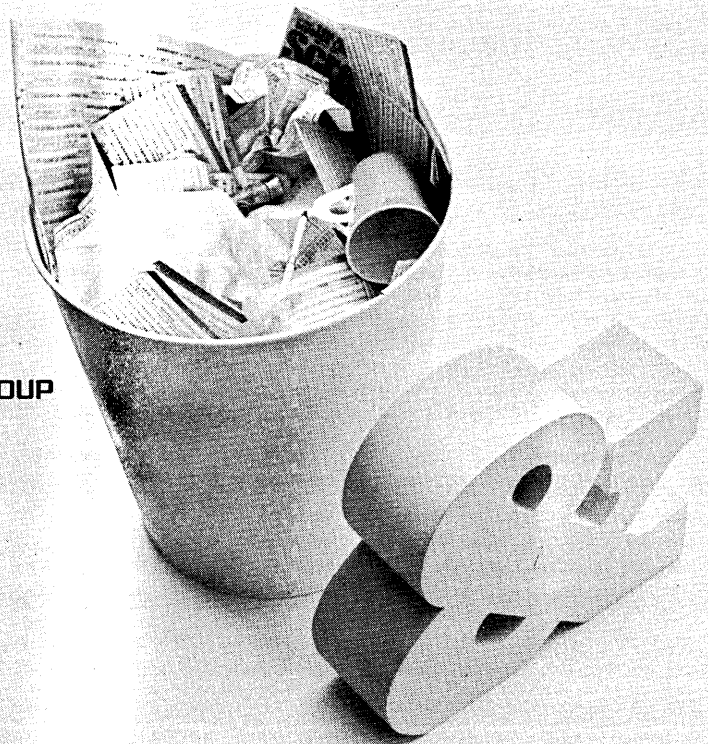
That's the hardware. But there's more. We've got a nationwide installation and service group. And a forms expert that designs the most efficient form for the job. So a customer gets on stream right away. No fussing around with expensive trial and error. All part of the package.

Sorry girls, but this is also a remarkable machine. MDR. Only from Bell & Howell. Electronics & Instruments Group, 360 Sierra Madre Villa, Pasadena, California 91109.

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Effective data systems have communications built in.
Not built on.

Since most computers are linked to other computers through the telephone network, and send and receive data that way, it makes sense to involve telephone people early in the planning of your system.

And it can save you time and money.

Because a Bell System data specialist knows the latest developments in data communications, he'll assist in selecting the communications services that will enable your system to work most effectively.

So when you first begin to make new data plans, call your local Bell Company Communications Consultant.

He'll come to talk with you.

And it won't cost you a cent.

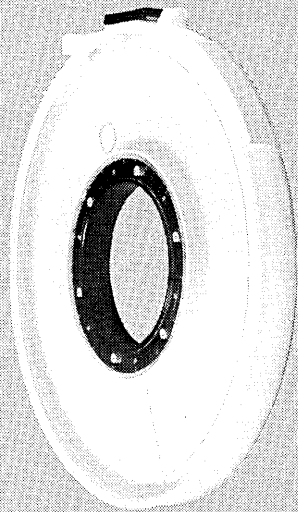
The American Telephone and Telegraph Company and your local Bell Company are continually looking for new ways to improve their service.

This time, by helping you plan your data communications.

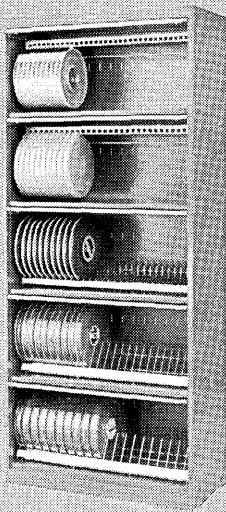


Tab has 700 ways to make your computer work better

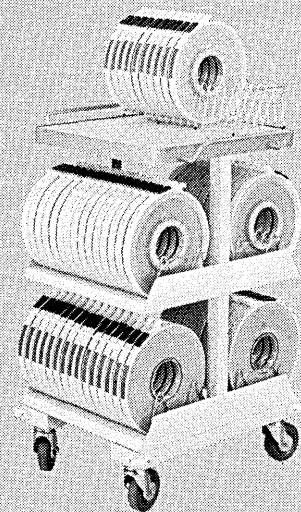
Here are some for Tape



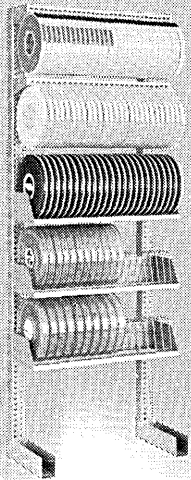
Tab Super Seal features molded-in hook, polypropelene plastic throughout. Get full tape protection, plus a lifetime far longer than ordinary seals.



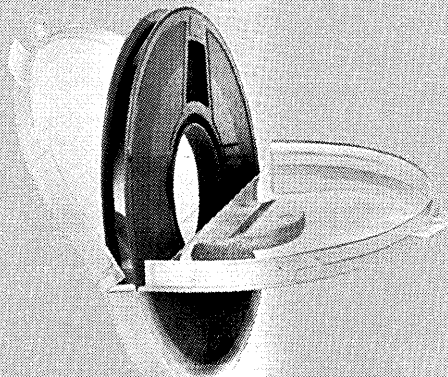
Two, three and five high Tab Data Media Cabinets provide safe, enclosed storage for tape. For security, individual or gang locks are offered.



A full line of compact, lightweight tape trucks that can handle up to 60 reels. Choice of reel rack inserts fits most reel containers. Highly maneuverable, turns around in 30" aisles.



Unit Spacefinder tape storage offers the most flexible system you can use. Post and rack construction lets you tailor system to your space. Great for cards and disks, too.



Exclusive Tab Reelgard one-piece construction assures positive protection for tapes, even if you use open aperture reels. And you get all this at the price of seals.

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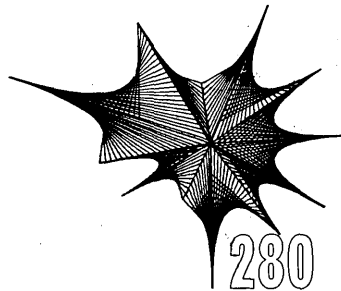
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CIRCLE 41 ON READER CARD

Literature

Computer Art

"Computer art combines the rare qualities of logic, precision, and human value," says a booklet containing samples of such art, which can be ordered



mounted, matted and ready for hanging. The booklet is complete with price list, drawing specifications, and order form. COMPUTRA, Upland, Ind. For copy:

CIRCLE 200 ON READER CARD

Sometimes Grim

Communications-oriented readers will have little difficulty recognizing the true identity of the major character of "A (sometimes) Grim Fairy Tale." It's dubbed "The Acme Power & Utility Company" and, in the beginning of the

story, it's the only company in "a far-away land" with the right to provide electric power. It had a subsidiary, Eastern Appliance Co., whose wares Acme rented to subjects of the land for "a high tribute." It all works out well in the end as things should in fairy tales. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. For copy: CIRCLE 201 ON READER CARD

Play and Plan

It looks something like a toy catalog, but it's a brochure describing kits available to office and computer room planners which include quarter-inch scale models of equipment. Four kits are available for IBM 360 and 370 installations. Also available are scale models for Burroughs, CDC, Honeywell, Univac, and NCR equipment. VISUAL INDUSTRIAL PRODUCTS, INC., Indianola, Pa. For copy:

CIRCLE 202 ON READER CARD

Optical Reader

Twelve-page "general description" brochure details features, operating modes, and specifications for vendor's OCR-71 optical reader. Photos and

diagrams are included. OPTICAL RECOGNITION SYSTEMS, INC., Reston, Va. For copy:

CIRCLE 203 ON READER CARD

INQUIRE Summarized

Technical summary describes capabilities of INQUIRE, a general purpose data management system, describing it as a system which "allows the user with no training in computer programming to interface directly with his information using the terminology of his application and provides the designer a means to rapidly implement effective application systems for the user while keeping the costs of implementation to a minimum." INFODATA SYSTEMS INC., Arlington Va. For copy:

CIRCLE 204 ON READER CARD

Data Entry Concept

Twelve-page, two-color brochure delineates vendor's KeyProcessing Systems concept of data entry in terms of what it means to those individuals who earn their livelihood in the field of data entry. It outlines procedural benefits available to operators, supervisors and edp managers. COMPUTER MACHINERY CORP., Los Angeles, Calif. For copy:

CIRCLE 205 ON READER CARD

Communications Systems

A batch-oriented communications system designed to be the link between a central cpu site and remote data terminals is described in a four-page brochure. POTTER INSTRUMENT CO., INC., Melville, N.Y. For copy:

CIRCLE 206 ON READER CARD

Systems Development

"The Systems Man's Role in Systems Development," a paper presented at the November 1971 Founders Conference of the Association of Computer Programmers and Analysts, defines the interacting roles of systems people, top management, and user management in the development of information systems. BARNETT DATA SYSTEMS, Rockville, Md. For copy:

CIRCLE 207 ON READER CARD

Memory Products

Short form catalog of cores, stacks and core memory systems covers: cores from 14 mil to 30 mil with switching speeds of 100 to 360 nanoseconds; stacks of both planer and folded types in sizes beginning at 4K x 18 with 2D/2 wire, 3D/3 wire, and 2½D/3 wire organizations; and memory systems ranging from minicomputer size

New TP-1375 MicroDek system eliminates paper tape

Under \$1500 complete.
For program development,
disc storage backup,
system loading,
high speed communications
data transmission.
Stores up to 256,000 12-bit words on
heavy duty 4-track cartridge.
For all PDP-8 family computers.
Immediate delivery.

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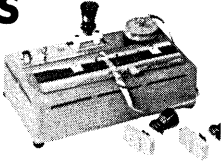
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—all computer accessories**

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The best tape splicer you can buy. Splices paper, Mylar, metallized and aluminum base tapes. Handles any level punched tape, chad or chadless quickly, safely and permanently without the loss of a single code.



reels/winding equipment



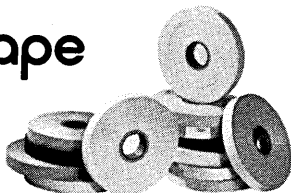
The widest variety of NAB-NARTB aluminum and plastic reels. Full, half and split reels and accessories in most sizes. A full line of winders and rewinders with variable speed controls. Optional foot controls also available.

editing punches



Features low-cost, simple editing of 5, 6, 7, and 8-level tapes and edge punched cards.

tape



A wide variety of one-inch control tape in rope, Mylar, metallized and foil tapes in continuous lengths of 1,000, 1,200, and 1,800 feet. Write for data sheet listing full specifications and prices.

- SPECIAL REELS • CONTAINERS
- SPECIAL HUBS & ADAPTERS

Shipments within 48 hours or less.
Write or call for a free brochure



computer accessories

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literature

to large core stores. DATA PRODUCTS CORP., Woodland Hills, Calif.
For copy:

CIRCLE 208 ON READER CARD

Educational Directory

"Directory of Educational Programs in Information Science, 1971/1972," the first edition of a proposed annual series, lists 91 graduate-level academic programs that include education in information science in the U.S. and Canada for the academic year 1971-72. It has four indexes for multi-access: educational institutions by state and province; degrees offered; information science courses offered; and faculty members interested in information science. Copies are available at \$4.50 to members of the American Society for Information Science and \$5 for nonmembers. Prepayment is required. AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1140 Connecticut Ave., N.W., Washington, D.C. 20036.

Remote Batch Processing

Four-page brochure, "System CP—4B, the Key to Remote Batch Processing," indicates basic and standard remote batch terminal configurations and includes a description of the standard features incorporated in each system. DATA COMPUTER SYSTEMS, INC., Santa Ana, Calif. For copy:

CIRCLE 209 ON READER CARD

Time-Share Plotter

A graphic plotter for time-share terminals is the subject of a two-page illustrated bulletin which describes its features, available software, system specifications and controls. GOULD INC., Cleveland, Ohio. For copy:

CIRCLE 210 ON READER CARD

Quarter-Century View

Lovely to look at but tough to store, the Association for Computing Machinery's "ACM 71—A Quarter-Century View," packages 25 years of computing history in a 18 x 10-inch container. For \$11.50 the container holds an elegantly bound historical survey by Saul Rosen, complete with tasseled bookmark and newspaper reprints of early day computer developments. Another \$2.25 adds a 17 x 35-inch wall chart titled "A Progress of Computation," with pictures of early computational machines, starting with the abacus, and the men who made and used them. ACM, 1133 Avenue of the Americas, New York, N.Y. 10036. □



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Dataman is a time and money saving service by and for EDP specialists. Dataman provides software that can increase your productivity and reduce your work load. Typical Dataman products can help you write and document programs; maintain and modify general purpose files; develop financial record keeping systems; and manage casualty insurance records. Dataman has also developed SYM/BOL, a symbolic COBOL generator language, that lets the computer take care of time consuming writing detail; and Dataman has PSM (Program-Source-Maintenance) that protects your company against loss of valuable program decks.

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DATAMATION

COMPUTERIZED TYPOGRAPHY? New Dimensions in Computer Science

Computerized typographic composition? Yes!
This new book tells you how—

COMPUTER COMPOSITION

Using PAGE-1

By JOHN PIERSON, RCA Graphic Systems

Computer Composition describes the revolutionary utilization of computers in composition and typesetting. The author details the language of the supporting PAGE-1 programming system, and applies it to *real* book composition problems. 1972 *In Press*

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Edited by ALFONSO F. CARDENAS, University of California, Los Angeles, LEON PRESSER, University of California, Santa Barbara, and MIGUEL A. MARIN, McGill University

Computer science has long needed a comprehensive overview of its significant developments. Here is a current guide to the whole spectrum of the science: from hardware to applications. In addition to the editors, Arnold E. Amstutz, Donald F. Calhoun, Chin Tung, Jean-Loup Baer, and Leonard Kleinrock are some of the contributors who have helped make *Computer Science* a valuable self-study and reference book for your professional library.

1972 126 illus. 560 pages \$19.95

the ideal language for the non-specialist—

PROGRAMMING TIME-SHARED

COMPUTERS IN BASIC

By EUGENE H. BARNETT, TRW Systems, Inc.

"...BASIC is an ideal language, for not only does it provide most of the capabilities available on more sophisticated computer systems, but it is also very easy to learn."

—from the Preface
1972 *In Press*

"...an extraordinarily good job..."

—Data Processing

A PROGRAMMING LANGUAGE

By KENNETH E. IVERSON, International Business Machines Corporation, Thomas J. Watson Research Center

Every worker in computer science utilizes algorithms which have been designed to calculate specific function values. In *A Programming Language*, Dr. Iverson demonstrates that optimal analysis depends on the *adequacy* of its programming language. The author first develops an entire language, detailing *all* of its elements. Applications follow: microprogramming, search techniques, metaprograms, sorting, and utilization in theoretical work.

1962 illus. 286 pages \$11.95

SYSTEM/360 JOB CONTROL LANGUAGE

By GARY DEWARD BROWN, The RAND Corporation

"Job Control Language causes more complaints from . . . users and results in more unsuccessful runs than any other single source of trouble.

"This book, read carefully and followed meticulously, should reduce the size and frequency of user problems with JCL."—*Computerworld* 1970 292 pages \$7.95

"... provides a thorough understanding of commercial real-time systems and the judgments involved in their design..."—Data Systems

GUIDE TO THE DESIGN OF REAL-TIME SYSTEMS

By MICHAEL F. ROTHSTEIN, Senior Systems Analyst, Data Dimensions, Inc.

"... permits the experienced designer to be certain he has considered all facets of a subject at any time, and enables the beginner to learn the design process as he encounters it."—*Data Processing Magazine*

1970 82 illus. 243 pages \$10.95

DIGITAL DESIGN

By R. K. RICHARDS, Consulting Engineer

Here is an up-to-date compendium of the design techniques and the network forms which are most adaptable to integrated circuits. Material previously available *only* in technical journals and conference proceedings has been integrated into the major discussions, which cover Boolean notation, component minimization procedures, error-control methods, and arithmetic implementation methods.

1971 illus. 577 pages \$22.50

"... presents the fundamentals of computer programming in as clear and simple a manner as suits the subject."—*Computing Reviews*

A GUIDE TO COBOL PROGRAMMING

Second Edition

By DANIEL D. McCracken, McCracken Associates, Inc. and UMBERTO GARBASSI, Esso Mathematics and Systems, Inc.

All of the topics essential to COBOL are completely explained within the framework of realistic applications.

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more than "equivalent to"

the CDS-340 magnetic tape transport

200 ips tape speed, bi-directional. Dual density. 7 or 9 track. 320K bytes/second, transfer rate. 45 second rewind time . . .

These are the basic specifications for a high performance tape transport, and right now there are several manufacturers that meet them. But, as an OEM, you probably need a tape transport that *more than just meets the specs*. That's why we've designed one for you and your customers that's a little better in a lot of ways.

For example, our CDS 340 includes such features as: Digitally-controlled single capstan drive. Loop-position sensing by multiple vacuum switches. High speed in-column rewind under capstan control. Electrically-operated reel/hubs. Automatic load. Fixed air-bearing surfaces. Write pre-emphasis. Precise read equalization. Modular construction. Industry-standard tape path geometry.

Of course there are other tape transports that offer some of these features, but only Century Data offers them all. That's why our CDS 340 is more than "just equivalent to . . .".

 **Century Data** SYSTEMS, INC.

1270 North Kraemer Blvd., Anaheim, California 92806 (714) 632-7111
A subsidiary of California Computer Products, Inc.

People

ED McCOLLISTER isn't retiring after all.

The former RCA edp marketing executive had decided he would quietly drop out of the industry after he and his team got shoved aside by Donegan and his band of ex-IBMers two years ago. But a couple of days after RCA slit its throat, McCollister got together with some of his old buddies at Burroughs, and they offered him a job.

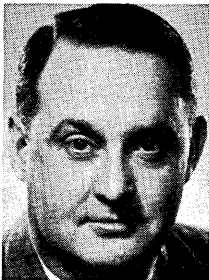
He accepted, although he doesn't yet know exactly what his title or duties will be. He doesn't care. Impressed by "the friendly feeling there," he'll serve, he figures, as "sort of a high-level helper-outer," probably in both domestic and international matters.

McCollister started his career at IBM in 1949, made an incredibly courageous leap to teensy ElectroData in 1955 where he served as marketing manager before and after its acquisition by Burroughs in 1956. When Burroughs sought to pull the ElectroData operation into Detroit, McCollister fled to Univac, where he headed up marketing briefly during the short, tempestuous Lou Rader regime.

Moving to RCA in 1961, he rose to vp of operations but helped convince the late Art Malcarney that Jim Bradburn (his old boss at ElectroData) was better qualified to run the show, and he went back to marketing.

Despite less than enthusiastic corporate support, he developed RCA computer sales from \$14 million in 1960 to \$237 million in 1969 . . . a growth rate of 35% per year, compounded. Despite this record, he gave way to Donegan—whom he had hired—in 1970.

Now he's back at Burroughs. Where probably they'll appreciate him. Both McCollister and the Burroughs' boss Ray McDonald, are famous for their ability to squeeze a nickel.

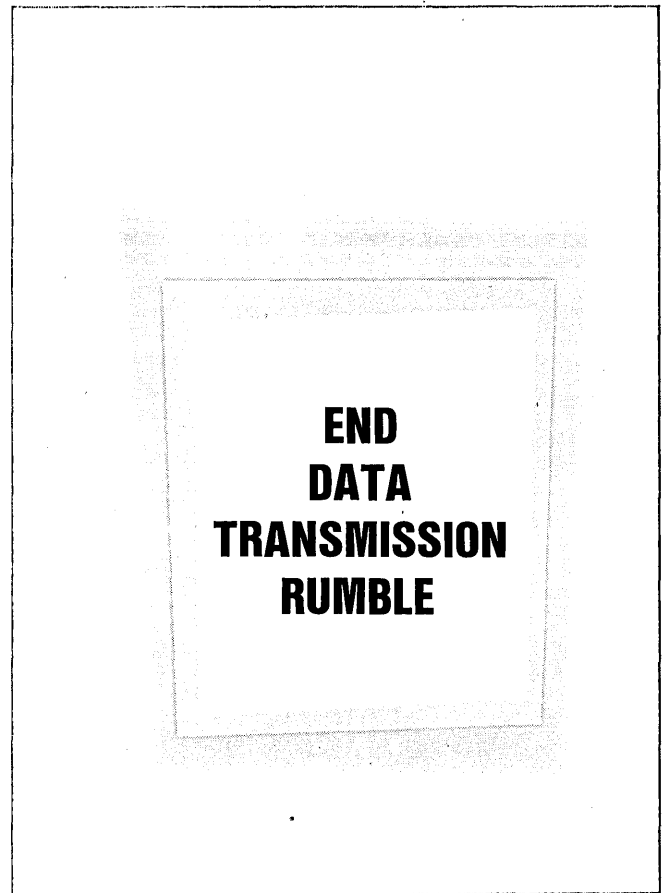


Ed McCollister

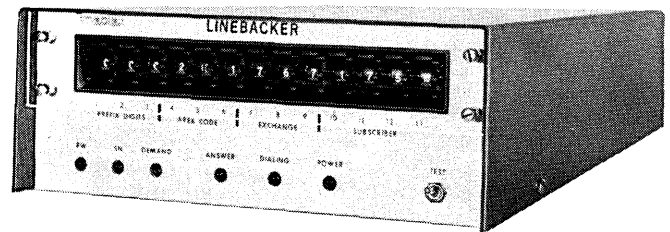
Approximately ten years after stepping into the top executive spot at Ampex, Inc., citing reasons of health, WILLIAM E. ROBERTS has resigned as president and chief executive officer, to be succeeded by ARTHUR H. HAUSMAN, former exec vp. Roberts, one time Bell & Howell vp, joined Ampex in

financially bleak 1961, the same year they acquired Telemeter Magnetics, Inc., manufacturer of core memories, which was to become the burgeoning Computer Products Div. He will continue as chairman of the board.

DR. MELVIN E. SALVESON, newly appointed president of newly established Pacific Div. of Decision Sciences Corp. in Los Angeles and father of that boon to man, Master Charge, is about to announce the birth of a new system called Data/Image Processing. Replacing what Dr. Salvesson dubs "two-stream data processing"—in which one element consists of the computer operation, the other the physical handling of the original document—will be a "one-stream" process whereby the image of the original document will be consolidated into the computer record. "The resultant simplification and cost reduction will bring about a wave of data processing growth larger than the original wave in



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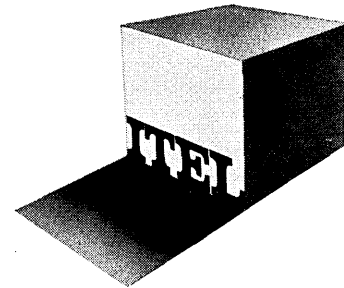
For instance, ITEL's Monolithic Main Memory Extensions, available for both the IBM/360 and 370, are of fourth-generation technology at significant cost savings over IBM prices. (This exceptional add-on is manufactured to our specifications by Advanced Memory Systems, Inc., Sunnyvale California.)

Similarly, the ITEL 7330 disk drive subsystem is plug-to-plug compatible with IBM's 3330 on all IBM System/370's and is actually a whole new level of high-density disk capability, in terms of both speed and capacity. Built by ITEL/Information Storage Systems, it uses standard 3336 disk packs and has 800-million-byte capacity per subsystem.

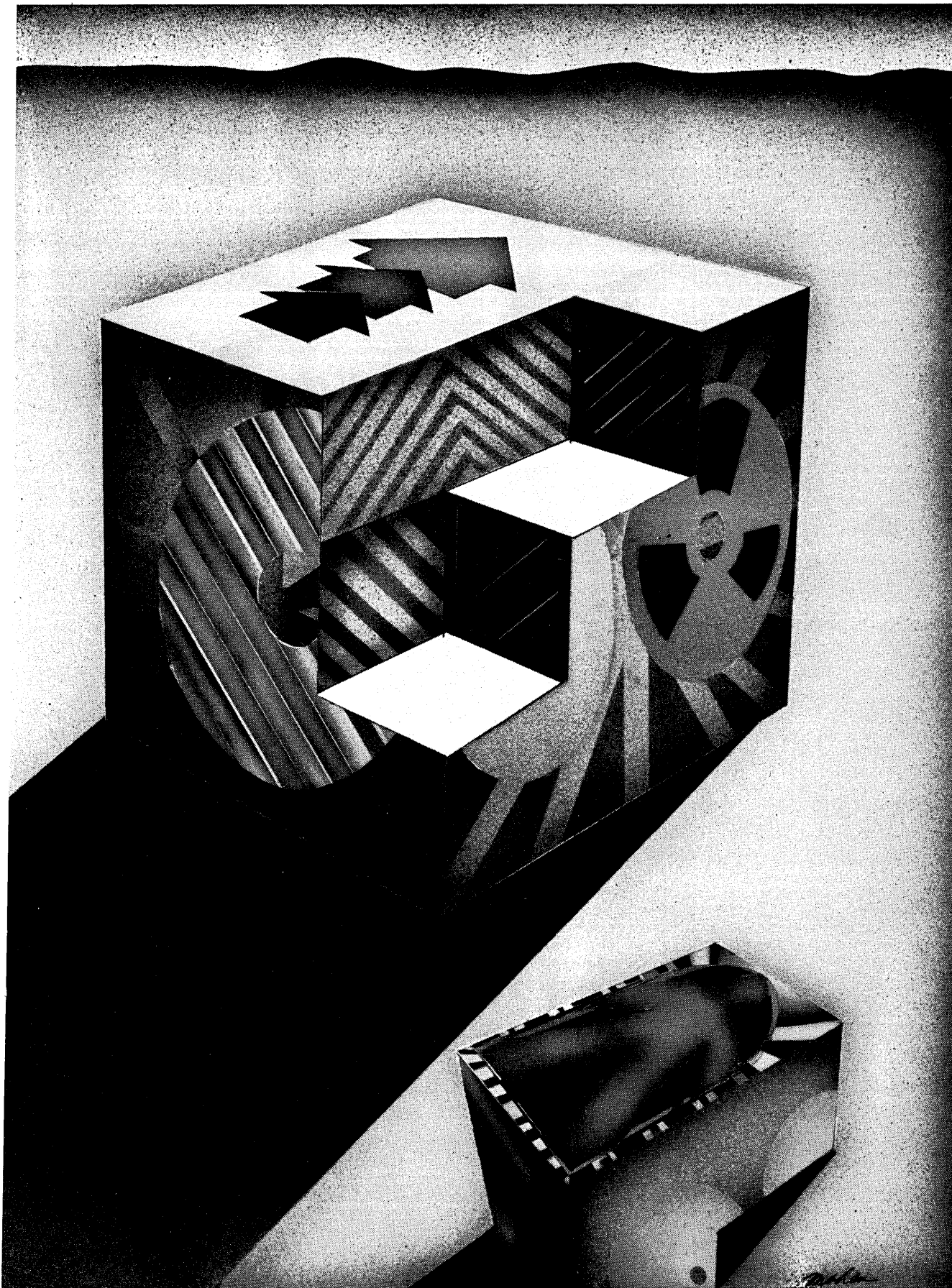
But what about service? ITEL has it. Economically, from a nationwide, on-call staff. A trained, qualified organization, skilled in servicing everything from IBM mainframes to add-on memories, disk drives, and other peripherals.

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Cybermatics got its expertise building on-line systems for giants like ITT and Western Union. You cash in on this experience when you buy a Tin Can system. And because it's a stock item, we can demonstrate one for you right now. Phone 201-871-1300.

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2. Tin Can hardware is Digital Equipment Corporation's PDP 11 series of mini-computers, with all the peripherals you could need and Cybermatics' Real-Time Executive Operating System.

3. The basic Tin Can systems handle 64 circuits. Deluxe models up to 300.
4. The basic model switches messages (for example) at 2,500 characters per second.

5. We know of no common carrier service or terminal arrangement that Tin Can systems can't work with. They interface with public and private networks and handle all transmission languages, at whatever speed they're spoken.

Tin Can

Cybermatics' software/hardware package.

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people

1951," says Salveson.

In addition to his credit system innovations, Dr. Salveson has been manager of operations research at GE in Louisville, Ky., and New York, founder and president of the Institute of Management Sciences, and his articles have appeared in Fortune and Banking Magazine.

Despite economic clouds of grey, witness the astronomical rise of On-Line Systems, Inc. JOHN T. GODFREY, who founded the company four years ago, has just been made chairman of the board and chief executive officer, while JACK ROSEMAN, who joined the firm as exec vp in 1970, has been elected president. While other time-sharing firms have been crying the blues, On-Line brought in revenues of \$2.4 million in '71, almost double the '70 figure, and hoisted their net income per share from \$.49 to \$.60.

His company out of Chapter XI, DICK BRANDON is sounding like the loveable, hateful Brandon of old. At a recent marathon (two days, but it seemed forever) debate with archenemy CHARLES P. LECHT, Brandon tried to explain his position on technology, of which he feels there is too much.

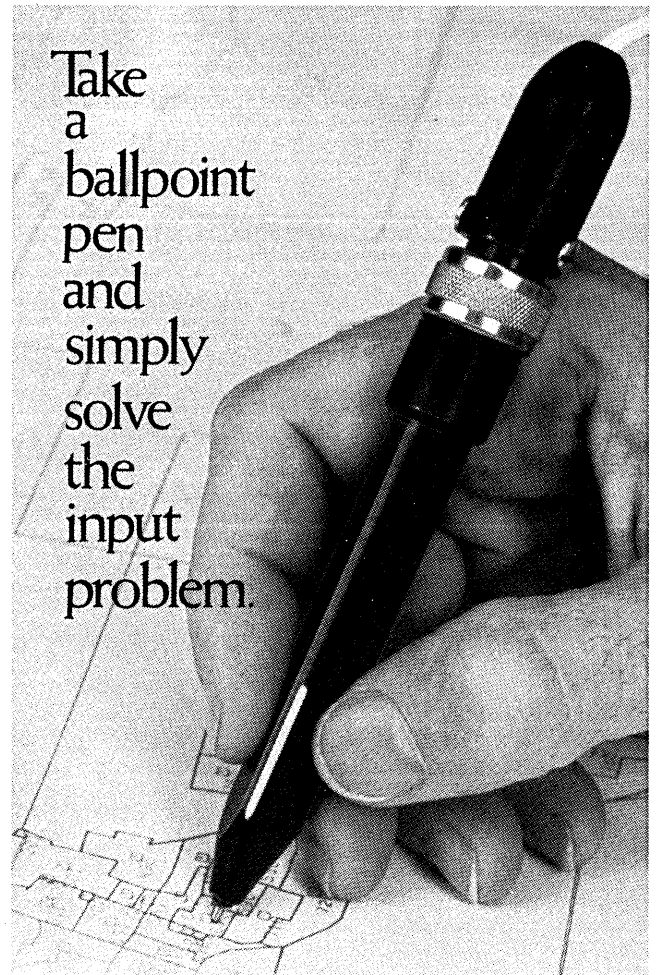
"I want to be remembered as the Margaret Sanger of the computer industry," he said. Pointing out that Margaret warned of overpopulation and plugged for birth control half a century ago, Brandon struggled to illustrate the parallel.

"I want to castrate the manufacturers," he said.

WALTER W. DURHAM has been named corporate manager-facilities by University Computing Co. and will continue to serve as president of UCC Venture Corp., the company's MESBIC (Minority Enterprise Small Business Investment Co.) subsidiary. Durham founded and was first president of Minority Business Advisors of Dallas, a volunteer organization of young businessmen who contributed more than 2,000 hours of free consulting time to Dallas minority businessmen in 1969-70. He also sits on the boards of five corporations, two of which are minority-community owned . . . One-time Omnitec president, HARVEY M. ROSS, has been appointed president of Automata Corp., Richland, Wash. . . . DR. LOUIS A. RONDINELLI, exec vp of Technology Service Corp., will serve also as president and chief executive officer of Decision Services, Inc., a newly formed subsidiary of TSI . . . RICHARD E. KAYLOR is president of Informatics' new Computing Technology Co., River Edge, N.J., a recent off-shoot of Informatics, Inc., Canoga Park, Calif. . . . Former IBM special-purpose software expert, JAMES J. BAKER, moves up to vp at Cullinane Corp., Boston . . . Joining the new Computer Products Div. of Computer Dynamics Corp., Cherry Hill, as vp and general manager, is WALTER L. HALL, former eastern regional sales manager for Data Products Corp. . . . WILLIAM K. GOOLISHIAN and ALAN M. HORLICK have been appointed exec vp and vp, respectively, at Syner-Data Inc., Beverly, Mass. . . . California Computer Products, Inc., has announced that its European subsidiary managers will now report to BRIAN HIGGINS, managing director of CalComp, Ltd., U.K., in order to centralize sales and support services in Europe. □

January, 1972

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pen
and
simply
solve
the
input
problem.



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letters

becomes zero due to real-world observations (not just mistakes in the data or the program), the most logical quotient that can possibly be reached has consistently been zero.

However, I have been shown other cases where X divided by zero "should" result in X . Perhaps the true problem lies in the existence of the "equals" sign. Personally, I believe the "equations" $X \div 0 = 0$ and $X \div 0 = X$ are both false. But that doesn't mean that " $X \div 0$ " has no value as a monadic expression.

Many people may say this represents a game of word play. But it would indeed be convenient if some standard could be reached in the computer industry to define the expression $X \div 0$ either one way or the other. I would like to see the results of a well-planned survey to determine the majority opinion on whether ($X \div 0$) is, (not "equal to"), but is either zero or X , assuming, of course, that the respondents are willing to admit the existence of such an expression.

I conclude by hoping that the fallacy in the fallacy is not an *impradox*. (That's one I introduce to describe a concept that is contradictory but inherently meaningful, yet still has no practical application.)

KEN WINTERS
Dallas, Texas

A thousand flowers

Sir:

In "On the ABM" (The Forum, Sept. 1, p. 79), Boris Beizer promotes the "scarecrow" theory of the ABM through sophisticated, intensely political arguments. All technical problems are related to hardware, and the attempt is made to hide the real technical problem, that of software. The ABM software requirement is orders of magnitude more complicated than anything which has ever been done successfully.

Dr. Beizer would deny us the right to discuss technical problems relating to the ABM. He would allow only political discussions along lines that he himself has laid out. In doing this, Dr. Beizer is asking us to play the communist game in communist style. This is censorship; it is brainwashing; and it is totally anti-American. Let a thousand diverse opinions be expressed.

Is Beizer a DOD employee?

W. J. K. HARRINGTON
Trenton, New Jersey

Dr. Beizer replies: I am not now nor have I ever been a member of the Communist Party and/or the Dept. of Defense and/or their affiliated front organizations. Like Mr. Harrington, I consider any form of censorship un-American. However, freedom of speech is not

a license for irresponsibility. If there are substantive technical (rather than political) arguments against the ABM, they should not be presented to the general public for arbitration, for that public is in no position to judge technical questions.

I think that those (computer scientists) who believe such software cannot be made to work should be prepared to prove their point. Let a study be conducted along the lines of the ORSA study, allowing both opponents and proponents to contribute, both having access to the same material. If the results of such a study would be to prove that the software cannot work, then it would have an impact upon mankind that far transcends the momentary question of the ABM. It would show the existence of fundamental human limitation regarding the complexity of that which we are able to construct. It would probably be the most important philosophical result of the century, if not the millenium.

Terminal case

Sir:

Your survey on batch terminals (Sept. 1, p. 22) contained errors in the descriptions of our equipment. Any interested readers please contact us for the correct data.

NEIL J. WEBER

Badger Meter, Inc.
150 East Standard Avenue
Richmond, California 94804

Algorithms and architecture

Sir:

I wish to add several comments to Dr. C. E. Cohn's article, "Speed Tests,

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RCA

letters

Costs, and Word Length" (Oct. 15, p. 26).

By using a single FORTRAN program, Dr. Cohn implies that 12-, 16-, and 18-bit word length computers are less cost effective than 24-bit length ones. I don't think the article can be regarded as complete and conclusive simply by utilizing a single testing program, coded in a higher level language such as FORTRAN, and by excluding computers which have bit patterns greater than 24 per word.

Although the FORTRAN timing test program on p. 29 appears to test all the main logic and arithmetic capabilities of each computer, the timings reported are somewhat clouded in that the program also tested indirectly the effectiveness of each *algorithm* utilized to execute each FORTRAN statement and each FORTRAN function (both intrinsic and basic external) in the equivalent machine language object program.

Although the test program appears to be written in standardized ANSI FORTRAN, the algorithms utilized to decode and execute the various FORTRAN statements and functions are not standardized in FORTRAN, let alone in the computing and information processing field. The algorithms for performing

specific tasks such as dimensioning, DO-loop control, computing the sine, exponential, log, etc., vary not only between computer manufacturers but also between various computer models from the same manufacturer.

If the test program had been coded in the actual machine or assembly language of each computer utilizing the same algorithms for the respective functions, and if computers processing more than 24 bits per word were tested, the results would be far more conclusive than reported.

Obviously, this procedure would entail additional time and expense, but at least the results would measure more effectively the cost-effective word length characteristics as attempted in the article. Furthermore, the question of whether an "optimum" is present, let alone if the "optimum" exists, would be settled by this procedure.

JOHN MANIOTES
Hammond, Indiana

Dr. Cohn replies: It is true that a given FORTRAN operation may be implemented by different algorithms for different computers. However, if we assume that the various FORTRAN systems tested were all developed by skilled programmers, we may take for granted that the particular algorithm used on a given machine is the one that is best suited to that machine's architecture. In some cases, of course, the choice of algorithm is constrained by the degree of compiler sophistication that the machine can accommodate. A poor algorithm thus implies a suboptimal

architecture. The use of FORTRAN for testing then provides a valid indication of the overall power of a computer for a particular task—that of compiling and running FORTRAN. In addition, as I pointed out in the article, it also provides an indication of the power of the computer for other tasks.

It would certainly be desirable to have test data on word lengths greater than 24 bits, but I do not see how these would have any possible bearing on the relative merit of 24-bit and shorter word lengths, which was the primary theme of my article.

Oui and non-FORTRAN

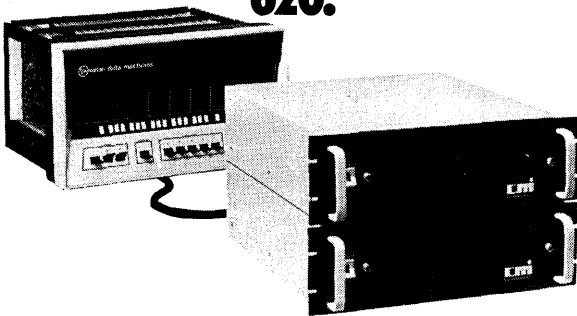
Sir:

I read Dr. Charles E. Cohn's article with interest. Unfortunately, his analysis fails in a basic premise. It is true, as Dr. Cohn states, that "the results do not merely reflect some peculiarity of compiler generated code, because most of the time for each operation is spent executing hand-coded library subroutines." However, it is not true that all "hand-coded library subroutines" equally optimize machine utilization. Thus the analysis includes a second independent variable, software efficiency, and the validity of the conclusions is highly questionable.

ROBERT C. NICKERSON
Salinas, California

Dr. Cohn replies: My comments on Dr. Maniotes' letter also apply here. In particular, there is no reason to believe that the system programmers for the 24-bit machines were more skilled than their counterparts associated with the shorter word machines. My refer-

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ence to "hand-coded subroutines" was meant only to reinforce my argument that speed tests using FORTRAN are indicative of computer performance on non-FORTRAN tasks.

Chile reception

Sir:

Robert J. Robinson (Nov. 15 Forum, p. 152) seems all too anxious to nationalize one of our industries. Does he perhaps come from a nation south of here? Could it be that only the stockholders of AT&T must be satisfied of the Picturephone's need and desirability during the R&D phase? In any event, the public market place will pass the final judgment. Is Mr. Robinson an AT&T stockholder as I am? I would bet not.

The need for a particular product is most difficult to establish prior to its development. Gaining acceptance by the public which it serves is a more equitable way of testing a product than prior determination by a federal investigation as Mr. Robinson advocates. Doesn't the federal government do enough for you already, Mr. Robinson? In an earlier era I am sure Mr. Robinson would have asked "Who needs telephones?"

One of Mr. Robinson's requests was that the FCC examine the social costs of Picturephones. Has he considered that at long last the deaf can have long-

distance communications through lip reading? Clearly the deaf need Picturephones. Now that I have answered Mr. Robinson's question of "who needs Picturephones," would he answer a question for me? "Who needs Robert J. Robinson?"

JIMMIE H. SMITH
Austin, Texas

More on man/machine

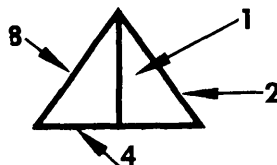
Sir:

Re Mr. Altshuler's letter in the July 1 issue (p. 15) concerning an alphanumeric font facilitating use of mechanical readers:

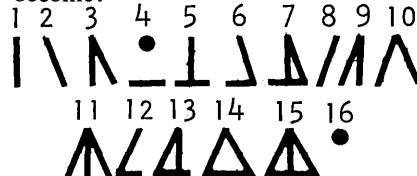
We strongly endorse the adoption of a font which will minimize the complexity of readers. The Epps system described by Mr. Altshuler looks good.

However, we would suggest that the font for the digits be adapted for direct binary reading—the Epps system does not provide this. Direct binary reading would permit both input and output from computers without resort to encoding matrices.

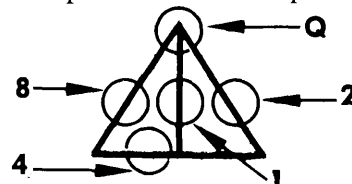
We have at times suggested such a font:



The suggested font suggests further the discard of our decimal numbering system and the adoption of a base-16 numbering system, the digits of which become:

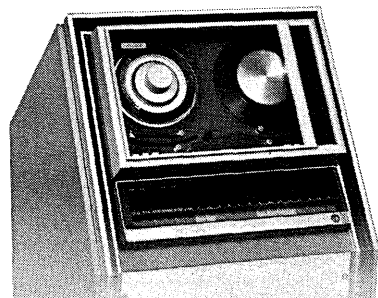


Such a digit may be read by a matrix of four photocells. Five are preferred.



Images of a string of digits to be read are moved from left to right across the photocell matrix. When the Q cell is darkened, the other cells are interrogated and those which are darkened set the corresponding binary lines. This "Assembler Digit" requires no encoder for either input or output. It has been built and used in an instrumentation system. Operating personnel reported no trouble in learning to read it visually.

R. O. WHITAKER
Rowco Engineering Co.
Indianapolis, Indiana



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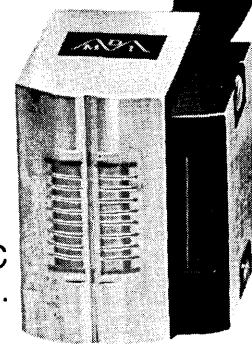
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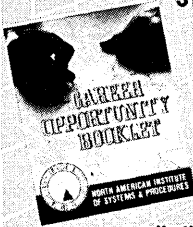
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CIRCLE 24 ON READER CARD

ALPHA-BITS

A is for Algol, divided in three parts
B is for Burroughs (as everyone departs).

C is for card, as in punch and in reader
D is for data, the party breeder.

E is for END, where programs are stopped
F is for flips, which sometimes get flopped.

G is for GO TO, a useful command
H is for Hollerith, the code of the land.

I is for Imperious Big Mother (you guessed?)
J is for JOVIAL, SDC's jest.

K is for keypunching, column by column
L is for logic (but let's not get solemn).

M is for memory (is Hope full of thanks?)
N is for numbers, hopefully in its banks.

O is for other (example is Honeywell)
P is for programmer (alive, making money, well).

Q is for queue (which may seem redundant)
R's for RETURN (happy ones are abundant).

S is for systems, which all need analysis
T is for tapes which cause their paralysis.

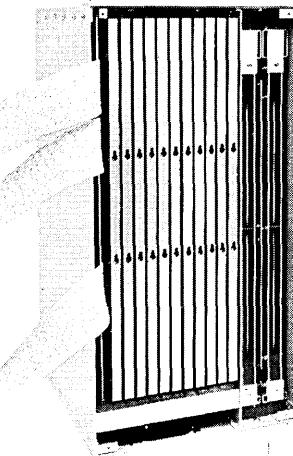
U is for Univac, CDC's cross-town rival
V is for variables (used to set IVAL).

W is for write-rings (this poem is improving)
X is for Xerox (with SDS, grooving).

Y is for yes-path (the no-path much worse is)
Z is for zero—which clears out these verses.

—EDMUND CONTI

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CIRCLE 21 ON READER CARD

Books

Vocabulary for Information Processing

(American National Standard) ANSI X3-12-1970
by the American National Standards Institute, New York.
128 pages. \$6.

Sometime in the last six months, this new glossary of computer terms came across my desk and then laid there in a queue until I got around to it. I needn't have bothered.

In my consulting business, I frequently have need for an authoritative source of computer words and concepts which I can cite in my technical reports and publications. Further, from time to time I work with very senior managers who are unfamiliar with our computer jargon. I need a document to leave with them so they can understand the contracts and proposals they must approve from time to time. I have written several tutorial glossaries of my own since the readily available published material is written to an audience that is too highly inbred or is obsolescent, lacking current terms of use in sales literature and technical presentations indigenous to our highly dynamic field. I had hoped that the new ANSI Vocabulary would fill this gap and allow me to assist my clients without having to stop to define the words for them.

In the front of the new ANSI glossary, it states that this glossary is a revision of their previous 1966 Standard. Measured from when IBM announced the S/360 computer family, the 1966 glossary was two years into the third generation. The current glossary is six years into the third generation; it still lacks a definition for microcode (or is that microcode) or a decent definition for read-only storage (ROS see fixed storage) which alludes to the fact that a computer can have a primitive order list available only to the maintenance engineers and the software designers while presenting a formal instruction set to the compiler writers and machine aficionados.

Along the same line, interpreter is defined as a computer program which translates and executes a source statement, but the definition ignores the fact that IBM and RCA built interpreters into the hardware some six years prior to the time this glossary was published.

I didn't really expect them to define modern terms such as cross-assembler or parochial terms such as symbiont, but I guess I did expect them to cover either swapping or paging, seeking (as on a disc) and compatibility (the theme of the third generation). It seems to me this 128-page paperback is in fact a *revision* of the 1966 words

and concepts and hence primarily aimed at historians reviewing the second generation of American computers.

The committee was made up of Americans from big and little industries and has some influence from the International Organization for Standardization Technical Committee 97/subcommittee 1. As far as I can tell, the document is a convoy approach to words and glossaries—we have selected the least common denominator and standardized on it. There is nothing in this plabum of words that will offend, lead, direct, or clarify. For the Talmudic scholars lodged in our colleges and universities, these 128 pages will allow them to debate precise meanings of obsolescent concepts. As far as helping the current practitioner in the field, the professor, or the student, this document offers very little.

In addition to the poor content, the administrative arrangements are not spectacular. After writing for a copy in late June, I borrowed a copy 30 days later as my first request did not promote action. The copy I borrowed carries the statement: "No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher." In addition to violating the letter of the copyright (by copying the copyright statement), I wish to observe that this is patently ludicrous. The purpose of a



Vocabulary is to promote the use of the standard words and terms. In following the literal interpretation of the copyright statement, a professor must obtain permission before including a definition in his course notes or I must obtain permission before including definitions in my client reports. I would like to reassure those at BEMA who produced this tome that they needn't worry about my citing it in any form.

—Robert L. Patrick

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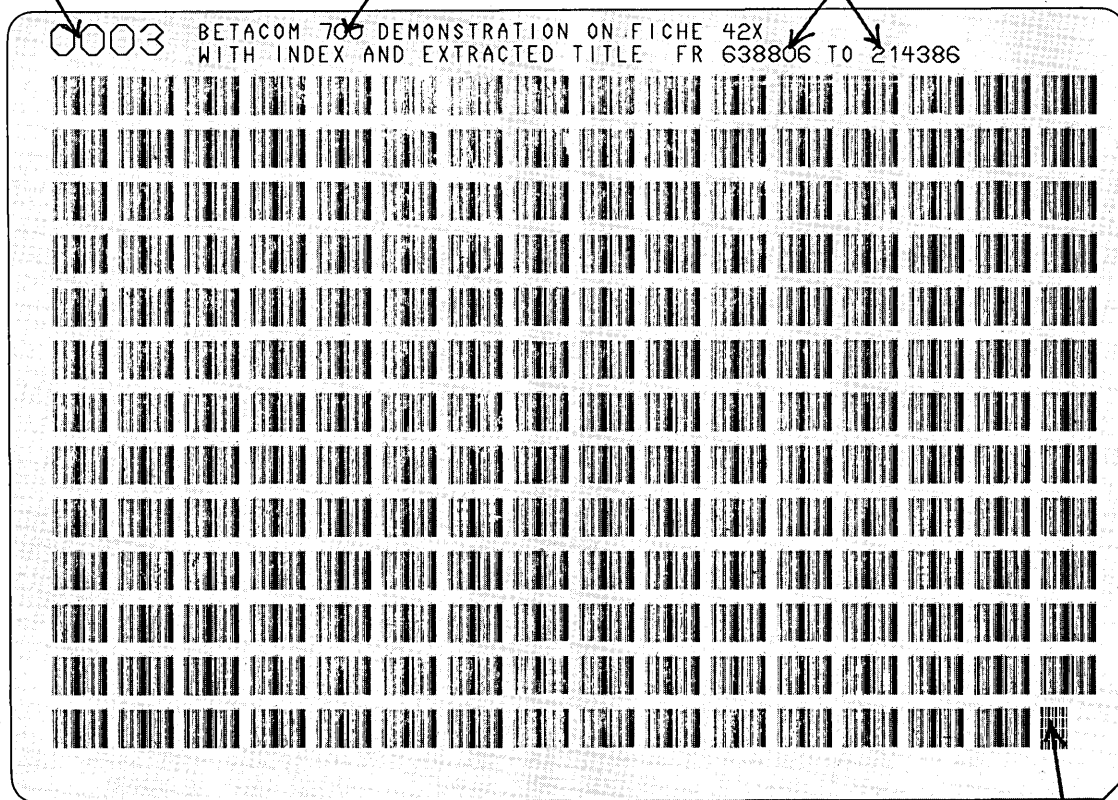
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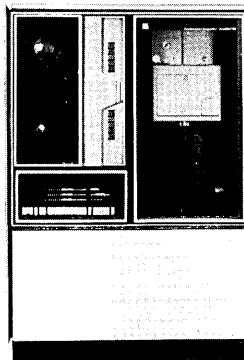
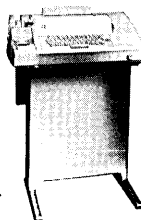


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DATAMATION

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The Forum

Exit-Without Flourishes

On Friday, Sept. 17, 1971, RCA announced that it was taking a \$250 million write-off and quitting the computer business. The strategy of emulating IBM in product and in marketing organization had failed; the sales volume did not cover the overhead. Okay, a company is entitled to cut off a loser, but the manner of the exit was so graceless that the long-term effects on RCA are rather dubious. Lots of people were hurt, and maybe some of them could have been spared; and the data processing industry was smeared to its customers and to the financial community. So here is a note of protest and a loud Bronx cheer for RCA.

On the first day of trading after the announcement, RCA stock went up \$5. Maybe the financial community was merely pleased to see old rumors confirmed. Let us all hope that this stock movement did not signal a general vote of censure for the whole computer industry.

... a snap decision, like switching the prime-time schedules on NBC.

If so, everyone but IBM is in trouble. Investment capital will be harder to find and more expensive than ever before.

The stock jump has its irony. Mr. Sarnoff, Mr. Donegan, and the other key executives who guided the RCA computer operation to its failure—as well as Mr. Conrad, who reportedly pulled the plug—are all presumably holders of RCA stock and/or stock options. Oh well, losing generals are often retired with high honors.

A few years ago, all kinds of companies were trying to improve their price/earnings ratios by announcing that they were getting into the computer business in one way or another. Now foolish excess seems to go in the opposite direction. Maybe the president of the Goody Candy Bar Company can add a few points to his company's stock by announcing that plans to enter the mainframe computer business have been abandoned.

But the stock movement is no joke. We can only hope that it reflects the feeling of the financial community that RCA, as an individual company, is better off out of the business. But this idea can be turned around; maybe the data processing industry is better off without RCA.

RCA's performance has not exactly been a model for the Harvard Business School. Over many months, RCA built up a computer operation suited to a sales volume that never arrived. And there are hints of incompetent accounting practices within the computer department. When the halt was finally called, it was seemingly a snap decision—like switching the prime-time schedules on NBC. It should be noted that if RCA's exit was not a snap decision, then the top executives of the company were explicitly deceitful in giving assurances to employees and to customers of their commitment to the computer business.

With a \$250 million write-off involved and some

11,000 people already laid off, there seems to be no evidence of calm reflection and consideration of alternatives. Could the computer department have been quietly scaled down and saved as a break-even operation? Could the department have been put into a holding pattern until a buyer was found? We will never know.

The contrast with GE is dramatic. GE sold a going concern at a negotiated price. Their transaction with Honeywell was rather like a merger, and redundant personnel were released over a relatively long period of time. RCA took its medicine in public all at once. People were fired in wholesale lots in the weeks following Sept. 17, and the going-concern value of the computer department was quickly eroded. RCA's negotiating position in the sale of the rental base could not have been strong.

This RCA record of mismanagement may hang over the company for years to come. Nearly all football fans will annually watch the Rose Bowl on NBC, and only a very few people will avoid buying RCA television sets

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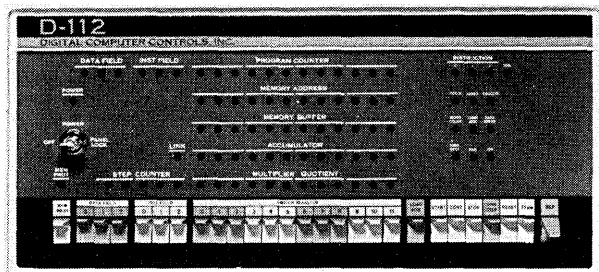
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the forum

as a protest. But it is certainly possible that some potential customers of technical products will choose alternative equipment whenever possible, and if the day ever comes again when engineers have multiple job offers, they might not want to work for RCA—especially the bright and inventive types who work in advanced technology applications. In the near term, the financial community may expect additional detail about the operations of each department within the company.

The computer industry clearly needs more profitable companies and an improved reputation for good management. So good riddance, RCA. But what chaos is left behind.

Certainly many people are grievously hurt. DP personnel were recruited by RCA during the year and right up to the middle of September; others were transferred to new cities. Homes were sold and new ones bought; children were enrolled in new schools; wives were faced with new neighborhoods; old friends

RCA employees, RCA suppliers and RCA customers were all raped.

and business connections were left behind. For these uprooted folk, the announcement of Sept. 17 must have been a special kind of shock.

There were also people who counted on selling to the RCA computer department, who built assembly lines and hired people and borrowed money, and who were suddenly left in the air—perhaps with their personal fortunes in hock.

And how about the RCA customers who bought equipment in the few months before September? These brave few were trying to save money for their companies. Why not? RCA provided the same gear, unbundled service, a 15% discount, and a "lasting commitment" to the computer business. Most of these spirited executives who signed recent orders with RCA have impaired careers; no doubt, a few of these people have prepared interesting resumes.

RCA employees, RCA suppliers, and RCA customers were all raped. The effects on the data processing industry are only slightly more subtle. IBM reduced the price of its peripheral equipment this spring, and RCA left the computer business at the end of the summer. IBM will surely want to avoid a repetition of this sequence of events. Considering IBM's position vis-à-vis the antitrust laws and the impaired credibility of competition, IBM's price umbrella will probably be raised one notch. This means that the general price levels in the industry will be higher than they might have been without the RCA exit. The industry emphatically does not need higher price levels while attempting to sell the expanded use of data processing techniques.

But of course the credibility of IBM's competition is the time bomb left behind by RCA.

The non-IBM manufacturers will operate under a great handicap. They will have to narrow their product lines, pick their marketing targets with great care, avoid copying IBM, and make steady profits.

But it will be a long time before the cloud of RCA's fast exit disappears. If the non-IBM salesman had it tough before, imagine his current problems. Who wants to be an NCR (XDS, Burroughs, Honeywell, . . .) salesman assuring a prospective customer that his company is in the computer business to stay?

—Louis B. Marienthal
Contributing Editor

DATAMATION

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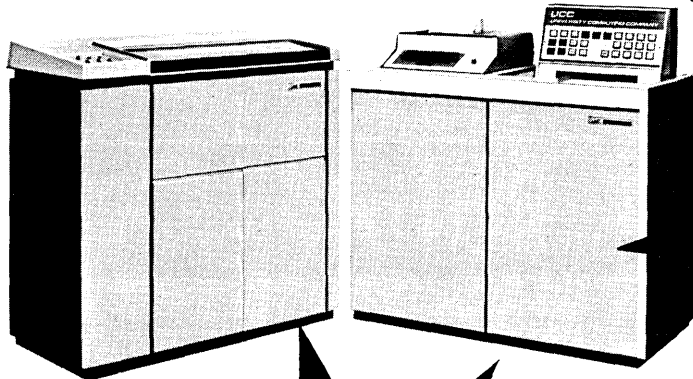
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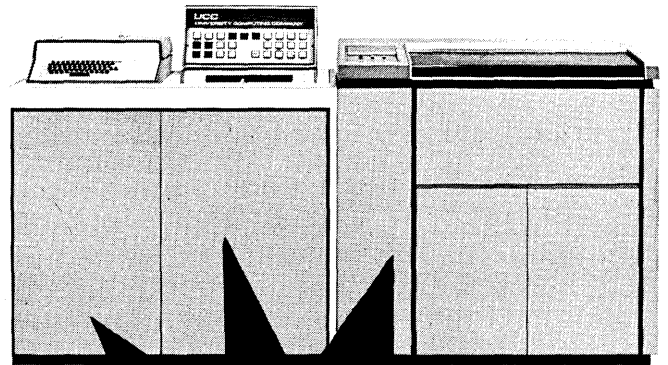
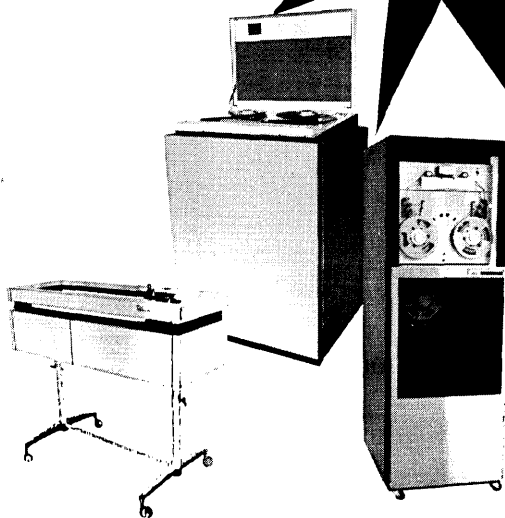
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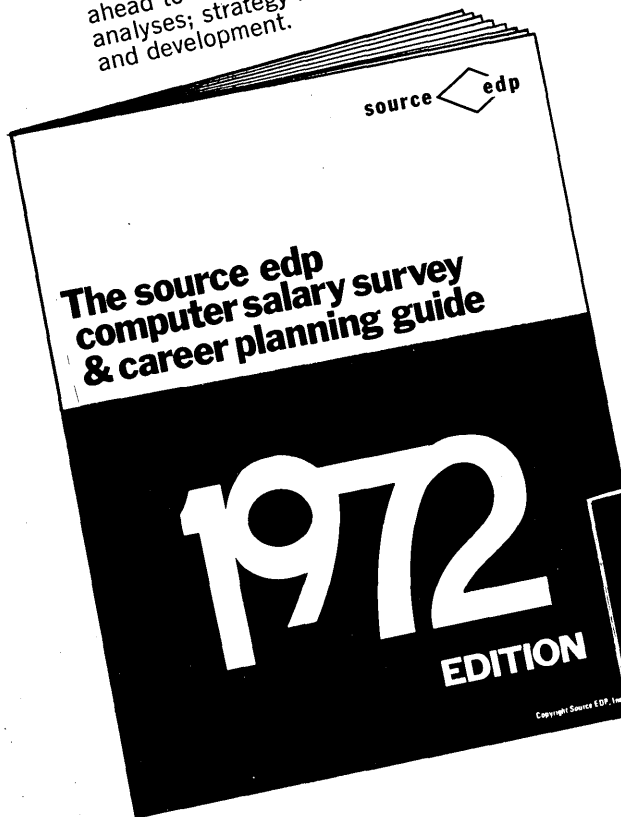
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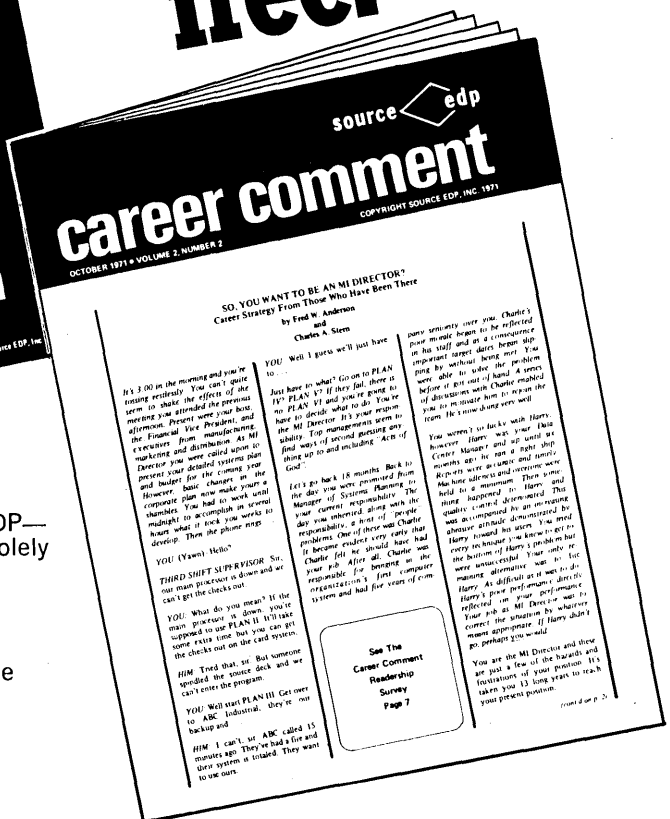
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SO YOU WANT TO BE AN MI DIRECTOR? Career Strategy From Those Who Have Been There

by Fred W. Anderson
and
Charles A. Stern

It's 2:00 in the morning and you're reading editorial. You can't quite seem to shake the effect of the meeting you attended the previous afternoon. Present were your boss, the Financial Vice President, and executives from manufacturing, marketing and distribution. As MI Director you were called upon to present your detailed systems plan and budget for the coming year. However, basic changes in the corporate plan now make your plan obsolete. You had to work until midnight to accomplish in seven days what it took you weeks to develop. Then the phone rings.

YOU: (Yawn) Hello?

THIRD SHIFT SUPERVISOR: Sir, our main processor is down and we can't get the checks out.

YOU: What do you mean? If the main processor is down, you're supposed to use PLAN II. It'll take some extra time but you can get the checks out on the end system.

HM: Fred, that's all. But someone specified the source deck and we can't enter the program.

YOU: Well, start PLAN III. Get over to ABC Industrial; they're our backup.

HM: I can't, sir. ABC called 15 minutes ago. They've had a fire and their system is in total. They want to use ours.

YOU: Well, I guess we'll just have to...

Just here to what? Go on to PLAN IV? PLAN V? If there isn't there is no PLAN VI and you're going to have to decide what to do. Thank the MI Director for your resignation. Top management seems to find ways of second guessing any thing you do and including "Act of God".

Let's go back 18 months. Back to the day you were promoted from Manager of Systems Planning to your current responsibility. The day you celebrated along with the responsible chief of there and Charlie. It became another very early day that Charlie felt he should have had your job. After all, Charlie was responsible for bringing in the organization's first computer system and had four years of com-

pany seniority over you. Charlie's name should have been reflected on his staff and in a consequence important respect dates began slipping by without being met. You were able to solve the problem before it got out of hand. A series of discussions with Charlie enabled you to reassign him to review the system the following year.

You weren't so lucky with Harry. However, Harry was your first Chief Analyst and up until 18 months ago he ran a tight ship. He had been a sales and marketing man in a previous position. Then you had him assigned to Harry and Harry started deteriorating. This was accompanied by an increasing number of errors in the work. You tried to advise Harry's problems but Harry insisted you know him better. You tried to advise Harry's problems but Harry insisted you know him better. You tried to advise Harry's problems but Harry insisted you know him better.

Harry. At different times it was to correct the situation the whatever moment appropriate if Harry didn't go, perhaps you would.

You are the MI Director and there are just a few of the hands and the frustration of your position. It's taken you 13 long years to reach your present position.

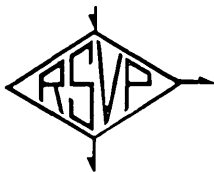
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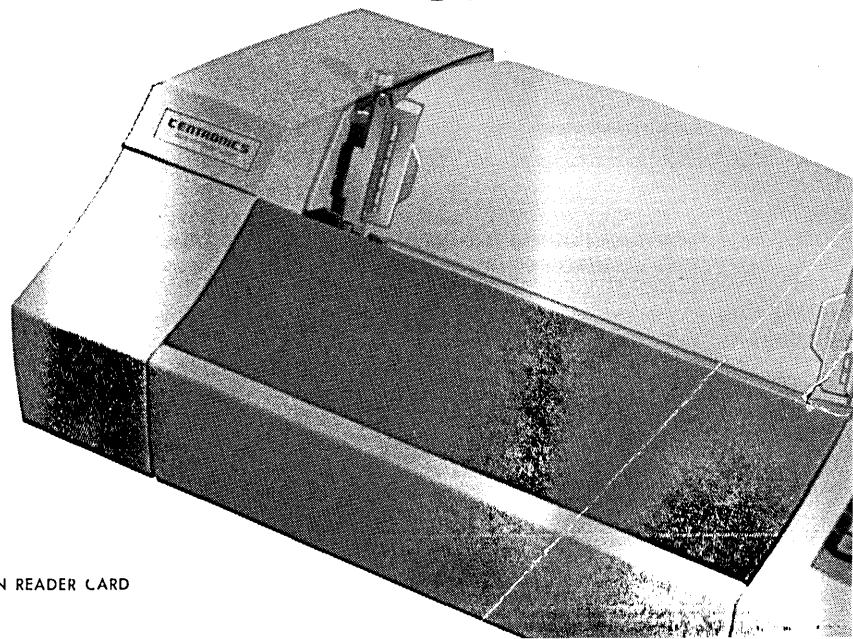
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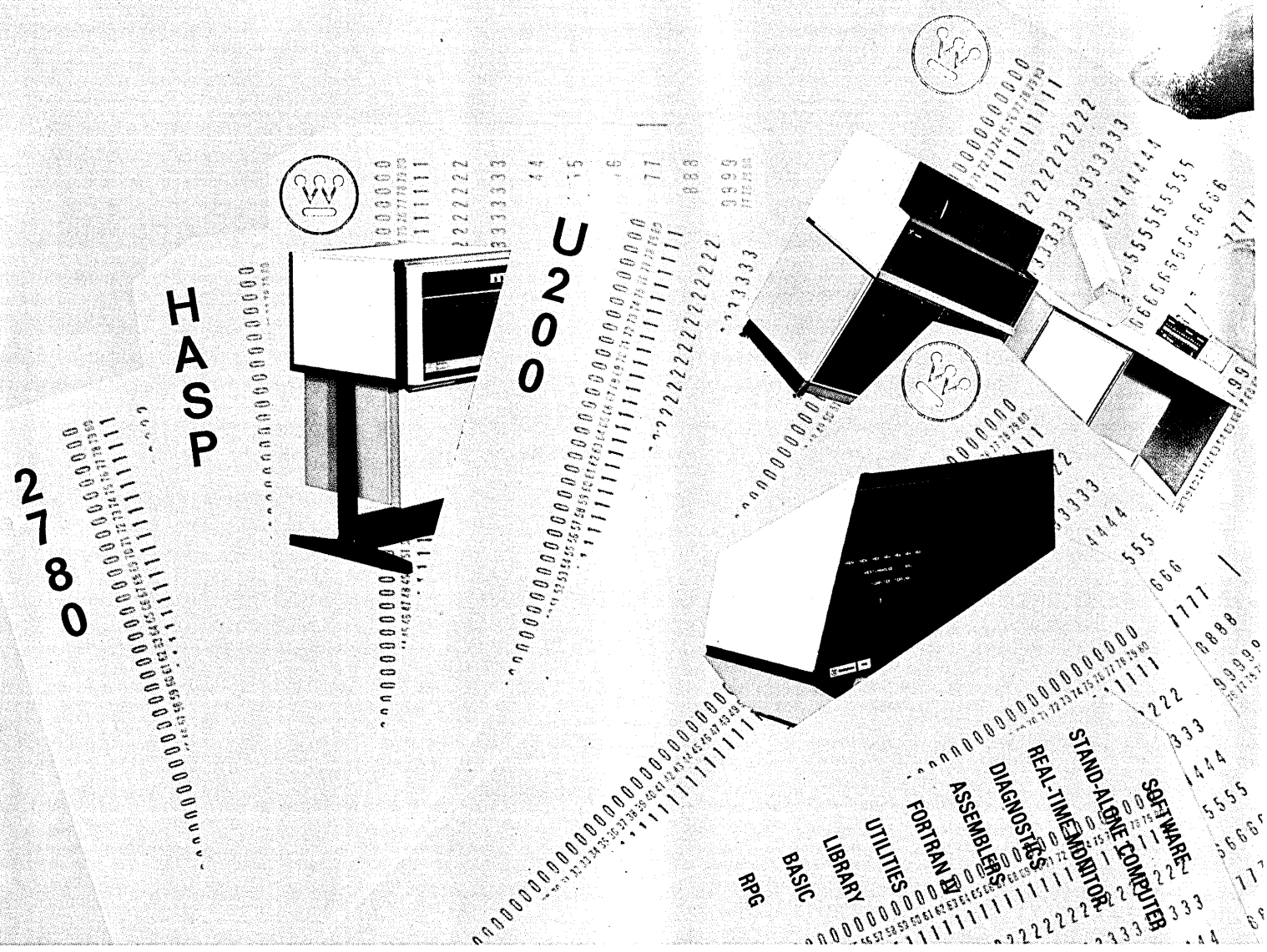
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