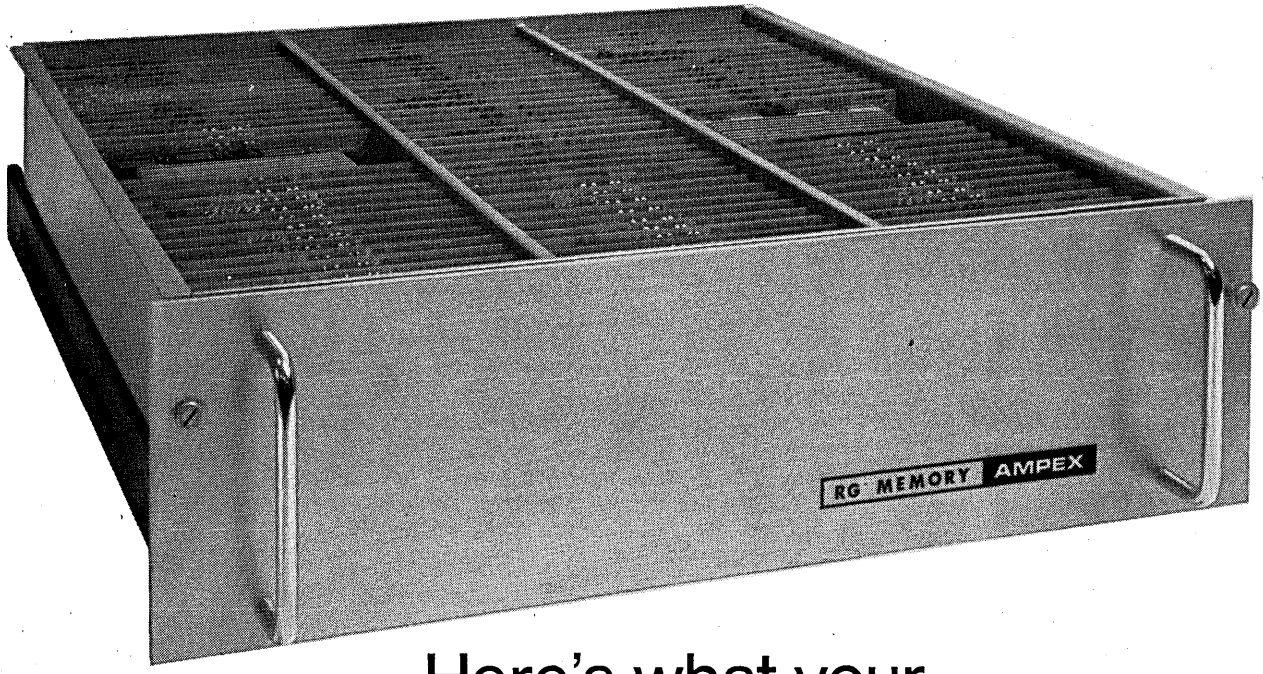
DATAMATION®

68

May

everyman a logic designer



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1. Access data in 350 nanoseconds
2. Expand in modules to 5 million bits
3. Sell for less

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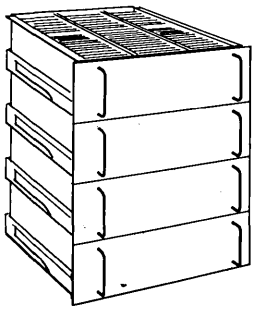

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AMPEX

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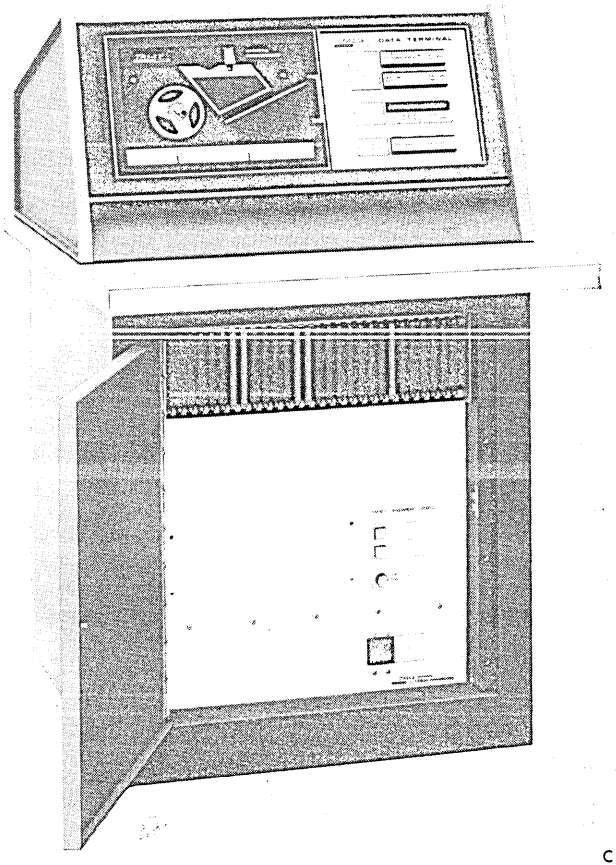

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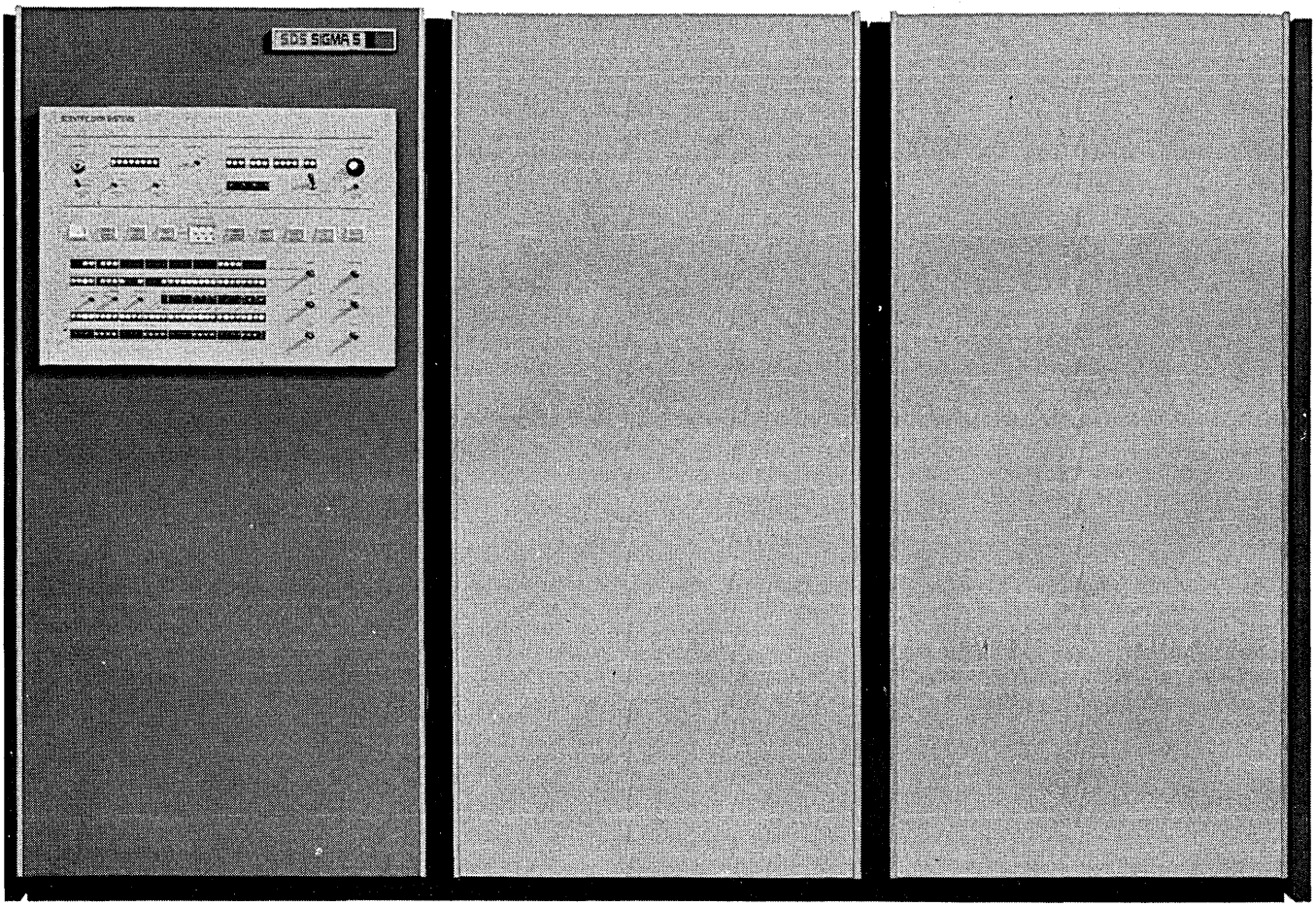

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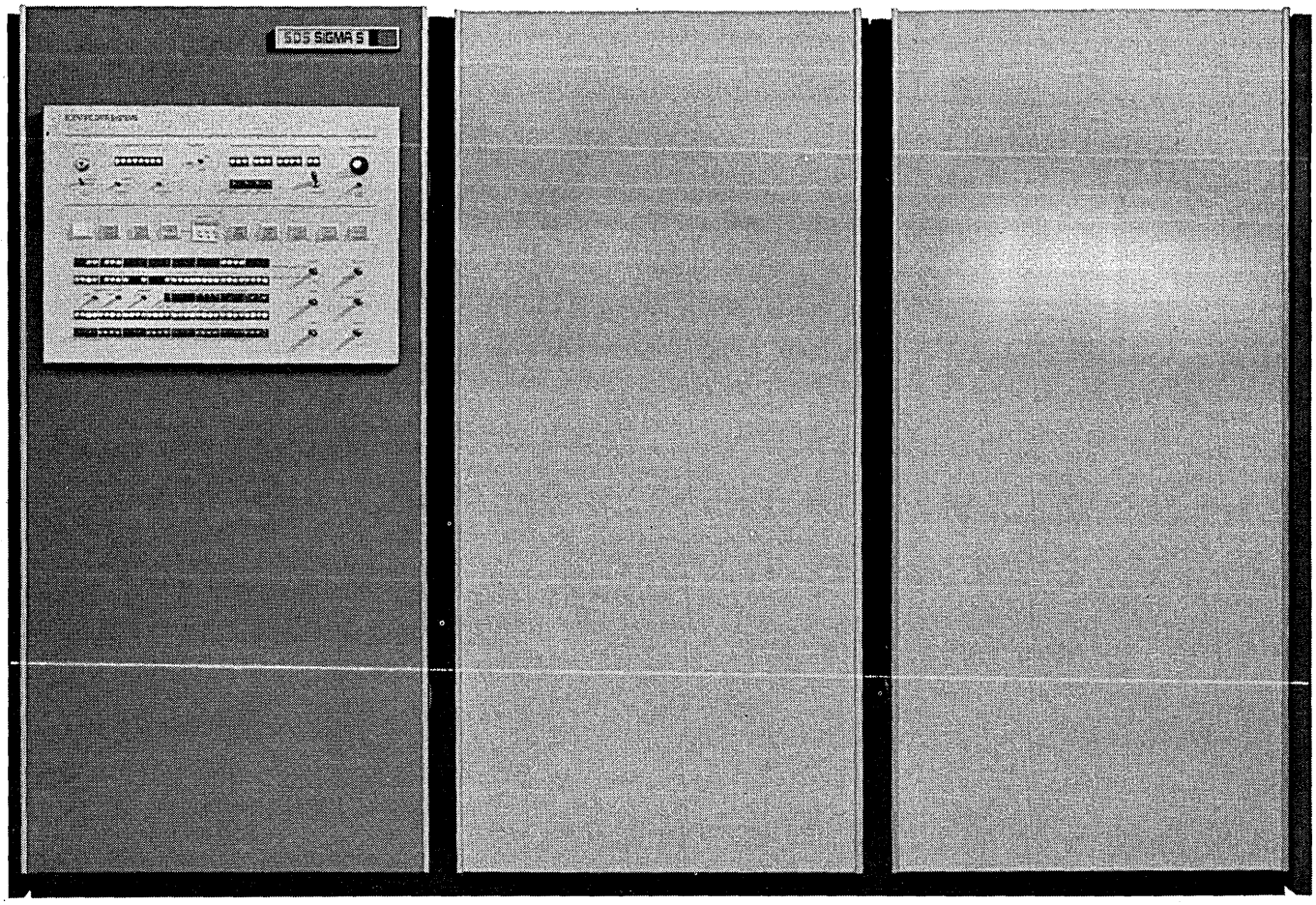

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Especially when it's the best computer you can get.

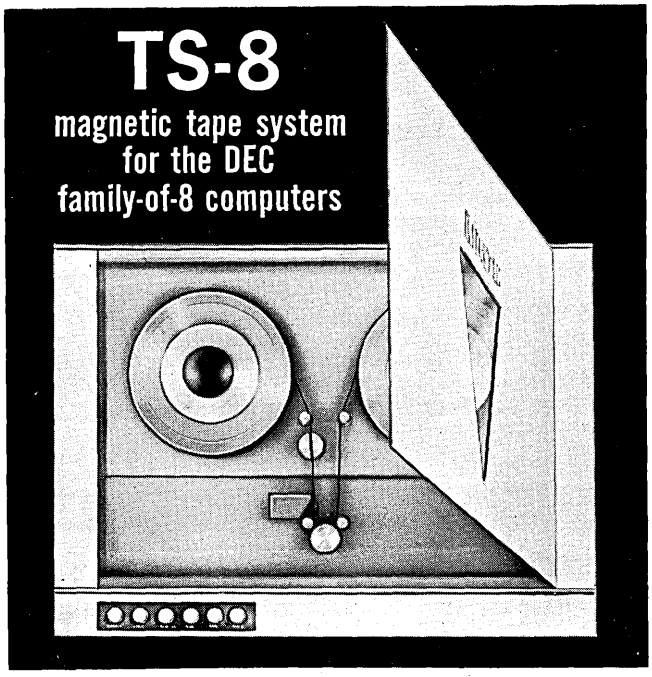
SDS

Scientific Data Systems, Santa Monica, California

CIRCLE 5 ON READER CARD

How to make any PDP* PLUS!

TS-8
magnetic tape system for the DEC family-of-8 computers



COMPATIBLE — produces fully IBM-compatible tape on both the 7-track and 9-track versions.

COMPACT — completely self-contained. Each unit consists of a tape transport mechanism and all electronics, ready for rack-mounting, or packaged in a compact cabinet.

SUPPORTED — software supplied with the TS-8 fully support all magnetic tape I/O and include error-checking and recovery procedures. Hardware maintenance and support are available through Infotec service personnel.

ECONOMICAL — this IBM-compatible tape system, designed specifically for DEC computers, is also the least expensive IBM-compatible tape system available anywhere — an Infotec cost breakthrough!

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INFORMATION TECHNOLOGY

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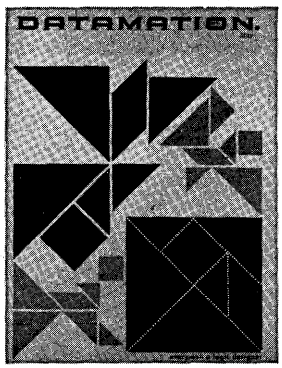

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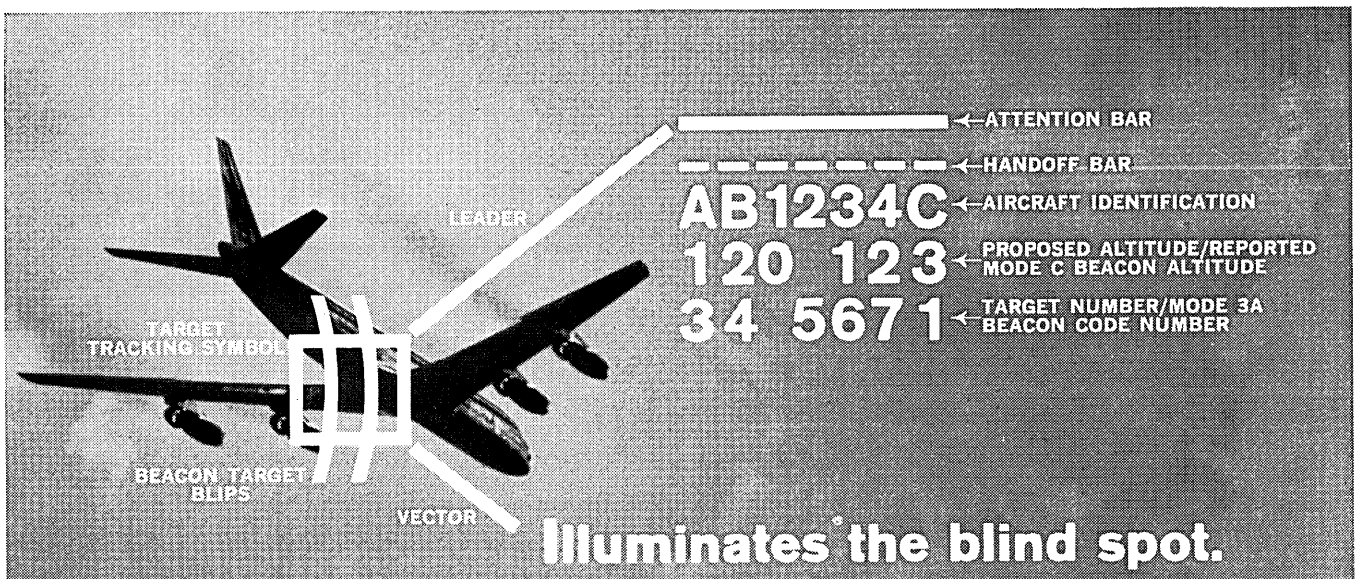

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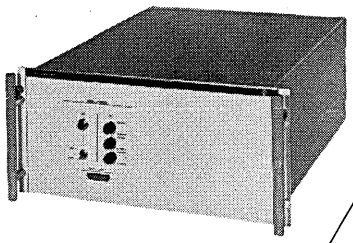

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Newport Beach, California 92663.
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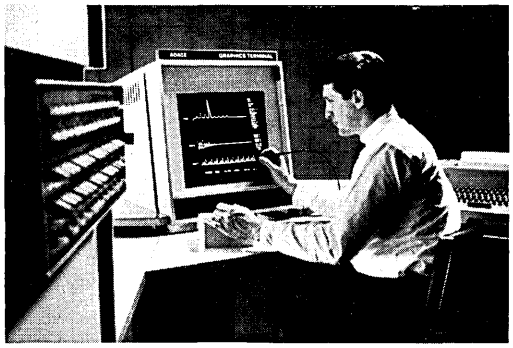
the $188,000 graphics terminal



that costs $60k

It used to be you had to spend that kind of money to do meaningful work in computer graphics. Now you can buy a complete interactive terminal from Adage for $60,000 — and get a lot better performance. That's our model AGT/10.

You can display more than 4500 vectors at 40 frames per second with resolution better than 100 lines per inch. "Straight" lines are really straight. They meet where they're supposed to, and they are uniformly bright regardless of length. And only with the Adage AGT/10 do you get built-in scaling and translation.

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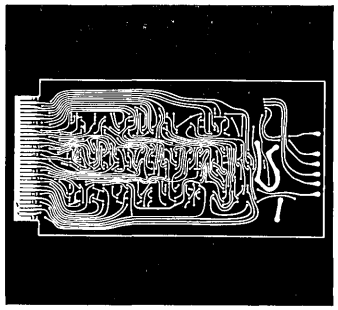
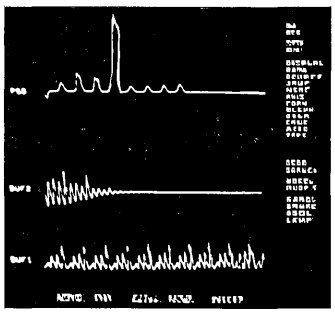
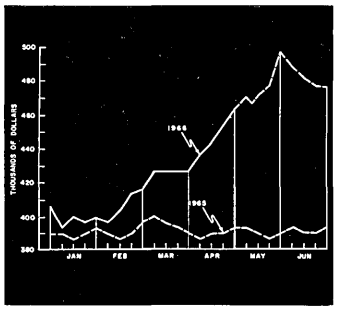
The terminal console houses the large-screen CRT with light pen, and comes equipped with function switches and controls. Graphics hardware options include joystick controls, an input data tablet, a character generator, and photographic hard-copy output.



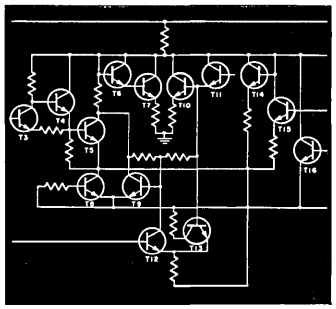
printed circuit layout



on-line signal analysis



business management systems



machine-aided drafting

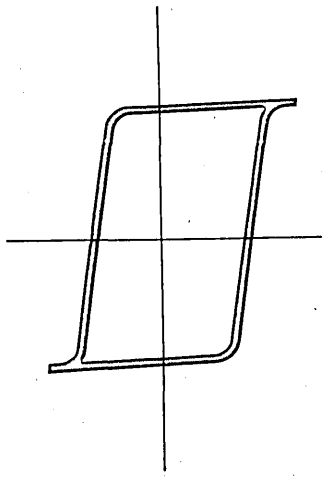
If you'd like more information about our under-priced AGT/10, or a 16 mm movie showing the Adage Graphics Terminal in action, write D. Sudkin, Marketing Services Manager, Adage, Inc., 1079 Commonwealth Ave., Boston, Massachusetts 02215.

Adage INC

CIRCLE 9 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/ CONTACT
June 10 June 11 June 13 June 14	Seminars on File Structures for On-Line Systems	New York Chicago Los Angeles San Francisco	ACM, 211 E. 43 St., N.Y., N.Y. 10017
June 12-14	Annual Meeting-Service Center Operations	New York	ADAPSO, 420 Lexington Ave., N.Y., N.Y. 10017
June 25-27	2nd Annual Computer Group Conf., Impact of LSI	Los Angeles	IEEE, 3600 Wilshire Blvd., Los Angeles 90005
June 25-28	International DP Conf. & Business Exposition	Washington, D.C.	DPMA, 505 Busse Hwy., Park Ridge, Ill. 60068
June 26-28	9th Annual Joint Automatic Control Conference	Univ. of Michigan, Ann Arbor	IEEE, 345 E. 47 St., N.Y., N.Y. 10017
July 15-18	5th Annual Design Automation Workshop	Washington, D.C.	SHARE-ACM-IEEE Computer Group, 345 E. 47 St., N.Y., N.Y. 10017
July 23-24	Nat'l. Symposium on Modular Programming	Boston	Information & Systems Inst., 14 Concord La., Cambridge, Mass. 02138
Aug. 20-23	Western Electronic Show & Convention	Los Angeles	WESCON, 3600 Wilshire Blvd., Los Angeles 90005
Oct. 18	Symposium on the Application of Computers to the Problems of Urban Society	New York	ACM/J.M. Spring, Computer Methods Corp., 866 Third Ave., N.Y., N.Y. 10022
Oct. 20-23	International Systems Meeting	St. Louis	Systems & Procedures Assn., 24587 Bagley Rd., Cleveland, Ohio 44138
Oct. 28-31	Annual Meeting-Users of Automatic Information Display Equipment	San Francisco	UAIDE/Ellen Williams, Marshall Space Flight Ctr., R-COMP-S, Huntsville, Ala. 35812
Dec. 2-3	2nd Conf. on Applications of Simulation	New York	SHARE-ACM-IEEE-SCI/ ACM, 211 E. 43 St., N.Y., N.Y. 10017
Dec. 9-11	Fall Joint Computer Conference	San Francisco	AFIPS, 211 E. 43 St., N.Y., N.Y. 10017



- ***Customer Satisfaction***
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- ***Speed***

That's what Datacraft Corporation engineers into each memory, whether it's an off-the-shelf 512 x 8 unit or a custom designed 65536 x 32 system.

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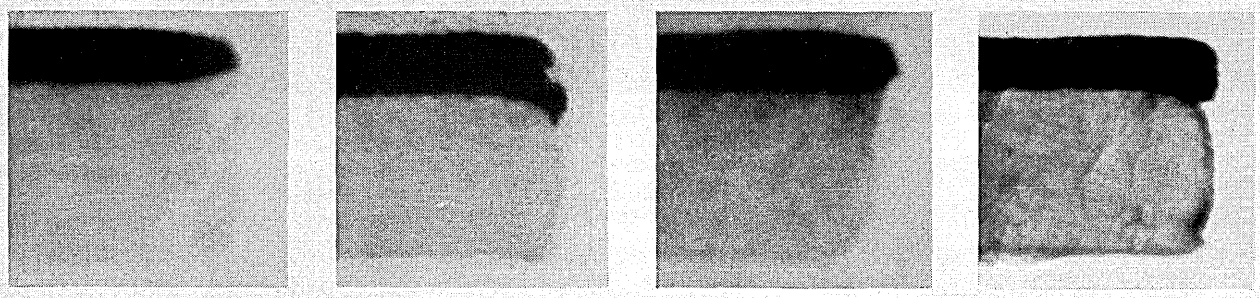
CIRCLE 10 ON READER CARD

TAPE EDGE COMPARISON

TVP 2 BRAND A BRAND B BRAND C



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TYPICAL INDUSTRY SLITTING

NOW... pick your computer tape

☐ You have probably never worried about how your computer tape looks in cross-section, but believe it or not, it's an angle worth considering.

☐ The unretouched photos above are representative cross-section views (at approximately 500X) of three leading "premium" tape brands, together with Computron's new TVP2.

☐ You can see at a glance that, of the four specimens, only TVP2 displays a clean, rectangular edge. Why is this important? Primarily because in this way TVP2 greatly reduces the possibility of error-producing edge debris.

☐ When oxide overhang is present, small fragments are almost certain to break off in use. With a non-rectangular cut there is uneven edge wear between the oxide and backing, weak spots develop and the edges fracture and chip. This means an increased probability of dropouts, both transient and permanent.

☐ In addition to solving the debris problem TVP2's clean, uniform edges result in skew characteristics which rival those of master skew tapes.

☐ TVP2's exceptional edges are the result of an exclusive new Computron slitting technique . . . another important factor in the Total Value Performance of this exceptional new tape.

☐ Consider it the next time you select computer tape.

HOW THESE PHOTOGRAPHS WERE MADE

1. The two ends of the tape were inserted into a plexiglass tube.
2. The tube was then filled with epoxy and allowed to cure.
3. When completely cured, the cylinder was put on a lathe.
4. The ends of the cylinder were then polished in several stages until the required smoothness was achieved.
5. The edges were then photographed under a microscope using a parallel light source, eliminating shadows which might result in undefined tape edges.

TVP2

COMPUTRON INC

GENERAL ELECTRIC / BASF GROUP

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CIRCLE 11 ON READER CARD

letters

an apology

Sir:

Over the years, Control Data has been the subject of editorial comment in virtually all trade and general business publications. On the whole, most of these comments have been favorable, but there have been some of the other kind as well. We here at Control Data have become used to both kinds. What we will never get used to, however, is bad taste, which we feel your article (Feb., p. 21) exhibited. For a bunch of "Conmen" (your word) with "a weak coaching staff and lousy bench," (also your words), our track record has been pretty good.

NORBERT R. BERG
Vice President, Administration and Personnel
Control Data Corporation
Minneapolis, Minnesota

Editor's Note: The choice of "Conmen" was hasty and ill-advised, and we apologize. Control Data's representatives are no more "conmen" than those of any other computer manufacturer.

refuting calculations

Sir:

The article by Professor Knight, "Evolving Computer Performance 1963-1967" (Jan., p. 31) exhibits some very serious deficiencies. The deficiencies are, primarily, fundamental inadequacies in the data base and oversimplifications or gross assumptions in the performance calculations. This article is a sequel to an article published in your September 1966 issue; and the first article is based on pre-1963 data collected for a doctoral dissertation. Quite obviously, major changes in dp concepts, system architecture, and applications or market structure have occurred since that time. Yet, the calculations of performance (P) in these two articles are based on these pre-1963 data.

In addition to this outdated data base, there are specific questions on fundamental statistical validity affecting the adequacy, the representativeness of the sample, and the assumptions made in calculating System Performance. These include:

1. The scientific mix has *only* five categories and is based on *pre-1963* data from IBM 704 and 7090 systems. It is not stated, but it appears that tracing to establish frequency weightings was static rather than dynamic.
2. The *same* five instruction categories selected from *scientific* data were used for the *commercial* mix. The frequency weightings are based on counts from nine pre-1963 705 programs. Obviously, no floating point instructions were found so the commercial mix has three categories – fixed add/subtract (25% or 45% weighting), multiply (1% weighting) and all others (54% or 74% weighting).
3. I/O estimates are based on IBM 650, 704, 705, 1401, 7070, 7090, Philco 211, Bendix G-15 with only those from the 7090 *"accurately obtained."*

4. A memory factor, rated as very significant, is based on the *opinions* of 43 engineers, programmers, and other knowledgeable people (*pre-1963*).
5. The equations used in the second article are identical to those used in the first, even though it is noted in the first article that: "The equations derived are therefore applicable only within the range of computers studied."

The following anomalies illustrate the deficiencies and the limitations of the approach:

1. The commercial performance rate of IBM 709 (a binary, fixed word system designed for scientific processing) is shown as about five times its scientific rate. By contrast, the IBM 7090, which is essentially the same system logic and design with faster hardware (transistors vs. tubes) shows a scientific performance rate more than twice its commercial rate.
2. Similar anomalies occur in the case of the 705 II and 7080.
3. On current systems, the commercial performance rate of the IBM 1130 (a small binary system) is shown as over four times the commercial performance rate. On the IBM 360/44, which has no decimal instruction set, the commercial performance rate is shown to be greater than that of the IBM 360/65, which not only has decimal instructions, but also faster circuitry.

The treatment of cost or price, which is the other factor in Professor Knight's analysis, is also unrealistic since only one configuration—the one available when the computer was introduced—is used. Taking System 360 as an example: when it was first introduced in 1964, it included 19 combinations of processing speed and memory capacity and 44 peripheral units. Today the system offers 43 combinations of memory and processing units and 90 peripheral units.

Such growth illustrates, among other things: (1) increasing diversity in and structuring of user needs; (2) increasing importance of I/O devices both in terms of effect on performance and in proportionate share of system cost. To ignore this and equate such systems as a 360/30, where a *maximum of 64K* memory is available to a 360/75 where a *minimum of 262K* is offered is to force statistics beyond the realm of reality.

Although dp technology and markets are far from static, there is sufficient experience and structure to establish the fact that any meaningful comparison of system performance requires (1) a reasonable balance in system configuration that avoids increasing cost without increasing performance, and (2) a selection of an appropriate environment for the systems being compared.

It seems apparent from the anomalies and other data cited above, that Professor Knight's analyses do not meet these minimum requirements. His analyses point to economies of scale in a very gross sense over a wide range of systems; but beyond that, they are not meaningful in assessing current systems performance in today's complex, competitive and diverse markets.

G. B. BRANNEN
Wappingers Falls, New York

Dr. Knight replies: Mr. Brannen's very thoughtful letter discusses many of the limitations of my article. My research has made me well aware of a general model that attempts to compare prob-

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letters

lems between today's different computing systems. The very complexity and rapid rate of change Mr. Brannen refers to demands that we attempt to analyze this important industry rather than bury our heads in the sand. It is my hope that Mr. Brannen's letter and my article will stimulate further efforts to explore the relationship between equipment development and computing power.

project control

Sir:

Max Gray and Herbert B. Lassiter have made a valuable contribution to successful systems implementation with their "Project Control for Data Processing" (Feb., p. 33). It will work.

We have a substantial effort going into the design and implementation of an integrated information system and are about three years into a seven-year program. The first implementation phase was approached in the traditional one-step-at-a-time and our timetable bombed. Oh, did it *bomb*. Meanwhile, we were putting the second implementation phase together and during one of our task group critiques, we began to focus on the need for better planning and decided that we ought to find out about our critical path. Our tentative timetable for this phase reflected 10 months of elapsed time to implementation. We spent about a month working out a PERT chart and it showed 18 months to implementation. Now we have reorganized the second phase into four small implementation steps and are targeting the first one—which will obtain considerable improvement for some 30 shops—for seven months to implementation. Incidentally, all of these time intervals are measured from the same beginning point so the improvements are real.

Because systems are what they are, we may not hit the keyhole but we have considerably improved project control because we no longer operate behind that veil of mystery Gray and Lassiter spoke of in their article. Anyone who has ever slid a target ought to try their ideas. It will hurt for only a little while—mostly from embarrassment.

TRUMAN EVANS
Director, Systems Planning
American Airlines
Tulsa, Oklahoma

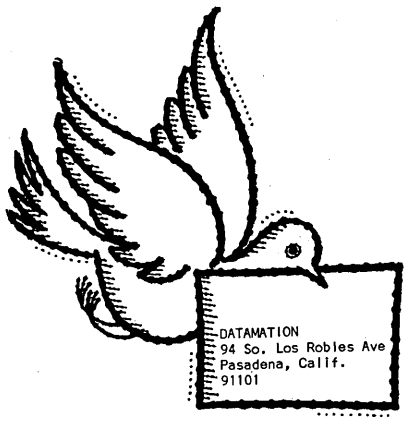
p.s. to a eulogy

Sir:

Sam Alexander, who led various National Bureau of Standards' electronic data processing efforts for many years, was indeed the interesting and imaginative pioneer that your eulogy (Feb., p. 65) suggests. For these pioneering efforts he had my respect and admiration even before I joined "The Sam Alexander Post-Graduate School" in early 1962.

However, the bad taste you expressed by your critical aside references to Representative Jack Brooks and to Norm Ream was not characteristic of the sense of honor of the man you have attempted to eulogize. Sam especially would not have appreciated your placing these references in the same context as references to his "enemies," to his questionable testimony at a Congressional hearing, and to criticism of his "pilot project," *even if you had been correct.*

In fact you were not. The events of 1964-65 culminated in Alexander's Information Technology Division becoming the core around which the NBS Center for Computer Sciences and Technology was built. It was Alexander, not Brooks, who played a strong role in recommending the selection of Ream as the Center's first director. Following this, Ream had the responsibility of becoming acquainted with the



spirit and intent of the Center's enabling legislation, i.e. Public Law 89-306, by opening a line of communication with the Law's sponsor, Rep. Brooks. Only in this way could the Center play its most meaningful and contributory role in the development of computer and related information system usage by the Federal Government.

The second point on which you erred was in the cursory mention of Alexander's "pilot project." Recommendations, in which neither Brooks nor Ream had a part, had already been made to NBS concerning the "pilot project." Ream, as director, and Alexander, as technical director, each commissioned an independent survey in order to confirm and clarify these recommendations. The two studies were approached from different points

of view, Alexander's being a solely technical one. The results of both surveys led to the same conclusion, confirming the earlier recommendation that the project be discontinued. However unhappy a conclusion this was, Alexander's role in it was a characteristically professional one as was Ream's resulting decision.

Both men (Alexander and Ream) have enjoyed the respect and admiration of the information systems community. The one you attempted to honor you have instead dishonored. The other, you seriously disserved by leaving his motives open to doubt—doubt which has no basis in fact in a man whose professional honesty is unquestioned, and whose public service is an example to others.

F. CLAYTON ROSE
Gaithersburg, Maryland

taxing users

Sir:

In "Brandon Panel Discuss Data Processing Management Problems" (Feb., p. 72) I noticed that someone is working on defining "systems analysis" and "programming."

If and when this is finished, who or what should be contacted to receive these great documents? Also, once specified how is "management" to be coerced to implement ideas that are not of their own choosing?

As to the suggestion of taxing computer users, I hope you realize to what extent "government" is involved and, therefore, not taxable. A better idea might be to sell the manufacturers on bearing the full cost of such a worthwhile venture.

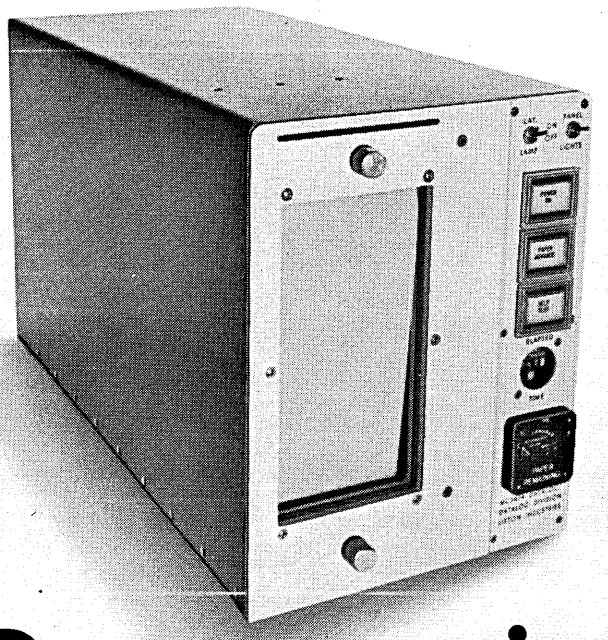
R. L. BROWN
Sacramento, California

t-s considerations

Sir:

Your report (Feb., p. 121) on large corporations losing interest in time-sharing indicated the popular concept of time-sharing as the on-line conversational mode of operation with immediate processing response to user inquiry. Unfortunately, too much attention has often been placed on designing immediate response time-sharing systems which operate mainly at the "high end of the processing response curve." This has caused excessive programming overhead and system costs when compared to the value received.

Too frequently, the user has no direct access to the computer and then is provided complete on-line control with immediate processing of all requests,



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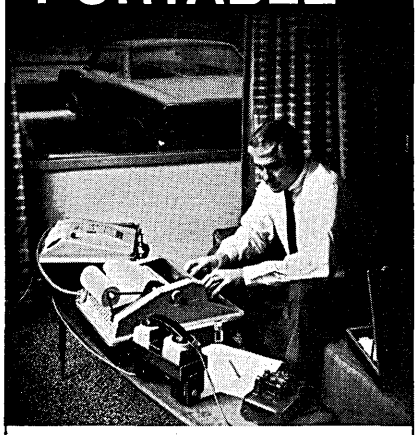

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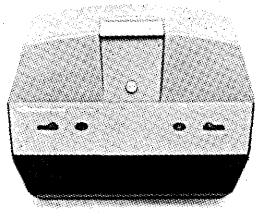

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letters

even when this is neither required nor desired. This is a "rags to riches" approach and often provides exceptional service to a restricted number of users.

It will become increasingly valuable to provide on-line direct access support for computer system users. However, the processing response time is a second consideration and should be controlled by criteria established by the corporation. An executive should be able to use the same time-sharing on-line terminal for immediate processing of an inquiry and then for requesting future processing for a report on a low priority basis.

The large corporation will not lose interest in time-sharing if systems are properly designed to provide more users time-sharing with more levels of processing response. Several commercial time-sharing companies are now selling computer time at different rates based on the user's required processing response. This is accomplished mainly on two levels (immediate and batch), but this should expand to more levels in the future; i.e., perhaps charges in accordance with core partition time-sharing priority levels when using IBM 360 systems.

James W. Gray
McLean, Virginia

design and selection

Sir:

Re Dr. Ruskin's article "The Potential Savings Yardstick" (March, p. 59), I offer the following summary: The name of the game is "smart."

Robert M. Gordon
Irvine, California

stump the machine

Sir:

The problem with simple models of machine learning ability is that we can always see through them and beyond them. We are not convinced and our fears are not allayed. In the case of a stacked deck and a very naive program, such as our friend the Hexapawn player (March, p. 67), the nature of the game changes.

In Hexapawn, the second player can *always* win. But if the machine is *really* as simple-minded as the article by Hughes and Engvold tells us, we can prevent it from learning to beat us *every* time.

Aside from symmetry, there are two possible first moves for the player, to which the machine has a total of five responses. If the machine response is either of these positions (X for player):

```
O O –      O O –
X – O      – X O
– X X      X – X
```

don't clobber it immediately, or you'll never get another chance. Instead (in either case) leave it with:

```
O O –
X X O
– – X
```

After it finds out it loses *whatever* it does beyond this point, it will probably blow a fuse or even push its own "function" button.

Millard H. Perstein
Santa Monica, California

edp for the blind

Sir:

As a member of the Braille Services of New Mexico, Inc., I am in the process of getting permission from IBM to reproduce in Braille their IBM System/360 Reference Data card X 20-1703-4 (12 pages, foldout). If approved, our organization will be able to supply to interested parties thermoform copies of this card (for the cost of materials) by writing directly to me.

David E. Mick
Chairman, Special Projects
Braille Services of New Mexico, Inc.
3101 Betts St., N.E.
Albuquerque, New Mexico 87111

Sir:

In response to my letter (March, p. 14), many readers have provided us with sources for programming information for the blind. Perhaps if you published the attached list, it would be of service.

E. A. Racicot
Rexdale, Ontario, Canada

Editor's note: The following list was compiled with the help of Dr. Racicot, Mr. Mick and Mr. Lagrone. Comments or descriptions are based on their information.

Recordings for the Blind, Inc.
215 E. 58th Street
New York, N.Y. 10022
Tape recordings on IBM/360 systems; a catalog listing will be sent on request.

Braille Services of New Mexico, Inc.
P. O. Box 3455
Albuquerque, New Mexico 87110
In addition to other services, a recorded instruction course on System/360 assembler language coding in two parts.

Science for the Blind
221 Rock Hill Road
Bala-Cynwyd, Pennsylvania 19004

This organization has a special tape offer for $10 with readings from issues of *Computing Reviews* and *Communications of the ACM*.

Jewish Guild for the Blind
1880 Broadway
New York, N.Y. 10023
General information on computers and data processing in Braille.

International Academy
4010 Volta Ave.
Brentwood, Maryland 20722

Braille Book Bank
Attn: Mrs. Richard Bent
85 Godwin Ave.
Midland Park, New Jersey 07432

National Braille Press
88 St. Stephen Street
Boston, Massachusetts

Royal National Institute for the Blind
224 Great Portland Street
London W1, England

Volunteer Services for the Blind
332 S. 13th Street
Philadelphia, Pennsylvania 19107

Mr. Karl Lappin
Textbook Consultant
American Printing House for the Blind
Louisville, Kentucky 40206

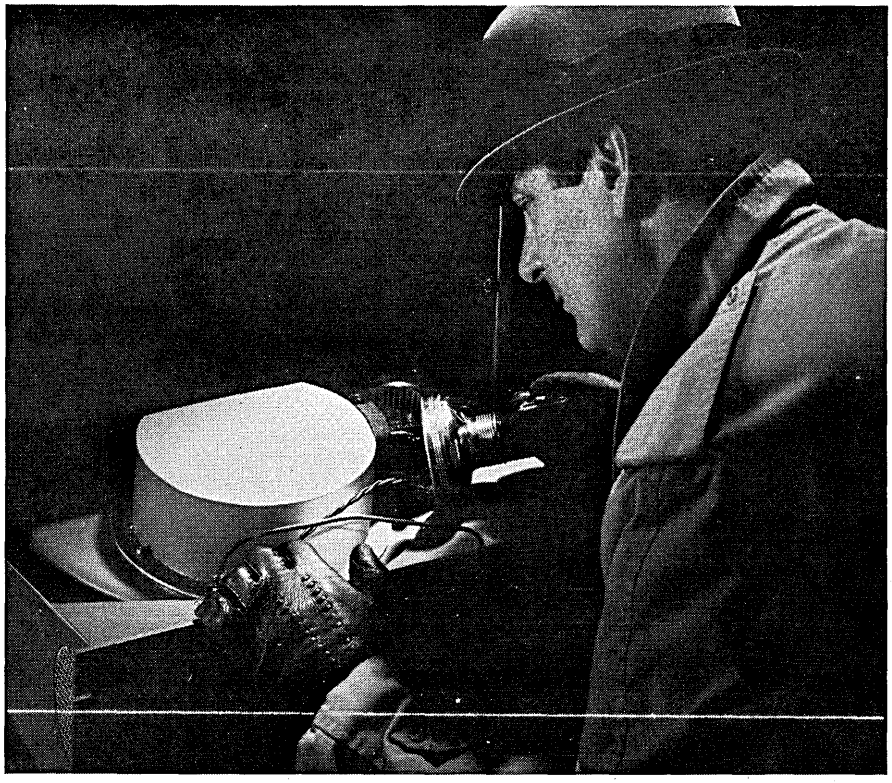
Science for the Blind
Haverford College
Haverford, Pennsylvania 19041

Volunteer Braille Services
1229 Taylor St., N.W.
Washington, D.C.

Two individuals willing to give further information and assistance:
Dr. Theodor D. Sterling
Chairman, ACM Committee on Professional Activities for the Blind
Dept. of Applied Math & Computer Sciences
Campus Box 1102
Washington Univ.
Skinker & Forsyth
St. Louis, Missouri 63130

Mr. Robert Lagrone
IBM Corporation
System Support Group
18,100 Frederick Pike
Dept. PC4, Room 2P25
Gaithersburg, Maryland 20760

DATAMATION welcomes correspondence about the computer industry and its effects on society, as well as comments on the contents of this publication. Letters should be typed, double-spaced, and brief. Only those reaching the editors by the 5th can be considered for the next month's issue. We reserve the right to edit or select excerpts from letters submitted to us.



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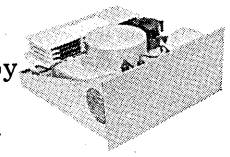

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For complete information contact **Data Disc,** Inc., 1275 California Avenue, Palo Alto, California 94304, Phone (415) 326-7602.

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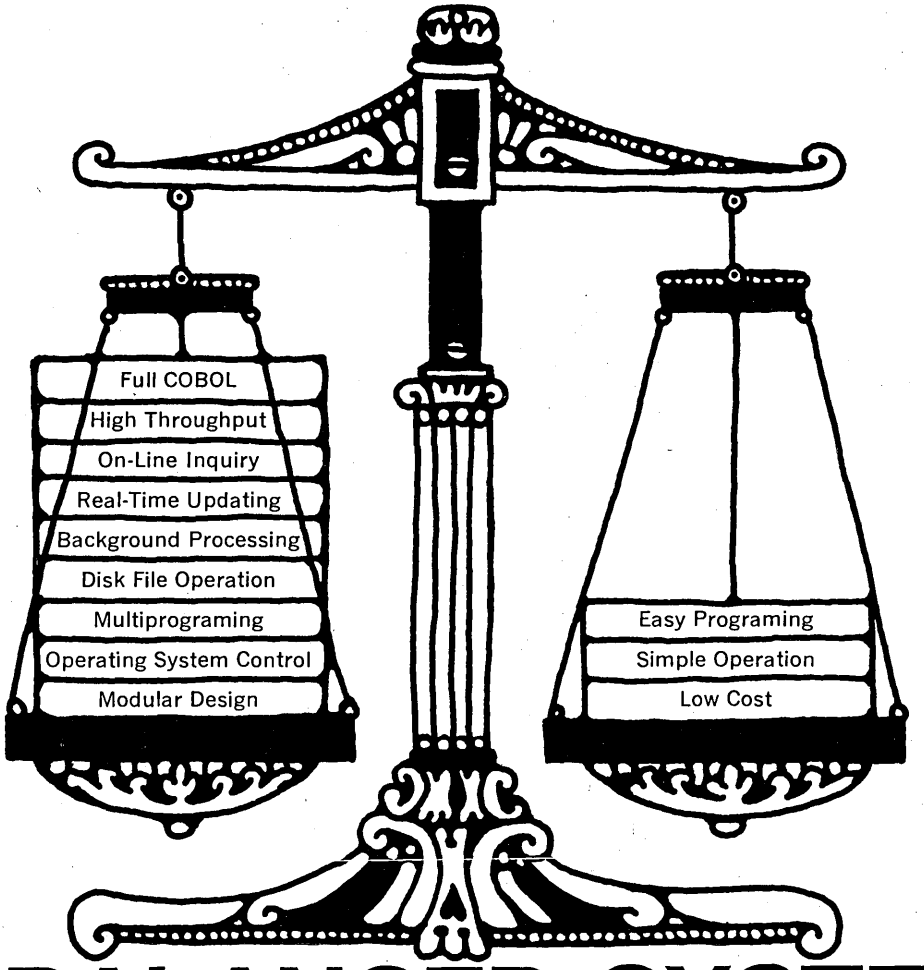

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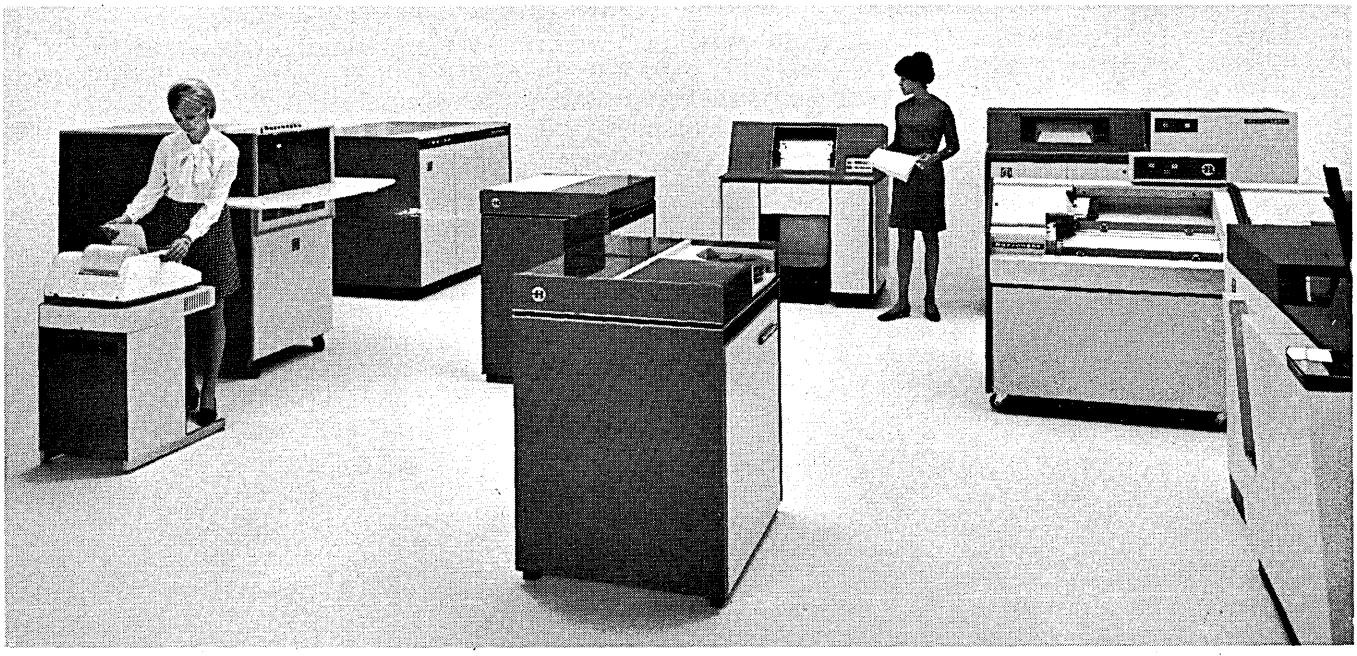

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look ahead

SDC MAY GO PUBLIC— AND, HOPEFULLY, PROFIT

Rumors of System Development Corp. giving up its nonprofit status have persisted for two or three years —dying out each time as too many obstacles came up to warrant a final decision. But now, we hear, they're about to jump, probably by the end of June.

There are a number of reasons why this might seem a sensible move to the management. The market for programming services appears headed toward proprietary packages—and a company needs to be able to raise money to develop them. Nonprofit organizations have trouble keeping key employees, since they can't offer those delicious stock options. And, now that SDC is competing with other software houses for some kinds of contracts, there has been criticism of their special status as giving them an edge in bids—since there are no stockholders to be kept happy.

Initial emphasis is expected to be on general-purpose proprietary program packages; marketing has already begun for the LUCID and TDMS time-sharing systems (the latter at a hefty $5K/month) as well as a JOVIAL compiler for the 360.

The plan for making the change-over from nonprofit status is said to involve setting up a profit-making subsidiary and transferring SDC's assets for payment of $5.5 million in notes and a block of stock. There would be an initial offering of stock to a large group of individuals as a transition step. Then, over a period of some five years, the stock would be distributed about one-third to employees and the other two-thirds to the public by the parent company. Rumor has it that maybe a third of the employees will qualify for stock options but with strings attached, such as gradual accrual of the right to exercise options and sell the stock according to the number of years employed by the company.

FROM CRISIS TO CRISIS WITH THE DISC PACKS

Now that the disc pack shortage for 2311 drives is being overcome—with the independents offering fast, fast, fast delivery and IBM countering with get-them-from-us ads—along comes a new shortage of packs to fit the 2314.

Since the new 25-megabit packs offer nearly four times the storage, the drives are an increasingly big seller for IBM. But a check of users turns up some sad stories. One got his drives but no packs and can't get even a promise of a delivery date. Now he learns that IBM is not liable for any damage to the heads on their equipment if he has trouble with packs from an independent. A couple of big, cool customers have no problem; they ordered the packs a year ahead of time for a set quantity to be delivered every month.

Meanwhile, the independents are scrambling to fill the gap. But most of them are talking about delivery in September or October. And one report sets

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We agree . . . this is no way to handle computer tape. But, it is an easy way to get the reel out of the canister . . . especially if you don't care too much about drop-outs and edge pinching. An easier way, and one that helps to promote proper tape handling is to use the TAPE-SEAL® System by Wright Line. With TAPE-SEAL, all you have to handle is the reel hub and the TAPE-SEAL belt. The belt comes off with a "flick of your finger" while you hold the reel by its hub as recommended by tape suppliers. We originally invented TAPE-SEAL to save space and money . . . our many customers now tell us it also saves tape by promoting better and safer handling. We'll be most happy to send you further information. Circle the readers' service number or write Wright Line, A Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.

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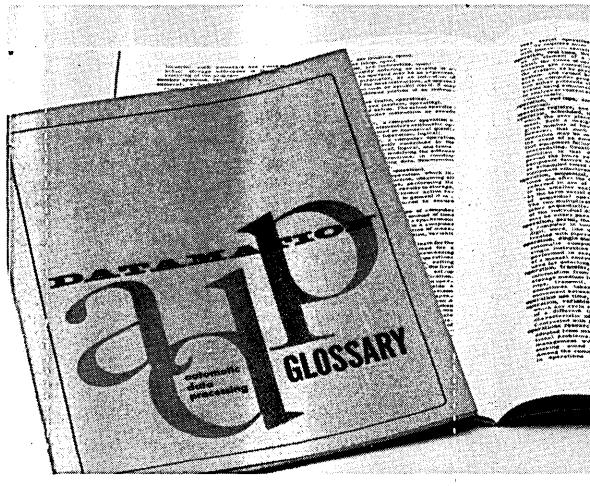

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One exception turned up is Thin Film Inc. of Los Angeles. They're quoting 30-to-60-day delivery but their production capacity now is only about 10 packs (110 discs) per day. Thin Film's packs, incidentally, are plated—as are the discs made by most of the computer manufacturers—but IBM is apparently sticking with oxide coating for a while.

WANT TO START A BUSINESS? BUY OUT THE OTHER GUYS

Maybe it's the inevitable result of the proliferation of small computer-oriented firms, but there seems to be a trend now to start out with just money and acquire a complete operation. Two new Los Angeles based outfits have surfaced this month—both following that route.

A broad cross section of computer-related firms will be grouped into "the first computer conglomerate," being organized by Dr. Mel Salveson, formerly a group vice president at Control Data.

The company will be called Computer General Corp. Capitalization, to be underwritten by the investment banking firm of D. H. Blair & Co., is in the $100-150 million bracket. Francis H. Hoge of Blair will be chairman of the board; Salveson is president, although he says that "this will be the first company that really has a computer for a president."

Negotiations are now under way with the firms that will be acquired to form Computer General and their identity can't be let out until the deals are set since "most of our vice presidents will be their ex-presidents."

The companies to be acquired range in size from a half million to $50 million volume. They cover software, operations research, systems analysis, service bureaus, computer training schools, and manufacturing.

The other one, also with plenty of dollars available, is U. S. Systems & Software. It's headed by Homer Rhoads, former president of Electrada. Executive vp is Dr. William Kirk from Planning Research Corp.

They have already picked up Medical Data Research, supplying programming services for medical and community applications, and Management Computer Services. The latter is a service bureau but will gradually change direction to software and programming support. And the hunt is on for both commercial and scientific software houses. USS&S has a board of directors featuring major executives from North American, Douglas, Martin-Marietta, and Union Bank. Their goal, says Dr. Kirk, is to "find companies that are making money and leave them alone."

IBM DOES A 180 ON 360 LEASING

Although recent reports have shown IBM hardening its corporate heart toward third-party leasing companies, it now looks as though a turnaround is under way.

Whatever the cause—heat from the lessors, interest of the Justice Dept., etc.—the company has now set up a liaison group called the Leasing Company Relations Dept. This organization will represent IBM to the third-party leasing companies for both sales and maintenance. Arrangements between this group

(Continued on page 125)

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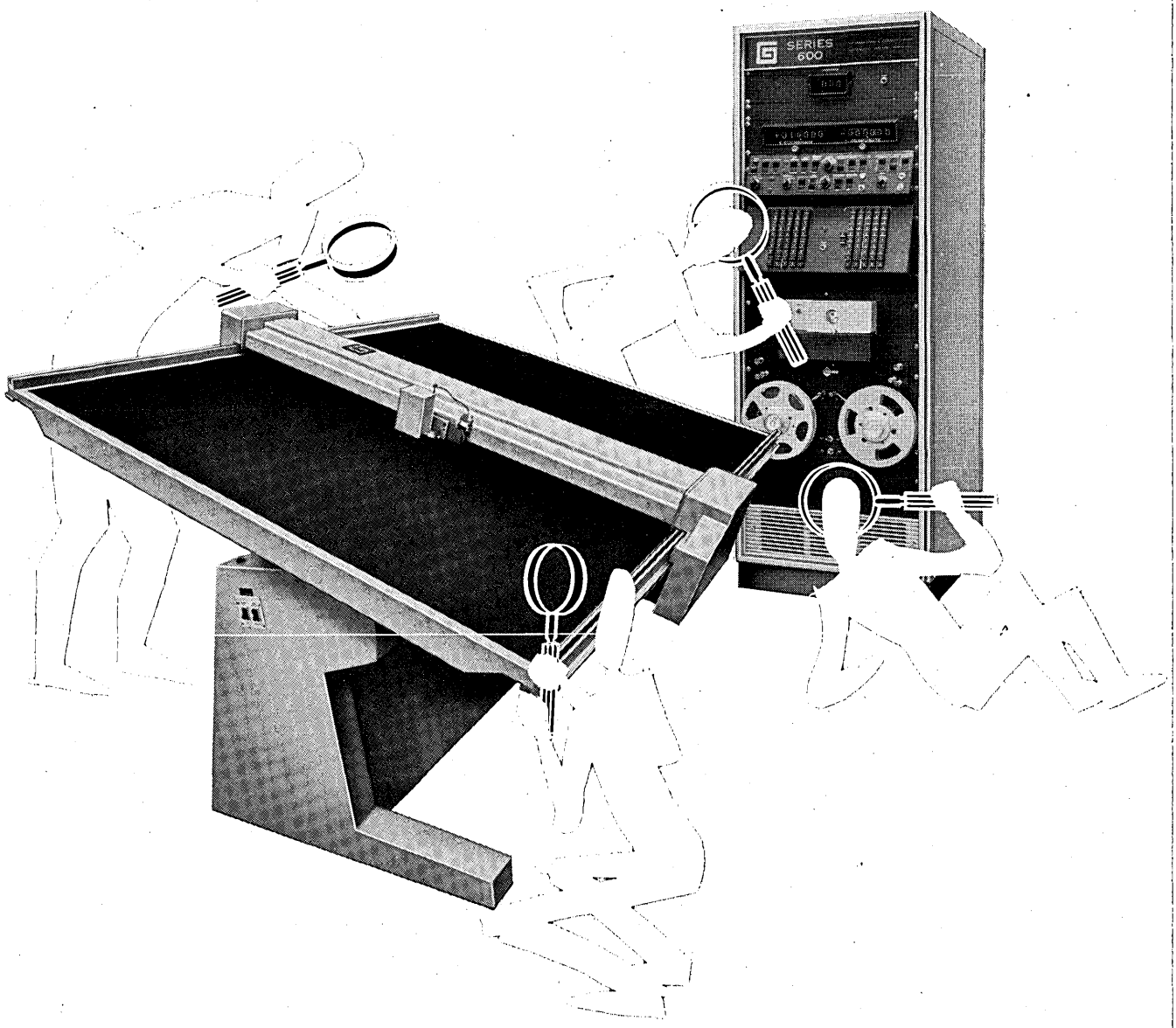

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CIRCLE 18 ON READER CARD

editor's readout

MAKING THE CONNECTION

It's been over two months now since 57 varieties and thousands of pages of opinions were dropped on the Federal Communications Commission (Apr. 1968, pp. 32-34), which by now is probably wondering why it ever decided to look into the sticky business of "regulatory and policy problems presented by the interdependence of computer and communications services and facilities."

As Kemo Sabe would say, it will be many more moons undoubtedly before the FCC comes up with any decisions or policies. Just trying to figure out how to draw the line between communications and data processing services ought to keep them busy for a while.

While the FCC is pondering the big, abstract ponderables, we hope they don't overlook what some feel is the strongest issue reflected in nearly every brief filed by non-carriers: the foreign attachment.

In essence FCC foreign attachment policies allow the carriers the right to determine what equipment will be attached to the ends of their lines. So far the carriers have limited equipment connecting the edp user to their dial-up networks to that of their own make. (Private lines have been able to take advantage of "foreign" modems with higher transfer rates.)

The carriers' arguments for the right to control the attachments to their lines revolve around their duty to protect the integrity of their lines and their service. So far, they claim, only equipment made, rented and serviced by them can be guaranteed to preserve that integrity.

But the users and their spokesmen—including edp equipment and independent communications gear manufacturers—seek greater flexibility and lower costs over dial-up networks. They want standard interface specifications which would permit the use of foreign attachments which could be bought, not rented at a rate arbitrarily set by the carriers under FCC mumbo-jumbo accounting formulas.

We'd bet that the communications technology *does* permit the establishment of such interface standards. And we believe that the importance of extending information processing services makes their establishment an absolute necessity.

The question of who should develop such interface standards remains. Interestingly, the biggest voice (500-plus pages of testimony representing 43 firms) of the edp community in the FCC hearings—the Business Equipment Manufacturers' Association—wants to leave that job up to the carriers.

Says the BEMA brief (p. 131): "There is every reason to believe that appropriate standards can be devised, and the carriers should be required to announce standards which should be subject to review, under Commission auspices, by groups representing the common carriers as well as the equipment manufacturers and other interested parties, in order that a detailed set of standards for equipment to be attached to the public switched communications networks may be adopted as promptly as possible."

The only problem with the BEMA proposal is that "as promptly as possible" may be a long, long time. The carriers cannot be expected to move swiftly toward the adoption of standards which would strip them of sizeable modem and terminal revenues.

Instead, we feel that the industry—through BEMA as a start—should establish its own interface standards blueprint along with a detailed description of the organization needed to carry it out. An edp industry-wide approach could do much to harmonize internal squabbles over foreign attachment requirements and force the carriers to come up with suitable alternatives.

If the information processing community waits for the carriers to move first, the foreign attachment disagreements could become critical . . . not only delaying and weakening the industry's response to eventual carrier proposals, but giving the carriers a chance to play one side against the other. It's a tactic they've used before.

There's a lot at stake. Let's go, BEMA.

some basics

LOGICAL DESIGN OF DIGITAL COMPUTERS

by PETER L. LINDLEY

Logical design is generally considered to have begun with the work of the nineteenth century English mathematician and philosopher George Boole (1815-1864). His classic book, *An Investigation of the Laws of Thought on Which are Founded the Mathematical Theories of Logic and Probabilities,* was published in 1854. Boole's intention was to perform a mathematical analysis of logic. He succeeded in constructing a "logical algebra" which now, in his honor, is generally called Boolean algebra.

Boolean algebra forms the basis of modern logical design of digital computers as well as of other digital or switching devices such as those employed in the telephone industry. The term "logical design," then, identifies that phase of computer design which is based on the mathematical aspects of philosophical logic. Some other phases of computer design are electronic or relay circuit design, design of mechanisms, and the structural aspects of product manufacture.

Twenty years ago, most individuals working on the development of a digital computer made some contribution to its mechanical, electrical, and logical design. Today's computer engineers have found it necessary to specialize in one phase of computer design or another.

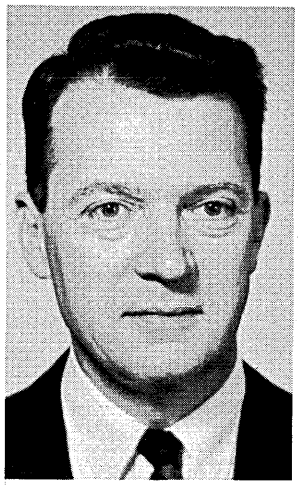
Computer logical design has thus become a discipline in its own right. Undergraduate and graduate courses in the subject are now offered by most universities and technical institutes. Until quite recently, however, logical design, and indeed Boolean algebra itself, were familiar to only a comparatively small group of specialists with degrees in electrical engineering, mathematics, or philosophy.

Now, in the mid-sixties, we find that there are thousands of computer engineers, field servicemen, operators, maintenance and repairmen, and technicians who need, want, or ought to know something of logical design. A basic knowledge of *mechanical* design and *circuit* design has been expected of them for many years. Helpful books and articles on those subjects have been available to them at all technical and academic levels. Excellent books on logical design are also available. These, however, invariably are aimed at the graduate engineer, the specialist. Their mathematical rigor, their technical completeness, their very size and language prove frustrating to any but the highly trained or the deeply interested.

Here, I shall present some basics of Boolean algebra and logical design. Obviously we cannot expect to cover the field completely, to go into a lot of special aspects, or to be mathematically or logically rigorous. As the title implies, I intend to give you "some basics." A fair amount of interest and a minimum of technical background should enable you to read and understand. Having understood and practiced for a little while, you should be able to solve many of the simpler problems in design and trouble shooting—and to go on to deeper and broader literature if and when you are faced with more complex problems.

binary numbers & elements

Computing devices deal with numbers, and also with operations such as addition, subtraction, multiplication, division, shifting, storing, reading, printing, etc. Numbers are made up of digits, of which there are ten in the decimal number system. Their numeric symbols are the familiar 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. To represent any of



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these ten digits physically in a computing system, the device which represents it must be able to assume ten distinct and distinguishable states. If the device were a single toothed wheel or ratchet (as it actually is in desk calculators and in early computers), the wheel or ratchet must have ten distinct positions. If it were a voltage on a single wire, the voltage must have ten distinct values; this is not practical for technical reasons. If it were a hole punched in a particular location on a card or tape, the hole must have ten distinct sizes or shapes; this is even more impractical.

It became clear early in computer development that devices that can assume ten distinct and distinguishable states are either too slow, too expensive, or too unreliable for this sort of application. On the other hand, there are many types of devices that can assume *two* distinct and distinguishable states, and that are fast, inexpensive, and reliable. Examples are relays which are either open or closed, voltages which are either high or low (i.e., well above or well below a pre-assigned value), hole locations which are either punched or unpunched, etc. Such devices are called "two valued" or *binary* devices.

Boole showed that even complex thought processes can be broken down into a larger number of simple binary processes. Others have shown that numbers can be represented by binary devices, provided these numbers are expressed in the binary number system, rather than in the usual decimal number system.

We are not concerned, in this article, with computer mathematics and number systems. Much has been written on this and, if you want it, you will have no trouble finding reference material. What we are concerned with is Boolean algebra and logical design which, for the above reasons, are based on strictly binary concepts. At this point you face the problem of shedding much of your mathematical knowledge, acquired and applicable elsewhere. Here we enter a binary world, in which there exist only two digits: 0 and 1; only two voltages: low and high; only two relay or switch positions: open and closed; only two resistance values between given points in a circuit: infinite and zero. In this world the equation $1 + 1 = 1$ is correct and meaningful. An accountant would be bothered by this equation—a Boolean logician, never.

You can take a drop of water and divide it into ever smaller droplets which will still retain the characteristics of water, until you reach a limit in a single H_2O molecule. You can dissociate this into hydrogen and oxygen atoms, but you will no longer be able to identify what you have as water. Similarly, while an electronic computer consists of resistors, capacitors, transistors, etc., these do not characterize a computer any more than they do a TV set or a hearing aid. The "molecules" of computers are called logical elements, but the analogy breaks down at this point. While there are typically many logical elements of the same description in a computer, it is also true that there are various types in the same machine.

There are two basically different categories of computer logical elements, all of which however are binary devices. One of these categories is called *memory elements*, the other is called *decision elements*. A memory element is a circuit "building block" which can store a single binary digit (or "bit") for an arbitrary or fixed time interval, at which time the quantity stored is available for inspection, copying, or removal. The most common and useful memory elements are the various types of flip-flops, high-speed transistor devices with which all modern computers abound. This article does not concern itself with flip-flops or any other memory element.

A decision element is a circuit "building block" which is wired in such a way that the output or outputs react in a predetermined manner to all possible combinations of inputs. Whereas in the physical world nothing happens instantaneously, the reaction time of decision elements in a properly designed system can be considered infinitesimal. This article concerns itself solely with digital computer decision elements and with the decisional (or switching) functions which they perform. In computers, as in offices, the better and more efficient you get at decision making, the less you need to worry about memory.

consants, variables & states

A *constant* is a quantity which, as the name implies, is constant. That is, once its value is known or given in any configuration and at any time, it can be relied upon to have that same value in any other configuration and at any other time. For example, in the non-binary world the numbers 0, 3, -17, $\frac{1}{4}$, -1.732, π are all constants. In

the expression K = 7 - 2, K is also a constant, but an unknown constant. As soon as we figure out that 7 - 2=5, K becomes the known constant 5.

Returning to the binary world, we realize there are only two binary digits, 0 and 1, and these are certainly constant. Hence there exist just two binary constants, 0 and 1.

A *variable* is a quantity which may, at various times and under various circumstances, take on a variety of values. It is usually represented by an alphabet letter.

In general, a variable may take on an infinite number of (positive or negative) values. However, in many practical applications there are expressed or implied limitations. For instance, if C were to represent the number of coins in a till, obviously neither negative nor fractional values of C would be meaningful. A variable which can represent either of the possible values of a binary digit is called a *binary variable.* A binary variable, at any given time and place, may have the value 0 or the value 1, but no other value is possible.

The possible values of a variable are often called its *states.* Thus, when a counter wheel displays the numeral 7, it may be said to be in the SEVEN state; voltage is applied when the power switch is in the ON state; a normally-open relay is closed when it is in the ENERGIZED state, etc.

A binary variable or a binary device can have only two possible values or states. These are often arbitrarily referred to as its ZERO state and its ONE state. Thus, a relay or toggle switch may be in its ZERO state, but whether this means that it is open or closed needs to be defined in a given application. There is, however, the convention that a relay is in its ZERO state when no power is applied to the coil, and in its ONE state when the coil is energized. Thus, in the ONE state, a normally-open relay has closed contacts, a normally-closed relay has open contacts, and

Table 1. States of combinations of binary variables

NUMBER OF BINARY VARIABLES IN COMBINATION	EXAMPLE	LIST OF ALL POSSIBLE COMBINED STATES OF THE EXAMPLE	TOTAL NUMBER OF POSSIBLE STATES
0 (None)	1	1	1 (or 2^0)
1	X	$\overline{X}$ X	2 (or 2^1)
2	X, Y	$\overline{X}$, $\overline{Y}$ $\overline{X}$, Y X, $\overline{Y}$ X, Y	4 (or 2^2)
3	X, Y, Z	$\overline{X}$, $\overline{Y}$, $\overline{Z}$ $\overline{X}$, $\overline{Y}$, Z $\overline{X}$, Y, $\overline{Z}$ $\overline{X}$, Y, Z X, $\overline{Y}$, $\overline{Z}$ X, $\overline{Y}$, Z X, Y, $\overline{Z}$ X, Y, Z	8 (or 2^3)
n		GENERAL CASE	2^n

the normally-open contacts of a double-throw relay are closed while its normally-closed contacts are open. Relays are generally diagrammed in the ZERO or non-energized state. See Figs. 1, 4 and 7.

Often a given state of a binary variable is called its "true" state, the other being called its "false" state. Thus, when relay X = 0 and relay Y = 1, one may say that for relay X "0 is true and 1 is false," while for relay Y "1 is true and 0 is false."

A convenient shorthand notation is the "bar," also known as the complementing sign, placed above the variable to show that it is in the ZERO state. Thus, in the above example, one would write that $\overline{X}$ and Y are true, while X and $\overline{Y}$ are false. The complementing sign indicates that what is underneath it is false and that the opposite is true, e.g. $\overline{\text{LIGHT}}$ is read "LIGHT bar" or "not LIGHT" and is equal to DARK, while $\overline{\text{DARK}}$ = LIGHT.

Several variables *in combination* may exist in many more states than the individual variables. Thus, three decimal digits, each having 10 states (0 through 9), may exist in 1000 different combinations (000 through 999). In the absence of any variables, of course, only one possible state can exist, which must be a constant.

The following table shows the possible states in which combinations of binary variables can exist, including the general case for which the number of variables is just given as "*n.*"

operations and symbols

In ordinary arithmetic and algebra one uses certain symbols to denote specific operations which are to take place involving two constants or variables. We are all familiar with the symbols "+", "−", "·", and "÷", which call for addition, subtraction, multiplication, and division, respectively. These operations are not applicable to Boolean algebra, however. It is possibly confusing that two of these symbols have been adopted to denote Boolean-algebraic operations which appear to have little if any similarity with their arithmetic counterparts.

Specifically, the "+" symbol calls for the OR operation and is called the OR symbol; the "·" symbol calls for the AND operation and is called the AND symbol. The AND symbol is often omitted when it is understood, just as the multiplication symbol in ordinary algebra is usually omitted.

The dot (AND), the cross (OR), and the bar (COMPLEMENT) are the only symbols we need, with their operations as indicated. Other authors have used different symbols for these and other operations on occasion, and one needs to be careful to have clear definitions at all times, since there is no universally accepted set of standard symbols.

Just what is implied by the AND and OR operations in Boolean algebra will be made clear in what follows.

The Boolean logical AND is a *restrictive* operator. An example will illustrate: Suppose a fashion magazine gave type-1 awards to girls with unblemished skin, type-2 awards to girls with beautiful figures *and* unblemished skin, type-3 awards to girls with attractive hair *and* beautiful figures *and* unblemished skin. Then if attractive hair is assigned the variable A, a beautiful figure the variable B, and blemished skin the variable C, it appears that:

Type-1 awards are made for $\overline{C}$ (unblemished skin)

Type-2 awards are made for $B \cdot \overline{C}$ (beautiful figure *and* unblemished skin)

Type-3 awards are made for $A \cdot B \cdot \overline{C}$ (attractive hair *and* beautiful figures *and* unblemished skin).

And it is also apparent that there will be *fewer* type-2 than type-1 awards, and that type-3 awards will be the *fewest.* (Of course, all this is only true in the general case in which A, B and C are *independent* variables. If we

knew that beautiful figures and unblemished skin always went together, then B and $\bar{C}$ would not be independent, and there would be just as many type-2 as type-1 awards.)

The truths of A, B and $\bar{C}$ are then *conditions* for the three awards, and the more conditions are imposed, joined by the AND operator, the more *restricted* a situation we have. Those who have learned the "New Math" now being taught in our schools will recognize the AND as the familiar "intersection."

We shall give a couple of more technical examples. Fig. 1 shows three relays, A, B and C, drawn, as relays always are, in their normal or non-energized states. They are connected in series between an input point and an output point, so that current can pass through relay A only if it is energized (state A), through relay B only if it is energized (state B), and through relay C only if it is non-energized

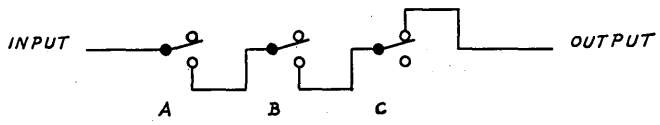


Fig. 1. And function A B $\bar{C}$ — relay implementation.

(state $\bar{C}$). Then, under what condition will there be a connection between the input and output points? The answer is:

Connection = A•B•$\bar{C}$.

In electronics we adopt the following conventions:

1. There are only two possible voltage levels—high and low.

2. High voltage represents true or ONE; low voltage represents false or ZERO.

Fig. 2 shows a three-input diode AND gate, consisting of three diodes, a resistor, and a high-level reference voltage source. Inputs A, B, and C are binary variables, which therefore may each be at a high or a low voltage. The inverter (INV.) reverses the C input voltage, so that its output is $\bar{C}$. If C is high, $\bar{C}$ will be low; if C is low, $\bar{C}$ will be high. Any of the three diodes having a low-voltage input will then clamp the output line of the AND gate to the low (false) level. Therefore, only when all the diode inputs are high will the output be high (true). This characteristic of the gate shown may be expressed as follows:

True output = A•B•$\bar{C}$

We have shown two different mechanizations of an AND circuit: the diode AND gate, and the series-relays configuration. The logical designer is not too concerned with the actual mechanization of an AND circuit to yield, as in this example, the function A•B•$\bar{C}$. He will use the general symbolism shown in Fig. 3.

the "or" operation

The Boolean logical OR is a *permissive* operator. Again, let us bring on the girls to illustrate: Suppose type-1 awards are again given to the ones with unblemished skin, but let us give type-4 awards to those girls who have unblemished skin *or* beautiful figures (or both), and give type-5 awards to those with attractive hair *or* beautiful figures *or* unblemished skin (or any two or all three of these traits). Then it appears that:

Type-1 awards are made for $\bar{C}$ (as before, unblemished skin)

Type-4 awards are made for B + $\bar{C}$ (beautiful figure *or* unblemished skin)

Type-5 awards are made for A + B + $\bar{C}$ (attractive hair *or* beautiful figure *or* unblemished skin).

And it is also apparent that there will be *more* type-4 than type-1 awards, and that type-5 awards will be *most* plentiful. Thus we see that the more conditions are imposed, joined by the OR operator, the more permissive a situation we have. Those who have learned the "New Math" will recognize the OR as the familiar "union."

The OR about which we have been talking is also called the "inclusive OR," because it includes AND. There is also an "exclusive OR", so called because it excludes AND. In ordinary English we do not distinguish between the two, except by guess. Suppose you are told, "If you are hungry *or* thirsty, you may raid the refrigerator." You would assume that the gracious host meant the inclusive OR. Otherwise, if you were both hungry *and* thirsty, the refrigerator would remain out of bounds. Suppose, though, you were told, "If you are hungry, you may eat the pie *or* the cake." This time you had better assume that the exclusive OR was meant. The lawyers do distinguish: they use the term "or" to denote the exclusive or, and the term "and/or" to denote the inclusive or.

In Boolean logic when we mean exclusive OR we say so;

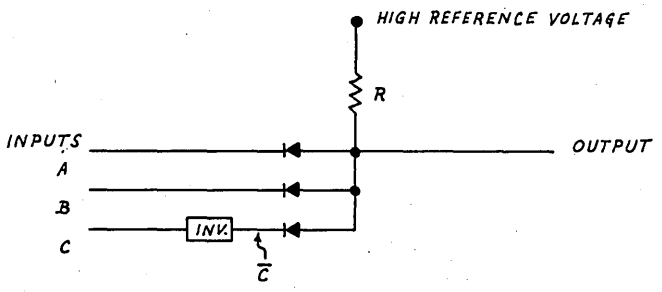


Fig. 2. And function A B $\bar{C}$ — diode implementation.

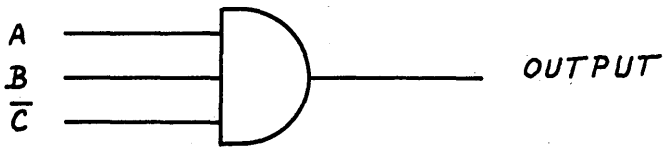


Fig. 3. And function A B $\bar{C}$ — logical symbol.

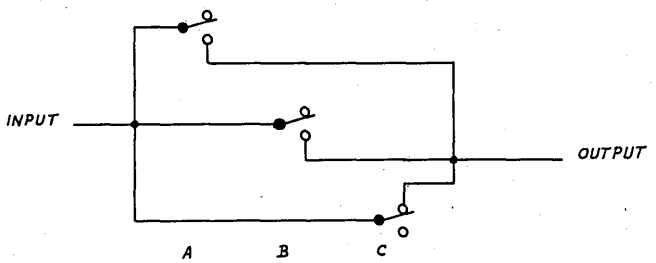


Fig. 4. Or function A + B + $\bar{C}$ — relay implementation.

when we just say OR it is always inclusive. Now for some technical examples.

In Fig. 4, relays A, B and C are connected in parallel between an input point and an output point, using the same drafting conventions as before. Under what condition(s) would we have a connection between these two points? The answer is:

Connection = A + B+ $\bar{C}$

In Fig. 5 we show a three-input OR gate, consisting of three diodes, a resistor R, and a low reference voltage. Inputs A, B and C and the inverter are the same as in Fig.

2. The output of this circuit will then be high (i.e., true) when *any* of the inputs to the three diodes are high, or

True output = A + B+ $\overline{C}$

We have shown two different mechanizations of an OR circuit: the diode OR gate, and the parallel-relays configuration. Again, the logical designer, unconcerned with the actual mechanization of an OR gate to yield A + B + $\overline{C}$, will use the general symbolism shown in Fig. 6.

the rosetta stone

The Rosetta Stone of history provided the key to deciphering the ancient Egyptian hieroglyphics. There is a small set of relationships which I like to call the Rosetta Stone of Boolean Logic, because they provide the key to what otherwise might appear to be difficult or complex problems. These relationships are the four possible combinations of 0 and 1, joined by the AND and OR operator.

1 a) $0 \cdot 0 = 0$	1 b) $0 + 0 = 0$
2 a) $0 \cdot 1 = 0$	2 b) $0 + 1 = 1$
3 a) $1 \cdot 0 = 0$	3 b) $1 + 0 = 1$
4 a) $1 \cdot 1 = 1$	4 b) $1 + 1 = 1$

Knowing what you now know about the binary constants and the two operators, you should be able to prove each of these equations to be correct. Incidentally, in 4 b) you will recognize the equation that separates the accountants from the Boolean logicians!

Now we have the basic tools for minimizing any Boolean logical function or expression: wherever we find

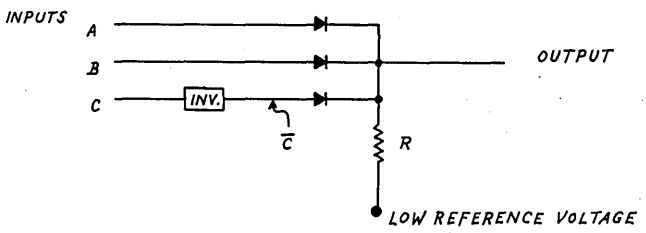


Fig. 5. Or function A + B + $\overline{C}$ — diode implementation.

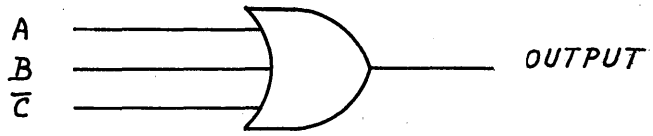


Fig. 6. Or function A + B + $\overline{C}$ — logical symbol.

one of the expressions on the left of an equality sign, we may immediately substitute for it the simpler one on the right. Also, (although the need for this may not be apparent at this point), it is permissible to substitute the other way around, making the given expression more complex than it was.

functions

A function is a way in which one or more constants and variables may be used, singly or in combination. The actual number of functions that could be written for any such combination is probably unlimited, but if one eliminates equivalent functions the total number possible can be determined.

Again, let us use an example to illustrate: Suppose we had some sealed boxes, each containing an input jack, an output jack, any amount of wire, and a prescribed number of double-throw switches with any number of poles; only the jacks and the toggle switch handles are accessible from the outside. In how many operationally different ways could these boxes have been wired inside? The answer to this question yields the number of functions that can be written for the given number of binary variables (toggle switches). See Fig. 7.

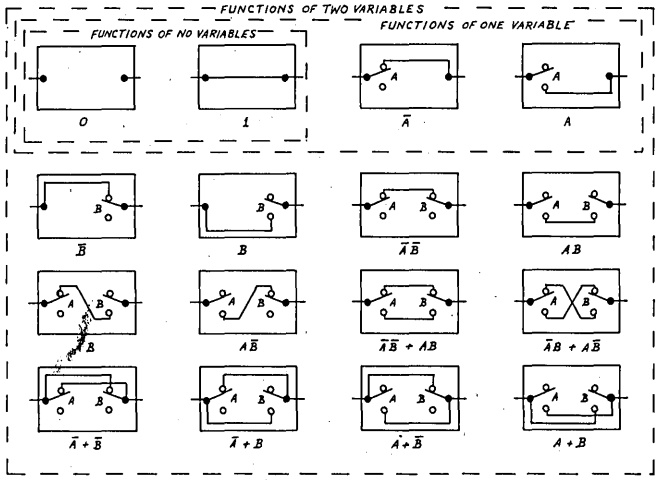


Fig. 7. Functions of zero, one and two variables.

Thus, for no variables, (i.e., no switches available for wiring), there can be only two functions:

0 (open circuit) and 1 (closed circuit).

For one variable, (say, switch A available for wiring), there can be four functions:

0, 1, $\overline{A}$, A.

For two variables (say, switches A and B available for wiring), there can be sixteen functions:

0, 1, $\overline{A}$, A, $\overline{B}$, B, $\overline{A}\,\overline{B}$, A B, $\overline{A}$ B, A $\overline{B}$,
$\overline{A}\,\overline{B} + A\,B$, $\overline{A}\,B + A\,\overline{B}$, $\overline{A} + \overline{B}$, $\overline{A} + B$,
$A + \overline{B}$, $A + B$.

We can now summarize our findings, and extend them to any number of binary variables:

Zero binary variables can yield 2 functions $(=2^1=2^{2^0})$
One binary variable can yield 4 functions $(=2^2=2^{2^1})$
Two binary variables can yield 16 functions $(=2^4=2^{2^2})$
Three binary variables can yield 256 functions $(=2^8=2^{2^3})$
etc. Or, in general terms,
"*n*" binary variables can yield (2^{2^n}) distinct functions.

Now one might think that some additional functions might be obtained, maybe just by juggling these variables (A and B) and these operators (AND, OR and COMPLEMENT). Suppose we suggest the function A B + $\overline{B}$. It turns out that this function is not in its most simplified, or minimal, form. Its minimal form is A + $\overline{B}$, which is indeed already listed. We have not shown how to minimize a function so far and must, therefore, take this on faith for the moment.

graphical representation

The nineteenth century English mathematician Venn devised a graphic or pictorial means for representing binary variables, binary states, and binary functions. His diagrams can be found in most textbooks on computer basics. However, they were never really useful in practice, being not only awkward to use but also restricted to no more than three binary variables.

Venn's diagrams did, on the other hand, inspire the

contemporary Americans Veitch and Karnaugh, in turn, to devise a more practical chart or map representation. In its present and further improved form, such a map is applicable to almost any reasonable number of variables, and is also quite easy to understand and use for the purpose of minimizing Boolean functions. We shall develop and describe such a map and shall call it a "minimap," for which we may be criticized but for which we feel we have some good reasons:

1. It serves to minimize Boolean functions.
2. It really is my version of the Karnaugh Map, which was an improvement over the Veitch Chart, which was a breakthrough in the utilization and expansion of the Venn Diagram.
3. Having given all due credit, let's coin a name that can stand continual improvement of the child without continual re-baptism.

the minimap

A minimap is a square or rectangle consisting of 2^n squares, where n is the number of binary variables being considered. Thus, there are two squares in a 1-variable map, four in a 2-variable map, eight in a 3-variable map, etc. A minimap will be square for an even number of variables, and rectangular for an odd number of variables. It is immaterial whether the rectangle is drawn horizontal or vertical, but horizontal somehow looks neater and will generally be used.

In Fig. 8 we have shown three steps in the development of a minimap for one variable, in vertical style for

(a) Each square designated by the corresponding variable in direct or complemented form according to its state

(b) Each group of squares designated by the corresponding variable, each square within the group designated by 0 or 1 according to the state of the variable

(c) Same as (b), except that 0 designations are omitted and 1 designations are replaced by lines alongside the squares

Fig. 8. Development of minimaps for one variable.

the variable A and in horizontal style for the variable B. Since the third or final version (c) is the simplest to draw and visualize, it will be used hereafter.

You will note that each of the squares of a minimap represents one of the *states* possible for the number of variables involved. In this case, there is only one variable involved in each map, and therefore only two states are represented. In the "A" map of Fig. 8(c), the states are $\bar{A}$ (upper square) and A (lower square). In the "B" map of Fig. 8(c), the states are $\bar{B}$ (left square) and B(right square).

Now we have learned that, for any given number of variables (n), there are a certain number of functions (2^{2^n}). Specifically, for one variable there exist four functions (2^{2^1}). For each of these functions certain states are true, while the others are false. Then we can represent any of the functions by marking the true squares (states) on a minimap with a 1. We can also mark the false squares (states) with a 0, but this is really superfluous and is therefore usually not done.

In Fig. 9 we show minimaps of the single variable A, marked to represent the four functions of that variable: 0 (never true), 1 (always true), $\bar{A}$ ($\bar{A}$ true but A false), and A (A true but $\bar{A}$ false).

If now we wish to plot an AND function, we will mark those squares which are true simultaneously for the two variables ANDed together. Let us plot $\bar{A} \cdot A$. Question: In what square(s) are both $\bar{A}$ and A simultaneously true? Answer: None. Hence we will mark no squares, which is the same as plotting the function 0. It appears that $\bar{A} \cdot A = 0$, which is indeed the case.

If we wish to plot an OR function, we will mark those squares which are true if either or both of the variables

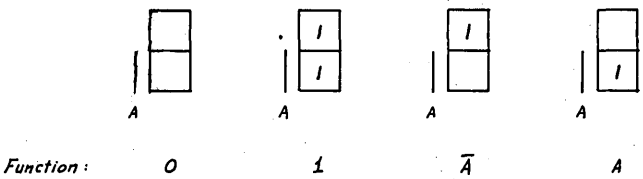
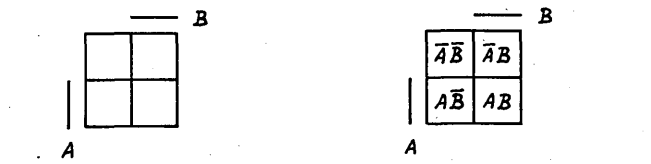


Fig. 9. Minimaps of functions of one variable.



(a) The Basic Minimap

(b) Identification of Squares with the States they Represent

Fig. 10. Minimap of two variables.

ORed together are true. Question: In what square(s) are either $\bar{A}$ or A or both true? Answer: Both. Hence we will mark both squares, which is the same as plotting the function 1. It appears that $\bar{A} + A = 1$, which is indeed the case.

Another way of looking at it is this: To plot $\bar{A} \cdot A$ we plot those squares which are marked in *both* a plot for $\bar{A}$ *and* a plot for A, namely none. To plot $\bar{A} + A$ we plot those squares which are marked in *either* a plot for $\bar{A}$ *or* a plot for A, namely both.

Let us now construct a minimap for two variables, say A and B. Since this is an even number of variables (two), the minimap will have the shape of a square. See Fig. 10. Since there are $2^n = 2^2 = 4$ states pertaining to two variables, the minimap must contain 4 squares. It will be, then, in a way, a combination of a vertical minimap for the

variable A and a horizontal minimap for the variable B, shown in Fig. 8(c). The horizontal rows represent the possible states of the variable A: Upper row represents $\overline{A}$, lower row represents A. The vertical columns represent the possible states of the variable B: Left column represents $\overline{B}$, right column represents B.

We remember also that each square of a minimap must represent one of the possible states of the combination of variables involved. In the case of the two variables A and B, the possible states represent the four possible combinations of A and B in direct and complemented form, that is to say, the respective AND functions.

mapping functions

In Fig. 7 we showed the sixteen (2^{2^2}) functions of two variables A and B, as implemented by wiring relays A and B sixteen functionally different ways. We have also stated that any and all of these functions can be represented by different ways of marking a two-variable minimap. Having learned what each of the squares represents, let us proceed to do so.

There is, obviously, just one way of marking no square at all. This represents "never true," or the function 0. See Fig. 11a.

There are four ways of marking just one square. These represent the functions $\overline{A}\,\overline{B}$ (Fig. 11b), $\overline{A}\,B$ (Fig. 11c), $A\,B$ (Fig. 11d) and $A\,\overline{B}$ (Fig. 11e). Each of these is an AND function of the two variables A and B, and represents the intersection of the particular row ($\overline{A}$ or A) and column ($\overline{B}$ or B).

There are six ways of marking just two squares, as follows:

Fig. 11f: Here we have marked the squares $\overline{A}\,\overline{B}$ and $\overline{A}\,B$, to form the function $\overline{A}\,\overline{B} + \overline{A}\,B$ which is a more permissive function than $\overline{A}\,\overline{B}$ or $\overline{A}\,B$ alone. The function can be rewritten $\overline{A}\,(\overline{B} + B) = \overline{A}\,(1) = \overline{A}$ and, in fact, had we been asked to plot all the squares in which $\overline{A}$ is true, that is, the function $\overline{A}$, we would have marked those same two squares in the top row.

Fig. 11g: Here we have marked $A\,\overline{B}$ as well as $A\,B$ to represent the function $A\,\overline{B} + A\,B = A\,(\overline{B} + B) = A\,(1) = A$.

Fig. 11h: Here we have marked $\overline{A}\,\overline{B}$ as well as $A\,\overline{B}$ to represent the function $\overline{A}\,\overline{B} + A\,\overline{B} = \overline{B}\,(\overline{A} + A) = \overline{B}\,(1) = \overline{B}$.

Fig. 11i: Here we have marked $\overline{A}\,B$ as well as $A\,B$ to represent the function $\overline{A}\,B + A\,B = B\,(\overline{A} + A) = B\,(1) = B$.

Fig. 11j: Here we have marked $\overline{A}\,\overline{B}$ as well as $A\,B$ to represent the function $\overline{A}\,\overline{B} + A\,B$. However, in this case there is no way to simplify the expression.

Fig. 11k: Here we have marked $A\,\overline{B}$ as well as $\overline{A}\,B$ to represent the function $A\,\overline{B} + \overline{A}\,B$. Again there is no way to simplify that expression.

There are four ways of marking just three squares, as follows:

Fig. 11l. This represents the function A + B. For, were we asked to plot the function A we would mark the two squares on the bottom row, $(A\,\overline{B} + A\,B)$. Were we asked to plot the function B we would mark the two squares in the right column, $\overline{A}\,B$ and $A\,B$ (again). Hence, to mark the function A + B we would mark $A\,\overline{B} + A\,B + \overline{A}\,B + AB$, there being, of course, no point in marking $A\,B$ twice.

Fig. 11m: This represents the function $A + \overline{B}$ for similar reasons as above.

Fig. 11n: This represents the function $\overline{A} + \overline{B}$.

Fig. 11o: This represents the function $\overline{A} + B$.

Finally, there is just one way of marking all squares. This represents "always true," or the function 1. See Fig. 11p. It may be noted that this function is composed as follows:

$1 = \overline{A} + A = \overline{B} + B = \overline{A}\,\overline{B} + \overline{A}\,B + A\,\overline{B} + A\,B.$

special names

Of the sixteen functions mapped in Fig. 11, eight can be seen to be symmetrical about a diagonal line drawn through the $\overline{A}\,\overline{B}$ and $A\,B$ corners. These eight functions would, therefore, remain unchanged if the variables A and B were to be swapped, one for the other. These functions are then, in a way, special and have been given names as follows:

Fig. 11a. 0 — NULL function (never true)

Fig. 11b $\overline{A}\,\overline{B}$ — NOR function. NOR is a contraction of "not or." The function is so called because it is equal to $\overline{A + B}$ by virtue of De Morgan's Law, which will be introduced later.

Fig. 11d $A\,B$ — AND function

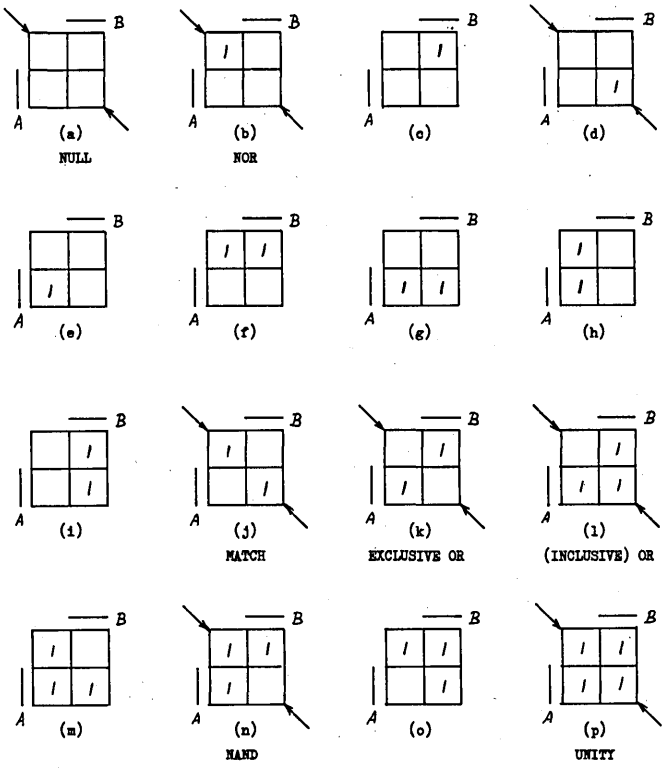


Fig. 11. Minimaps of functions of two variables.

Fig. 11j $\overline{A}\,\overline{B} + A\,B$ — MATCH function, so named by the writer because it is true when A and B are matched; i.e., both true or both false.

Fig. 11k $A\,\overline{B} + \overline{A}\,B$ — EXCLUSIVE OR function. Sometimes written $A \oplus B$. (It could be called the "non-match" function.)

Fig. 11l $A + B$ — INCLUSIVE OR function.

Fig. 11n $\overline{A} + \overline{B}$ — NAND function. NAND is a contrac-

tion of "not and." The function is so called because it is equal to $\overline{A\,B}$ by virtue of De Morgan's Law.

Fig. 11p 1 UNITY function (always true)

Entire computers can be and have been designed and built on the basis of the operators AND, OR and COMPLEMENT. Techniques for simplifying logical functions using these operators can be made simple and fairly straightforward, as we shall see shortly. With the introduction in recent years of integrated circuits, however, there has come about a preference for NOR and NAND logic modules which lend themselves better to this type of design, largely because they have a built-in complementing feature.

Should you be interested in designing or analyzing NOR and NAND logic equipment, the techniques given here for AND and OR may be used provided that you will take account of the fact that NOR is the complement of OR, and is therefore a *restrictive* operator, while NAND is the complement of AND, and is therefore a *permissive* operator.

Before we play a game, we must establish some rules for it. Since diode gates are the most common decision or switching elements, we shall establish that the circuit with the fewest diodes will be considered the simplest. Since diodes cost more than resistors, and resistors vary pretty much in proportion to diodes needed anyway, this makes the "simplest" circuit the cheapest one that will perform the required function.

Logic structures will consist of OR gates feeding AND gates, and AND gates feeding OR gates. (There is never a need for a gate feeding another of the same type.) The number of gates thus connected in a logic chain determines the "order" of the function implemented. In Fig. 12 we show functions of 1st, 2nd, and 3rd order, leading off with an OR gate on the left, and with an AND gate on the right. We have also indicated the number of diodes required to implement each structure. For technical reasons of diode back-resistance drop and cumulative timing error, structures involving many diodes in series are considered relatively unreliable. It is possible to reduce any function to one of (first or) second order, and this restriction will therefore be imposed: Even though we may be saving diodes, and thus minimize a function by going to third or higher orders, we will not do so, but will minimize on the basis of first and second order functions. Accordingly, we have redrawn the third order functions in Fig. 12 as second order ones, and shown the price we pay in additional diodes.

minimap of several variables

The design of a minimap of several variables is based on the design of a minimap of one less variable and is twice the size of that minimap. We obtained a two-variable minimap (for A and B) by taking a one-variable minimap (for A) and adding a mirror copy of it on its right-hand edge. We then designated the original half, where there was no B variable, as $\overline{B}$ and the new half as B.

It is generally preferable, if only for aesthetic reasons, to make a minimap square (for an even number of variables) or a horizontal rectangle (for an odd number of variables). Admittedly, the one-variable minimap for A was drawn vertically for teaching reasons—I will not do it again. So, to change an even-variable minimap into a larger odd-variable minimap, we shall mirror-copy it to the right of the original. To change an odd-variable minimap into a larger even-variable minimap, we shall mirror-copy it below the original.

Further, having initially determined how many variables we need and what their letter-designations are to be, it is best not to assign them until the map is actually drawn, complete with the required designation lines along the left and top edges. It is then easy to assign the first half of the variables to the row designators, and the second half to the column designators. In the case of an

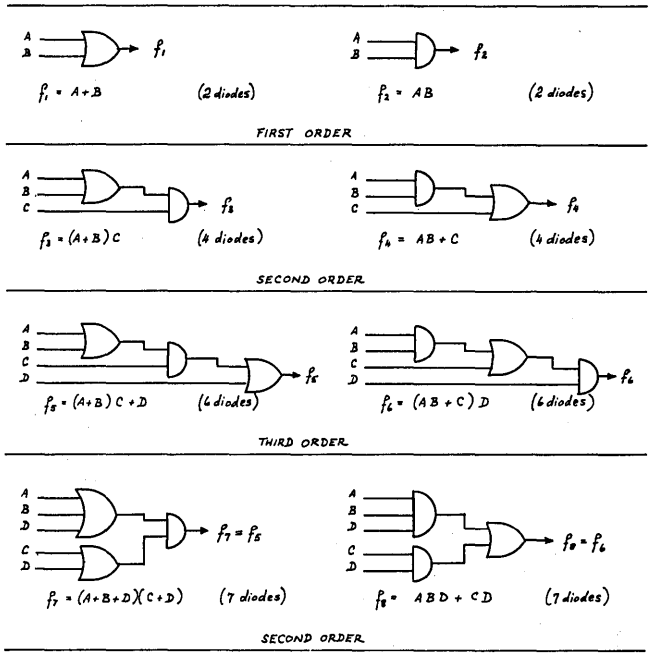


Fig. 12. Logic functions of first, second and third order.

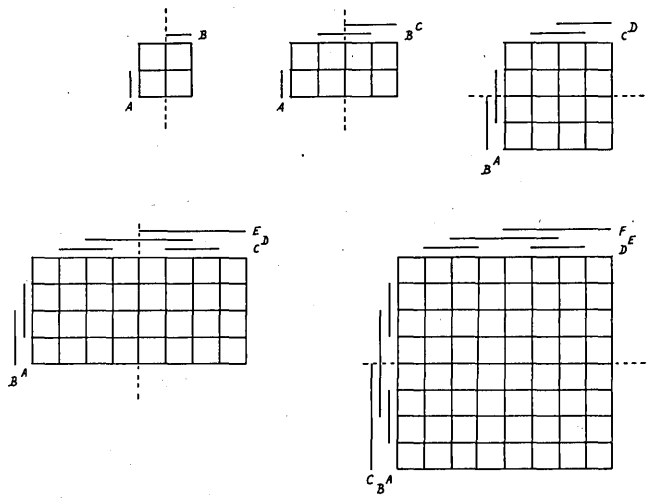


Fig. 13. Development of minimaps for two, three, four, five, and six variables.

odd number of variables, we shall choose to have one more column designator (and its variable) than row designators, to wind up with a horizontal rectangle. See Fig. 13.

It is apparent from the figures that minimaps for almost any reasonable number of variables can thus be constructed readily. The dashed line shown in each of the drawings is, of course, not a part of the minimap, but indicates how the next-smaller minimap was mirrored to draw the new one in each case.

Consider as an example the six-variable minimap. We

call the vertical lines on the left the row designators, the A row designator being the row designator of first order, B the designator of second order, and C the designator of third order. Likewise, we call the horizontal lines on top the column designators, the D column designator being the column designator of first order, E the designator of second order, and F the designator of third order. Although it is not apparent at this point, it will be beneficial later on to be able to distinguish between designators of lower and higher orders.

minterms and maxterms

Consider again the plots of two variables in Fig. 11, excluding the NULL and UNITY functions which do not contain either of the variables A and B. A special name has been given to those functions which occupy the *minimum* number of squares (namely, one). They are called *minterms* and there are 2^n of them: $\overline{A}\,\overline{B}$ (Fig. 11b), $\overline{A}\,B$ (Fig. 11c), $A\,B$ (Fig. 11d), and $A\,\overline{B}$ (Fig. 11e). The complete set of minterms comprises all possible combinations of the variables involved, in direct and complemented form, combined by the AND operator.

A special name has also been given to those functions which occupy the *maximum* number of squares (namely 2^n-1 or, in this case, three). They are called *maxterms* and there are also 2^n of them: $A + B$ (Fig. 11l), $A + \overline{B}$ (Fig. 11m), $\overline{A} + \overline{B}$ (Fig. 11n), and $\overline{A} + B$ (Fig. 11o). The complete set of maxterms comprises all possible combinations of the variables involved, in direct and complemented form, combined by the OR operator.

The expression "minterm function" generally refers to a function consisting of one or more minterms combined by the OR operator, e.g., $(A\,B) + (A\,\overline{B})$. The expression "maxterm function" refers to a function consisting of one or more maxterms combined by the AND operator, e.g., $(A + B)\,(A + \overline{B})$.

A useful device in the task of minimizing Boolean logical functions by means of a minimap is the concept of axes of symmetry of the different variables. The axes of symmetry of a variable are the (imaginary) lines which could be drawn through the minimap at right angles to the designator of that variable and passing through its end points. See Fig. 14.

Thus in the first minimap in Fig. 13, the vertical dashed line drawn through the end of the B designator coincides with one of the B axes of symmetry; the right edge of the minimap is another. A horizontal line through the middle of the minimap and passing through the top end of the A designator is one of the A axes of symmetry; the bottom edge of the minimap is another.

It should be pointed out at this time that a minimap must be considered to "fold back" upon itself, both horizontally and vertically, in the same manner as a complete map of the world folds back upon itself horizontally: Siberia generally appears on both sides of the map. Thus, the bottom edge of a minimap coincides with its top edge; the right edge coincides with its left edge.

So we see that the minimap for two variables has B axes of symmetry along both sides and through the middle; all are vertical lines, i.e., they are at right angles to the B designator. Similarly, it has A axes of symmetry along the top and bottom and through the middle; all are horizontal lines, i.e., they are at right angles to the A designator.

A minimap for five variables then (see Fig. 14) has these horizontal axes of symmetry: two for A, and three for C.

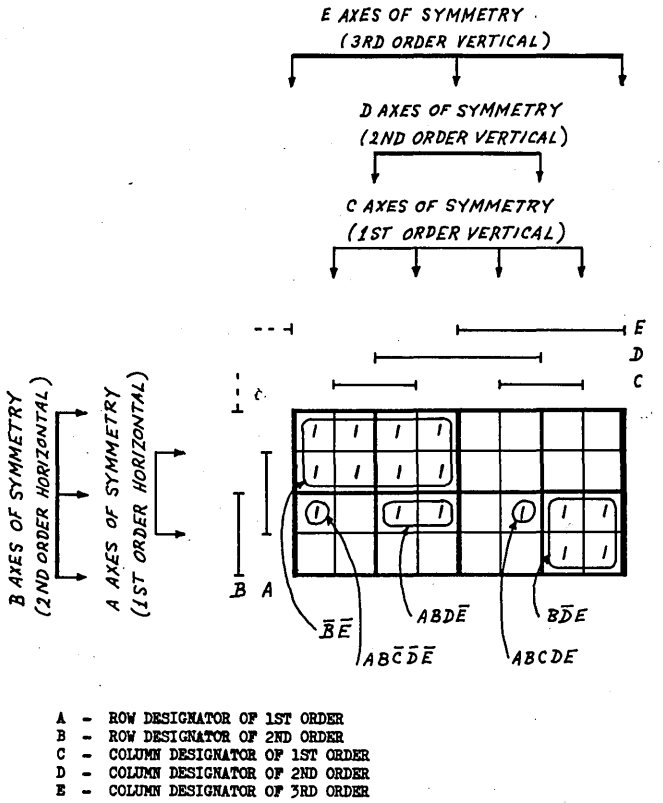


Fig. 14. Function plotted on a minimap of five variables, showing row and column designators and horizontal and vertical axes of symmetry.

Likewise it has these vertical axes of symmetry: four for C, two for D, and three for E.

plotting

Suppose we wish to plot a function of five variables on a minimap. This minimap will have 2^5 or 32 squares, and it will be rectangular. The row designators will be A and B; the column designators will be C, D, and E. Let the function be: $A\,B\,\overline{C}\,\overline{D}\,\overline{E} + A\,B\,C\,D\,E + A\,B\,D\,\overline{E} + B\,\overline{D}\,E + \overline{B}\,\overline{E}$. This function contains five terms, of which the first two are true minterms, in that they contain all of the five variables. Each of these will be plotted in one square of the minimap. The other terms are called minterm-type, or incomplete minterms; the number of squares that must be plotted for each of these doubles for every missing variable. Thus, the third term is plotted in two squares, the fourth in four squares, and the last term in eight squares. It happens often, but not in this case, that a certain square may be marked more than once; that is, it belongs to more than one term. Having marked it once, we may or may not mark it again as we please—the condition has been imposed and we will neither add to it or detract from it by repeating it.

Examine now the two squares plotted for the term $A\,B\,D\,\overline{E}$. You will find that they are balanced about a C axis of symmetry, and that no axis of symmetry of higher order passes between them. This is a pictorial way of saying

that A B D $\overline{E}$ = A B D $\overline{E}$ (C + $\overline{C}$) = A B C D $\overline{E}$ + A B $\overline{C}$ D $\overline{E}$. Conversely, if the two true minterms A B C D $\overline{E}$ + A B $\overline{C}$ D $\overline{E}$ were given, we would know that they contain (C + $\overline{C}$) between them, which can be eliminated with a resultant simplification.

Examine the four squares plotted for the term B $\overline{D}$ E. They balance about the A axis of symmetry and also about the C axis of symmetry, and no axis of symmetry of higher order passes among them. Thus, the variables A and C need not appear in the term, as indeed they do not.

Finally, examine the eight squares plotted for the term $\overline{B}$ $\overline{E}$. They are found to balance about A and D axes of symmetry, and each equal half of the group further balances about C axes of symmetry, without there being axes of symmetry of higher order passing through the group.

minimizing functions

Given a function plotted on a minimap, we have now learned enough to read it back out of the map in minimized form. The clue is, that a single square must be identified by a full minterm, but that certain combinations of several squares can be identified together by less than a minterm. The following guidelines apply:

1. The number of squares to be thus combined must be a power of 2.
2. The squares to be combined must balance about one or more axes of symmetry; the variable(s) that can be eliminated by minimization are the variables identified with the respective axis or axes of symmetry.
3. No axis of symmetry of higher order than that under consideration, and parallel to it, may pass through the group of squares to be combined.

As an example, let us again look at the minimap as plotted in Fig. 14, pretending we did not know the function from which it was plotted in the first place.

The largest group of squares eligible for combination is a group of eight (2^3) at the top, left. It balances about an A axis of symmetry, and no higher-order axis passes through it horizontally. It balances about a D axis of symmetry, its equal halves balance about C axes of symmetry, and no higher-order axis of symmetry passes through it vertically. Hence the variables A, C, and D can be eliminated, and the combination of eight squares identified by the term $\overline{B}$ $\overline{E}$.

The next-largest group of squares eligible for combination is the group of four (2^2) at the bottom, right. It balances about an A axis of symmetry, and no higher-order axis passes through it horizontally. It balances about a C axis of symmetry, and no higher-order axis passes through it vertically. The combination of these four squares is identified by the term B $\overline{D}$ E, variables A and C having been eliminated.

Next in size would appear to be the circled group of two squares in the left half of the minimap. However, if we may use certain squares more than once (and we may, if it is desirable!), we may consider these two squares in combination with the two directly above as a group of four (2^2). This group is balanced about B and C axes of symmetry, no higher-order ones passing through, indicating that these two variables can be eliminated. The combination of these four squares is then identified by the term A D $\overline{E}$.

There remain two squares, or conditions, which have not yet been taken care of or satisfied. They balance about a C axis of symmetry, the second from the left. However, higher-order vertical axes pass between them, one of D and one of E; thus these two squares are not combinable. If we are to satisfy them separately, we would require a full minterm for each. Let us look closer.

First, consider the square A B C D E. One square to the right of it is the square A B C $\overline{D}$ E and the two can be combined into the term A B C E eliminating the variable D. Alternatively, three squares to the left of A B C D E we find A B C D $\overline{E}$ and the two can be combined into the term A B C D, eliminating the variable E. Both solutions are equally good and inexpensive.

Next, consider the square A B $\overline{C}$ $\overline{D}$ $\overline{E}$. One square above it is the square A $\overline{B}$ $\overline{C}$ $\overline{D}$ $\overline{E}$ and the two can be combined into the term A $\overline{C}$ $\overline{D}$ $\overline{E}$, eliminating the variable B. Alternatively, three squares to the right of A B $\overline{C}$ $\overline{D}$ $\overline{E}$ we find A B $\overline{C}$ D $\overline{E}$ and the two can be combined into the term A B $\overline{C}$ $\overline{E}$, eliminating the variable D. Alternatively, seven squares to the right of A B $\overline{C}$ $\overline{D}$ $\overline{E}$ (or one square to the left!) we find A B $\overline{C}$ $\overline{D}$ E and the two can be combined into the term A B $\overline{C}$ $\overline{D}$, eliminating the variable E. All three of these solutions are equally good and inexpensive.

Having originally plotted the minimap in Fig. 13 to represent the arbitrarily chosen function:

$\overline{B}$ $\overline{E}$ + B $\overline{D}$ E + A B D $\overline{E}$ + A B C D E + A B $\overline{C}$ $\overline{D}$ $\overline{E}$,

we have now managed to minimize it to yield the following six functions, each of which is equivalent to the original one, each of which is equally good and valid, and each of which is appreciably cheaper to implement than the original one:

$$\overline{B}\,\overline{E} + B\,\overline{D}\,E + A\,D\,\overline{E} + \begin{Bmatrix} A\,B\,C\,E \\ \text{or} \\ A\,B\,C\,D \end{Bmatrix} + \begin{Bmatrix} A\,\overline{C}\,\overline{D}\,\overline{E} \\ \text{or} \\ A\,B\,\overline{C}\,\overline{E} \\ \text{or} \\ A\,B\,\overline{C}\,\overline{D} \end{Bmatrix}$$

de morgan's law

One of the very useful tools in Boolean logic is De Morgan's Law. It states in essence that the complement of any function is obtained if one complements each variable in the original function and changes all AND operators to OR operators, and all OR operators to AND operators.

Do you remember the girls who got type-3 awards for having attractive hair (A) *and* beautiful figures (B) *and* unblemished skin ($\overline{C}$)? Question: Who did *not* get type-3 awards?

Type-3 = A B $\overline{C}$ (attractive hair *and* beautiful figure *and* unblemished skin—few of these, unfortunately)

$\overline{\text{Type-3}}$ = $\overline{A}$ + $\overline{B}$ + C (many of these)

Answer: Those who had unattractive hair ($\overline{A}$) *or* unbeautiful figures ($\overline{B}$) *or* blemished skin (C). And do you remember the girls that got type-5 awards for having attractive hair *or* beautiful figures *or* unblemished skin? Question: Who did *not* get type-5 awards?

Type-5 = A + B + $\overline{C}$ (attractive hair *or* beautiful figure *or* unblemished skin—many of these)

$\overline{\text{Type-5}}$ = $\overline{A}$ $\overline{B}$ C (few of these, fortunately)

Answer: Those who had unattractive hair *and* unbeautiful figures *and* blemished skin. Ugh.

Let us illustrate with a few further examples, where f

denotes a particular function and $\overline{f}$ denotes the complement of that function.

If $f = A\,B\,C + \overline{A}\,\overline{B}\,\overline{C}$ then $\overline{f} = (\overline{A} + \overline{B} + \overline{C})\,(A + B + C)$

If $f = A + B\,\overline{C}\,(\overline{A} + C)$ then $\overline{f} = \overline{A}\,(\overline{B} + C + A\,\overline{C})$

If $f = (A + B)\ (\overline{B} + \overline{C})\ (A + C)$ then $\overline{f} = \overline{A}\,\overline{B} + B\,C + \overline{A}\,\overline{C}$

In graphical representation, it can be demonstrated that if a function is plotted on a minimap, then the complement of that function will be plotted to look like a "photographic negative" of the first plot. That is, the minimap of the complement of the function will have ones where there were none in the original map, and will have blanks where the original map had ones.

Besides making it easy for us to find the complement of a function, De Morgan's law, when applied, does another thing which may or may not happen to be welcome. That is, it changes a function in minterm form to its complement in maxterm form, and it changes a function in maxterm form to its complement in minterm form. Of course, as far as the number of diodes required to implement a function is concerned, it doesn't matter what form it is in. For instance, $f = \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,B\,C + A\,\overline{B}\,C + A\,B\,\overline{C}$ is a mintern function requiring 16 diodes to implement it, while $\overline{f} = (A + B + C)\ (A + \overline{B} + \overline{C})\ (\overline{A} + B + \overline{C})\ (\overline{A} + \overline{B} + C)$ is a maxterm function requiring also 16 diodes, but in a different configuration.

minimizing maxterm functions

There are methods of minimizing functions in maxterm form directly. However, they are generally cumbersome and prone to error on the part of the logical designer. We favor minimap methods of minimization—and functions in maxterm form are difficult to plot on a minimap.

One approach, of course, is to go through a lot of Boolean algebra and change the function from maxterm to minterm form before attempting to plot it. This, again, is cumbersome and error-prone.

A better approach utilizes the fact that if a function is in minimized form its complement will be, too. Alternatively, if the complement of a function has been minimized the function itself has been, too. We also make use of the following knowledge:

1. Applying De Morgan's Law to a maxterm-form function will complement it and put it in minterm form.
2. We can plot a function in minterm form on a minimap, and then minimize it.
3. Applying De Morgan's law to a minterm-form function will complement it and put it in maxterm form.

The following sequence is then followed to minimize a maxterm type function by use of a minimap, and with a minimum use of Boolean algebra or intuition, other than twice applying De Morgan's law: (See Fig. 15)

1. Starting with the function f in maxterm form, apply De Morgan's law. This results in the function $\overline{f}$ in minterm form.
2. Plot the function $\overline{f}$ in minterm form on a minimap and proceed to minimize it. You now have the minimized function $\overline{f}$, in minterm form.
3. Apply De Morgan's law to this function. You end up with the complement of $\overline{f}$, which is again f, in maxterm form, and it is still minimized.

To illustrate, let it be required to minimize the maxterm type function $f = (A + \overline{B} + C)\ (\overline{A} + B + \overline{C})\ (\overline{A} + \overline{B} + \overline{C})$. Applying De Morgan's law, $\overline{f} = \overline{A}\,B\,\overline{C} + A\,\overline{B}\,C + A\,B\,C$. Plotting this on a minimap (see Fig. 15) and then

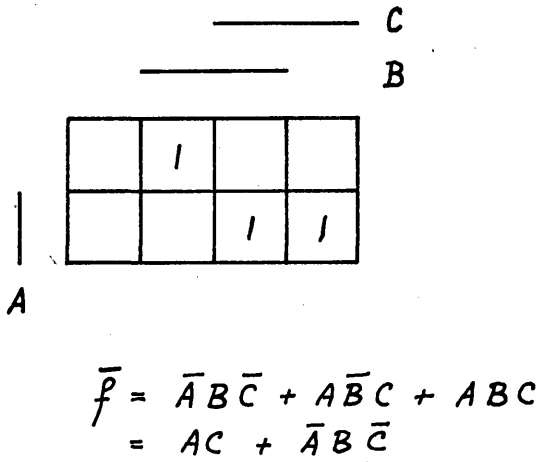


Fig. 15. Minimizing a maxterm type function by minimap method.

minimizing this complement of the original function, we get: $\overline{f} = A\,C + \overline{A}\,B\,\overline{C}$. Applying De Morgan's law again, we obtain the original function, minimized, and in maxterm form: $f = (\overline{A} + \overline{C})\ (A + \overline{B} + C)$.

If you have followed the writer up to this point, you do not necessarily rate the title of logical designer, but you will have gained considerable insight into what logical design is and how it can be used readily. Useful applications for this skill are not restricted to digital computers but are being found in many other aspects of science and technology.

As has been noted in the introductory paragraphs, there are many excellent books and papers which, if interest or need warrant, will carry you deeper and farther into the field. If you will permit an analogy, you can now play easy tunes and have fun on an instrument about which you may not have known much when you started reading this, and you will better understand and appreciate the virtuosity of the accomplished performer. Whether or not you aspire to virtuosity yourself is up to you, of course. Just remember, though, that virtuosity in logical design, as in instrumental music, is not acquired in a day. ■

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guidelines

SELECTING A PRIVATE EDP SCHOOL

by EDWARD W. MARKHAM

Too many private data processing schools specifically set up to train the novice are not doing their job; they are short-changing their students.[1] Recently an ACM committee was formed to deal with the problem.[2] In the last couple of years, two recognized trade school accrediting agencies have become involved in reviewing data processing schools. Other changes are in the wind. But while long-range reforms are being considered, students continue to enroll in high-priced courses which are not providing them with an adequate education. Something must be done now, as the following comments bear witness.

"Our instructor told us the school hired him to teach programming even though all he'd done before was operate a computer. He studied along with us so he'd know what to do the following day."

"They told me 80% of all programmers don't have a college degree. Now everywhere I go I'm told they're sorry but they only want college people."

"When I called the school six months after graduation for placement assistance, they told me I must be kidding. They were having enough trouble placing their current graduating classes."

"They offered me a job as the school receptionist."

"They gave me the name of an employment agency."

"We spent six weeks on arithmetic, the IBM card, and keypunch. No wonder the course takes 1,000 hours."

"Even before our branch officially opened, I got a call from a graduate of another school. Seems they couldn't place him, and he wondered if I could find him a job."

"They told me I had to know programming before I could learn to repair machines. I did; then nobody would hire me because I didn't have enough electronics background to become a technician."

Sometimes a prospective student contacts an individual working in edp to ask, "What school should I go to?" Too often the response is, "I don't know; check with the Better Business Bureau," or "They're all rotten; why don't you go to college?" It is easy for an insider to categorically veto all private schools and shrug off the question. But to the man wishing rapid entry into the field, suggesting a four-year stay in college is useless. People have entered the edp field without either a degree or prior training. An edp school prospect, especially a recent high school graduate, might better be advised to first apply for a beginning job, such as a control clerk or a tab machine operator, before resorting to a data processing school. Without adequate counseling, the prospect is ripe for the soothing promises of an edp school salesman, "There's room for everyone. The industry needs people. You've got what it takes."

Certainly the industry, through its professional organizations, should press for tighter state licensing controls; additional computer-oriented companies should consider providing instruction to the general public[3]; to guarantee the school prospect impartial results, pre-entrant testing by organizations other than edp schools should be made generally available and given adequate publicity; high schools should be encouraged to expand their curriculums to include data processing; and disappointed students and graduates should be encouraged to complain through proper

[1] Markham, E., *EDP Schools—An Inside View*, DATAMATION, April, 1968.

[2] ACM Steering Group for Accreditation. For information write: Dr. Carl Hammer, Univac, 2121 Wisconsin N.W., Washington, D.C. 20007.

[3] At present Control Data, through its education branch, Control Data Institutes, is the only computer manufacturer directly engaged in non-customer training. At least one other manufacturer, however, is considering a similar operation. CDC has also taken over the Automation Institute franchises through its acquisition of CEIR. Acquisition is bringing other computer-oriented companies into the edp school business as well, e.g. Computing and Software, Inc. has recently purchased the several International Tabulating Institutes. Computer Usage Corp. also offers training through its Computer Usage Education subsidiary home study courses. In addition, many companies offer professional training programs and seminars; these, however, are intended for those already in the field rather than for novices wishing to prepare for employment.

channels such as state boards of education, state legislators and Better Business Bureaus, to effect legislative action and protect future students.

But these changes will come about slowly, at best. In the meantime, increasing numbers of students are indiscriminately enrolling in private edp schools. To help make their selection meaningful, the data processing community should encourage and support distribution of student guidelines to selection of the best data processing school available. In this way, members of the industry can provide a public service without endorsing any individual institute, while at the same time insuring a flow of qualified junior personnel into the data processing field.

student guidelines

There are four areas of concern in selecting an edp school: 1) preadmission interviewing and testing, 2) curriculum and hands-on training, 3) quality of instruction, and 4) placement assistance.

Pre-admission interviewing and testing. Before approaching a data processing school, a serious prospect should first read at least one introductory text. This will help him decide if he wants to enter the field, and, if the answer is yes, provide him with a background for asking meaningful questions and understanding the answers during school interviews. Several computer manufacturers offer excellent, inexpensive introductory manuals.[4] There are any number of excellent texts to be found at the public library. And there is I. J. Seligsohn's light and informative discussion of job classifications, their requirements, and people in data processing in *Your Career in Computer Programming*, published in 1967 by Messner, priced at $3.95.

A course at a private edp school usually costs between $1,000 and $2,000 and takes from three to nine months of study, four or five hours per week day. As an alternative to this high investment, anyone seriously considering edp studies should be encouraged not only to read available literature but also to investigate nominally priced adult education courses offered by local public school systems and colleges. In addition, some community colleges have established curriculums leading to an Associate Degree in Data Processing. The cost of such a two-year course is far less than that of a private edp school.

The curriculum in Table 1 is taken from a 1967/68 community college catalogue. Maximum resident tuition is $90 a semester or $6 per hour.

If after preliminary investigation of the field an individual still wants to go the private edp school route, he should investigate several schools. In doing so, advertising claims should be discounted, including lists of group memberships, such as Better Business Bureaus, Chambers of Commerce, and DPMA, and lists of approving organizations, such as a state department of education and the federal government for training of veteran and foreign students. Organization membership does not constitute endorsement; most states have lax licensing requirements. If, however, a school advertises accreditation either by the Accrediting Commission for Business Schools or the National Association of Trade and Technical Schools, it indicates that the school has submitted to inspection by a team of impartial commissioners and has been found to meet at least the group's minimum standards for accreditation.[5] Unfortunately, edp school accreditation is still so new that standards are not all they might be; few schools have felt the need to apply, and still fewer have been accredited.

When a prospect contacts a school, he receives either an invitation to come in for aptitude testing and counseling or a letter with a do-it-yourself aptitude test enclosed. The latter situation should be suspect. It indicates that the school is not interested in controlling the test environment and will probably ignore the test results, accepting enrollment from all comers whether or not they indicate a likelihood of success.

Most schools utilize some version of the IBM Programmer Aptitude Test (PAT), the test most widely encountered by programmers in interviewing for a job. Many employers are interested only in those scoring an "A" on the test. Some will consider those scoring a "B"; below this mark job opportunities are limited. Thus it is important that the test is accurately administered and that the applicant is apprised of his actual score and grade standing.

In one frequently used version of the test, scored on the basis of the number correct minus one-quarter the number wrong, 61 and above is an "A" and anything below 36 is a "D" or failing, out of a possible 95 questions. The test currently administered by IBM itself contains 80 questions, with 57 and up an "A", 47-56 a "B", 37-46 a "C", and anything below 36 a "D" or failing, scored on the basis of right minus wrong. Schools which use their own test often offer a simplified version of PAT. This is particularly dangerous because it encourages enrollment of students who have a limited chance of success. This doesn't mean that all non-IBM tests lack validity. It does mean, however, that if a

Table I

SEMESTER I—15 hours

Introduction to EDP—Includes basic dp cycle; types and uses of equipment; systems and techniques; manual, mechanical and electronic applications; data representation; programming systems; Programmer Aptitude Test.

DP Math—Includes concepts of notation, number systems, representation of numbers with arbitrary bases, fixed and floating point numbers, precision and significance, basic algebra, linear equations.

Principles of Accounting I **English**

SEMESTER II—15 hours

DP Math—Concept of iterative process, solution of simultaneous linear equations, logic, Boolean algebra, methods of numerical computation, classification of errors in numerical solutions of a problem.

Unit Record Processing **English**

Principles of Accounting II **Physical Education**

SUMMER—6 hours

Industrial Psychology **Elective**

SEMESTER III—15 hours

Introduction to Computer Programming **Cost Accounting**

Systems and Procedures—Includes methods analysis, identification of basic data, operations and controls, development and maintenance of procedures, work simplification, forms design, records management.

DP Experience—Work-experience or special directed study.

Typing

SEMESTER IV—15 hours

Computer Programming—COBOL **DP Experience**

Business Systems Design and Analysis—Includes establishing objectives, data collection, analysis, solutions, system specifications and installation.

Physical Education **National, State, Local Government**

[4] See suggested readings at the end of the article.

[5] For information: Accrediting Commission for Business Schools, Suite 724, New Center Bldg., 7430 Second Avenue, Detroit, Mich. 48202; National Association of Trade and Technical Schools, 1601 18th Street N.W., Washington, D.C. 20009.

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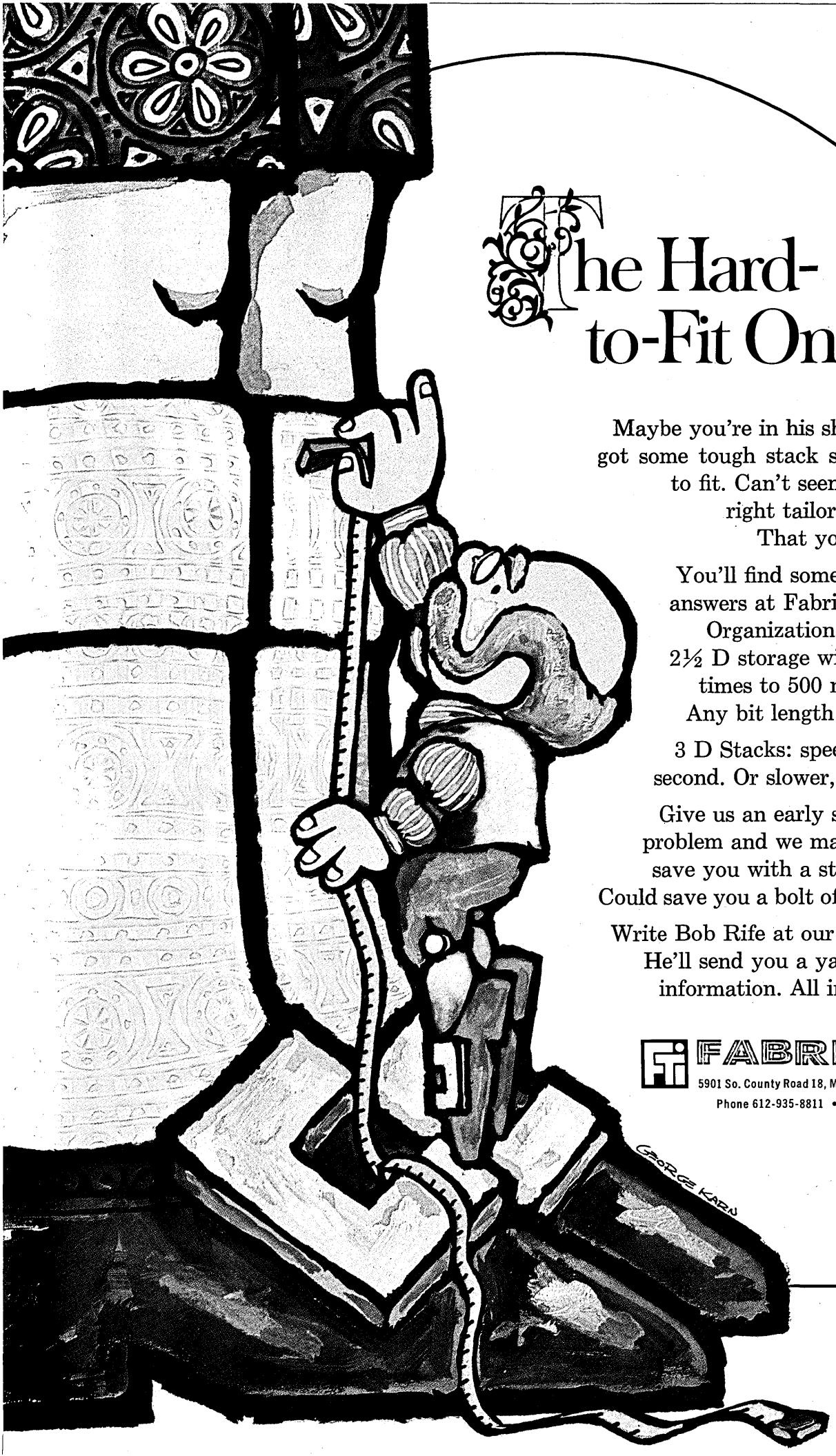

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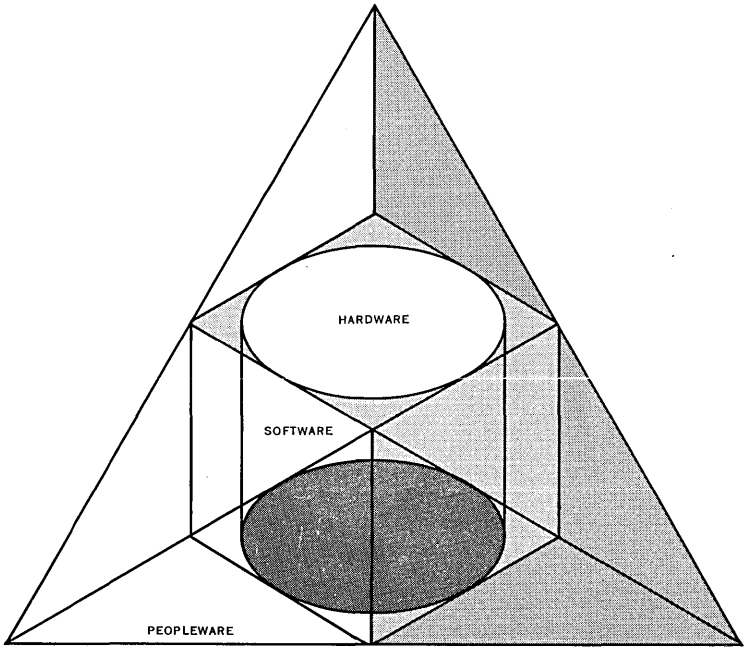

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school claims to be administering an IBM test, the student should be able to verify that the test is genuine. All IBM tests are printed forms bearing the IBM trademark on the front and a form number on the back cover, using the format LDD-DDDD-D, where L is a letter, D a digit, and the last D indicates the revision, 0 for original edition, 1 for first revision, etc.

Regardless of what the test, or how it is administered, aptitude should be tested at more than one school. Then if one school records a high score while another records a rather low one, the prospect has an indication that he should seek further, impartial testing before proceeding. Universities, high schools, and some YMCA's are among those offering aptitude testing services. Sometimes there is a charge of $40 or $50, a small fee when compared to school tuition, particularly for an individual who may later find he lacks either aptitude or genuine interest in a data processing career.

Close to the time of his initial school contact, a prospective student will be requested to fill out a general application form, which, along with personal statistics, might request information on enrollment objectives, where the applicant first learned of the school, etc. He will also likely be given literature concerning the school and reprints of articles from respected publications stressing high salary potential and tremendous job opportunities available in the field. In reading school-published literature, the prospect should accept only the hard facts—curriculum content, location of facilities, on-site equipment, extent of advertising to the industry, etc.[6] In reading general interest magazine and newspaper reprints, the prospect should realize that while the figures quoted were meant to be informative, the articles themselves were never intended for use in a sales pitch. Reprints of articles specifically praising a given institution, though the publisher may have attempted verification of facts, are generally the work of a good public relations man.

checking out the school

Once past the testing, the prospective student is usually taken on a grand tour of the school to impress him with the complexity of the on-site equipment and the hustle-bustle of student activity. He is also involved in a counselor interview. It is during the interview that the prospect should begin asking questions relative to curriculum, quality of instruction, nature of on-site equipment, hours of direct hands-on experience, additional machine time and placement facilities.

There are several pitfalls in accepting a counselor's statements at face value. As a rule the counselor is strictly a salesman, usually with no more than a smattering of "computerese" and a bagful of "puff" designed to impress the novice. "Everyman has a future in edp; placement is a snap; starting salaries are $700 a month minimum; the school curriculum includes everything needed to make the grade." The salesman comes on as sincerely interested in the prospect's future. But once the contract is signed, that's it; the salesman's income, after all, is straight commission on sales.

In deciding on a school, then, a prospect would do well to talk to the school's director of education. If the director also appears little acquainted with data processing (a prospect might inquire about his employment history, length of association with the school, and time as director) or if he wastes the applicant's time bragging of his own successes or those of his graduates, the school should be rejected. To exercise real control over instructors and classroom activities, the man in charge must have knowledge of, and interest in, the school's educational objectives, not simply in making money.

Another thing worth checking is whether or not class starts are pre-scheduled or spur-of-the-moment, whenever enrollment justifies. In either case, postponements can result from pre-commencement dropouts or unanticipated enrollment lag, but the latter situation can also lead to a delay while a staff instructor rushes an existing group to graduation or the school hunts up a new instructor who, due to the urgency of the need, may fall short of being qualified. Last minute scheduling also makes inter-class transfers difficult. In this regard, the prospective student should determine whether or not there is an inter-class transfer fee and under what circumstances it applies. For schools with more than one facility, provisions for inter-school transfers and the availability of placement from other than the graduating institute should be investigated.

The student should also inquire about course repeats—whether they are provided free of charge, require repayment of the tuition fee, or are not permissible. There are valid reasons for repeats, such as time loss due to illness, but a school which permits weak students to hang on until they can be pushed to graduation reduces the quality of the class. Either a student has the ability and interest to complete the course, or the student should be dropped with refund of the unused portion of his tuition and incidental fees. In the event of an authorized withdrawal, some schools permit student reinstatement with full tuition credit, within a period of a year. Registration fees, however, must be repaid. Maintenance of quality in the classroom requires adequate checks of student programs, a schedule of student-teacher conferences, the availability of tutorial assistance, and, so that crib-sheets cannot be circulated, continual revision and rewriting of reliable tests designed to check student ability to reason rather than to memorize.

Class size is also important. In general, a class should not exceed 15 students. For straight lecture sessions class size is insignificant. But when it comes to debugging programs or unit record control panels, an instructor with a big class cannot give individual attention and still keep the class moving on schedule; he must often rely on the quicker students for assistance. Some schools which are otherwise of poor quality limit class enrollment; some of the best have large classes, and vice versa. (Large class size is often considered necessary to offset an expected high attrition rate.) If a school that otherwise looks good has large classes, the prospect should find out if a second instructor is available when log-jams occur and if the regular instructor has time to check programs and schedule conferences outside classroom hours. The important thing is that the prospect be aware of the advantages attendant to small class size and consider this as a factor in school evaluation.

read the contract

Once the choice of schools has been narrowed down, the prospect should request a copy of the enrollment contract to be perused in private. Many contracts simply contain a commitment by the student or his guardian to pay; the terms of the payment for enrollment, tuition, and incidental fees; and a termination clause permitting the school to cancel the contract in the event that the student fails to comply with the standards, rules and regulations of the institute. Such a contract binds the student to pay full tuition, even in the event of withdrawal, unless the school chooses another course of action. Regardless of statements in the information brochure, a prospect should protect himself by insisting the contract include an escape clause permitting withdrawal with refund or waiver of unused portions of the tuition and incidental fees. The prospect should also note whether or not there is a penalty for late payment, whether the

[6] Some schools include a faculty list in their brochures. However, frequent personnel changes often render such lists meaningless.

school has arrangements for tuition loans, and whether payment in full prior to the first class session results in a bonus, e.g., some schools drop the textbook fee for early payment. Those eligible for GI benefits should be certain that the school qualifies before signing a contract.

School contracts are generally concerned only with payment of fees and contain no statements regarding course content, hands-on training, etc., except, perhaps, of the vaguest sort. The contract may specifically state that the signed document contains all the terms of the agreement and is not subject to either verbal or written amendment, leaving the student no legal recourse if the course of instruction does not live up to promise.

Curriculum—After reading about the nature of data processing and available careers, a potential school applicant should narrow down his career choices, selecting his course accordingly. Most schools offer training on IBM equipment only; some offer only programmer courses, giving identical training to potential console operators and programmers alike; other schools provide separate, shorter, operator courses. Some few schools offer technician courses; some require a complete eam program or even keypunch as a prerequisite to entrance to any advanced curriculum. Some offer COBOL as part of the course; some offer it as an extra; some offer it not at all. Scientific programming is rarely mentioned. Some schools offer long, intensive programs at a lower cost than the short programs of other schools. This confusion of choices makes curriculum advice critical to the student's potential success.

A prospective student should know that keypunch competence is not a prerequisite for machine operators, programmers, or technicians. For these individuals, a single lesson is sufficient. Nor is tab operation a requirement for potential programmers. Properly taught, eam can be justified as a valuable introduction to programming concepts and as something to fall back on for an individual who finds programming too difficult, but an employer looking for a programmer isn't likely to be impressed with 300 hours of unit record studies.

Across the board agreement on what a programming course should contain is impossible due to the diversity of companies employing data processing personnel, but some characteristics do stand out. Programmer training should include tape and disc as well as card input/output. It may be unrealistic to expect a complete tape/disc installation at a school not associated with a service bureau (most small schools lease an IBM System 360/20 card system), but students should reasonably expect contact with such an installation. The school should have standing arrangements to rent sufficient time for an outside party to adequately demonstrate tape and disc handling, system operation, etc. Further, the school should provide for compiling and testing all student tape and disc programs, with or without the students' presence. Some schools assign tape problems as exercises to be followed by classroom discussion. (Disc is largely ignored.) This is inadequate. If a choice is to be made between two schools of seemingly equal merit, the student should seriously consider selecting the one with the most complete installation. An operator trainee, of course, should not consider a school without a reasonably complete on-site installation, and no student should seriously consider enrolling in a school which lacks some in-house computer facility.

In addition to programming for a broad range of input/output devices, a good business programming course should include a heavy dose of COBOL. Since many graduates are destined for small installations, there is also justification for inclusion of RPG in the curriculum.

Every student should be required to analyse, diagram, code, run successfully, and fully document several realistic problems, including several sort routines, with the school providing test data. Toward this end, the prospective student should inquire about the availability of additional machine time outside classroom hours. Schools with the most complete facilities, those associated with service bureaus and the like, might not be able to accommodate student demand for extra machine time. However, they should have provisions for instructors to assemble and run programs during slack hours. Whether extra time is needed is a moot question, but the student should be aware of school policy prior to enrollment.

A student should be made to realize that a school can teach only a small part of the field of data processing. He should, however, expect the course to broadly outline the big picture, including: the major computer manufacturers and their products; different approaches to machine design which directly affect programming, such as floating and fixed point notation, variable and fixed word length, etc.; special purpose computers and their function; related industries, such as software houses, forms manufacturers, off-line systems manufacturers, component manufacturers, service bureaus, and time-sharing operations; various job categories; other problem-oriented languages, what they are, how they are structured, who uses them; etc. The student should clearly understand the difference between applications and systems programming, perhaps even analyzing a small portion of the assembler used in the course. He should know how to employ macros and monitors, how to debug a program and read a core dump, how interrupts are handled, how to use the input/output package, how to estimate time and costs, etc.

Some schools claim inclusion of "systems" in their course of study. Students should be warned to discount such claims. What is covered are such subjects as an introduction to accounts receivable and payable, payroll accounting, sales analysis, inventory control and the like. These areas are best covered lightly through related programming assignments. Though a good background in accounting practices is helpful to the business programmer in determining what part his program plays in the big picture, the prospect should understand it is not a job requirement. He is unlikely to enter systems work until much later in his career, if at all. Accounting, per se, can be better left to a later date when courses can be taken from qualified instructors in an adult education program.

Instruction—Though it is difficult for a novice to judge the quality of an instructor, there is at least one thing that he can check. During the interview with either the enrollment counselor or the school director, the applicant can request job profiles of the teaching staff. Such a profile should indicate the instructor's educational background; the number of years of edp experience; the names of his employers, past and present (many instructors teach only part-time), and the nature of his duties in each instance.

Generally, a programming instructor should have at least one year of actual, recent programming experience. Unless his programming background is extensive, the profile of an instructor teaching a system with which he has never worked should indicate some formal training on the system. It is best if an instructor is not a graduate of the school at which he is teaching. Too often the graduate is sought because the school knows where to find him in a hurry. And too often graduates who return to join the school staff do so for an assumed prestige and before they have had sufficient experience to command a substantial salary elsewhere.

A college degree is not an essential instructor credential. However, a school with a high percentage of college graduates on its staff is likely shooting for professionalism. Since instructors are often hired on an as-needed basis, a display

of profiles indicating college training and heavy field experience indicates, but does not guarantee, that the enrollee's own instructor will be well qualified. Again this emphasizes the need for an escape clause in the enrollment contract and the right to request a class transfer without charge.

In reviewing instructor profiles, the prospective students should not expect to find instructors with heavy, or perhaps any, prior teaching experience. Those who enter edp rarely plan for careers in education. Teaching experience, certainly, is valuable in developing communication skills and in helping the instructor decide whether or not he enjoys the job. (With this in mind, schools have been known to hire professional teachers and train them in data processing.) But enthusiasm, a thorough knowledge of the subject, and a desire to teach can serve the novice well. Many "trained" teachers are pretty dull and uninspiring. If, however, a review of several profiles indicates a high instructor turnover, i.e., most of the instructors are new, the applicant should be wary lest this indicate a serious problem in teacher morale, with the possibility of unplanned instructor changes throughout the run of the course. For continuity of instruction, the ideal situation is, of course, for the student to locate a school where instructors are *under contract.*

The planned use of several instructors throughout the curriculum, or team teaching, can be valuable. Multiple instructors can provide fresh approaches to programming, provide for the correction of any instructional errors, and help clarify areas of student difficulty. It also can provide a check and balance system for the school. If one instructor is consistently found to be doing a poor teaching job, he has more likelihood of being detected.

Next in importance to quality instructors stand good texts. The prospective student should expect to be provided with personal copies of vendor manuals, programming aids, and other reference materials. Since these are the publications in use in the field, they should be supplied to students even if the school also publishes its own set of textbooks. Some schools which appear to publish their own materials have reprint rights to IBM publications and, therefore are presenting field references, though in a school binder.

As part of his school investigation, an applicant might note if the school provides for outside speakers, has a library with up-to-date magazine subscriptions and new book releases, utilizes films and filmstrips, has overhead projectors and copy equipment for making slides so that time is not lost transcribing student programs to the blackboard, provides study facilities, has a reproducing system, etc. All of these are helpful, though not essential to quality instruction.

A prospect asking all these questions might find the administration raising an eyebrow or two. "We don't have such things as profiles; why do you want to see them?" Such a display of hurt feelings should put the applicant on his guard. If an institution is proud of what it has to sell, it should be pleased to show it off. Adult education programs and colleges provide brief instructor profiles as a matter of course. A good instructor can take a handful of students anywhere, supply them with texts, add a blackboard and do a training job which could turn any capable student into a competent programmer. Quality instruction is the key to good education, not the physical plant, on-site equipment, placement, etc. In choosing a school, all factors should be weighed; but quality instruction, the most intangible of all, is of primary importance!

Under some circumstances, it might be possible to arrange a class visit before enrollment. Given the opportunity, the prospect should try to evaluate classroom rapport rather than the instructor's teaching qualifications. Classroom visits are disruptive and cannot always be planned at a point in the course where observation is fruitful, thus there is valid reason for turning down a visit request. Mingling with students during a coffee break or talking with current students or recent graduates are other ways to gain insight into school operation.

Placement. The reason people enroll in a trade school is for vocational upgrading. Yet, placement is often the weakest link in the edp school chain of operations. Usually the salesman counselor gives the prospect the big build-up to generate enthusiasm for edp. But all too often his claims are far from the truth. The school applicant needs to be told that realistic starting salaries for non-college graduates can run from a low of under $400 a month to a high of $685 a month, with most falling around the midpoint. Top salary for an experienced programmer is about $900-$1,000 a month, and this top is most quickly attained by the college graduate. The salary of a programmer/analyst runs from approximately $800 a month to $1,100 a month, while that of a project leader runs to approximately $1,300 a month.

What an employer wants when he hires data processing personnel varies with the nature and size of his business. But as a rule, graduates are hired as trainees or junior programmers, not as senior programmers or analysts. Because of the shaky reputation of most data processing schools, many employers discount school training entirely, selecting school graduates as they would any other applicant, solely on the basis of tests and interviews. Some smaller companies hire graduates who have been trained on the specific equipment which they have in their shops; retraining costs for others run too high. Some companies are interested in graduates only because they have been subjected to problems requiring logical thinking, not because of any specific skill. Commented one employer, "Any guy that would spend that much time and money going to a school means business; sure I'd give him a try. But probably I'd use him in machine operations or at best on small programs. For a senior programmer, I want a college man."

Companies interested in hiring console operators are often discouraged because the school graduate has had little hands-on training. Those looking for tab operators have a similar complaint. The graduates have wired boards and handled packs of fifty to a hundred cards, but they have no concept of what goes on in a production shop, nor have they worked under pressure. A man who runs an edp employment agency indicated that he has most luck in placing young graduates as control clerks at under $400 a month. Though the schools graduate men over the age of 40, he finds them difficult to place as trainees. Most promotions to trainee positions, he indicated, are from within. Data processing jobs are the plums, and they are passed out with discretion. Where placement is possible, it is most commonly in machine operation.

The demand for computer personnel is growing, but placement cannot be a part-time, happenstance job. According to 1965-66 AFIPS projections, demand for programmers will grow from 120,000 in 1965 to between 200,000 and 650,000 in 1970; and for operators of computer consoles, tab machines, and keypunches, scheduling and control clerks, etc., from approximately 43,000 in 1965 to 80,000 in 1970. And these projections are regarded by many as much too conservative. As one wit noted, "If current projections are extended, the whole country will be in data processing by the year 1990."

To check on placement facilities, it is wise for the school applicant to meet with the placement director and learn how placement is handled, including a request for a breakdown of placement statistics by job type and number relative to the number of graduates as a whole, a review of testimonial letters from employers of successful graduates, and a request for names of graduates whom the applicant might contact. A postponed meeting because the placement director is in class should be fair warning that placement may not be receiving adequate attention.

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CIRCLE 21 ON READER CARD

trol Data Institutes. Near graduation time, the school invites representatives of various companies, including those with whom previous graduates have been placed, to come in and talk to the students. Those students interested in interviewing with a given company sign an interview sheet. The employer is then given access to the student records. If he is interested, an interview is scheduled. Such an approach, of course, can only work for a school with an established reputation.

Students should be aware that many schools, particularly those of poor quality, make an effort to place only their top graduates. A school isn't about to risk whatever reputation it has in the community by sending out marginal students, regardless of whether it is willing to grant them a certificate. Thus, it is not enough simply to graduate; it is necessary for the student to graduate on top to insure that the school will make a maximum effort at placement.

Pre-admission testing, curriculum and hands-on training, instruction, placement—these are the four areas a prospective student should investigate before reaching a decision. Considerations of physical plant have been omitted because this, along with proximity to home or job, are the easiest and, therefore, often the only criteria on which many students currently base their selection. Provided with a checklist, the diligent edp school candidate should be able to eliminate the worst prospects and narrow the field to one or two choices. But no school prospect can possibly do a thorough job. He lacks both business sophistication and a free hand in his investigation. Again, it is up to the data processing community to come forward and help the school prospect help himself.

In the long run, accreditation standards should be reviwed and tightened and widespread accreditation urged; tighter state licensing is a must; more computer-oriented companies should join in non-customer testing and training; high schools should be encouraged to add edp courses to their curriculums; the public should be informed of edp school abuses and proper avenues of complaint. But these things cannot take place in a short time. In the meantime, the industry can take an immediate step by encouraging its professional organizations and other interested parties to publish and publicize selection criteria designed to aid the prospective student. Criteria information could then be distributed to high school students, aptitude testing facilities, placement services, to members of the industry—even to the schools themselves. In this way, the industry stands both to serve the public and to serve itself—by reducing the need for costly in-house training programs, often the only means currently available to guarantee an adequate supply of junior data processing personnel. ■

SUGGESTIONS FOR FURTHER READING

1. *Introduction to IBM Data Processing Systems*, #C20-1684, 76¢. IBM DP Div., 112 E. Post Road, White Plains, N.Y. 10605.

2. *Digital Computers*, #CDI 081866A, 091266A, 032367, $11.90 for a set of three volumes. Control Data Institutes, 3255 Hennepin Ave., Minneapolis, Minn. 54408.

3. *Introduction to Electronic Data Processing*, #143.0005.0000.0-111, no charge. Honeywell EDP Div., 151 Needham St., Newton Highlands, Mass. 02161.

4. *Glossary of Computer Terminology*, #90 09 57A, 50¢. Scientific Data Systems, 1649 17th St., Santa Monica, Calif. 90404.

5. *The American Standard Vocabulary for Information Processing*, #1026-903, no charge. Burroughs Corp., Distribution Services, 14247 Tireman, Dearborn, Mich. 48126.

6. *Glossary of Data Processing Terms*, reprinted from the Bureau of the Budget, $1.00. F. D. Thompson Publications, 94 S. Los Robles, Pasadena, Calif. 91101.

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CIRCLE 22 ON READER CARD

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CIRCLE 23 ON READER CARD

a tale of horror

SOME PROBLEMS WITH TIME-SHARING

by BRYAN WILKINSON

Many articles have been written about the benefits that can come from a time-sharing system. (And they are great.) There is a "loud silence" about the problems one can encounter on the way to obtaining those benefits. This is an actual case history of the trials one company underwent when installing a time-sharing system. Our case was extreme, but not unique, and it could happen to you.

Late in 1966 our bank decided to experiment with commercial time-sharing, looking toward the day when our 360 branch banks would be linked to a central computer. I was given the responsibility for this experiment. There are two major telephone companies operating in the Los Angeles area and at least five companies selling commercial time-sharing services. We contracted with one of the larger, more experienced time-sharing vendors. Only one of the two telephone companies was involved.

Our system was installed in February 1967, and with the vendor's representatives at the controls, we were ready to enter the promised land of time-sharing. He dialed the system. Our terminal dutifully typed its recognition code. The computer replied "INVALID TERMINAL" and "hung up." We speculated that enough time hadn't elapsed to enter our code into the system so we waited an hour and repeated the call-in, with the same result. A phone call revealed that we were on the system, but repeated calls produced "INVALID TERMINAL" and disconnected. There was much speculation as to the cause of the problem. Finally, the computer operator was asked to verify our recognition code. He found that "someone" had made a typographical error when entering it into the computer. It was corrected, and we were on our way to bigger and better things—or so we thought.

The next day the potential users in our company and I were given a four-hour briefing on a simplified programming language and the system operation. We were handed three manuals (none of them indexed), and we were "experts."

training difficulties

The terminal, besides being an inexpensive, sturdy machine, allows one to enter programs or data by paper tape. It was our intention to have these tapes prepared by the secretaries so we asked who should train them. The time-sharing people indicated the telephone company, and they agreed. Fortunately, I decided to sit in on this session because the telephone company's training representative started to teach our secretaries how to use the terminal as a teletypewriter, not as a time-sharing device. (The differences are considerable and confusing). When I asked the instructor to cover only the relevant items, she was at a loss. She knew nothing about time-sharing. It developed that each time-sharing company makes special use of some of the characters so that only they could give adequate training about those things. Here, on our initial day of operation, we ran into the first of many vendor coordination problems. The time-sharing people could train on how to use their system; the phone company could train on how to use the terminal; but no one could give complete training. Until this could be resolved (and five months later it hadn't been) the idea of using secretaries had to be shelved.

The next day we started "using" the equipment. Strange things would happen: Sometimes we would be disconnected in the middle of a run; sometimes we would get a few bad characters from the computer; on occasion we would get "garbage"; our machine would start typing its recognition code and would be disconnected; we would get "INVALID TERMINAL" messages. One user could never get in. His user identification was always recognized as "INVALID."

The time-sharing vendor referred us to the phone company. The phone company said it was probably the computer but they would take a look. Over a period of several days, while the problems continued, the terminal was checked out. The answer-back drum was inspected and pronounced "perfect." Several circuit boards and components were replaced. The telephone instrument was replaced three times.

Minor improvements were noted, but the most annoying problem—being disconnected in the middle of a calculation —continued. After about six weeks someone decided that the "end of transmission" signal might accidentally be triggering. This key was disabled, and that helped somewhat.

I was beginning to feel that we could live with the inabil-

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ity to make contact and the garbled characters (though not for a branch bank update and inquiry system). Then, one day we got two different answers when the same program and the same data were used. That really shook us. A day or two later I signaled the computer to run the next part of the program by typing in the number "3." Instead it stopped, which signified that the "3" was received by it as a "7". Needless to say, my complaints were redoubled.

The phone company made noise counts and discovered that sometimes, but not always, we would have one "hit" a second. (A hit is noise strong enough to be read by the computer.) What was causing the hits? Were our calls to the computer traveling different routes from one call to the next? This might account for the intermittent nature of the problem but would make it almost impossible to find and remove the "noise-maker." Speculation about this continued for two months. Finally a "conference" of five high level telephone people was held. They determined that the route of our messages to the computer was always the same.

At this point a brief explanation might be in order. In the Los Angeles area three general types of message switching devices are used—electronic, cross-bar, and rotary. Electronic and cross-bar will handle data. Rotary is generally too noisy for data transmission.

One switching station that we always went through had cross-bar switches as primary, rotary as secondary, and cross-bar as tertiary. Thus if traffic was light, or very heavy, our chances of getting cross-bar switches were good, and the transmission would be noise-free. Moderately heavy traffic would probably put our message through the noisy rotaries —hence the intermittent nature of the problem. To test this hypothesis we were given a special high-grade line direct to the computer for a short time. Many, but not all, of the problems were immediately cleared up.

terminal bugs

Another set of problems centered around the terminal. These were:

(1) The printout would not line up on the left—about 40% of the lines would be offset one space to the right. One telephone official indicated that it was probably the terminal's fault. An equally high-placed official who was in charge of the equipment assured me that it was the fault of the computer system.

(2) Our terminal was still sometimes called an illegal one by the computer and we would be disconnected.

(3) The switch on the paper tape unit has three positions: "off," "on," "initiate transmission." It would sometimes transmit a signal when the switch was left in the "on" position even though the "initiate transmission" signal had not been given and even though no paper tape was in it. This was not supposed to happen. If it occurred while we were establishing contact with the computer, we would be disconnected. If it happened when the computer was sending a message to us, we would receive "word hash."

Though I had repeatedly asked that the terminal be replaced, the request was denied. Finally, when the special line was installed for us, it became clear to me that the terminal was a source of some of our problems. An ultimatum was delivered—"Change it, or remove it altogether." The next day when putting in the new machine, a fourth inspection was made of our answer-back drum (which contained our recognition code). If O.K., it would be used rather than making a new one. This time, after three prior "perfect" inspections, it was found to be imperfect.

The "new" machine was assigned on a temporary basis, since it was actually used. It was to be replaced when a new one became available. With it, the margin lineup problem and the paper-tape switch problem disappeared. The new answer-back drum corrected the disconnect problem.

When we received our new terminal (the third), the paper tapes we had cut on the second (or temporary one) would not work. It seems that the paper-tape punch and read mechanisms can get out of adjustment slightly. (Proper maintenance will prevent this.)

The third instrument worked faithfully for five months and then developed a "habit" of doubling some characters. (The computer finds it difficult to understand "LEET.") A call to the phone company would bring a repairman who would take two minutes to make a slight adjustment—which would clear up the problem—for a day.

We finally have had the keyboard replaced. (Interestingly, another terminal that we now have linked to the same time-sharing systems, has worked perfectly from the start.)

and more problems

While all of the above was happening, other unusual things were occurring. The computer would accept some, but not all, lines of data or instructions; it would drop instructions previously accepted and used; and would add lines of data. This would be discovered when we received unexpected error messages or obviously wrong answers. A listing of the program and/or data would then be called for, and the additions or deletions would be evident. In one case the printout we received from the computer included lines that looked very much like a portion of someone else's program.

The nature of these errors was such that the telephone company and I felt that they must be due to operating system problems in the computer and not to the noise that we were experiencing. The time-sharing people insisted that these things were caused by the line noise, and refused to do anything about it until the noise was removed.

Dropping instructions and data and adding data continued after we were given the special telephone line, and even after the terminal was changed. The time-sharing representative then admitted unofficially, but never officially, that they might be having problems.

Just at this time, the vendor was installing a second computer system in the Los Angeles area to accommodate an increase in business. We were placed on the new system, and the problem of dropped and added lines disappeared.

Incomplete training or inadequate manuals created other problems. For example, when a user gives an illegal command, the computer will respond with an error message. If the user continues to transmit while the computer is trying to send the error message, the two transmissions will interfere with each other and up to half a line of "garbage" will be printed out. It took me almost six weeks to figure this out.

Another case—the operating system on rare occasions would not clear working areas. Thus to avoid wrong answers, it is necessary to set these working areas to zero. This was not covered in the manuals or the training, and was not known by our vendor's representative.

Some new users, who were not adept at typing, would accidentally create illegal messages which were interpreted by the computer as "tampering with the system." The result would be an immediate disconnect. There was no standard pattern to these typographical errors so it was difficult to separate these disconnects from those that were caused by line noise and teletype malfunction. Our users apparently have improved their typing ability because we seldom have this problem now.

Several times one of the telephone terminals on the vendor's end of the line was bad. If we happened to get it, our recognition code would be rejected, and we would be disconnected. This source of trouble was not detected until

after the line noise problem and our own terminal difficulties were both eliminated. It could be overcome by waiting a short while and calling again. This would generally result in connecting us to a different input port. The question could legitimately be raised as to why other users had not alerted the time-sharing organization to this problem. They may, in fact, have done so, but no record of trouble calls and causes was maintained by the vendor.

There were miscellaneous troubles that had nothing to do with communications or training. Power would be lost or equipment would malfunction right in the middle of a long run. This usually meant that we would have to start over again. For example, one day I heard on the radio that a truck had hit a power pole and blacked out the area where the computer was located. Sure enough, it was affected. In accordance with Finagle's law, we were on it and were 75% through with a two-hour run—an hour and a half wasted.

We uncovered another problem that could have serious implications for other users. The vendor supplied two different statistical programs, both of which provided a multiple correlation coefficient. The two gave different answers when the same data were used, although the answers should have been the same. These programs had been in the library for two years and had been used extensively. Normally a person would use one or the other of the programs, but not both. One of our users "made the mistake" of running her data through both. When advised of the problem, the time-sharing staff was sure we were not using the programs correctly—or maybe we were still having undetected line or terminal troubles. They agreed to try the programs—with the same result, two different answers. All of their statistical programs underwent a review.

...and still more problems

Several months after our difficulties had been "solved," the terminal stopped in the middle of a line and the print-head began bobbing up and down. Usually when you are waiting during a subscriber poll, the print-head remains at rest. I had a horrible vision of a recurrence of either our line or terminal problems. After a short pause the program picked up again and typed a half line, then the same situation recurred. This was much too short a time between polling pauses, and anyway the print-head should not have been bobbing up and down. I waited for about a minute (considerably longer than the normal wait period) and then disconnected. A call revealed that a new FORTRAN compiler was being loaded on the system. My program was not written in FORTRAN so there should have been no interference, but I was advised to delay until the loading had been completed.

Another time the system was printing out a long table which was to be placed in a research report. Right in the middle, the computer stopped and we received a message from the operator that the system would be down from one to two a.m. on the following Tuesday. The computer then resumed the preparation of the table. It was necessary to rerun the program in order to have clean copy. We asked time-sharing management not to send messages this way or not to charge us for the rerun time. It was two months before the procedure was adopted to give informational messages when the user signs on.

Time-sharing systems can do marvelous things. Ours charged us for 7643 seconds of computer time during two minutes of elapsed time. (Time compression? Expansion?) Fortunately we retained the printout and so were not charged.

Three or four hours of instruction are enough to learn the general approach to the simplified languages used by most time-sharing systems, but not enough to learn their more advanced aspects. Programming assistance is supplied by telephone, but it is difficult to do debugging that way. Hopefully the manuals would provide the needed assistance. I have inspected the manuals for four different time-sharing systems, and I could classify only one as adequate. Our particular vendor furnishes four systems and programming manuals plus a manual which describes the programs in their library. None of these contains all of the *fundamental* information about their simplified language. None of the manuals, including the one which lists available applications programs, contains an alphabetical index. If a question arises when one is on the computer, it is usually necessary to sign off because too much time will be wasted hunting through the manuals for an answer. Our vendor has tried to close some of the instructional gap by providing instructional programs which may be run on the system. It is rather expensive to learn in this way.

new dilemmas

Five months after the installation of the system we decided to expand by contracting with a second vendor. A new set of problems arose.

With our first vendor we could input our program and data on a paper tape—speeding up the process and eliminating typographical errors. The size of the input was limited only by the size of working core available to us. Not so with the second. The input drum on this system has much less capacity than working core. As a result input must be entered in short segments. We found this out the hard way—incorrect answers to problems.

The second vendor's operating system is more "sophisticated." We may be programming in one language, but will receive error messages and must make responses in a second language. This gives the programmer greater flexibility and more options. The technician likes it. The occasional user is confused.

The new system has a priority process. It may be this or it may be operating system problems which sometimes cause a 7 to 8 minute delay when our run is interrupted for a user poll. The maximum delay we had with the first system was about 15 seconds. (A user poll is made after the user has been on the computer for a very short time, seconds or milliseconds, to see if other users are waiting. If so, they are serviced in turn, or in priority order, and then the computer is returned to you to use again. In the meantime, you sit and wait.)

The new vendor is also suffering equipment and software problems which seem to be associated with third generation equipment. As a result he has an unusual amount of down time. In addition, such things occur as all programs and data which were supposedly saved during one day were in fact not saved. This was discovered several days later when we were attempting to use one of the programs. His software problems have also caused us to lose programs which had been saved for some time. These situations make it evident that some sort of hard copy or paper tape should be retained.

The above is not intended to "point the finger" at any one time-sharing or communications vendor. Ours were chosen after considerable study and we still believe that we have selected the best. Problems similar to those above are being experienced on all systems—though perhaps not in such concentration to one user.

In spite of our experiences we are sold on time-sharing. It has proved to be a valuable tool. However, it should be embarked on with caution. I recommend that users bring their problems, even those which appear on the surface to be trivial, to the attention of the telephone companies and the time-sharing vendors. A concerted "attack" can serve to clear up the problems for all. It may also lead to better coordination between the time-sharing and communications companies so that the user with a problem need no longer feel that he is caught in the middle. ■

CONGRESS SEEKS A SYSTEMS APPROACH

by ROBERT L. CHARTRAND

The United States has achieved and sustained its position as a great power in a changing world because of its bountiful resources, the ingenuity and industry of the citizenry, and its utilization of the significant technological advances of the past few decades.

The impact of technological change has been felt in all sectors of society—business, commerce, government, and the academic world—and a pattern of continual adjustment has been necessary on the part of management, labor, and the consumers. The responsibility of governing the nation necessarily is a cause for concern on the part of the leadership within the federal government. In striving to cope with a new set of problems generated by an ever-growing and complex society with a high degree of population mobility, the nation's leaders not only must ensure national security but also must make every attempt to provide a rising standard of living.

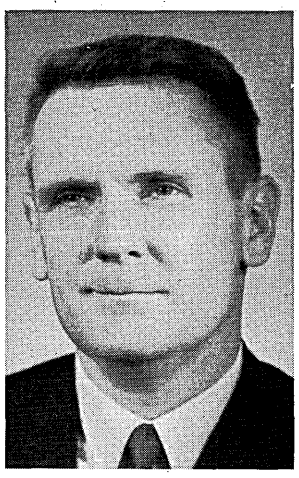
In the years following the Second World War the decision-makers and planners have faced the indisputable fact that while this country is more richly endowed than any other in history, its resources are not unlimited. Therefore, those who govern must determine how to preserve our heritage while still responding to the needs of society. The problems of the 1960 decade demand an expertise that must be at the same time diversified and detailed. The challenge of our times is set forth in the recent report of the National Commission on Technology, Automation, and Economic Progress:

> Our problem is to marshall the needed technologies, some of which are known and some not yet known. If we are to clean up our environment, enhance human personality, enrich leisure time, make work humanly creative, and restore our natural resources, we shall need inventiveness in the democratic decision making process as well as in the needed technologies.[1]

With the development of new devices and associated techniques, those in authority have called for a re-examination of the role of technology in solving the crucial problems in the public domain. Air and water pollution control, transportation planning, solid waste disposal, natural resources preservation, and urban renewal and expansion are among the problems forcing federal, state, and local planners to seek new methodology.

A realization has evolved at all levels of responsibility that one essential facet of management planning is the structuring of salient information so that relationships are identifiable, and thus meaningful. Gradually, government agencies and private corporations have incorporated carefully planned procedures for delineating goals and programs. The "systems approach," initiated early in the century by Frederick W. Taylor in his concept of "scientific

gradually



Mr. Chartrand is the information sciences specialist for the Legislative Reference Service of the Library of Congress. A political scientist with several years' experience in systems technology, he is the author of general studies for the Congress covering the application of dp and systems techniques to public problems and Congressional operations.

The views expressed in this paper are those of the author and are not necessarily those of the Legislative Reference Service nor the Library of Congress.

[1] National Commission on Technology, Automation, and Economic Progress. Technology and the American Economy, v. 1. Washington, U. S. Govt. Print. Off., February 1966, p. xiii.

management," now has become an accepted part of management's mode of operation.

The techniques associated with systems analysis and operations research, and such "tools" as automatic data processing (adp), have achieved acceptance in the federal government, particularly in the executive branch. Today, the legislative branch is beginning to perceive the value of the systems approach, both in terms of its daily operations and in connection with the formulation of creative legislative solutions to many of the problems facing society.

the systems approach

The wartime emphasis on sharply compressed development of new weapons systems was translated successfully into tangible results through a combination of the use of operations research techniques, unlimited financial and material resources, and the creation of a new group of uniquely oriented scientific manpower. In the post-war years, new organizations such as the RAND Corp. came into being and functioned effectively in assisting federal planners conduct complex studies, primarily of defense-oriented problems.

Systems analysis achieved formal recognition as an integral part of federal management during the Kennedy Administration. Charles J. Hitch, formerly of RAND, was chosen Comptroller of the Department of Defense (DOD) and was responsible for injecting the use of systematic quantitative analysis into the mainstream of Pentagon planning. The new concept of operation within DOD was called the Planning-Programming-Budgeting System (PPBS), and was considered to be so effective that late in 1965 President Johnson directed the Bureau of the Budget to implement the system in all executive departments and establishments. Executive commitment to the PPBS concept was reinforced in a late-1966 Presidential memorandum to the heads of departments and agencies, informing the recipients that they must:

> Train and recruit the necessary staff.
>
> Subject objectives, programs, costs, and accomplishments to systematic and continuous review.
>
> Search for new and more effective ways of accomplishing objectives.
>
> Relate analysis explicitly to budget requests so that those requests follow from and support comprehensive and well-thought-out agency plans.[2]

Specific directions regarding procedures to be followed in implementing PPBS were set forth in supplementary documentation, which identified two forms as being essential to the success of the system: the Program and Financial Plan, and the Program Memorandum. The Program and Financial Plan provides a listing of program outputs (i.e., "services" or "equipment") and program inputs, which are denoted as items of cost or related financial data. The Program Memorandum contains detailed narrative and statistical data on each program identified in the Program and Financial Plan, and is issued on an annual basis.

An adjunct to the introduction of innovative procedures and techniques into federal operations has been the growing use of adp equipment. The June 30, 1967, computer inventory indicates 3,000 units while procurement and operating expenses for fiscal 1967 approximated $1.2 billion.[3]

Since virtually all adp capability resides within the executive branch, the lack of comparable tools and techniques to support the legislative branch has led to the first stages of corrective action by the Congress.

congress in our time

The demands upon the Congressman of today are legion. He must be a veritable Everyman, cognizant of several dozen major and minor issues of key significance to the nation as a whole, his party, the political unit which he represents, and the various elements of his constituency. He must master and work within the intricacies of a framework founded nearly 200 years ago, and yet be attuned to the personalities and procedures of the present. His handling of information must be well timed, highly selective, and reflect the constraints of protocol and pragmatism. In commenting upon this distinctive milieu, Dr. Charles R. Dechert points out that:

> . . . the Congress as a corporate body within the governmental structure is essentially an information processing and decision system, characterized by an extremely complex internal network of channels and filters, with some flux in membership and communications nodes.[4]

As the population of the United States increases, and the problems which accompany this growth are reflected in legislation, it may be useful to recall the mounting pressures upon the individual Congressman. For example, in the days of our nation's beginning, a member of the House of Representatives would be elected by a constituency averaging 33,000 persons; today's Representative comes from a district averaging 460,000 constituents. The volume of legislation which must be dealt with is of awe-inspiring proportions: during the first session of the 90th Congress (1967), more than 20,000 public and private bills and resolutions were introduced in the two chambers.

Each Congressman serves as a member of several committees and subcommittees, spending hours considering agenda items and hearing testimony. In addition, he is called to the chamber floor for quorum calls, yea and nay calls, and division, teller, and voice votes by the hundred.

The contemporary Congressman has every incentive to discover new ways to function more effectively. He and his limited staff are hard pressed to collect, filter, assimilate, and recall the pertinent information which will help answer a given problem. The dilemma of the overworked Congressional staff is not easily solved, for in addition to supporting the member in legislative matters, there is a heavy load of constituent-related work. Correspondence from constituents may run as high as several thousands of letters a day. The office staff also must screen large numbers of telephone calls and play host to many visitors.

So numerous are the requests for information that the Congressional office must utilize all possible resources. In many instances, requests will be relayed to the appropriate executive branch agency; on other occasions, support will be obtained from the Legislative Reference Service of the Library of Congress, or perhaps some group from the private sector (e.g., universities or lobbyist organizations). With all of these pressures upon them, many Congressmen are commencing to examine seriously the potential of the systems approach in handling some of their legislative and administrative problems.

computer support for the congress

Within the past two years, there has been discernible interest on the part of Congressional members in the appli-

[2] Executive Office of the President, Bureau of the Budget. Memorandum from the President to the heads of departments and agencies on the government-wide planning, programming, and budgeting system, November 21, 1966. In weekly compilation of Presidential documents, v. 2, n. 46, November 21, 1966. p. 1705-1706.

[3] Executive Office of the President. Bureau of the Budget. Statement of Philip S. Hughes, Deputy Director of the Bureau of the Budget, before the House Committee on Government Operations, Subcommittee on Government Activities, on data processing management in government. Washington, July 18, 1967. p. 8.

[4] Dechert, Charles R. Availability of information for Congressional operations. In Congress: the first branch of government. Washington, American Enterprise Institute for Public Policy Research, 1966. p. 168.

cation of information technology to various aspects of legislative functioning. Consideration of this approach was addressed by the Joint Committee on the Organization of the Congress, under the leadership of Senator A. S. Mike Monroney and Representative Ray J. Madden. A number of specific recommendations designed to modernize the organization, operations, and support capabilities of the Congress was prepared. Among these, as embodied in the Legislative Reorganization Act which has passed the Senate and now is being considered by the House of Representatives, is a provision for the creation of a computer facility to support the Congress.

Other sections related to the use of systems technology established the responsibility for the continuing study of adp for Congress with the proposed Joint Committee on Congressional Operations, and called for the development of a standardized information and data processing system for budgetary and fiscal data for use by all federal agencies.

In addition to the provisions found in the Legislative Reorganization Act, a series of bills have been introduced by a bi-partisan group of House members calling for the establishment of an adp facility which would support exclusively the Congress. Representative Robert McClory, who introduced the first bill for such a facility late in the 89th Congress, repeatedly has urged his colleagues to consider realistically the need for improved information handling by Congressional elements.

Congressional awareness of its information problems has led some of the members to discuss common problems with outside groups such as the American Political Science Association, and to request surveys and studies of the information problem. In a report prepared for general distribution

Fig. 1

CANDIDATE APPLICATIONS FOR CONGRESSIONAL USE OF ADP AND THE SYSTEMS APPROACH

Legislative Functioning:
- Status of pending legislation
- Current schedule of committee and subcommittee activity
- Authorization and appropriations data
- Topical research information and statistical data
- Computer-oriented index of Congressional documents
- Pre-vote information on major issues
- Post-vote analytical information
- Information on federal contract awards

Administrative Functioning:
- Histories of committee and subcommittee activity
- Lobbyist activity information
- Constituent interest file
- Constituent correspondence file
- Congressional payroll accounts
- Current Congressional telephone book

to the Congress entitled "Automatic Data Processing for the Congress," several priority applications where adp could be useful were identified and discussed;[5] Fig. 1 presents a listing of the candidate task areas. In some instances, the Congress as a whole might benefit; in other cases, the functioning committee or individual Congressman would be the chief beneficiary. Included for consideration were: a current schedule of committee hearings and meetings, summary information on issues up for vote, an automated index-catalog of Congressional documents, histories of committee action, the content and status of pending legislation, and an adp-oriented Selective Dissemination of Information (SDI) system to retrieve key subject matter information and materials which would be responsive to the requirements of the member or committee.

Initial steps now are being taken to provide enhanced support to the Congress. The Legislative Reference Service has designed a computer-centered system which allows entering identifying and synoptic information on bills and resolutions introduced in both chambers of the Congress via keyboard terminals to a remote computer. Also, selected bibliographic data are being placed on magnetic tape for the future generation of lists of selected references.

Information technology today is able to allow the operational implementation of certain needed improvements. The decision as to when and where systems technology is to be applied resides, appropriately, with the Congress itself.

legislating a systems approach

The United States Congress has moved to position itself to better address the many problems now facing our civilization. Age-old questions are being asked, but with a new urgency. On what projects should we spend federal funds? How much needs to be spent? What should be the scheduling for these expenditures? The society which for the past generation has empowered its representatives to place overwhelming emphasis on defense, space, and nuclear energy developmental projects now is demanding that increased attention be given to the new series of problems which touch the daily lives of all citizens.

Organizations and establishments in the private and public sectors have begun to review their ability to meet the new challenges. Realistic plans for urban renewal and expansion, environmental pollution control, precision design of transportation networks, and other problems are achievable only after intensive, imaginative planning.

Among the first members of the Congress to consider the possible advantages of using the systems approach in the new problem areas was Senator Gaylord Nelson. In his Scientific Manpower Utilization Act, he stressed the need to mobilize the scientific and engineering manpower of the nation and to employ systems analysis and engineering in support of these scarce skilled groups. Senator Nelson also called upon state and local governments and private enterprise to apply their resources to the fight against these specters of disaster:

> Nothing short of a massive effort by industry and government at every level will solve this problem. This can be done only after a total analysis of the problem and development of an overall program of action.[6]

The need to forge a strong business-government action group also is championed by Representative F. Bradford Morse. Both in the 89th and 90th Congresses he has served as spokesman for a group of nearly 50 House Republicans calling for the establishment of a National Commission on Public Management. Similar legislation has been introduced in the upper chamber by Senator Hugh Scott and more than a dozen colleagues. The Morse-Scott approach concentrates upon the need for further study of the applicability of systems technology to civil problems. Representative Morse believes that:

> We are on the threshold of an entirely new approach to the solution of these public problems. Long-standing relationships between government and business will, of necessity, have to be exerted through the evolution,

[5] Chartrand, Robert L. Automatic data processing for the Congress. In U. S. Congress. Joint Committee on the Organization of the Congress. Organization of Congress. Hearings before the Joint Committee, Part 15, Appendix. (89th Cong., 2nd sess., 1966). p. 2313-2317.

[6] U. S. Congress. Senate. Committee on Labor and Public Welfare. Special Subcommittee on the Utilization of Scientific Manpower. Scientific manpower utilization, 1965-66. Hearings before the Special Subcommittee (89th Cong., 1st sess., November 18, 1965). p. 16. [Remarks by Senator Gaylord Nelson].

[7] Morse, F. Bradford. Private responsibility for public management. In Harvard Business Review, v. 45, n. 2, March/April 1967. p. 7.

testing, and full utilization of more forceful, imaginative techniques and devices.[7]

As the result of discussions between Senator Nelson, Senator Scott and Representative Morse, efforts are underway to merge the grants-in-aid approach of Senator Nelson—wherein a state office or university receives funds for the development of a pilot project—with the Morse-Scott proposal.

Other Congressional activity reflects the alternative ways in which systems technology may be applied, including the use of systems analysis and PPBS techniques in organizing federal research and operational efforts in pollution abatement. Another development involved the projected study of how adp and systems procedures might be applied to the administration of the courts of the United States; this was contained in the Federal Judicial Center legislation. Thus, the areas in which Congress is beginning to see the desirability of including direct provision or recommended consideration for the use of systems tools and techniques are increasing in number.

The solution to many of our problems will not be reached without a considerable struggle, and we must scrutinize most thoroughly how our national resources are to be distributed between the defense-space-nuclear power programs and the new areas demanding attention. President Kennedy's concern over the existing imbalance in spending and manpower prompted him to caution the nation that:

> . . . in the course of meeting specific challenges so brilliantly, we have paid a price by sharply limiting the scarce scientific and engineering resources available to the civilian sector of the economy.[8]

Positive corrective action is taking place within the legislative branch as the policy makers there, together with the leadership of the executive branch, strive to apply the nation's resources to the problems of the age.

summary

The Congress gradually is charting a course which may allow it to function more effectively in relieving the pressures and solving the problems created by an expanding, urbanized society. Positive action has been initiated to consider the ways in which systems management and planning, operations research and analysis, econometrics, simulation and modeling, and automatic data processing devices and techniques might be applied to assist the Congressman as he fulfills these roles:

As a legislator, responsible for studying, debating, and making decisions regarding issues of national and international scope;

As a representative of his district or state, with prime responsibility for its welfare, relationship to other governmental units, and the legislation concerning its people; and

As an ombudsman of sorts, looked to by each individual constituent as the point of contact for assistance in any one of a thousand forms.

The burdens imposed by these roles are causing increasing numbers of Congressmen to ask what may be done *now* to alleviate the problem of "too much to do and too little time or staff." The systems approach does not represent a complete solution to the dilemmas faced either by the Congress or by society at large. The complexities of our civilization are causing the nation's leadership to reassess the political and technological systems which comprise and affect our government. In support of this objective, the systems approach can constitute a powerful mechanism to be used by the decision-makers who are responsible for the welfare of the nation. ■

[8] Economic report of the President. Washington, U. S. Govt. Print. Off., 1963. p. XXV.

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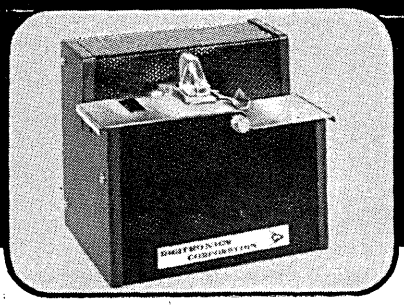

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CIRCLE 25 ON READER CARD

divide and conquer

MODULAR PROGRAMMING IN COBOL

by HARRY T. HICKS, JR.

A recent addition to COBOL permits communication among separately compiled programs. This valuable facility has been available in other high level languages (e.g. FORTRAN) and a number of assembly systems, and has been widely used within the scientific programming community. However, because of its relative newness in COBOL, most commercial programmers do not know how inter-program communication functions or how it can be used.

The availability of inter-program communication allows the user a greater degree of freedom in how he structures his systems. In general, large problems are most easily solved by factoring them repeatedly into smaller, more logically independent parts until the solution of each part is either available (i.e., the problem has been solved before and the result recorded) or is clear. The set of solutions thus developed forms the solution of the large problem. This particular problem-solving process is greatly facilitated by inter-program communication.

The COBOL-oriented system designers have always been free to use this solution method. They could divide a large problem into a number of modules (subprograms, subroutines, Paragraphs, Sections, etc.) and assign them to different programmers. However, the previous rules of COBOL were such that a run-time entity had to be compiled as a single source program. Thus, most of the potential benefits of modularization were lost because the hardest task—debugging—had to be performed on the problem in its entirety.

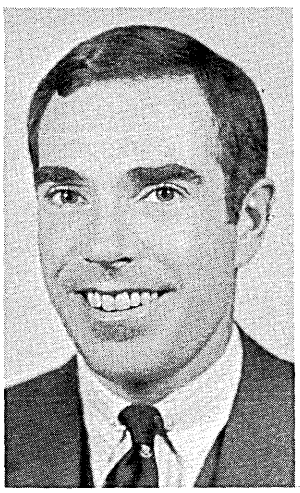
Inter-program communication allows these modules to be programmed, compiled and tested as independent COBOL programs. Amalgamation occurs only at run time, and then is a function of the operating system rather than the compiler. The modules always retain their individual identity as free-standing COBOL programs.

The following discussion describes the facilities for inter-program communication provided by COBOL, presents some ground rules for using these features and, finally, explores the use of modular programming in conjunction with an overlay facility.

inter-program communication facilities

In general, any COBOL inter-program communication facility must permit separately compiled programs to do two things:

1. One program—the "calling" program—must be able to transfer control to another program—the "called" program. The called program may itself call other programs and be called by more than one program provided that no calling program is called by a program in its chain of calls. For example, if program A calls program B, B cannot call A nor can any program called by B call A. Called programs must be able to return control to the calling program in a way that is distinct from a run-terminating command. All programs that appear in a chain of calls operate as a single program at object-time.
2. Programs that interact through this mechanism must have the ability to share data. Clearly, when several interacting programs refer to a particular data item, the correct item must be available to each. It would be economical of storage if all references to a particular data item were resolved into a single object-time address rather than into as many replications of the item as there are programs referring to it. The usual method of obtaining both objectives is the provision of a special Data Division Section whose entries are used by the compiler to obtain data characteristics but not to allocate storage. When data items defined in this Section appear as Procedure Division operands, the COBOL compiler generates instructions based on the item's characteristics, but leaves the address fields of those instructions incomplete—to be resolved by the system before program execution. All data referred to by more than one program is defined as usual in one of the programs (usually the one that issues the initial Call), and is defined in the special section of all the other programs using it. At the time the programs are combined, the system logically superimposes the entries in each program's special section on the cor-



Mr. Hicks is director of applications services for Information Management, Inc. He has previously been employed by Computer Usage Co. and Boeing and has BS and MBA degrees from the Univ. of California at Berkeley.

responding entries in the consolidated File, Working-Storage and Constant Sections of these programs.

Provision may also be made for the sharing of files among programs. This provision would cause the merger of all the File Definition entries of a set of interacting programs and eliminate all but one of each set of identically defined files. This would permit calling and called programs alike to refer to the same file at run time.

Sever COBOL compilers have implemented an inter-program communication facility in advance of the official COBOL specification that was approved by the COBOL Language Sub-committee of CODASYL on Jan. 25, 1967. For this reason, and because of the delay between the time a COBOL proposal is passed and the time it is implemented in a COBOL compiler, current compilers and those available in the near future will contain inter-program communication facilities that deviate in various ways from the official COBOL version.

Therefore, the official COBOL version will be described, then compared to the facilities offered by five "third-generation" COBOL compilers: GE 625/635, IBM System/360 (all levels), RCA Spectra 70 (all levels), Univac 1108 and CDC 6400/6500/6600. The prudent COBOL user will utilize the facility currently offered by his compiler so as to maintain maximum compatibility with the official COBOL specification.

cobol facilities

To transfer control among interacting programs, COBOL now provides the CALL verb with the format:

CALL program-name [USING identifier-1 [identifier-2]...]

The program-name appearing in the statement identifies the called program. It is the name of an object program; any limitation concerning the source language in which it can be written is left for the implementor to specify. The identifiers appearing in the USING clause specify data times in the calling program's File, Working-Storage, Constant, or (if this "calling" program is itself a "called" program) Linkage Section. Items appearing in the list are made available to the "called" program.

A called program returns control to the calling program via an extension to the EXIT verb.

EXIT [PROGRAM]

When an EXIT PROGRAM statement is executed within a program running under control of a CALL statement, control is returned to the calling program at the statement following the CALL. If no CALL is in effect when EXIT PROGRAM is executed, it has no effect.

The CANCEL statement is provided to release the storage occupied by called programs. When executed in the calling program, the statement

CANCEL program-name-1 [program-name-2]...

ends the logical relationship between the calling program and program-name-1, etc. The relationship can be re-established by the execution of a new CALL to any of the program-names.

The sharing of data is effected through the Linkage Section. This section appears in a COBOL source program between the Constant and Report Sections and employs the same over-all structure as the Working-Storage Section. The section functions exactly as described earlier; i.e., it defines all data but does not cause storage to be allocated. Therefore, all data items defined in the Linkage Section must have corresponding definitions in the file, Working-Storage or Constant Section of some other program. It should be noted that although information in record areas can be shared among interacting programs, the official COBOL specification makes no provision for sharing the files to which these records belong.

Called programs provide a list of Linkage Section items to be matched on a one-for-one basis to those appearing in the USING clause of the calling program's CALL statement. This list follows the Procedure Division header of the called program:

PROCEDURE DIVISION [USING identifier-1]identifier-2]···]

Each identifier appearing in the USING list must represent an 01 or 77 level item that appears in the Linkage Section of the same program. This list is paired, item by item, on a positional basis with the USING list from the CALL statement of the calling program and the paired items are logically equated at run time.

The following example shows three separately compiled but interacting programs named Alpha, Beta and Gamma. Alpha is a calling program and calls Beta. Beta is both a called and a calling program, being called by Alpha and calling Gamma, which is a called program.

```
IDENTIFICATION DIVISION.
PROGRAM-ID. ALPHA.

ENVIRONMENT DIVISION.

DATA DIVISION.
FILE SECTION.
FD A-FILE . . .

01 A-FILE-RCD.

WORKING-STORAGE SECTION.
77 A-W-1 . . .

01 A-W-RCD.

PROCEDURE DIVISION.

    CALL BETA USING A-FILE-RCD, A-W-1, A-W-RCD.

    CANCEL BETA.

(last statement in the Procedure Division.)


IDENTIFICATION DIVISION.
PROGRAM-ID. BETA.

ENVIRONMENT DIVISION.

DATA DIVISION.

WORKING-STORAGE SECTION.

01 B-W-RCD.

CONSTANT SECTION.
77 B-C-1 . . .
LINKAGE SECTION.
77 B-L-1 . . .
```

```
77 B-L-2 . . .

Ø1 B-L-RCD.

PROCEDURE DIVISION USING B-L-RCD, B-L-2, B-L-1.

    MOVE B-L-RCD TO B-W-RCD.

    CALL GAMMA USING B-C-1, B-L-1.

    EXIT PROGRAM.
```

(last statement in the Procedure Division.)

```
IDENTIFICATION DIVISION.
PROGRAM-ID. GAMMA.

ENVIRONMENT DIVISION.

DATA DIVISION.

FILE SECTION.

LINKAGE SECTION.

Ø1 G-L-1.

Ø1 G-L-2.

PROCEDURE DIVISION USING G-L-1, G-L-2.

    MOVE G-L-1 TO G-L-2.

    EXIT PROGRAM.
```

This example illustrates a number of facts:

1. Alpha, Beta and Gamma are complete COBOL programs. Each contains the four divisions and may have its own File Section, Working-Storage Section, etc. The only restriction imposed on interacting programs is that a called program must contain a Linkage Section if it refers to data items defined in a calling program.
2. The Procedure Division headers of Beta and Gamma contain USING clauses indicating that they are called programs. Beta also contains a CALL statement indicating that it functions also as a calling program.
3. CALL statements can refer to Ø1 or 77 level data items defined in the File (A-FILE-RCD), Working-Storage (A-W-1), Constant (B-C-1) and Linkage Section (B-L-1). The USING clause associated with the Procedure Division header may only contain items defined in the same program's Linkage Section (B-L-RCD, G-L-1, etc.).
4. The following data items are made equivalent by the interaction of Alpha's CALL and the USING list of Beta's Procedure Division header:

A-FILE-RCD	≡	B-L-RCD
A-W-1	≡	B-L-2
A-W-RCD	≡	B-L-1

The pairing is done on a positional basis only. The names and level numbers of the paired items may be the same or different. It should be noted that the equivalence of A-FILE-RCD and B-L-RCD does not permit Beta to refer to A-FILE.

The following equivalences result from the USING lists of Beta and Gamma.

B-C-1	≡	G-L-1
B-L-1	≡	G-L-2

Note that the net effect of both sets of equivalences is A-W-RCD ≡ G-L-2.

5. The Move statement in Beta

```
MOVE B-L-RCD TO B-W-RCD
```

executes at run time as if it were written

```
MOVE A-FILE-RCD TO B-W-RCD.
```

The Move statement in Gamma

```
MOVE G-L-1 TO G-L-2
```

executes at run time as if it were written

```
MOVE B-C-1 TO A-W-RCD.
```

6. The EXIT PROGRAM statement does not have to be the last statement in the Procedure Division (see Beta), but it may be, if desired (as in Gamma).
7. If either Beta or Gamma contained a CALL to Alpha, or if Gamma contained a CALL to Beta, the results would be unpredictable because of the previously stated rule that a calling program must not be called by any program in its chain of calls.

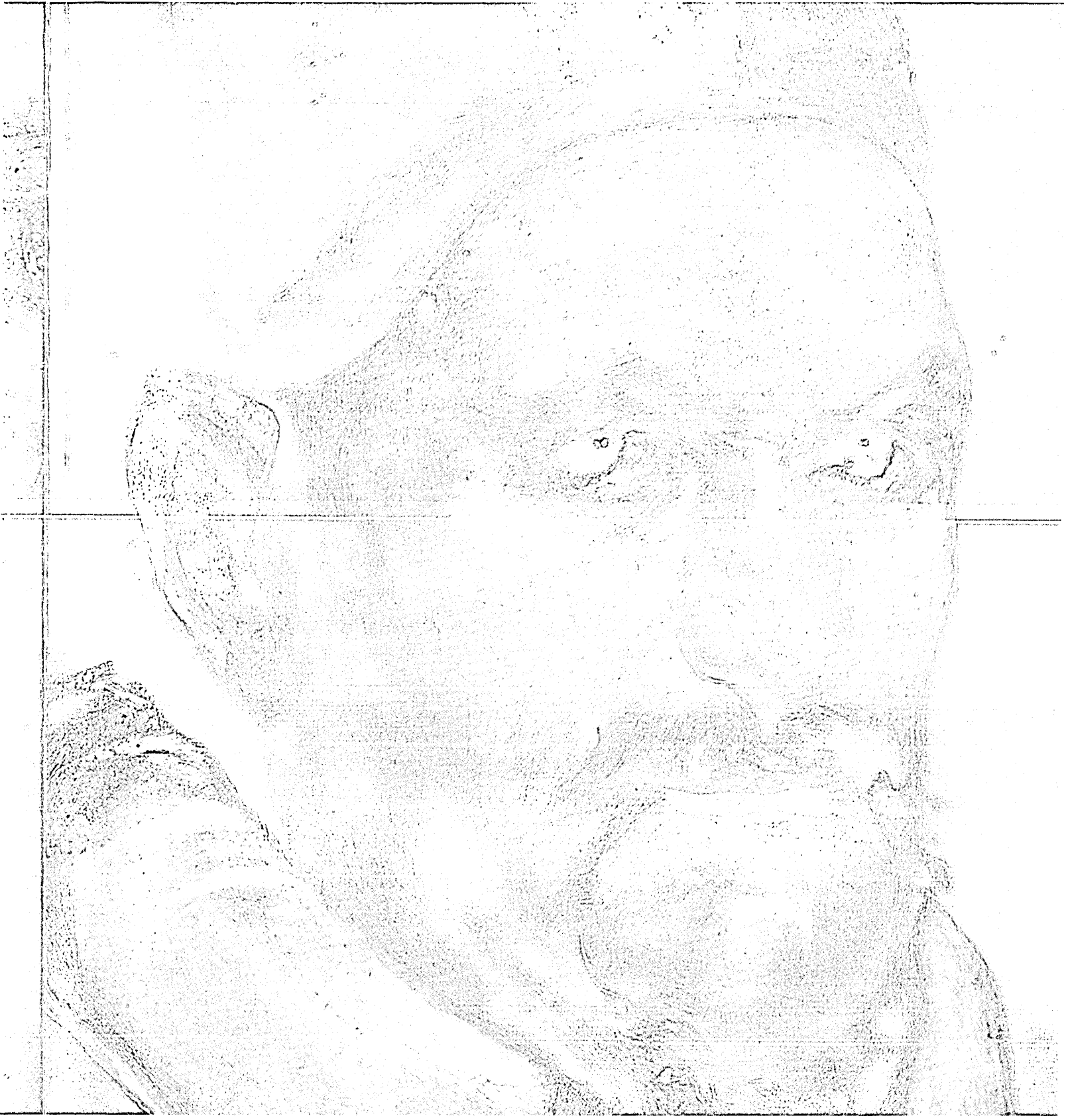
current compilers' facilities

The table (p. 57) presents the pertinent features of the inter-program communication facilities offeered by five late-model COBOL compilers.

1. Four of the five compilers provide a special Data Division section for shared data. The GE 625/635 uses the Special-Names paragraph in the Environment Division to permit the assignment of "labels" to blocks of the Working-Storage and Constant Sections. Data within these blocks is available to each program that describes the block and associates an identical label with it. The Univac 1108 and CDC 6400/6500/6600 use a Common-Storage Section that appears in both calling and called programs. Only the "main" program's Common-Storage Section is loaded. Therefore, each sub-program must contain an identical definition of that area, from its beginning through the last item referred to by the sub-program, in order to insure the correct run-time resolution of addresses. The IBM and RCA Linkage Sections function in the same manner as that in the official COBOL version.
2. Four of the five compilers provide for the sharing of files. In the GE 625/635 and Univac 1108 versions, any file that is identically described in the Environment and Data Divisions of two or more interacting programs is shared. The CDC 6400/6500/6600 has an added restriction that all files referred to by a set of interacting programs must be defined in the main program (as identified to the operating system). Sub-programs must contain identical descriptions of those main-program files that they refer to.
3. IBM, RCA and GE provide a CALL verb similar in function to the COBOL CALL. However, in all three compilers, the verb must be preceded and followed by the ENTER verb, in the manner shown in the table. In addition, the GE CALL verb does not have a USING clause when it refers to COBOL programs. The Univac 1108 and CDC 6400/6500/6600 both permit any Procedure Branching verb (GO TO, ALTER and PERFORM) to refer to procedure-names not defined in the program in which they appear. The compiler assumes that these undefined procedure-names are entry-points in separately compiled programs.
4. None of the implementations provide a means for terminating the relationship between a calling and called program.
5. All of the compilers except the GE 625/635 require the explicit definition of entry points in called programs (GE uses the called program's PROGRAM-ID as the sole entry

CIRCLE 26 ON READER CARD

FOR MEMOREX CIRCLE 27 ON READER CARD→



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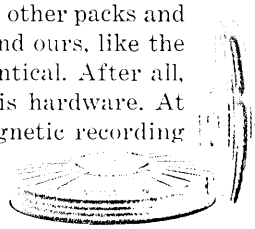

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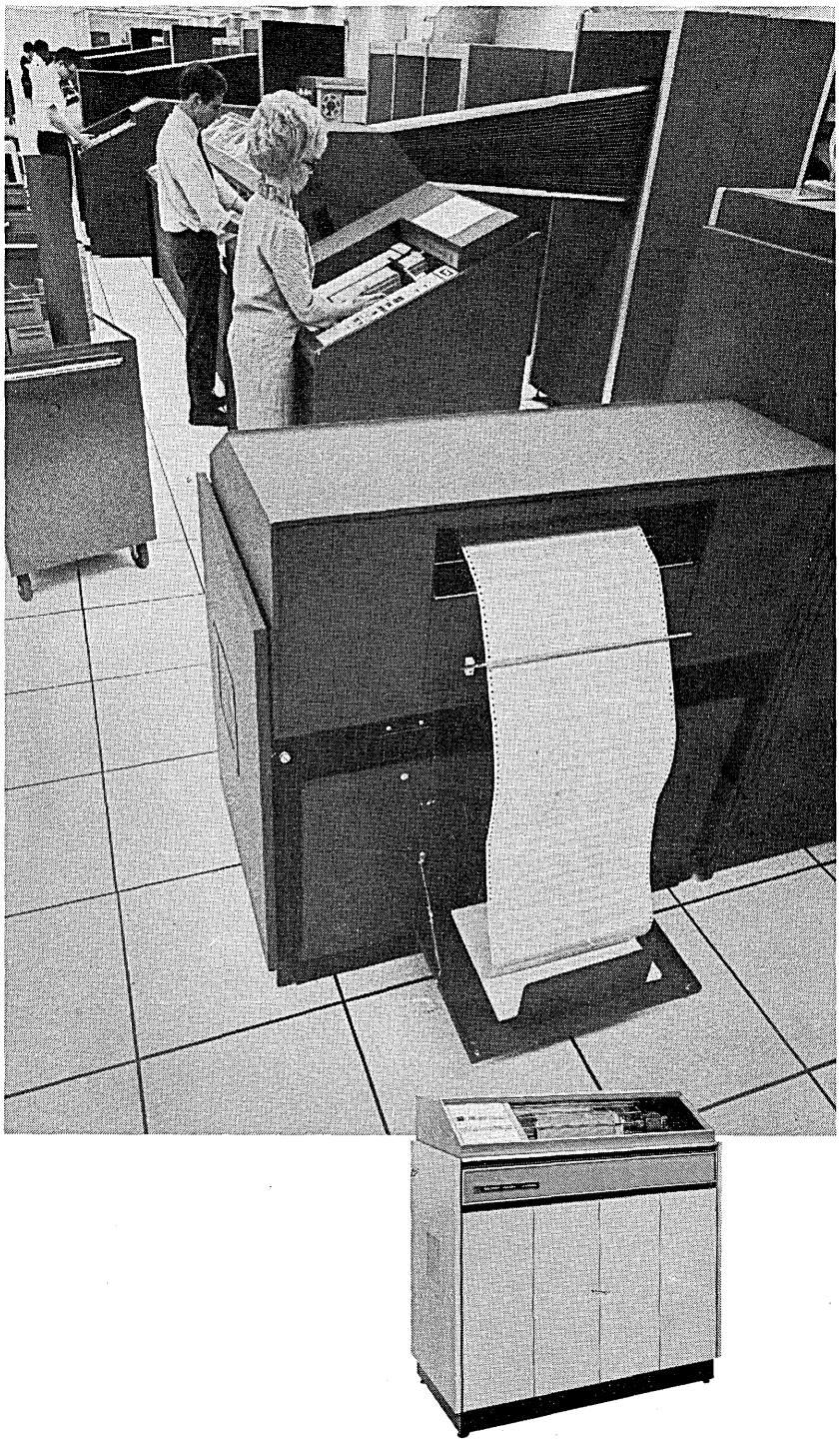

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CIRCLE 28 ON READER CARD

point). System/360 and Spectra 70 require the ENTER verb to precede each definition, while the CDC 6400/6500/6600 compiler requires an ENTRY statement at the beginning of the Declaratives section of the Procedure Division of called program.

6. In the Univac 1108 and CDC 6400/6500/6600 there is no difference in the transfer to and subsequent return of control from procedures in the same or in separate programs. Control is returned to the calling program by a GO TO (if a GO TO was the calling mechanism) or by executing the last procedure in the range of the PERFORM that effected the Call. In the GE 625/635, control returns after the last physical line of the called program's Procedure Division has been executed. System/360 and Spectra/70 use the RETURN verb to indicate the points in the called program from which control is returned to the calling program.

In comparing these implementations to CODASYL COBOL, several points are apparent:

1. The Linkage Section is the most flexible of the three data sharing facilities used, since it provides access to data stored in any other Data Division Section (except the Report Section) of the calling program. Both GE's labelled blocks and the Common-Storage Section of Univac and CDC require that the calling program transfer information from other sections into the Working-Storage or Common-Storage Sections in order to make it available to called programs.
2. While COBOL has no explicit facility for sharing files, implementors are free to provide this as a function of their Operating System. (Users interested in compatibility will probably wish to ignore any such facility.)
3. The COBOL facilities and those of the GE 625/635 permit the calling of complete COBOL programs only, while the other implementations permit interaction at the procedure level.
4. Official COBOL is the only specification that provides a method of terminating a called program. Such a feature is useful when modular programs run in a multi-programming pool.
5. If a user wishes to maintain maximum compatibility with COBOL while using one of the five current implementations, he should: 1) avoid sharing files, and 2) transfer control at the program level only.

guidelines

We will discuss first some general planning requirements and testing techniques for modular programming, then cover several special considerations that arise when a facility

FACILITY AVAILABLE TO

Implementation	SHARE DATA	SHARE FILES	CALL A PROGRAM	CANCEL A SUB-PROGRAM	INDICATE A "CALLED" PROGRAM	RETURN CONTROL
GE 625/635	Blocks of Working-Storage assigned labels in Special-Names. Blocks with identical labels are merged.	Identically defined files are merged and shared.	ENTER LINKAGE-MODE. CALL program-name. ENTER COBOL (USING clause not used.)	NONE	NONE	Control returns after executing last (physical) procedure.
Univac 1108	COMMON-STORAGE SECTION (only main program Common is loaded).	Identically defined files are merged and shared.	GO TO, ALTER, PERFORM a procedure-name in sub-program.	NONE	ENTER COBOL procedure-name . . . (Statement can appear anywhere in Procedure Division.)	Depends on verb used to transfer control.
CDC 6400/6500/6600	COMMON-STORAGE SECTION (only main program Common is loaded).	Main program files are loaded. Sub-programs may access files by using identical definition.	GO TO, ALTER, PERFORM a procedure-name in sub-program.	NONE	ENTRY procedure-name . . . (Appears as first statement in Declaratives.)	Depends on verb used to transfer control.
IBM System/360 and RCA Spectra 70	LINKAGE SECTION.	NONE	ENTER LINKAGE. CALL entry-name [USING . . .]. ENTER COBOL.	NONE	ENTER LINKAGE. ENTRY entry-name [USING . . .]. ENTER COBOL.	ENTER LINKAGE. RETURN. ENTER COBOL.
"Official" COBOL	LINKAGE SECTION.	NONE	Call program-name [USING . . .]	CANCEL program-name . . .	PROCEDURE DIVISION [USING . . .].	EXIT PROGRAM.

for overlaying modules is available and used. The use of the official COBOL facilities is assumed throughout.

Planning for modular programming begins once the system has been divided into its component programs. Each program should be analyzed to determine whether it in turn should be divided into modules and, if so, the best way to divide it.

Generally, modularization is most appropriate to large problems and then only when there are several programmers available. Clearly, the process of dividing a large program into smaller parts is beneficial regardless of how many people do the coding, but it is probably not worth the effort required to treat each part as a separate program unless there is some equality between the number of such programs and the people available to code them. When there is not, the separate parts can be treated as subroutines within one large source program.

Another condition that makes modularization attractive exists when one or more parts of a program are likely to change frequently in relation to the remainder. Isolating these changeable parts in one or more modules avoids the necessity of recompiling and testing the entire program each time a change is made. For example, the tax calculation routines of a payroll update program are likely to change every year while the remainder of the update probably will not. Thus, placing state tax, federal tax and FICA calculations in three separate modules would reduce the impact of changes to these routines on the whole program.

Once it has been decided to modularize a particular program, the lines of separation will usually become obvious. The objective is to obtain a set of modules with minimum interdependence. In cases where alternative schemes for modularizing are available, additional objectives such as ease of check-out and average level of programming difficulty can be used to select the best one.

The next step in the process is to define the control relationship among the modules. The logic that determines the sequencing of the modules should be isolated in a single "control" module. This module functions as the main program and has the responsibility for determining which module is called at any point in time and the sequence of actions when control is returned. The structure of the entire program is simplified if all calls are made by the control module and all shared data is defined in its File, Working-Storage and Constant Sections.

The control module takes on even more importance in the event that files will not be shared among modules. In this case, all files that are not unique to a single module should be under its control. This control can be exercised directly or by calling one or more modules whose sole function is input/output. A means for modules to communicate their I/O requirements to the control module is essential. This usually consists of a set of program switches that tell the controller whether to write, read or read/write when control is returned to it.

Finally, naming conventions should be established. Each data item shared among modules should be assigned the same data-name wherever it appears. Although this is not a requirement of the system, it enhances the documentation value of the program and reduces debugging problems at the program level. In addition, such a practice provides the capability of coalescing a set of modules into one large program by simply appending the Procedure Divisions of the various modules to the entire control module and replacing CALL's by appropriate PERFORM's. This technique is not available if the same item is referred to by different names throughout the modules.

When a particular module is ready to be tested it is most likely that neither the module(s) that calls it nor the module(s) it calls will be available. As a result, each module may have to be tested as a separate entity.

Testing the control module is not difficult since it issues calls but is not itself called. Each module it calls can be simulated by an identically named dummy module that displays its identification and returns control. After a test run, the sequence of calls shown on the display device output is compared to the sequence that should have resulted from the test data used. As the actual modules become available, they replace their dummy counterparts.

An easy way to test a called module is to simulate the module that calls it. This simulated module will have three functions: 1) CALL the module being tested, 2) display results from the called module when control is returned and 3) define in Working-Storage all items named in the Linkage Section of the module being tested. An alternative method of testing called modules is to run them as independent programs. To do this, it is necessary to: 1) remove the Linkage Section header, so that items defined there become Working-Storage items, 2) remove the USING clause from the Procedure Division header, 3) insert routines to acquire data and display results in appropriate places in the program. This procedure is reversed when the module is to be integrated with the control module. (The first test method does not require any changes to the source program prior to integration.)

In either case, an easy way to acquire test data and display test results is through the use of the Accept and Display verbs, since neither requires file definitions nor supporting procedures such as OPEN and CLOSE.

There will be some modules whose logical relationship to the controller is complex enough to make independent testing very difficult. The best solution for testing these modules is to wait until the controller has been independently tested, then test the module in question with it.

It is important that all test data and simulated calling and called programs be preserved after individual testing has been completed, so that individual modules may be tested independently in the future when changes are made.

overlay facility

Most modern operating systems include a dynamic overlay capability. This facility permits a programmer to designate for each run which entities (programs, segments, control sections, etc.) are to be core resident and which are to reside on an external device. Based on this information, the operating system allocates available main memory between the resident portion and a portion for overlays. The latter must be large enough to contain the largest of the overlaying portions. During the run, when a call is issued to a routine that is not in the resident portion, the operating system locates the entity to which the called routine belongs and brings it into the overlay portion of memory. This is true unless the called routine is already available in memory as the result of a previous call. If the call does result in an overlay, the portion of memory being overlaid is usually not preserved in its existing form. As a result, each time an overlay occurs, the routine being brought into memory from external storage is loaded in its initial state. Because whether a routine being called is already in memory determines its state when control is transferred to it, all routines assigned to the overlay portion of memory must accomplish their own initialization.

Operating systems supplying this overlay capability usually permit it to be used with COBOL programs. Thus, one or more called programs (or programs containing called statements, paragraphs, or sections) may be assigned overlay status. The use of modular programming together with an

overlay facility gives an added dimension to COBOL systems design.

Conventional commerical systems are designed so that data is passed through a series of resident programs. When core memory is severely limited in relation to the task, the system may consist of a number of programs each of which partially processes a file, with each program connected to its successor by a work file. The availability of an overlay feature gives the system designer the option of reversing the roles of data and procedure; he may now choose the alternative of passing parts of the system against data. In this case, the resident portion of the program reads the data, then calls a series of modules that are "rolled in" from external storage to process that data. When the last module has finished, the next record is read and the process repeats.

Because the availability of the overlay feature will affect how the system is divided into programs, planning for modularization must be done earlier in the design phase. Basically, the choice to be made is between the writing and reading of work files with no overlaying, or the loading of overlays from external media and not writing work files.

Two additional factors must be considered during the design phase. First, since the initial state of an overlay is unpredictable at each call, data whose importance spans more than one call (e.g. counters and program switches) must be located in the core resident control module in order to insure against its destruction. Second, in order to facilitate system debugging, control information (e.g. subscripts) from each module should also be located in the resident module regardless of whether that information is initialized at each call. Because it is almost always true that the overlay that creates an error during system test is no longer in memory by the time the error leads to disaster, the ability to dump information from each overlay is essential to pinpointing the overlay that created a particular error.

Use of the overlay feature in conjunction with inter-program communication permits programs immediately to make full use of additional main memory. This additional memory may become available when the program occasionally runs on a different configuration or through a permanent upgrading of the existing configuration. A change in control information is usually all that is required to add more modules to the resident portion. Clearly, when former overlay modules are added to the resident portion in the order of the frequency with which they are called, each increase in available memory will result in a decrease in the system's total run time.

conclusion

The inter-program communication facility recently added to the official COBOL specification and currently available in various forms in several compilers permits modular programming. This technique facilitates the programming of a large problem by permitting portions of the problem to be coded, compiled, tested and maintained as independent COBOL programs while still being treated at object-time as a single entity. When used in conjunction with an overlay capability, modular programming in COBOL removes the limitation imposed by memory size on system designers.

The use of modular programming requires the expenditure of some additional effort throughout the implementation process, and may also increase the run time of individual programs without a system, especially when overlays are used. If its use is planned carefully, however, these extra costs are more than balanced by the power of the solution method it offers. ■

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CIRCLE 72 ON READER CARD

THE ARMY'S NEW UNIT RECORD CONCEPT

comes the revolution

by DONALD D. CURRY

The U. S. Army Electronics Command, Fort Monmouth, N. J., has evolved a new unit record concept designed to replace the present punched card. The Army has long been plagued with the problems associated with the punched card and now has taken its first step toward replacing it.

It has often been said that the punched card will always be with us; but that is not necessarily true—at least for the Army. The vast improvements in computers today obviously should be matched by improvements in unit record systems.

This new concept is the result of trying to overcome some of the deficiencies in our present day punched card, especially as related to the Army and its tactical environments. There is a huge discrepancy between the efficiency of unit records as the I/O functional or source documents and the efficiency and use of a high speed central data processor.

material and handling drawbacks

This laboratory has first-hand information from Vietnam that the punched card is not suitable for the military environment. The punched card stock is unsuitable in a highly humid climate. Constant high temperatures and high humidity are normal for this area and in the Army both the supply and personnel adp systems are dependent upon punched card input. These cards are not only vulnerable to the weather but also to poor handling conditions. Kept in tub-files, which are located in tents, the cards accumulate dust, sand particles, and grime while being manually processed. Much of this foreign matter, therefore, gets into the machines during updating and reporting cycles. Thus a new medium and a new form of handling is needed that would be immune to dust and dirt.

Another limitation of punched cards is their low data density. There are only 80-90 bits contained on 24 square inches, while magnetic tape today can easily store one million characters in the same area. This low density results in many trailer cards being needed for each unit record and vast amounts of storage space.

Turning to the actual card handling equipment, serious deficiencies exist here also. At present, input/output equipment is the major cause for down time. The equipment requires precise adjustments and frequent periodic

Mr. Curry is the project engineer for developing new unit record techniques at the U.S. Army Electronics Command, Ft. Monmouth, N.J. He is currently involved in studying new exploratory techniques in data storage, imaging, printing, and handling related unit record (punched card) processing, paper tape usage and miniaturized printers. He has a BS in electronics from Purdue Univ.

preventive maintenance by trained personnel. The present punched card equipment is also expensive, bulky, heavy, and requires large amounts of power. In the same light, computers today have been miniaturized through smaller circuits and are now smaller volume devices. In the Army's tactical adp systems, I/O equipment represents the major weight factor in a shelter configuration and in some instances this equipment causes the weight capacity of a desired shelter to be exceeded.

The present punched card equipments are speed incompatible; many are too slow for their functional uses. This speed incompatibility requires elaborate buffering systems, programming time, and computer time. The slowness of this equipment therefore requires supplemental equipment and systems controls, thereby increasing the cost and lessening the efficiency of the over-all computer system.

For these reasons, plus their mechanical limitations, faster punched card equipment with increased capability is beyond the knee of the cost versus performance curve. Ruggedization of punched cards for military use would be very costly and would not increase speed, data density or

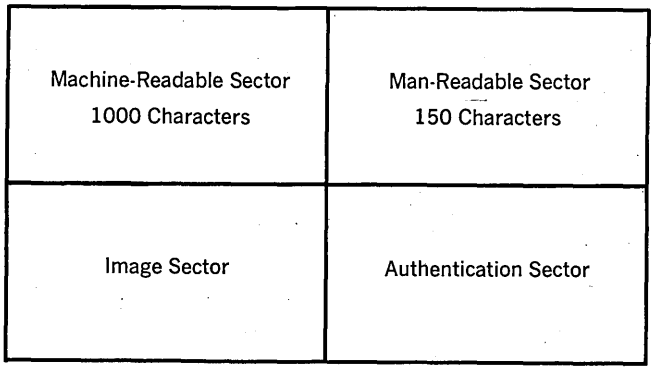


Fig. 1

equipment/volume ratio. Punched card systems for the military just are not doing the job. The military services in a military field combat environment certainly need a more functional form of unit record, one that would meet the stringent requirements of combat and provide a higher character data density in addition to imaging and legal considerations.

the new unit record concept

Therefore, acknowledging the requirements and frailties of existing input/output equipment, and recognizing their inadequacies as a major handicap to maximum field use of data processing equipment, the Communications/ADP Laboratory at Fort Monmouth instituted over three years ago a unit record techniques program to study unit record processing for the field army. This program is directed toward replacement of the punched paper card and elimination of the inherent defects of present-day punched card equipment.

At the outset of this program a new unit record concept was formulated, with characteristics and key parameters based upon functional applications. An operations research approach was used to determine the optimum capacity, physical size, and format of the new unit record to satisfy functional needs, and four areas were studied having the greatest potential for future use of unit records. These were: personnel, logistics, military police, and command and control. Their applications could be considered typical of the whole Army.

This work resulted in a unit record being defined as a separable document which contains information about one item and is both man and machine readable. Separable document is taken to mean a document that can be removed from and put back into the same file containing other similar documents.

The new unit record has four functional areas:

1. The machine-readable sector, an area possessing at least 1000 characters of machine-readable information.
2. The man-readable sector, an alphanumeric section whose minimum capacity is 150 characters.
3. The image sector, an image area on the order of 1.5 inches by 2 inches.
4. The authentication sector, an area approximately ½ inch by 2.5 inches, able to accept signatures.

An abstract representation of the new unit record is shown in Fig. 1.

This new unit record concept with the four different functional areas now can be tailored to any application. This is most important. A new unit record should offer maximum flexibility for different classes of users. Certain users could require all digital storage, while others could require all image storage; another class could require a combination of all four functional formats. This unit record is responsive to the needs of the military and capable of handling any form of data. The man-readable sector could be a summary of the machine-readable sector, or the functional areas could be physically combined if desired.

The human factors group at Fort Monmouth conducted a series of tests on various sizes of unit records to determine the ideal size to meet manual handling requirements. The results of manually sorting and searching various sized documents by length, width, and area indicate a new unit record should be, from a physical handling point of view, on the order of 3″ by 5″. If this size is chosen by the military for a new record, great savings would be achieved in physical storage space of the cards and also in the size of the handling equipment.

There are significant advantages in this unit record processing concept. Data can be processed mechanically and also handled manually. Not only can unit records be sorted, summarized, and reported, but they can be easily read, inspected, stored and shipped. This means too that, because of their authentication, they can be used as a legal document.

To date, considerable experience has been gained in unit record processing through the widespread use of punched cards. Again this experience has shown that a basic disadvantage of these cards is that each unit is limited to 80 to 90 characters of data. When a unit record exceeds these low limits the unit record principle is extended to more than one card. Consequently, unique identification must be repeated on each card relating to a record of data. This redundance of identification means that the density of data decreases and the file size increases to become undesirably bulky. This new unit record concept, which provides at least 1000 characters per card, virtually eliminates the expedient of carrying individual identification across many cards so common in current punched card processing. Therefore, maintenance of a record in the field, whether mechanical or manual, is made easier. The proposed 1000 character minimum unit record will eliminate most of these multiple trailer card situations.

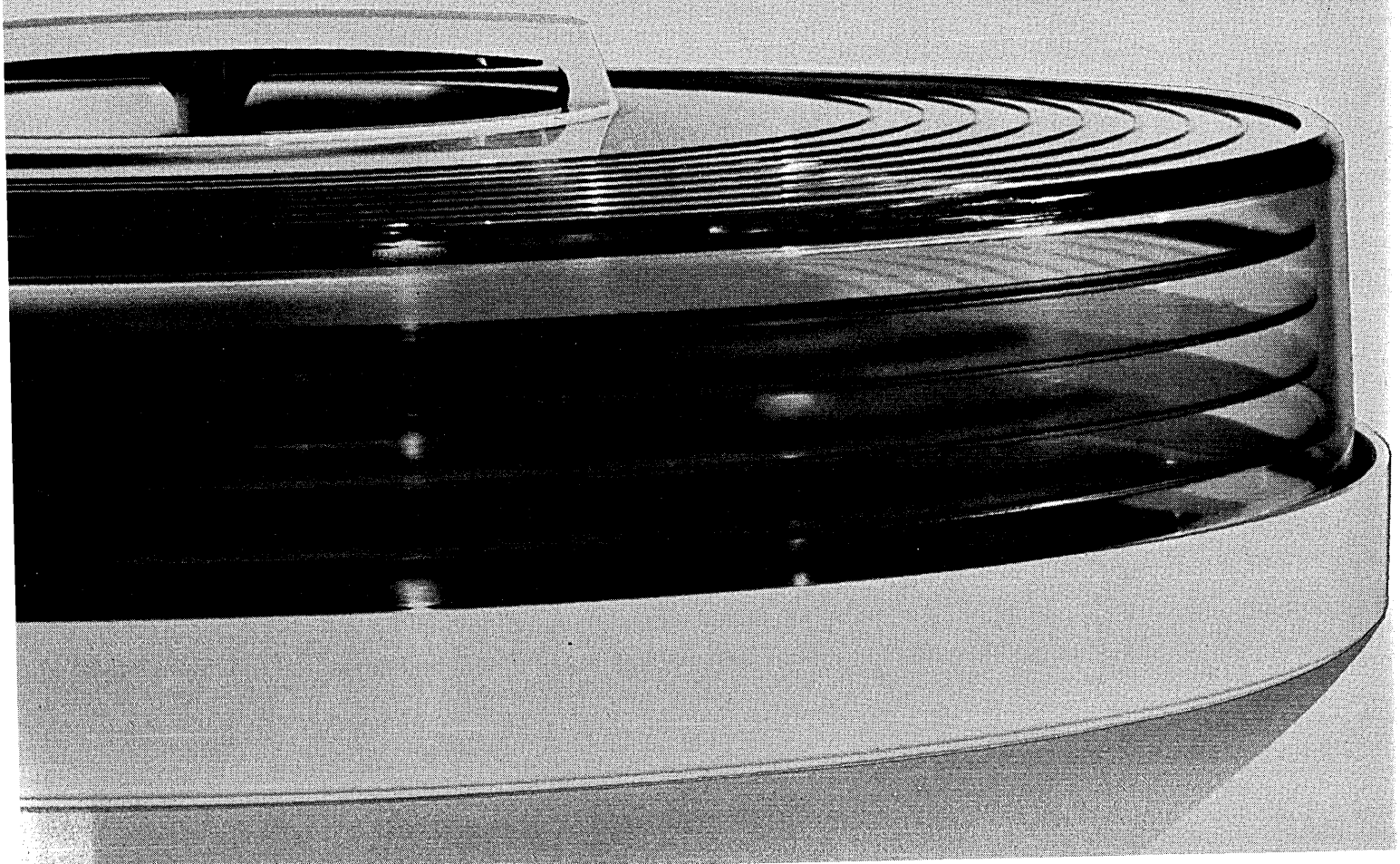
This new concept has been the basis for two exploratory development contracts, one to Univac, Blue Bell, Pa., and the other to Magnavox Research Laboratories, Torrance, Calif. Each contractor is pursuing a different approach. The outcome of these contracts for the Army will be the first step taken toward actually replacing the adp punched card in the military.

Highlights of each exploratory development contract are:

UNIVAC

Unit Record Medium 2.5″ by 4″, 5 mil mylar, electroless-

What could possibly top the ATHANA Disc Pack?



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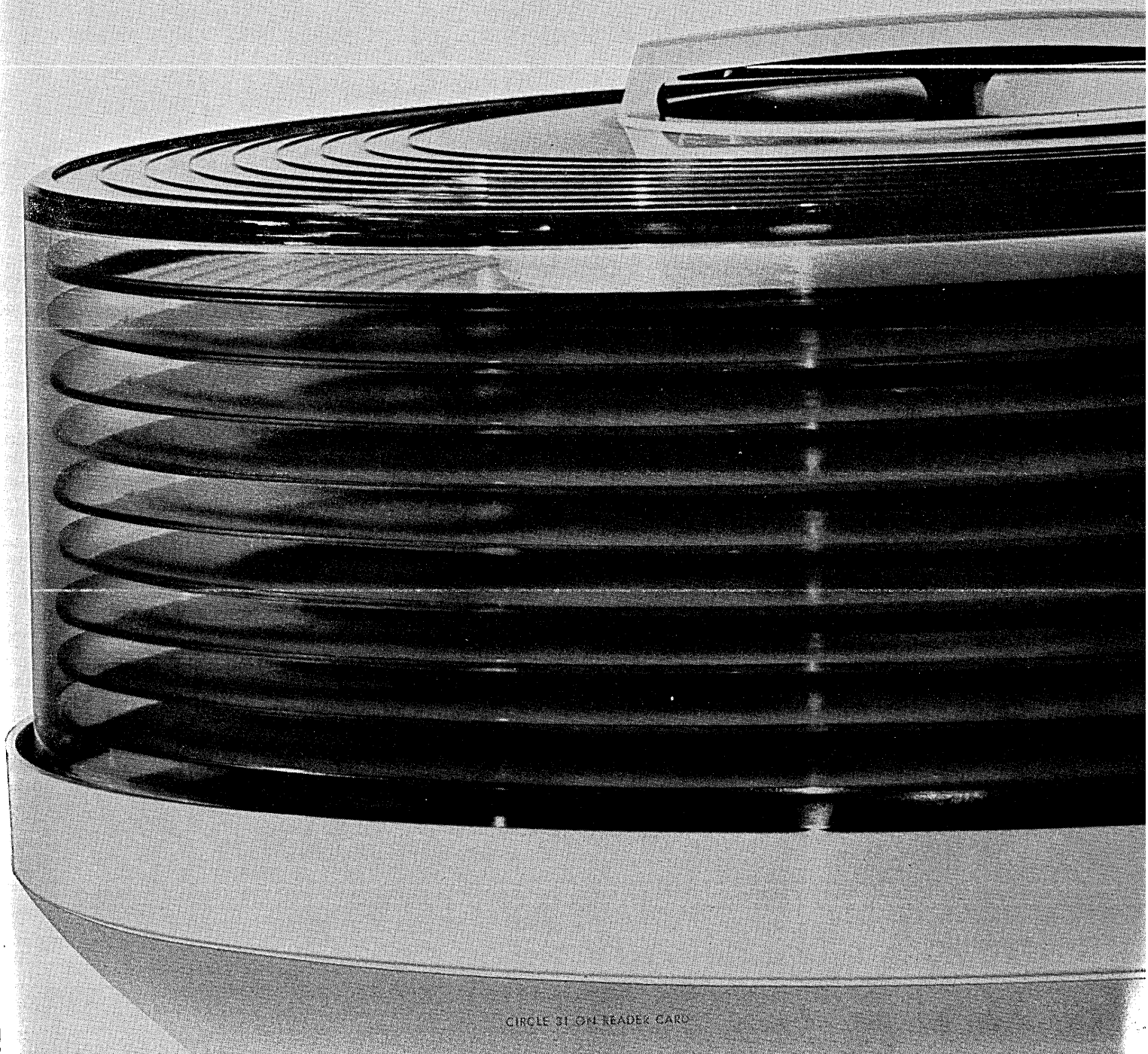

CIRCLE 31 ON READER CARD

	plated on both sides with a thin film of magnetic nickel-cobalt alloy.
Machine-Readable Sector	1024 characters at 400 bits/inch. Magnetic, reusable.
Man-Readable Sector	180 characters. Impact printing. Special inks needed for reusability.
Image Sector	35 mm microfilm (aperture card technique).
Authentication	Accepts ball-point pen signatures.

Handling of the unit record will be by an all fluid (air) transport. The transport will employ all fluid techniques in picking, accelerating, transporting past the read-record head, and gating unit records, along with cartridge loading and unloading.

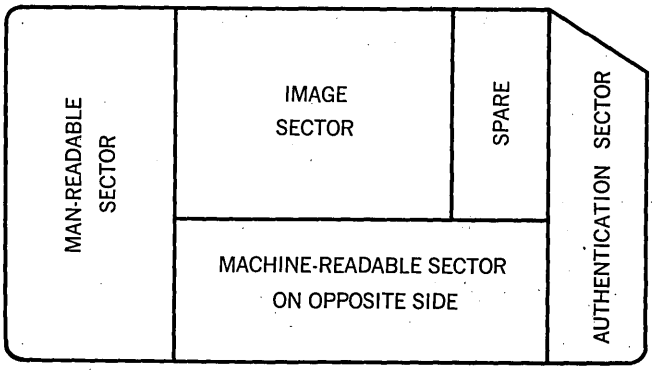

Fig. 2

The unit record will be handled at 5 per second at 75 inch/-sec. The recording-reading rate of the machine-readable sector will be approximately 30,000 char. per second.

The unit record cartridge-magazine will hold 2,000 unit records, which is over 2,000,000 characters.

(See Fig. 2 for sector layout.)

MAGNAVOX RESEARCH LABORATORIES

Unit Record Medium	3″ by 4.5″, 7.5 mil mylar. The upper 35 mm by 4.5″ section of the record has a magnetic oxide coating. The lower 35 mm by 4.5″ section has a diazo emulsion film coating.
Machine-Readable Sector	1016 characters at 250 bits/inch. Magnetic, reusable.
Man-Readable Sector	80 characters at 10 characters/inch. Space available for 320 characters. The characters are recorded as a magnetic facsimile of the characters and are rendered visible by means of a developer or a small viewer. Reusable.
Image Sector	35 mm microfilm form on the diazo emulsion. Nonreusable.
Authentication	Accepts ball-point pen signatures.

Handling of the unit record will be by mechanical pneumatic means.

The unit records will be processed at 10 per second at 120 inches/sec. The recording-reading rate of the machine-readable sector will be approximately 30,000 characters per second.

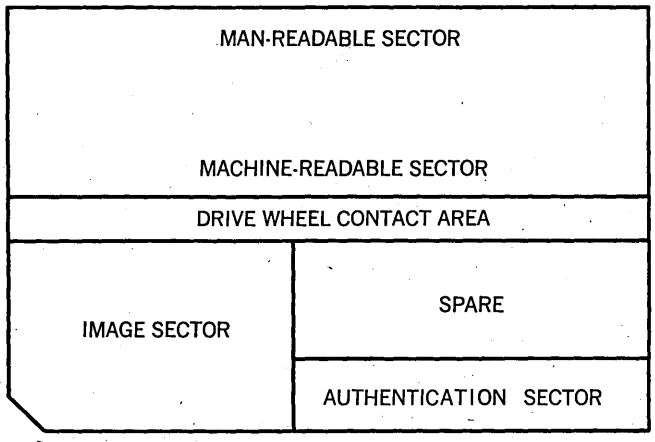

Fig. 3

The unit record cartridge-magazine will hold 1,000 unit records, which is over 1,000,000 characters.

(See Fig. 3 for sector layout.)

characteristics and objectives

The major objectives of the new unit record concept are:

1. More efficient storage of data on the media.
2. Media that would be usable in all military environments.
3. Increased writing and reading speeds so that the data transfer rates will be closer to that of new adp equipment.
4. Simplified handling mechanisms for smaller, lighter, and more reliable equipment.
5. Media handling diverse forms of data.
6. The data storage capacity of one new unit record would be over ten times that of a punched card.

Reliability, simplicity of maintenance, and the ability to withstand rugged field environments are vital not only in the unit record medium, but also in the record handling equipment. The importance of air fluid handling with no moving parts for unit records cannot be overemphasized for operation in a military environment.

From talks held with various potential military users, i.e. personnel, logistics, military police, command and control, it has been determined that they all desire a significantly better method of entering data to a data processor and of being able to more effectively utilize the data output. Favorable response from these people has been received for this new unit record concept. It appears a new unit record would solve many problems for military users.

It is felt that at the end of the exploratory development contracts it will be possible to see certain advantages in one particular technique. This will point the way toward a new technologically updated unit record for the Army. This selected program will also offer in the future field unit record handlers displaying unequalled reliability even under the most stringent field conditions.

Some possible uses for unit records besides the normal use for input/output data and programming would be for dog tags, pay checks, and all hard copy documents. A new unit record technique could conceivably revolutionize the entire adp community. ■

a keypunch alternative

THE MT/ST TAPE READER

In the growing search for alternatives to the keypunch, two specific developments have emerged: the optical document reader and the keyboard-to-computer-compatible magnetic tape recorder.

The model TR-6708 tape reader, manufactured and sold by Data Corp. of Dayton, Ohio, is the most recent entry in the keypunch alternative slate. Basically, the reader permits non-computer-compatible data recorded by an IBM Mag Tape Selectric Typewriter (MT/ST) to be read into a computer. Data, therefore, can be captured at the source as a by-product of the original typing.

The MT/ST is a combination of a Selectric typewriter and a mag tape recorder playback unit using a plug-in cartridge. Data can be recorded on tape while the secretary types, or a previously recorded tape can be typed out.

Data Corp. is not the only company to see the possibilities of adapting the MT/ST for computer input device. Digi-Data Corp. has developed an incremental mag tape recorder that attaches to the MT/ST and produces a computer-compatible tape. (This unit can also be used as a tape-to-tape converter, accepting tapes made on unmodified MT/ST's and producing computer-compatible tape at a 15-20 cps conversion rate.)

Data Corp.'s Model TR-6708 tape reader does not require any modifications or special attachments on the MT/ST. The reader can be operated on-line with a computer or off-line in a MT/ST tape-to-computer-compatible-tape converter. The prototype unit of the reader is attached to the multiplexor channel of a 360/40. The tape is read at a rate of approximately 100,000 characters a minute. A complete tape cartridge, containing up to 24K characters, is read and rewound in 30 seconds.

With one exception, the reader does not impose any different procedures on the typist operating the MT/ST. Three successive STOP codes must be recorded at the end of the data on each cartridge. This is necessary because the tape cartridges are reusable and are not normally bulk-erased between uses. A REFERENCE code must also be recorded at the beginning of a tape; however, this is normal, although not always necessary, MT/ST operating procedure.

Data Corp.'s reader, interfaced to the System/360, reads all recorded characters into the computer, including the MT/ST control codes (REFERENCE, STOP, and a few more). Characters are presented in MT/ST's 9-channel, odd-parity code. No decoding or editing is done within the reader, but is accomplished with computer software. The reader transmits to the computer all characters between the first REFERENCE code and the three successive STOP codes.

According to the company, operation of the reader is "extremely simple." The operator inserts the cartridge and presses the READY button. Reading is then initiated by the computer. The tape is read continuously from end to end and then rewound. At the completion of rewind, the COMPLETE light informs the operator that the cartridge can be removed and a new cartridge inserted. Simultaneous reading of all 9 channels is accomplished by a double gap playback head (which takes advantage of low tape density).

At the present time, the prototype unit of the TR-6708 tape reader is being used as an input device for an information retrieval system. Other applications are in the planning stage. For information:

CIRCLE 240 ON READER CARD

"all set" for ASCII plus...

Think about it. A new heavy-duty terminal that forms and shapes some of the most complex shapes and forms in data communications. It's the Model 37. Another answer from Teletype R&D for moving data efficiently, at very low cost.

* * * *

Soon, the simplest of language communications to the most complex forms, formulae, charts and graphs will be printed (or punched in paper tape) at 150 words per minute. On-line or off, the Model 37 ASR (automatic send-receive) set from Teletype will give you complete control of just about any data handling situation. And it generates all 128 ASCII (U.S.A. Standard Code for Information Interchange) characters making computer dialog easier than ever before.

Features Galore

The Model 37 types in upper and lower case. Will print two colors if desired. In time sharing situations the terminal's capability in printing graphs, equations, text material and tables is uncommonly fast and efficient. It will have half-line feed—both forward and reverse. Puts everything you need for programming, problem solving, cataloging, and information retrieval at your fingertips. And you get all this flexibility from a keyboard arrangement that is similar to the familiar keyboard found on a typewriter.

Traveling Tabs

Helping you speak the computer's language is only one of many new and important capabilities built into the Model 37. The terminal can be used to produce multiple copy business forms on-line. It has a vertical and horizontal tab stop for every place on the page. Operator will be able to set tabs from the keyboard on-line and off. Or, tabs will be able to be set on-line by a computer—or any remote terminal that uses the ASCII code. Operator can advance and fill in forms in any number of

remote terminals. The on-line tabbing capability also will be useful for programming large volumes of tabular data.

The Line's Complete

The Model 37 line consists of the ASR shown here, KSR (keyboard send-receive) sets, RO (receive only) sets, plus paper tape punches and paper tape readers housed in modular units. You will have a completely integrated data moving system with all the important options you've been looking for.

The Model 37 is one of many exciting moves being made by Teletype R&D *in moving data at very little cost.* That's all we're really concerned with. Providing equipment that keeps data on the move quickly, reliably, economically . . . machines that can help you move data a mile, thousands of miles, or just down the hall. If you would like more information on the Model 37, write Teletype Corporation, Dept. 81E, 5555 Touhy Avenue, Skokie, Illinois 60076.

CIRCLE 33 ON READER CARD

If you think getting into ECPI is easy, you could have another think coming.

PROGRAMMING APTITUDE TEST

ecpi

At ECPI, we run what is probably the toughest obstacle course in the business. But not every would-be programmer gets a chance to run it.

First he has to get by our aptitude test. Because desire is one thing, and ability another. Then, if he's got the ability, we give him an in-depth interview just to make sure he's got the proper attitude. In fact, our screening is so intense that 9 out of 10 high school graduates who apply don't pass the requirements.

But that's only the beginning. In the course of study, each student must put through hundreds of hours of class work, plus several hundred more of homework. He has to write 21 programs. What's more he gets practical work on third-generation equipment and plenty of time to de-bug what he's written.

Then, just to make sure he's got it all filed away in its proper form, each ECPI student has to pass five tough mid-term exams and a three-hour final that's the final crusher.

Our course isn't easy. In fact it's pretty tough. More than 20% of our students don't even make it through. But, we figure the harder we make it for them, the quicker they'll make it with you.

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ecpi ELECTRONIC COMPUTER PROGRAMMING INSTITUTE

The toughest obstacle course in the business.

CIRCLE 34 ON READER CARD

a conference report

INSURANCE AUTOMATION FORUM

Although the theme of the Automation Forum of the Life Office Management Assn. was "Information, Please," the current president of this group of life insurance managers and analysts suggested alternate themes of "Innovation, Please" and "Imagination, Please." "Manufacturers try to educate management more than necessary . . . management should study insurance not computers," said W. Dawson Sterling, president of Southwestern Life of Dallas, also indicating disappointment in what computers have done for life insurance companies. Such remarks grated harshly on the ears of those who decry the kind of judgments about automation made at top management levels this last decade. Some look to the elevation of superior technicians to high levels of management as the only hope for improvement in the next decade.

Highlights of the Forum held in St. Louis in March were the contributions of such computer professionals as Frank Wagner, executive vp of Informatics; Robert Harmon, general manager of McDonnell Automation; and William R. Lonergan, vp for product planning at RCA.

the panel

Wagner's paper, "Operating Under Third Generation Concepts" was, in spite of the title, the high point of the conference. Some of it was a reiteration of much that has been said before: "There is really no choice but to use the manufacturer's software . . . we must use an Operating System . . . why continually reinvent the wheel? . . . Direct access is too much for programmers to handle, the multiprogramming idea assumes higher level languages, not assembly programs." Three or four ideas, however, were particularly notable: "PL/I may replace FORTRAN but not COBOL—but something will. . . . You must get into communication, branch offices must have access to computers. . . . Management information must be adequate for action, accountants are not action oriented. . . . The mainstream of business must develop its own data base. . . . Would not graphical output devices better represent situations in the insurance industry than columns of figures? . . . and lastly, data management systems afford a standardized method of handling data."

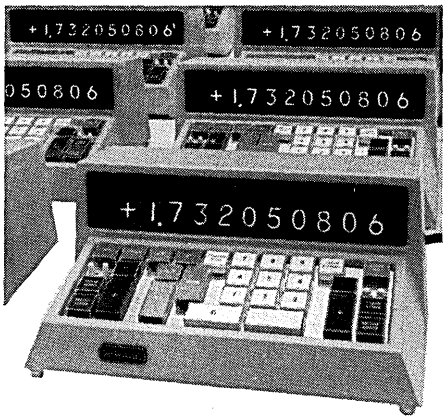
Lonergan gave one of those short commentaries on the present and future of computer hardware for which he is now so well known.

Harmon defined the term "data drome" as sort of an arena for sophisticated processing and outlined some of the salient facts about the "drome" he manages. After eight years he has 1,400 persons on board, 55 computers of various makes—IBM, RCA, Control Data, GE—terminals in many parts of the country feeding data to the St. Louis center, auto dealers all over the

country reporting daily results, getting back statements of sales, inventories. "Shared use of large facilities affords more economical computing," he commented. Harmon suggested an insurance processing utility with a gigantic data bank shared by all companies.

projects

The major automation project of two large companies was described by Messrs. York and Dow, senior vice



Why companies standardize on WANG electronic calculators

VERSATILITY Just one basic calculator design, the WANG 300 Series, can solve the needs of many company operations. On compact keyboard displays, all basic arithmetic functions (+, −, ×, ÷) can be performed instantly, silently, accurately by simply touching a key. Optional keys produce x^2, $\sqrt{x}$, $\text{Log}_e x$, e^x. 80 Step tab cards and plug-in card readers can make any model fully programmable.

EXPANDABILITY As needs increase, add-on compatibility makes it possible to expand into a powerful computing system that will branch, loop, do subroutines, make decisions and manipulate arrays.

CONVENIENCE Wang calculators are as simple to learn and operate as a ten-key adding machine but infinitely faster and more powerful.

ECONOMY Wang multiple keyboard systems cost far less per station than any comparable electronic calculators. In use, they can eliminate 67 to 93 per cent of calculation time. (One leading company reports a saving of $73,000 four months after installing Wang Electronic Calculators.)

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CIRCLE 35 ON READER CARD

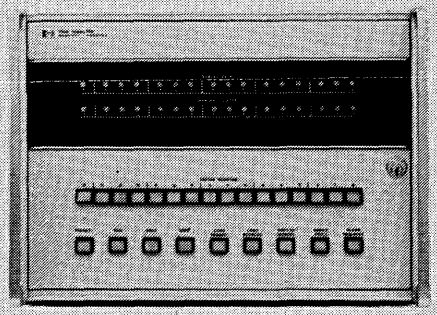
Is it possible to get a really good computer for less than $10K? How about $9,950 and some odd change?

That's what the new Hewlett-Packard 2114A will be pegged at. But it'll heave to just like its big brothers. Throwing around big 16-bit words. Storing 4000 (or 8000) of them at a time in memory. Fetching them out of memory in two microseconds. It'll tie in I/O devices with standard plug-ins and use the same set of programming languages—FORTRAN, ALGOL and Conversational BASIC. It may be the littlest computer in the HP family... but even at that it more than holds its own against its big brothers.

That's right. The HP 2114A offers the most desirable price/performance ratio of any computer on the market. And it won't take up much room, either, not even on your desk. One compact package 12¼" tall houses both processor and power supply.

Yet the economy model is fully compatible with all the 2115/2116 software and I/O interfaces. The main frame accepts either 4K or 8K memory, has eight I/O plug-in slots and operates within a wide temperature range. Low-cost options include parity error check and power-fail protection.

If you think this powerful little computer is right for you, get more information from your local HP field engineer. Or write Hewlett-Packard, Palo Alto, Calif. 94304; Europe: 54 Route des Acacias, Geneva.



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DIGITAL COMPUTERS

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The Kennedy Model 1600
the finest low-cost incremental recorder available today—$2750.

The Kennedy Co., the acknowledged leader in incremental recorders, announces a new generation—the Model 1600—a low cost solution to the data gathering problems of business and scientific applications.

The Model 1600 offers all the performance features of IBM-compatible recorders previously available, but at a cost lower than older, inefficient recording methods.

All new integrated circuitry and extensive tooling have been applied to produce a high performance recorder designed for new systems or retrofitted into existing systems, and at great savings (even more with OEM quantity discounts).

In addition to the write-only version, the Model 1600 is available in most of the variations currently offered in other Kennedy models. These include:

- Incremental write/continuous read
- Incremental write/incremental read
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- 0-500 character/second write

Basic 1600 specifications are:

- Reel size: 8½" 1200' capacity
- Recording format: 7-track IBM compatible
- Recording speed: 0-300 characters/second
- Skip rate: 1000 increments/second
- Density: 200 or 556 BPI
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- Input logic levels; IC compatible (DTL)
  O V ±.5 V false +4 V (min) true
- Output logic levels: IC compatible (DTL)
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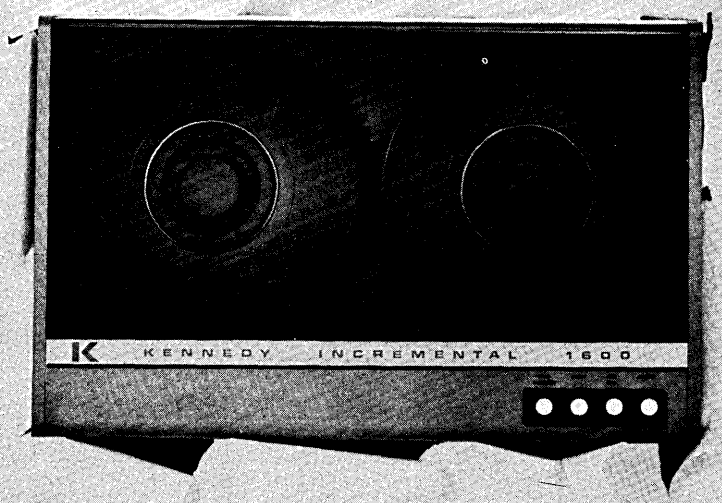
- Size: 19 x 12¼ x 10 deep
- Power: 115V 60 Hz 120 watts

So, whatever data gathering system you may be using or contemplating, now is the time to move. You can see that we had you in mind.



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CIRCLE 36 ON READER CARD

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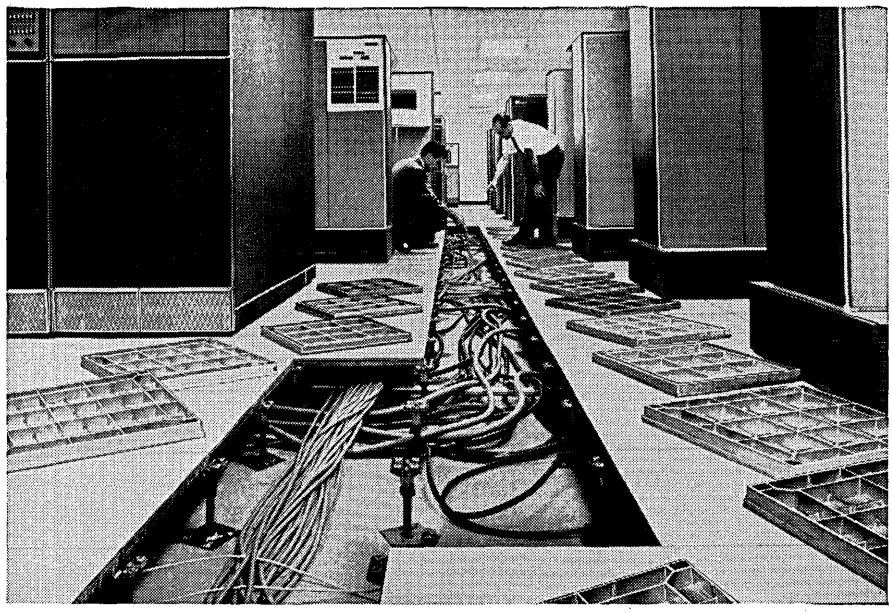

Here are five good reasons why Floating Floors elevated flooring systems belong in your computer room:

1. TOTAL ACCESS. Simply lift a panel, and you have complete access to cables. Maintenance is easy. And system changes can be made quickly—with no downtime.

2. NO STATIC BUILD-UP. The floor is completely grounded for safe, worry-free, continuous operation. That's a "plus" feature of non-magnetic aluminum.

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5. SAFETY. These panels are fireproof. They're lightweight, easy to lift, won't hurt you if accidentally dropped. Proven application and continuous testing by the company that pioneered free access floors is your further guarantee of total safety.

There are more reasons why your computer should have the best available raised floor system—and your local Floating Floors distributor will be glad to outline them for you. Call him today. Or write National Lead Company, Floating Floors, Inc., Room 4617, 111 Broadway, New York, N.Y. 10006.

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CIRCLE 37 ON READER CARD

presidents of Metropolitan and Prudential, respectively. The Met has given priority to installing their field communication network, supported by a formidable platoon of giant Honeywell computers. The Pru has given first place to its home office administrative procedures for individual policies, with identical programs on its IBM computers in eight regional home offices.

Sales aids and agents' support was chosen as first priority by the London Life of Ontario, Canada, and was the subject of a talk with visual aids presented by that company's secretary, William L. Pollard. Remote operations for handling group insurance claims were described by John H. Fabretti, vp of California-Western States Life of Sacramento, who demonstrated on stage with an IBM 1050 terminal connected to a computer back at the Cal-West ranch in California. (A strong sales pitch emerged when it became known that Cal-West would demonstrate the system throughout the conference from their hotel suite and that their program package is for sale at $375K per copy!)

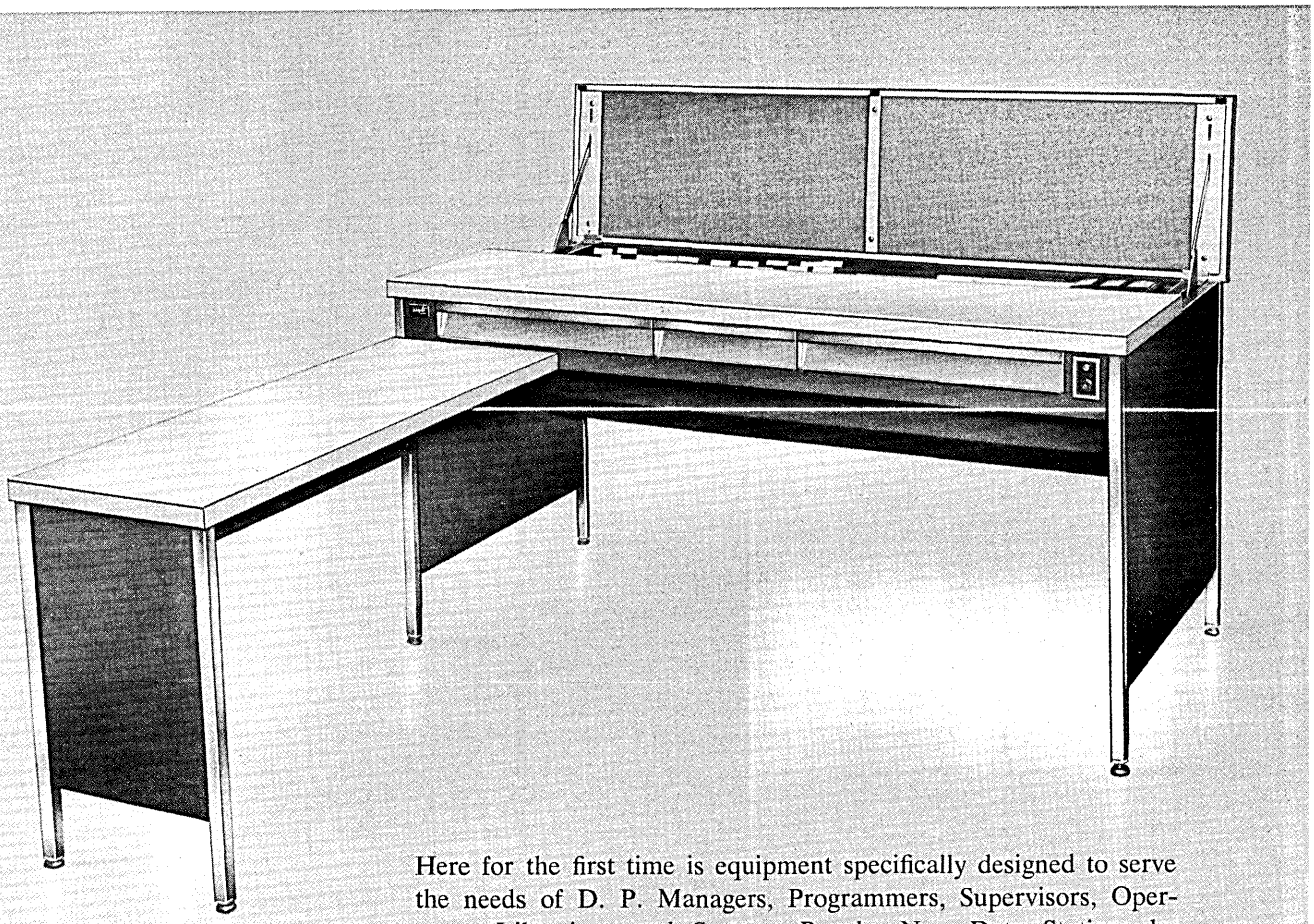
sessions, workshops

Half the Forum was turned over to concurrent sessions and work shops. Both consultants and representatives of several companies delivered papers; retrieval, management research, wire communication and direct access systems all came in for their share of discussion. Workshops dealt with phases of administering computer operations, including training and evaluation of programmers and systems analysts. A progress report was given on IBM's ALIS package (Advanced Life Insurance System). Experience with key-to-tape, display terminals for input and output, audit response control systems, and tape-to-microfilm were reported.

Attended by over 700 representatives of life insurance companies in the United States and Canada and at least one from France, the Forum was acclaimed by all as one of the better conferences of its kind. Held every three years since 1959, this one was arranged by a committee headed by John Bevan, actuary for Connecticut General, and will rank easily as the best of the series. A repeat performance at least by 1971 can be predicted.

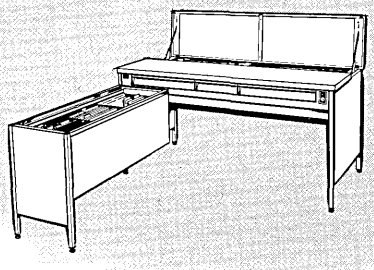
—E. F. COOLEY

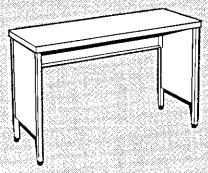
it's about time someone recognized the special needs of Data Processing People...

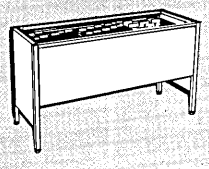


Here for the first time is equipment specifically designed to serve the needs of D. P. Managers, Programmers, Supervisors, Operators, Librarians and Systems People. New Data Stations by Wright Line are designed and built to be used by people who must handle and work with punched cards, forms and other specialized materials.

These handsome, computer styled stations feature smooth acting plastic-laminate efficiency tops that glide open at the touch of a button to expose a large tub storage compartment with tailored space for cards, program decks, binders and both letter and legal size Pendaflex folders. The inside of the top is a cork bulletin board. Three drawers are provided for pencils, paper clips and other miscellaneous supplies. Side bars, back bars and side tubs are available for additional storage or work space. For complete information, circle the reader service number below or contact Wright Line, A Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.





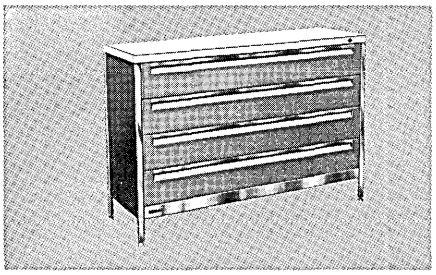


Wright LINE

DATA PROCESSING ACCESSORIES

For More Information Circle Reader Service Card No. 108

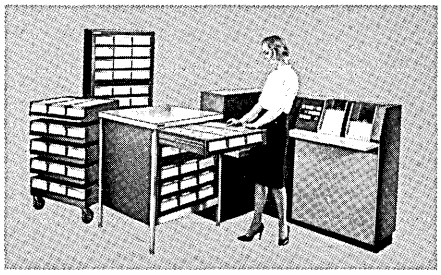
WRIGHT LINE . . . everything for data processing . . . except the computer



DISK PACK STORAGE

Full suspension drawer cabinets and library units for maximum safety and protection for both 4″ and 6″ disks. Counter height cabinets have plastic laminate tops.

For More Information, Circle Reader Service Card No. 102



GOLD STAR FILES

The most beautiful and most versatile card files available today. Line includes counter top model with plastic laminate surface, truck and transfer files.

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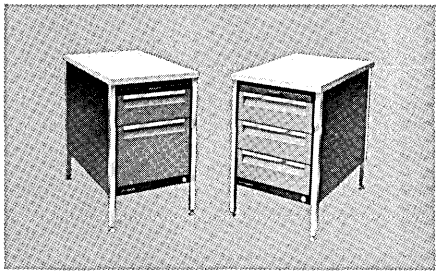
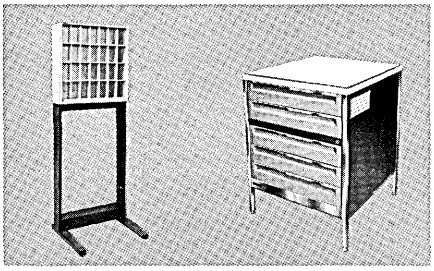


KEY PUNCH DESK

Provide complete work stations by adding work surface and drawer space at the key punch machines. Attractively styled units for use with all key punches.

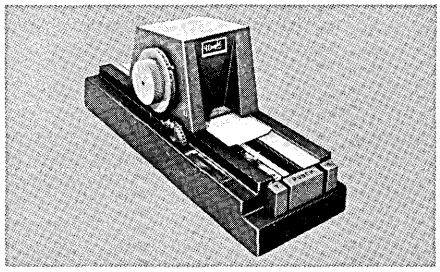
For More Information, Circle Reader Service Card No. 104



COMPUTER ACCESSORIES

Custom designed accessories for third generation computers. Line includes Data Stations and Control Centers with efficiency tops plus card handling and storage equipment.

For More Information, Circle Reader Service Card No. 101



PORTABLE CARD PUNCHES

Models for punching only or for punching and simultaneously printing. Printing punch has tab stops. Plastic card punch for Hollerith and other coding in plastic badges and cards.

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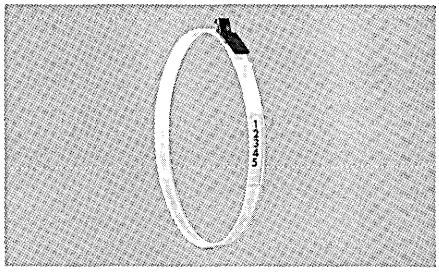

TAPE-SEAL® SYSTEM

The safest, easiest handling, most economical method of storing tape. Complete line of Tape-Seal cabinets, trucks and accessories is beautifully styled to compliment computer equipment.

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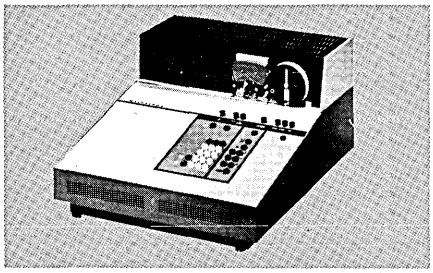

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Much more than just a calculator, Mathatron has the capability to solve complex problems that are written directly with the keys. Mathatron can also be programmed and can make logical decisions.

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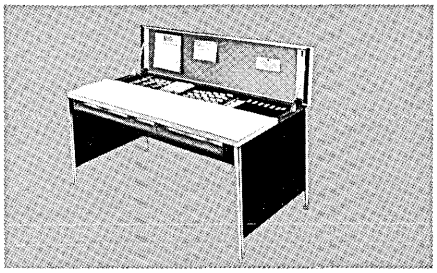
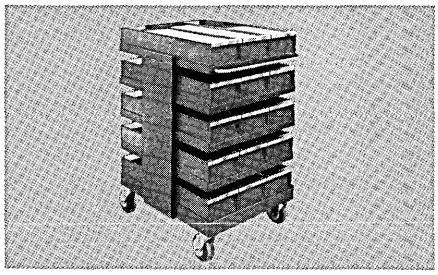


DATA STATIONS

Specifically designed for data processing applications, Data Stations combine the best features of a desk and a tub file with custom storage for cards and supplies.

For More Information, Circle Reader Service Card No. 108



TRUCKS

Custom trucks for transporting cards, tape, disk packs and all other data processing supplies. Trucks combine straight tracking with easy turning and ramping.

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. . . and other products:

• TUB FILES • GUIDES • CONTROL PANELS • PANEL STORAGE • BINDERS • DATA-CELL STORAGE • SORTING RACKS • Wright Line serves the data processing field exclusively with full-time Wright Line field specialists in all areas of the United States, Canada and throughout the world.

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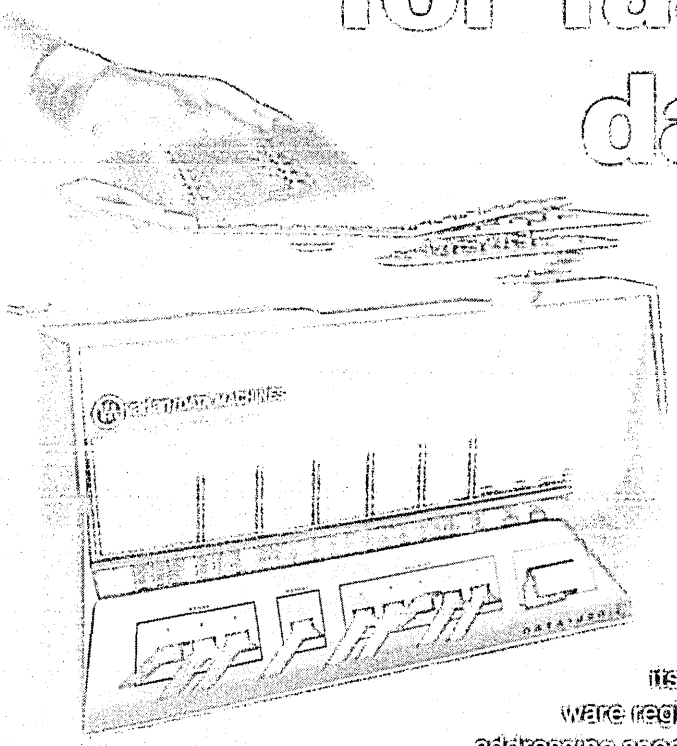
A DIVISION OF BARRY WRIGHT CORPORATION

VARIAN DATA 620/i

gives you more hardware power for faster system data handling



The Varian Data 620/i computer has more hardware power than any other computer in its class. To the systems engineer this means greater system capability—and lower system costs.

Varian Data 620/i's hardware power is reflected in its 9 hardware registers, including 4 operational 16-bit hardware registers. These registers give the 620/i faster arithmetic and addressing speeds, without resorting to time-consuming software subroutines. Varian Data 620/i's 16 or 18 bit word length handles most input/output data requirements without double precision. And the exclusive MicroEXEC option handles instructions at submicrosecond speeds, giving a 10 to 1 speed advantage over stored programs.

For easy interfacing with your system, Varian Data 620/i has Party Line communication, over 100 basic commands, and a directly addressable 4K- to 32K-1.8 microsecond memory.

IC construction, rack-mounted packaging, complete choice of peripherals, and field-proven software make the Varian Data 620/i today's best buy for systems applications. $13,900 with teletypewriter. Less than 45 day delivery on the basic machine.

We have a new 620/i brochure full of facts, figures, instruction lists, and diagrams. Write for your copy today.

We have excellent professional openings for engineers and programmers.

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CIRCLE 62 ON READER CARD

We promised PDP-8/I Computers for spring...Spring is here.

Last fall, we announced a brand new computer for spring deliveries. PDP-8/I. All integrated circuit. Teletype. $12,800.

The flowers are blooming. So are PDP-8/I's. Demand has been greater than even we anticipated. We have turned on full-scale production. The result — even better delivery than we have been quoting. 90 days in most cases. Only a little longer for large systems.

We were taught how to mass produce computers by our experience with the most successful small computers ever built — PDP-8 and PDP-8/S. We've made thousands. PDP-8/I replaces the PDP-8. PDP-8/S is still the least expensive full-scale computer available.

PDP-8/I hardware includes standard 1.5 μsec 4K core memory expandable to 32K, with the first extra 4K just plugged in. The processor is pre-wired to accommodate many options such as a high speed paper tape reader and punch, automatic multiply/divide, real-time clock, incremental plotter, scope display — all without further interfacing.

Software appropriate for the PDP-8 and PDP-8/S is appropriate to the PDP-8/I. MACRO-8 Assembler. Two FORTRAN Compilers. On-line editing and debugging. But now, in addition, systems software which takes full advantage of 32K or more of DECdisc or DECtape memory. A new conversational language called FOCAL, that makes man-machine an easy marriage. Hundreds of logic compatible modules that make machine-machine interfacing easy. Choose from a full line of peripherals for delivery with your machine, or installed on-site by an application engineering and field service group second to none.

PDP-8/I is available as a stand-alone console or mounted in a standard 19-inch rack. Outfit yourself for spring. Write, call, or wire your local DIGITAL salesman. If you haven't spoken to him lately, he has good news for you.

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CIRCLE 39 ON READER CARD

news briefs

POLITICAL PRO'S APPLYING COMPUTERS TO CAMPAIGN

"Awareness of what computers can do has increased by several orders of magnitude since 1964," reports Winn Martin, ex-Arthur Young & Co. systems consultant who is now research director for the Republican National Committee. Al Mark, Martin's opposite number on the Democratic National Committee, agrees. Both groups are busy gearing up their dp operations for the campaign.

The DNC recently replaced a 1401 with a five-tape 360/30; it is working the equipment 2½ shifts or more just about every day, and shortly plans to add at least one disc pack. The Democrats have "a substantial number" of in-house programmers who provide "a large percentage" of the required support, says Mark.

The RNC is renting 25 hours/month on an SBC Mod 40 and lesser time from another D.C. service bureau, Integrated Business Methods, Inc. The RNC has one in-house programmer—Honeywell alumna Priscilla Fletcher—and is using Datamatics Corp., L.A., for additional support. The committee is dickering locally with two other firms—Systemetrics and CSC—for a demographic analysis job.

Much of each party's dp work is being done in the field by state and county party organizations which contract nearby for support. Both national committees send their people around the country giving the locals short courses in edp management and applications.

The Republican state central committee in Lansing, Mich., is a particularly active edp user, says Martin, as is Gov. Winthrop Rockefeller, who has his own service bureau in Little Rock. In both parties, the applications consist mostly of addressing, machine letter-writing, and assembly of voter lists.

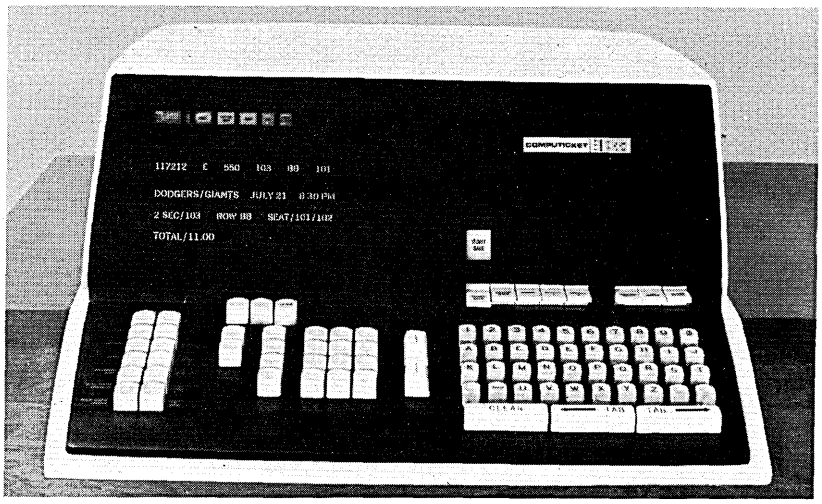
DATA NETWORK NOW HAS LESS ROOM AT TOP

The board of directors at Data Network, time-sharing service bureau, has fired much of the "top heavy" management over disagreement with their "over-ambitious goals." Among 17 personnel gone (50 remain) are Ben Zitron, president, who was replaced by H. L. Meckler, board chairman; Richard Purdue, executive vp; and George Purdue, marketing vp. The marketing management has been trimmed from four to one—national sales manager Jack Conifrey.

Contrary to rumor, Meckler (also board member of a leasing company and time-brokerage firm) and his board of investment brokers very much intend to keep DN in business. But they won't try to tackle as many applications as rapidly as originally planned. (A contract for a coin dealer's data bank went with Zitron.)

Time-sharing for scientific applications is offered on two SDS-940's; 35 contracts involving about 100 termi-

COMPUTICKET SHOWS GEAR, GETS SET FOR JULY CURTAIN



Computicket Corp., the subsidiary of Computer Sciences that has been working on an on-line entertainment reservation and ticket system, has demonstrated its equipment and expects to start its Los Angeles operation July 1.

The company has signed up a market chain, some department stores, banks and hotels to serve as locations for the terminals. They will be hooked into a 360/40 at CSC headquarters. Negotiations are still going on with the entertainment sponsors, but Computicket expects to have a variety to offer—including theaters, sports events, and musical attractions.

The terminal is mounted in a desk-like unit, with the display and keyboard on the left and a small printer on the right, hidden away. When a fun seeker approaches the machine, an operator asks a few questions about the event he wants to see, price, number of tickets, and so forth. This sort of information is then entered through the keyboard and the computer either OK's it or makes a countersuggestion if all the parameters can't be met. When the customer is happy, the machine turns out the tickets on the spot.

Probably because the company's marketing head is Nick Mayo, an experienced theater owner and producer, the system is set up to handle all the whims of both customers and entertainment entrepreneurs. For example, the policies of each theater owner on refunds, discounts for children—even papering the house for a slow mover—are built into the computer program.

A big side benefit is the automatic accounting function. Returns from each unit are always current and the theater manager can find out what's happening at any time by tapping into the system. In addition, he gets all kinds of reports quickly that help in deciding if he's got a smash or another turkey.

Plans call for expansion into New York City later this year, followed by other major cities. Each set-up will have dual 360/40's. Sharing the spotlight, however, is Ticket Reservations Systems of New York. They started demonstrating their equipment several months ago and are already in operation in New York. What's more, they have announced an invasion of Los Angeles in July—the same month Computicket goes on.

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nals have been signed. Hardware and software problems with the 940's have been cleared up, says new executive vp Jay Callanan. An installed 360/40 and a 50, due this summer, will be used for commercial t-s applications. Two SDS-92's are also in the NYC headquarters.

IRS FILES SUIT AGAINST CSC TO GET REFUND BACK

The Internal Revenue Service has filed suit in Federal Court in Los Angeles against Computer Sciences Corp. to recover $158,226 on an asserted overpayment of an income tax refund. The suit maintains that the IRS was in error in allowing the additional refund for the fiscal year ended March 31, 1963, based on a carryback of an operating loss in 1965.

The feds contend that CSC acknowledges the refund was in error but refuses to return it. However, Jack Rudder, corporate tax manager at CSC, states that the government's suit is "protective," filed within the three-year civil statute of limitations to keep the case open until accounting procedures can be evaluated. According to Rudder, CSC anticipates that final audit will indicate that an even further refund is in order, and the company considers it injudicious to release needed working capital to the government that would only have to be returned.

COMPUTER PROCEDURES CORP. OFFERS GAP-BRIDGING PLAN

A new service designed to "relieve firms of the problems created by the implementation of manufacturer-developed software" was recently unveiled by Computer Procedures Corp., Mineola, N. Y.

Known as Syscon, the CPC offering is aimed at bridging the software gap between the time an operating system is developed by a manufacturer and the time the system is ready for what CPC calls "normal" operation. During this period, as the manufacturer improves the system, CPC massages changes on an IBM 360 and releases the improved version to the client ready for use.

"In delegating systems operations to CPC," explains executive vp Philip J. Pesapane, " a client will be effectively releasing his most highly-trained personnel to direct their attention to the company's immediate needs." For information:

CIRCLE 239 ON READER CARD

TASK FORCE REPORTS ON GOVERNMENT DATA FLOW

The Intergovernmental Task Force on Information Systems, set up by the Bureau of the Budget, the Advisory Commission on Intergovernmental Relations, and other organizations representing state and local governments, has turned in the report titled The Dynamics of Information Flow giving its recommendations for improving the flow of information within and among federal, state, and local governments.

The task force's study covered two subjects: finding out what impedes the information flow; and recommending action to improve the flow. Noting the need for action, the task force points out in the report that the increasing amounts of government money going into medical care, transportation improvement, and attempts to solve urban problems requires much closer cooperation among the separate levels of government. But, they say, present information systems fall far short of meeting the new demands. Some of the shortcomings cited by the report: the difficulty of information exchange; unreliability of data; unnecessary duplication of systems; and conflicting demands for information.

Among the causes for these conditions noted by the authors are: a lack of coordination in system development and operation; inadequate consultation between lower and higher levels of government; the scarcity of technical skills, especially in local government; the lack of a mechanism for exchanging successful dp experience; and the incompatibility of equipment and software used by various governmental units.

The task force proposes a total of 20 major actions to change this state of affairs, ranging from the passage of legislation now being considered by Congress to creating new organizations. They would like to see a standard package of socio-economic data, developed under the leadership of the Bureau of the Budget, that could be used as a basis for gathering information from successively lower levels of government. And they also recommend methods of information exchange, such as creation of an intergovernmental unit to serve as a clearinghouse. To promote system compatibility they urge active participation by state and local governments in the USA Standards Institute projects.

EXPERT ASSESSES FUTURE OF LSI

The large scale integrated circuit arrays of the next generation have been the topic of several recent speeches by Dr. Clare G. Thornton, director of R&D at Philco-Ford's Microelectronics Division. The arrays include a 1,024-bit read-only memory containing 1,250 transistors on a 70 x 100 mil chip; and a 16 x 16 random access serial memory (developed under contract from Wright-Patterson AFB) containing 1,400 transistors on a 100 x 120 mil chip. Both these arrays permit the implementation of complete subsystem functions on a silicon chip. The wafer-chip technique bonds individual LSI chips face down on a silicon wafer containing a high density of interconnections which are produced by the same basic process as that used on the chips. According to Dr. Thornton, the use of this technique will result in a 50,000-bit, 10-chip assembly that can be fabricated at a cost of a few hundredths of a cent per bit, probably as soon as the early 1970's.

SINGER PLANS ACQUISITION OF GENERAL PRECISION

Singer Co. has announced an agreement in principle to acquire General Precision Equipment Corp. in an exchange of stock, but final agreement depends on approval by both boards of directors and their companies' shareholders.

Terms of the deal are complex—involving both common stock and a new cumulative preferred issue—but the money value amounts to over $400 million. Singer has been accumulating General Precision stock in the last few months and now owns about 15% of it. GP had a lawsuit going to make them stop but it was dropped at the same time the proposed merger was announced. For a size comparison: GP's sales last year were about $461 million; Singer did $1.1 billion.

Although still identified with its beloved sewing machines, Singer's a swinger in the computer business. They own Friden, with its business machines, small computers, and fast-moving new product line of terminals. And they have top management that likes computers and knows what to do with them. Their centralized dp center in Syosset, Long Island, deals with order and accounting information for some 1900 retail outlets and is considered a model for successful application of new techniques.

If they take over General Precision, they may get deeper into the computer business. GP has a horde of divisions, subsidiaries, affiliates, licensees, and even a couple of joint ventures—covering such fields as oceanography, optics, rubber, meters, aerospace products and systems, controls, training devices, heating and air conditioning,

theatre supplies, etc. Among them are Kearfott, Link, and Librascope: all are associated in one way or another with information processing.

Kearfott makes airborne analog, digital, and hybrid computers. Link has a systems division that includes, besides the famous aircraft simulators, data storage, retrieval, and display systems. Librascope is the one most closely connected with computers. They were pioneers at one time and, although they sold off the main frame part of the operation, are still involved in discs, plated wire memories, and digital components.

The companies are not ready to talk about plans at this early stage of the proposed acquisition, but the betting is that Singer's alert and computer-wise management will take an active interest in that side of the business.

TAPE AND CARD DATA SURVIVE COMPUTAB FIRE

Plastic mag tape cans and metal card cabinets were largely responsible for preventing a major disaster when fire swept through the Computab division of Automatic Data Processing, Inc., last February.

Although the fire warped the tape containers and blistered the paint on the cabinets, their contents suffered relatively little damage. "We salvaged the historical records of all but four or five of our approximately 500 customers," reports Computab President Ronald Cohen. He added that a provision in Computab's service contract limits its liability, when customer data is destroyed, to only the value of the related processing. Additional protection is provided by a liability insurance policy that covers Computab when a customer sues for losses beyond physical damage to his data file.

Computab, which is located in Philadelphia and specializes in payroll processing, lost some software in the fire but it wasn't critical because "we regularly keep a duplicate of each object deck in an off-premises vault and maintain extra sets of program documentation," Cohen explained. "IBM did a tremendous job in replacing our equipment. Less than 24 hours after the fire, which occurred the afternoon of Saturday, Feb. 10, they had located a 360/30 system to replace the one we'd lost. By the following Tuesday morning, we were back in operation at temporary quarters."

Most customer data files, although salvaged, had to be reproduced. The bulk of this work was done at headquarters of ADP, Inc., in Clifton, N.J., and at another division of the parent company in Miami. The rest was farmed out to dp installations in the Philadelphia area.

Insurance will cover the cost of the four-tape 360/30 lost in the fire, said Cohen. By the end of the year, he added, Computab expects to have two /30's installed.

PRINCETON SCIENTISTS TRACK ELEMENT SOURCE

Two astrophysicists at Princeton University, Martin Schwarzschild and Richard Härm, believe they have located the time and place at which many of the chemical elements, including silver, lead and iron, are born. Two articles published in the December 1967 issue of "The Astrophysical Journal" describe the computer model used by the two men to study the evolutionary processes of a star similar to our sun, and the resulting discovery of the s- (or slow-) process.

The production of elements (the s-process) occurs during the last four billion years of a "typical" star's 10-billion-year lifetime. This process consists

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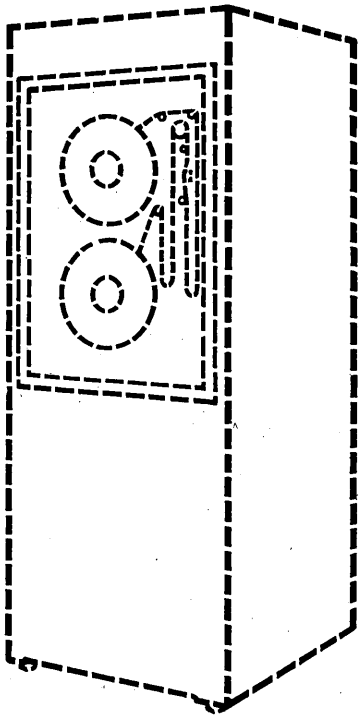

of a series of helium-shell flashes (or "thermal runaways"); the flashes break through the helium shell previously thought to be impenetrable, and the resultant mixture of hydrogen and carbon forms heavy metals. (This process is expected to take place in our sun in about four billion years.)

The program (about 1,000 FORTRAN statements) took several months to prepare and debug, and is being constantly modified as the research continues.

Production runs have been conducted at the Institute for Defense Analyses, first on a 32K CDC 1604, and, more recently, on a 60K 6600. Trial runs are occasionally done with Princeton's 32K 7094. The project, which is being sponsored by the Air Force Office of Scientific Research, has so far taken over 500 hours of computer time.

The contributions of the computer to research in theoretical stellar evolution has been an interest of Professor Schwarzschild's for over 20 years; he and Mr. Härm were early users of von Neumann's I.S.A. or "Princeton" machine at the Institute for Advanced Study. Commenting on the discovery of the s-process and the use of computers, Dr. Schwarzschild said, "This whole process had not been thought through at all . . . by putting what we presumed to be the right physics into the computer, it gave us a consequence of physical laws that no one had predicted. It was my first experience with what von Neumann emphasized, 'Use the computer not to replace thinking but to get you onto new tracks of thinking.' "

IBM DROPS INDUSTRY INFORMATION SERVICE

IBM ended its Industry Information Service on Feb. 15, and with it went the 2½-year-old contract with Dun & Bradstreet to market D&B census data.

The massive D&B data base was coupled with IBM's I/O model of the economy to produce various market profile reports for firms in numerous industries. IBM says the service, under the information marketing group of the Data Processing Div., was not compatible with the group's effort: to provide "direct and rapid access to computer, computerized data, and programs through terminal-based systems."

So far this has primarily meant QUIKTRAN and Data Text, though other services are in the offing. The IIS backlog will be processed.

COMPTROLLER GENERAL URGES IN-HOUSE DPE MAINTENANCE

Federal agencies could cut costs several million dollars a year by maintaining more of their dp equipment in-house, GAO reported last month.

The comptroller general recommended that the Budget Bureau modify Circulars A-54 and A-76 accordingly; the former helps agencies determine whether needed equipment should be leased or purchased; the latter helps them decide whether technical services should be performed in-house or by contract.

The comptroller general didn't say specifically how much could be saved. Instead, he pointed out that "significant savings and operating advantages are being realized by organizations within the federal government and outside which maintain their own adpe." The federal government is now spending about $50 million per year on dpe maintenance, and the vast bulk of this money is going to outside maintenance organizations, the report added.

It compared maintenance charges quoted by eight dp equipment manufacturers and found that they ranged from 18.5% to 45.8% of the related system purchase prices. The implication was that some contractors are making

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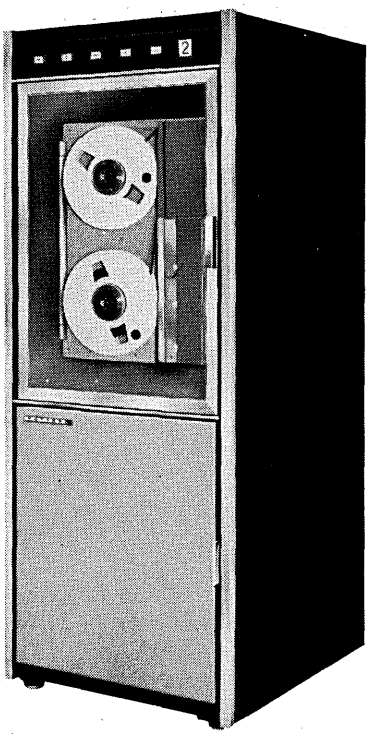

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CIRCLE 41 ON READER CARD

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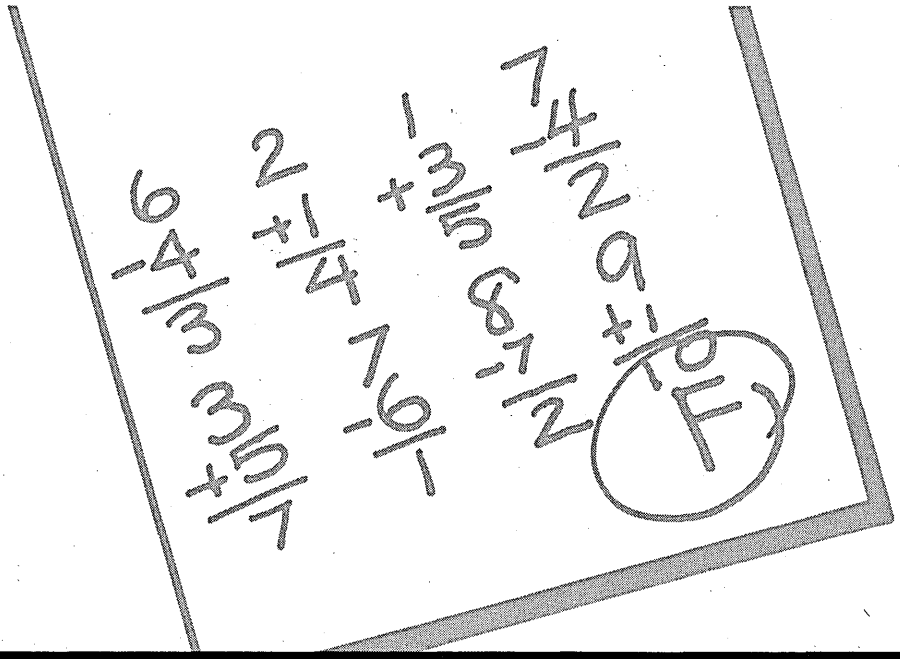

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CIRCLE 43 ON READER CARD

news briefs

unreasonable profits. But the comptroller general sidestepped such a volatile statement. Instead, he concluded that there was "a considerable variation in relative maintenance charges for similar maintenance service."

Besides cutting costs directly, in-house adpe maintenance would produce indirect savings, GAO said. For example, it would provide the added technical expertise needed to purchase dp components directly from the manufacturer rather than on a resale basis from the computer maker. The report cites two drum memories purchased by the U.S. Fleet Numerical Weather Facility in Monterey, Cal., to indicate the magnitude of the savings obtainable. In one case, $50K was saved by dealing direct; in another, $425K.

Last fall, Lewis R. Caveney, assistant vp of Bryant Computer Products, cited similar examples when he appeared before the Joint Economic Committee and recommended that DOD permit independent peripheral makers to bid on dpe system procurements. (For news of this development, see the GAO story following.)

The comptroller general's report added that the Army's logistics data processing center in Washington is cutting costs partly by cannibalizing parts from obsolete dpe rather than buying spares from the manufacturers. If other agencies had additional expertise, the report said, they could do likewise.

GAO recommended that a study of adpe maintenance practices within the federal government, now being made by GSA, should be accelerated, "so as to provide . . . guidance (for) federal agencies in obtaining adequate maintenance . . . at least cost." Pending completion of the study, GAO proposed some guidelines of its own, and recommended that they be used.

These guidelines, which take up several pages, suggest that in-house maintenance becomes more desirable when: a particular dpe system affects public safety or security, is partly owned and partly leased, and contains components from many suppliers. If contracted maintenance is poor, the cost of downtime is high, and the economies of in-house vs. outside maintenance are substantial, the justification for an inside setup increases further.

Lack of experienced personnel doesn't seem to be a problem, GAO said, based on its visits to several federal installations using in-house maintenance. But the report added a caveat, and underlined it for emphasis: "the assumption of maintenance re-

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news briefs

sponsibility *without having available at least one experienced man, previously trained in the system to be maintained, is not recommended.*"

In-house maintenance operations can be set up in several ways, GAO said, and advised BOB, in altering the two circulars, to make using agencies fully aware of them. The major choices are part or full purchase of hardware, with maintenance, in each case, supplied from inside or outside.

Where a system isn't large enough to demand a full-time in-house maintenance team, the report suggested assigning personnel to other duties or establishing joint maintenance operations with other agencies.

GAO HUNTING EVIDENCE TO SUPPORT CAVENEY STATEMENT

The Government Accounting Office is currently carrying on an investigation in all areas of the federal government from coast to coast, as directed by the Subcommittee on Economy in Government, resulting from testimony before Congress in November, 1967, by Lewis R. Caveney, Bryant Computer Products.

The investigation is to establish the differences in cost of data processing systems owned and/or leased by the government in respect to Caveney's statement that "if independent peripheral manufacturers were allowed to bid on any portion of a total computer system required by the U.S. government, tremendous savings could be realized."

The results of the investigations will be given to the subcommittee sometime during the spring of 1968. Caveney states that at the subcommittee's 1968 hearing he will also present factual evidence to substantiate the unethical procurement practices of the federal government in "freezing out" independent peripheral manufacturers from bidding on any portion of a total system required by the federal government.

IBM OPTICAL IMAGE UNIT SIMPLIFIES ON-LINE INPUT

A remote crt terminal featuring a split screen and a simplified data input scheme is among the latest products from the jolly electronic giant in White Plains. Hospitals, warehouses, branch sales offices, and motor vehicle licensing agencies are some of the likely users of its Model 2760 optical image unit, says IBM.

A questionnaire or check list, stored on an adjacent film cartridge, is projected on the right side of the new crt, and needed information is input on the left side. First, the operator places a template on the left side. Touching this template at the appropriate points transmits the corresponding information, via phone line, to a central data base stored inside a 360/25 or larger computer. Simultaneously, the information can be listed by a Selectric alongside the crt.

Users can access information "in terms completely familiar to them," reports IBM. "They don't even have to know how to operate a keyboard." Multiple- as well as limited-choice answers can be input, the company adds, for among the templates available is one representing a typewriter keyboard. It puts the operator in touch with a full range of alphanumeric symbols.

Prototype 2760 installations are operating at a Midwestern hospital, a Southern California aerospace firm, and at several IBM plants. First commercial deliveries are scheduled for fourth quarter '68. The terminal, typewriter, and cartridge will rent for $205 /month and sell for $9,975. An IBM 2740 communications terminal is also needed. It rents for $98 a month and sells for $4,050. For information:

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CIRCLE 45 ON READER CARD

IRS COMPUTERS INCREASE RETURN REVIEW AND REVENUE

Internal Revenue Service computers will process about 109 million corporate and individual tax returns this year, versus about 105 million in 1967. This effort will produce about $155 billion in revenue, up some $7 billion from last year.

The basic processing routine is the same as last year's, the first in which computers handled all returns.

Data is first keypunched at each of seven regional centers and fed into Honeywell 200's; they perform validity and arithmetic checks and output onto mag tape. The tapes then go to a national computer center in Martinsburg, W. Va.; here, a complex of 360/65's and 7094's completes the job.

AIR TRAFFIC UPSURGE PROMPTS MORE AUTOMATION

Faster methods of handling anticipated large increases of air travelers in 1970 when the jumbo jets arrive are being sought by the airlines through the Air Transport Association and International Air Transport Association.

Recently the ATA-IATA sent out proposed specifications to 100 hardware, forms, and plastic manufacturers in the U.S. and abroad to test the feasibility of proposals developed by a joint industry committee task force. The initial proposals covered the document specifications: tickets, baggage checks, credit cards. Tickets are envisioned as having magnetic stripes for encoding; baggage checks may be a tear-apart section of the ticket. Replies are being evaluated; a report of the results is expected about the end of May.

When the results are approved, the second phase will be getting hardware feasibility validated: hardware to automatically issue tickets from computer stored reservations, hardware at the departure area which could issue tickets for reservation holders with credit card (also magnetically encoded), and self-ticketing machines for passengers without reservations via credit card, and hardware at the departure gate to approve the boarding document. All this would be on-line, able to handle registration information requirements; those without reservations would be directed to an agent for standby status.

Action is needed because air traffic has been increasing about 15% annually. In 1961, shortly after the advent of jets, domestic airlines carried about 58½ million passengers; by 1967 the figure was 127 million. At present rates of increase, by 1970 an anticipated 168 million people-in-a-hurry will be seeking plane seats, and if the larger planes prove attractive this increase may be even greater.

NEW SYSTEM GENERATES HIGH-PRECISION ARTWORK

An automated plotting system for generating precision artwork (for example, the designing of electronic components) is being offered on a rental basis by its developer, the Buckbee-Mears Co. of St. Paul, Minn. The system, called BMAPS, uses a Univac 418 computer and a Gerber 532 plotter. According to the company, the function of the system is the drawing of a shape so accurately that the part to be manufacturered from the pattern or template will perform its task "perfectly."

The dimensions of the customer's blueprint, translated into machine language by a Univac 1004, are input to the computer on a plotter driven tape. A master tape is retained to allow any modifications or additions the customer may request later. The plotter can draw with either a pen on paper or with a light beam on a photosensitized piece of film or glass to an accuracy of ±.0009" across a four- or

five-foot plotting board. For information:

CIRCLE 237 ON READER CARD

BIG POLITICAL STUDY TO BE MACHINE-RETRIEVABLE

The Inter-University Consortium for Political Research (ICPR) at the Univ. of Michigan, Ann Arbor, has been loaned a 16-ton study for conversion to machine storage. It was prepared by several hundred lawyers, historians and political scientists as a WPA project during the '30's.

The collection was loaned to ICPR with the help of the American Historical Assn. after languishing at Columbia Univ.'s Butler Library for nearly three decades. It includes the results of 50,000-60,000 roll call votes of Congressmen from 1787-1935 (House of Representatives), 1787-1938 (Senate), and some information on the Continental Congress of the 1770's. The project was compiled under the direction of Clifford Lord, then a teacher at Columbia Univ. and now president of Hofstra College. The material was to have been published as a series of atlases, but only one atlas was completed.

It is estimated that the collection, which includes such political items as maps of Congressional districts, originally cost between $1-$2 million to compile.

ICPR has had the collection insured for $600K. Storing this information on a 360/40 will require nearly a half-million punched cards. Once stored on a computer, the material will be readily available to scholars in the 113 member universities of the ICPR.

FARRINGTON ACQUIRES PHOTOETCHING PROCESS

A process for photo-etching plastic that makes possible the production of plastic cards to imprint photographs, signatures, and fingerprints as well as conventional data has been acquired by Farrington Manufacturing Co. from Plastron, Inc., of Wellesley, Mass. The deal gives Farrington manufacturing and marketing rights in return for an undisclosed amount of cash and Farrington stock. Farrington will now have a new subsidiary, Plastron Systems, Inc., while the original privately owned Plastron, Inc., will hold a minority interest in the subsidiary.

Some five years of research have gone into the process. Others who have experimented with the technique say that there have been problems in adapting it to high speed production. Farrington says they are now accepting limited orders for cards but that general marketing is not expected until late this year. In lots of 200-300 the cards cost from $1 to $1.50 vs. about 85 cents for a conventional embossed card.

CONFERENCE HEARS DETAILS OF NUMERICAL CONTROL GAIN

Sales of numerically controlled machine tools are increasing about 35% per year, the fifth annual meeting of the Numerical Control Society was told last month by consultant R.M. Dyke. Foreign applications are growing "fairly rapidly," spurred by the foreign affiliates of American concerns and by international licensing agreements.

Numerical control of smaller turning lathes is one of several new applications, Dyke reported. Tape-controlled contour plane cutting machines are another. "Some machine tool builders are using adaptive control," he added. However, "much more could be done in this area to make automatic operation more reliable," particularly in regulating spindle speeds, sensing broken cutters, detecting vibration or chatter, and counteracting the effects of temperature variations on machine elements.

Another recent development is wider use of general purpose digital computers to run machine tools in real time. Dyke listed Bunker-Ramo's System 70, the Bendix computer-numerical control system, Houdaille Industries' Strippit system, and System 24, a product of the English manufacturer, Moline Machine Co. Ltd., as examples. He cited computer graphics as a potential parts programming method and added that optical systems capable of scanning masters and models are another likely development; the output of this scanning operation would be automatic control data and computer-generated N/C tapes.

Bunker-Ramo's N/C system was the subject of another technical paper presented at the NCS meeting, as was the Bendix entry. John R. Hicks, industrial engineering products manager for the Gyroscope Div. of Sperry Rand Canada, described an automatic N/C inspection center, and Charles Newman, board chairman of Information Control Systems, discussed the implementation of powerful tape translators on inexpensive computers for processing N/C programs. Other speakers talked about N/C systems built around time-shared computers; they included IBM's Harry Randall, CDC's William Brown, and W. T. Bessert and A. E. Jacobs of Teletype.

GE officially unveiled its N/C time-sharing system at the NCS conclave, about nine months after commercial

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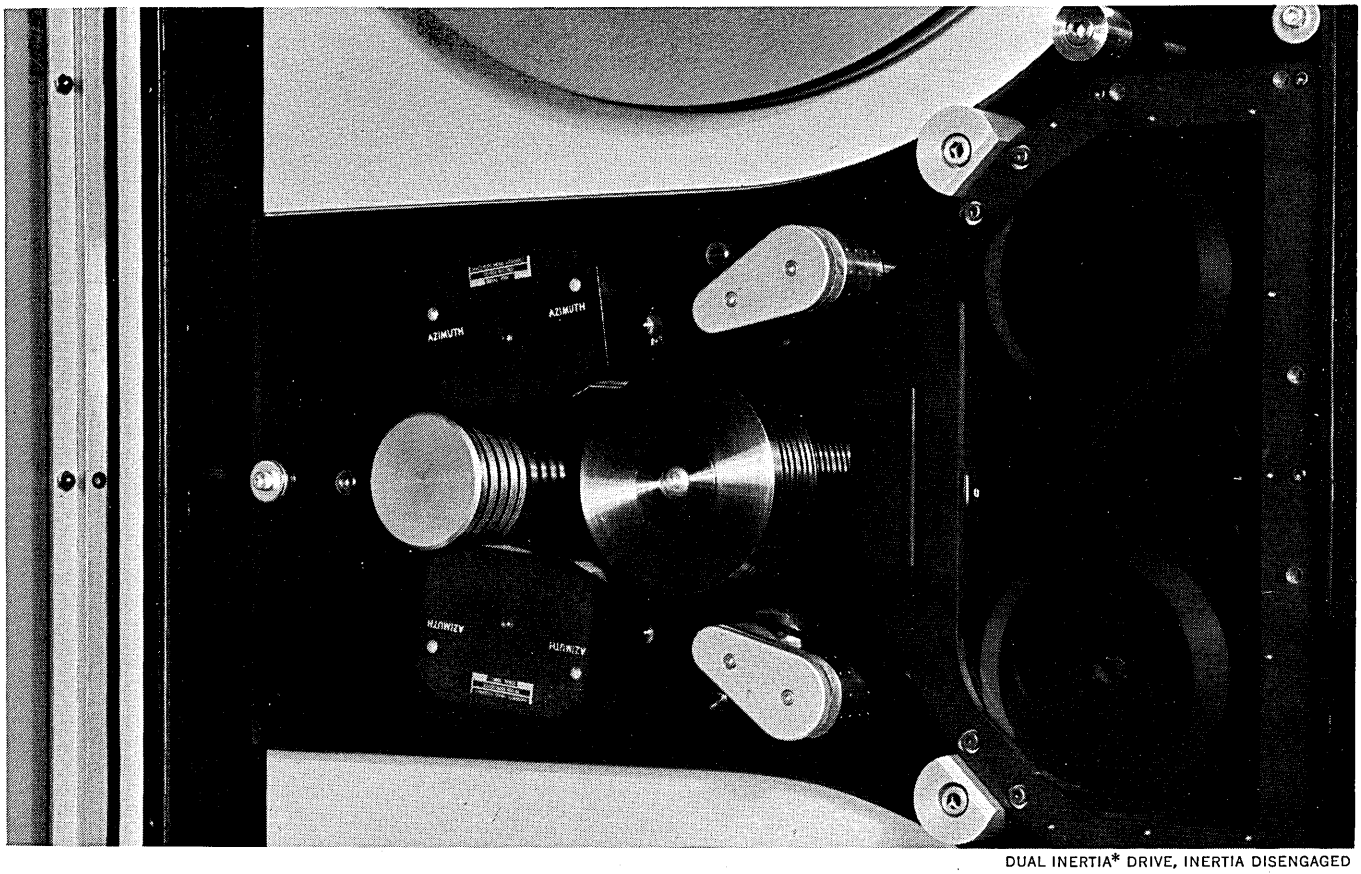
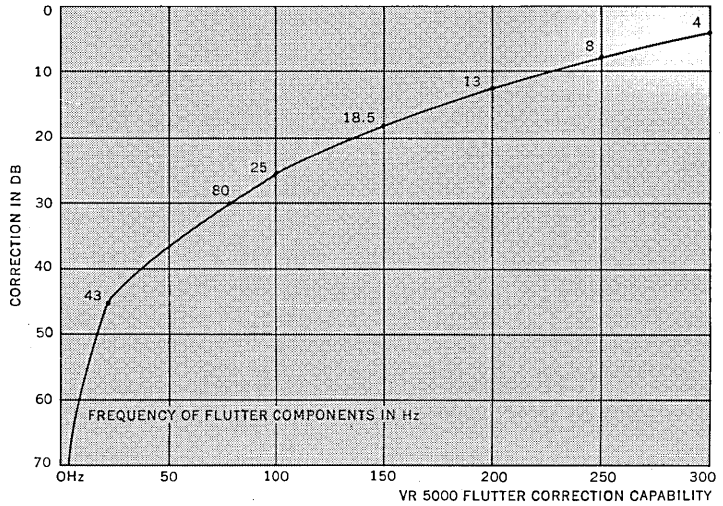


DUAL INERTIA* DRIVE, INERTIA DISENGAGED

Flutter's out–Data's in



VR 5000 FLUTTER CORRECTION CAPABILITY

The instrumentation recorder that can do it is CEC's VR 5000. For the "5000" has a flutter correction capability far superior to any other recorder known today (see graph).

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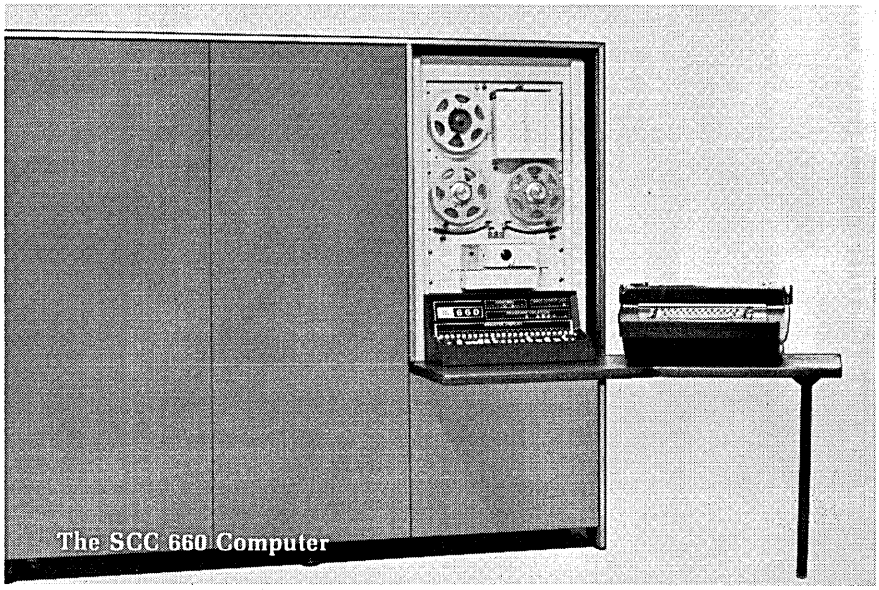

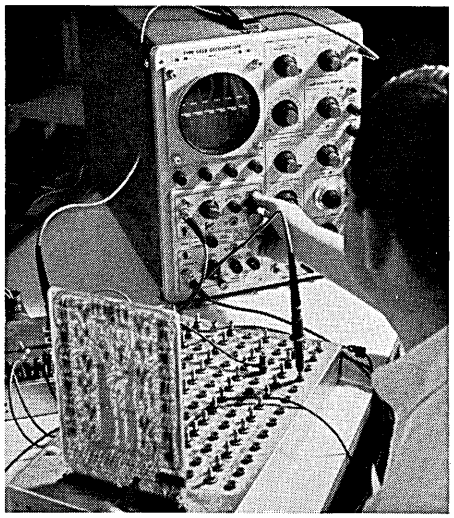

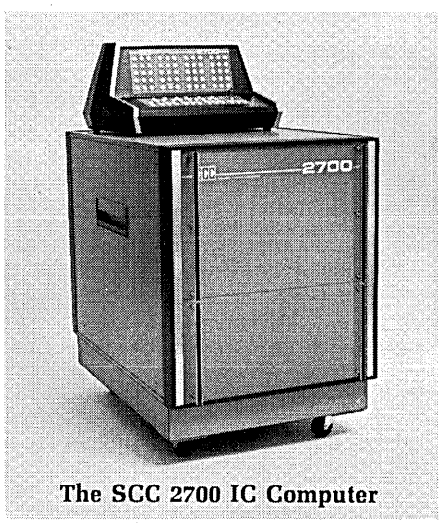

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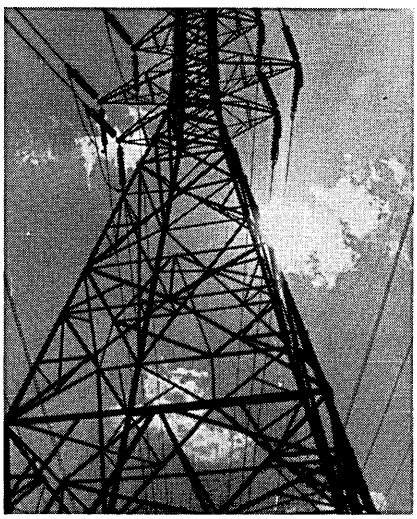

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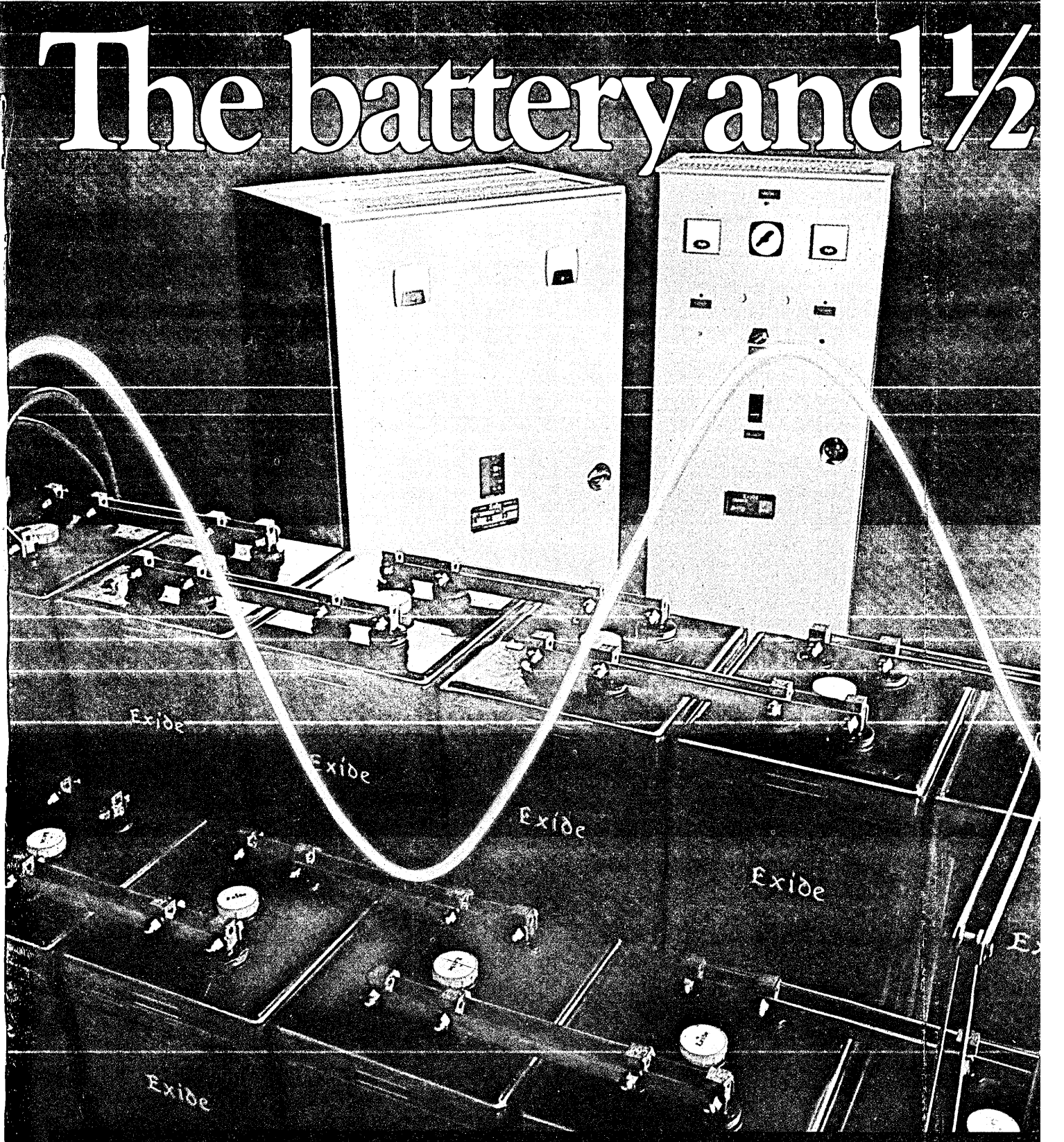

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service began on a limited basis. Some 40 companies, mainly in New England, Pennsylvania, and Ohio, are now using the system, which is reportedly the first to be offered by a commercial service center network.

GE's N/C software package is separated into three modules to analyze parts geometry and calculate X-Y coordinates, format the calculated data for specific machine tool controllers, and direct the punching of EIA-coded tape. Along the way, the individual instructions transmitted in ASCII code are printed out at the terminal (a mod 33 or 35 Teletype) so the user can check them.

The new software is being marketed through all of GE's domestic and foreign service centers. Most are equipped with mod 265 computers, but this equipment is being replaced by 600 series hardware.

Users of the N/C time-sharing service don't have to be programmers, GE emphasizes. Although the programs are written in FORTRAN, the customer converses with the computer in simplified words and characters which reportedly can be understood and manipulated after brief instructions.

The service can be "readily used to prepare control tapes for most two-and three-axis point-to-point numerical control machine tools" and for contouring operations on "many" two-axis machines, reported E. L. McCleary, marketing manager of GE's Information Service Dept. He told DATAMATION that new programs are now being field-tested. Probably, some will be released before fall. The first is likely to be a program accommodating more complex contouring work. Others will control multi-access machine tools, handle specialized machining problems, and provide adaptive control.

Another GE source said the company is planning, within the next few months, to introduce an attachment that will permit ASCII-formatted instructions to be converted into EIA code at the user's terminal. This could reduce transmission time and cost significantly. Other suppliers reportedly are working on similar devices.

COM-SHARE EXPANDS CLEAR TO HACKENSACK

Com-Share, one of the largest commercial time-sharing companies in the country, opened its fourth time-sharing center in March in Hackensack, N.J. Beginning two years ago with five men and $63K capital, the company presently has a $2 million registration with the SEC and a $3 million loan from Continental Bank. The money will be used for computers at four additional centers to be established within the next year.

Centers in Ann Arbor and Chicago use SDS 940's and have 87-million-character discs, model 33 and 35 Teletypes, and off-line CalComp plotters. Com-Share began operating from its Ann Arbor center in the fall of '66 with eight customers; it now services around 200 accounts, one-third of which are multiple users. The R&D division installed a PDP-8 last fall to be used in investigating high speed computer linkage and testing terminal interfaces.

Software currently offered by Com-Share includes CAL, BASIC, QED, FORTRAN II, Conversational FORTRAN IV, TAP, DDT and Conversational SNOBOL. There are also COMPACT, a program for numerical control; CAM-CHECK, to predict cam performance; and several business packages.

GE MOVES AHEAD WITH EXPANDED T-S SERVICE

GE plans to begin offering its Mark II time-sharing service throughout the U.S. within the next month or two. By then, installation of a 635 computer to service Mark II customers should be completed at the company's new Inglewood, Calif., service center. First Mark II installation has been operating commercially since last November at GE's Cleveland service center.

Mark II reportedly runs jobs 10 to 15 times faster than its predecessor, which was designed for the GE 200 series. This increased capability is opening new applications markets, GE says. They include corporate profit optimization studies, modeling and simulation jobs for both businessmen and engineers. We understand that the system is batch only—not conversational—at this time.

The service fee is $10 per hour of on-line connect time, plus 40 cents per second ($24/minute) of cpu time, plus $2 per month for each 1280 characters of data stored. The "regular" service rates are the same except that cpu time costs 4 cents per second and the storage charge is $2.50 per month for 1536 characters. This is a pretty stiff increase in rates over the 265, which went for 2½ cents per second, but buys a share of an immensely faster computer. For another rate comparison: Allen-Babcock's modified 360/50's can be had for $6.50 to $15.50 per minute, depending on core size

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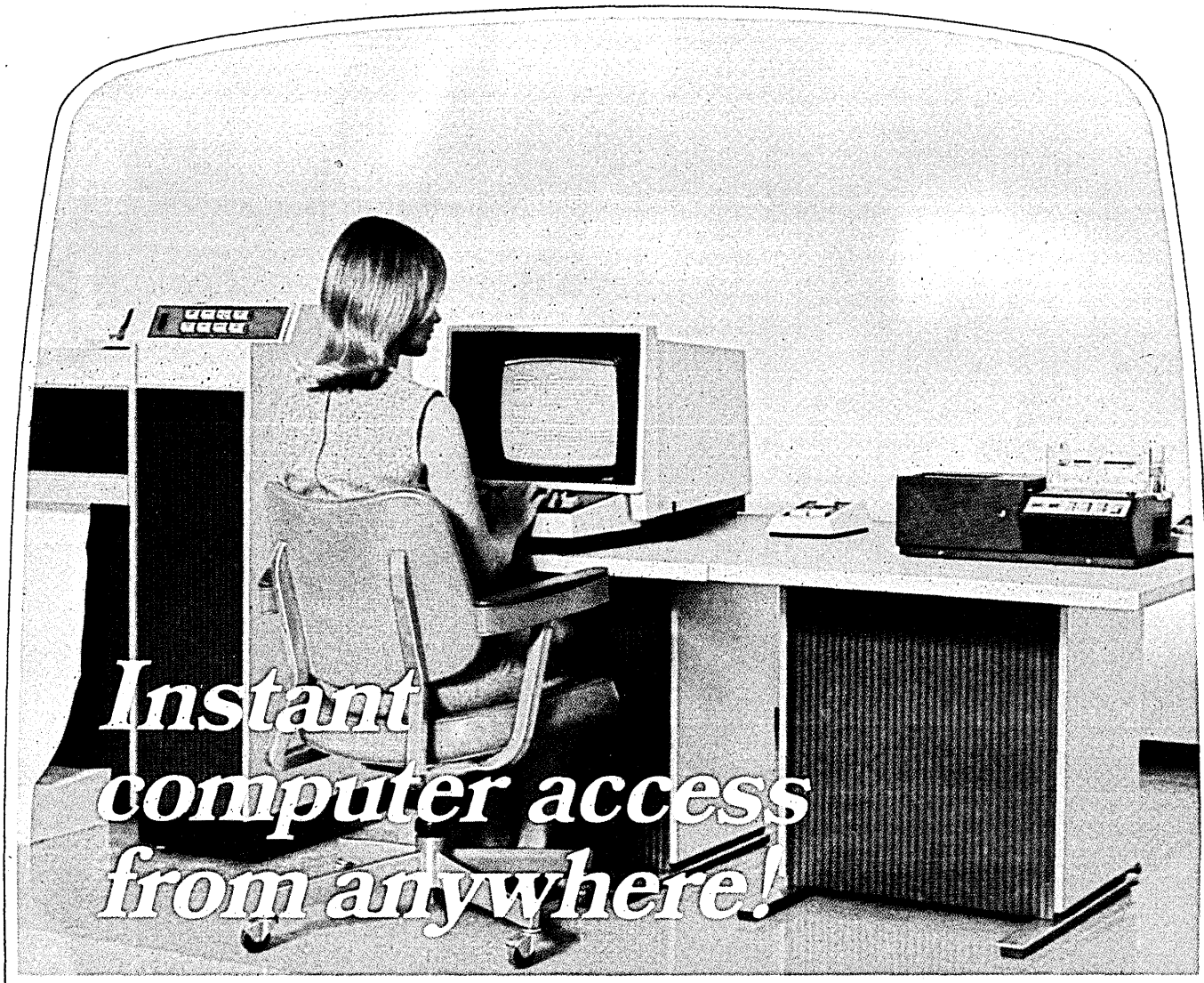

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The CDC 200 User Terminal consists of a CRT/keyboard entry-display, a card reader and a printer. Data is entered via the keyboard. Response from the computer appears either on the screen or as hard copy from the printer.

The entry/display station has a 14" screen with a capacity of twenty 50-character lines (thirteen 80-character lines optional). The photoelectric card reader has a capacity of 100 cards per minute. Its 1,000-character buffer gives it a throughput equal to that of larger, more expensive readers. In line printers, you have a choice between an 80 column or 136 column, 300-line-per-minute reader. Either device may also be used for off-line card listing.

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needed from 8K to 32K, with no connect time charge, no separate core cost, and disc at 12 cents per K monthly or data cell at 4 cents.

GE also announced that the Dartmouth regional time-shared educational network, enhanced by a recently installed 635, has been expanded from 18 to 27 users. The new ones, like the older ones, are primarily junior colleges in New England. Dartmouth's system is the first regional educational network to be supported by federal funds, and the largest serving junior colleges. Most users are students taking engineering, math, and economics.

LOW-LEVEL RADIATION CHECKED BY COMPUTER

A computer-related system of measuring low levels of gamma radiation has been developed at the biomedical div. of the Univ. of California's Lawrence Radiation Laboratories at Livermore.

The system, which was described by Livermore scientists at the American Chemical Society meeting in San Francisco in April, is used to study the impact of man-made radiation on the biological environment. The results of the measurement are important to the Plowshare Program for the peaceful use of nuclear explosives, and can also apply to any release of gamma radioactivity resulting from nuclear energy applications. The purpose of the system is to discover the biological travel route of every isotope, the processes involved in its travel, and any ultimate biological effects in man.

The new technique involves germanium-lithium crystals 2.8-square-inches x .4" thick; the large size is necessary to detect faint sources of radiation.

The detector is connected to a computer which records each gamma ray, distinguishing among them by their characteristic energy and assigning them to a particular isotope in the sample. There may be as many as 40 radioisotopes in a sample; all will be identified and the amount present noted.

The technique eliminates expensive and time-consuming chemical processing; now only freeze-drying of the sample is required to remove some of the water. The specific record revealing the spectrum of gamma radioisotopes released after a nuclear event can be obtained within a few hours as compared to three or four days needed by older methods.

UNITED OFFERS HOPE AS FCC MULLS TELPAK RATES

The common carrier communications industry started to begin to commence to answer data processors' demands for a nationwide, high speed data transmission network recently, when United Utilities, Inc., filed a tariff with the FCC covering "wide spectrum" service.

United—which operates telephone companies in 19 states from Florida to Oregon—proposed to transmit along 200kH and 6mH channels (referred to as "units" in the tariff). Their data-handling capacities would be 100K bps and 3 million bps, respectively. Rates, in both cases, would be considerably lower, bit for bit, than present Telpak charges.

Telpak D, rated at 500K bps, presently costs $45/airline mile/month. United is asking $12/route mile/month. The price is the same for either a 200kH or 6mH unit.

The United tariff becomes effective this month unless FCC objects; it offers both private (point-point) and public (exchange-exchange) transmission, separately and together. Service is limited to points, or exchanges, within 25 miles of each other, but users could be farther apart if they combined the two kinds of service.

The tariff, significantly, permits the use of any foreign attachment which works "satisfactorily" with the service furnished by the telephone company, and which "avoids . . . hazard . . . (or) damage" to the telephone company and the public. This language is considerably more liberal than the foreign attachment provisions imposed by the carriers on their other data transmission services, and goes at least part of the way toward meeting a complaint made by the dp industry in the computer utility inquiry.

United's president, Paul Henson, expects "other telephone companies to file similar tariffs in the future, making possible, perhaps within the next decade, a nationwide, interconnected grid."

While United was offering a new data transmission service, Ma Bell was seeking higher rates for an old one—Telpak C and D—over the spirited objections of its customers.

The rate hike was requested in a brief filed with FCC last March. Telpak C and D transmission rates would be increased $3 and $15 per airline mile per month, respectively, beginning June 1. This request superseded an earlier proposal, under which existing mileage charges for Telpak C would have been raised $5, to $30 per month, and Telpak D rates would have gone up 40, to $85/airline mile/month. Increased terminal charges, originally amounting to a maximum of $20 per month, were also modified in the March tariff, as was the proposed reduction in telegraph/voice equivalency ratios. Reportedly, Ma Bell pulled back in the hope of avoiding an investigatory hearing by the commission, and, failing that, of presenting a stronger case.

When AT&T filed its amended increase in March, two user groups were right behind with petitions asking FCC to suspend the increase. Air Transport Association and Aerospace Industries Association both told the commissioners, in effect, that they couldn't logically evaluate the new rates before deciding whether present Telpak sharing restrictions should be reduced or increased. ATA added that a related question—whether existing Telpak rates are compensatory—also hasn't been disposed of. The airline association said the pending tariff and the pending Telpak sharing docket should be folded into phase 1B of the over-all telephone rate investigation. One aim of the latter proceeding is to determine whether Bell's individual services, at current rates, are compensatory.

"If C and D rates are increased before the sharing question is disposed of," explains one source, "users will be behind the eight ball. For, if all sharing is eliminated—and this is a definite possibility—the affected users would then have to pay the increased rates. And if the commission permits more widespread sharing, AT&T will be able to come back to the commission and ask for a further increase in Telpak C and D, on the grounds that its revenue base has been reduced."

Actually, regardless of what the commission does about sharing, AT&T probably will ask for a further increase. Shortly before the March tariff was filed, Mark Garlinghouse, a Bell vp, said the company planned to increase C and D rates in "a couple of steps." If the commission permits wider sharing, Bell's case will almost certainly be stronger.

HOLOGRAPHERS DISCUSS PROGRESS OF THEIR ART

The current status of the field of holography was the topic of a paper given recently before the '68 IEEE convention and exhibition in New York. Prof. E. N. Leith and Juris Upatnieks, both from the Univ. of Michigan, reported that the most active areas of holography at the present time are hologram interferometry, ultrasonic holography, data storage, color holography, com-

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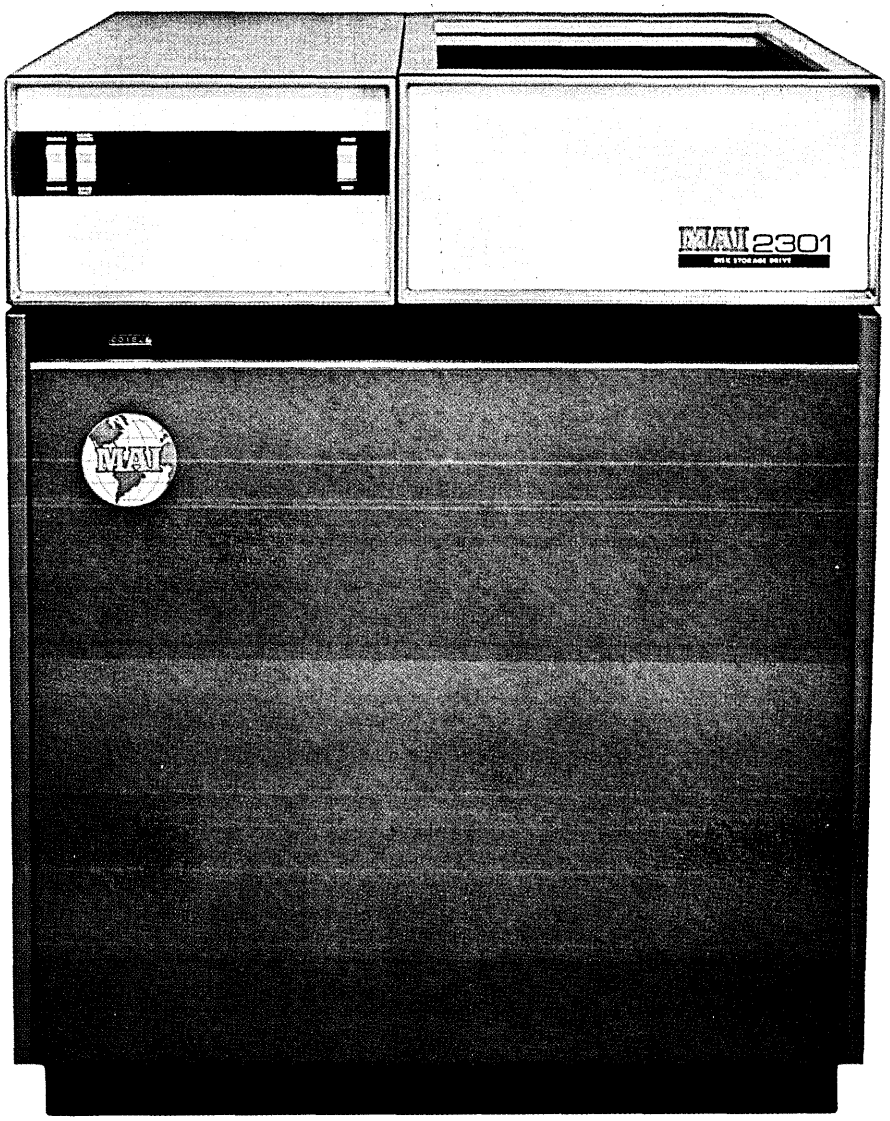

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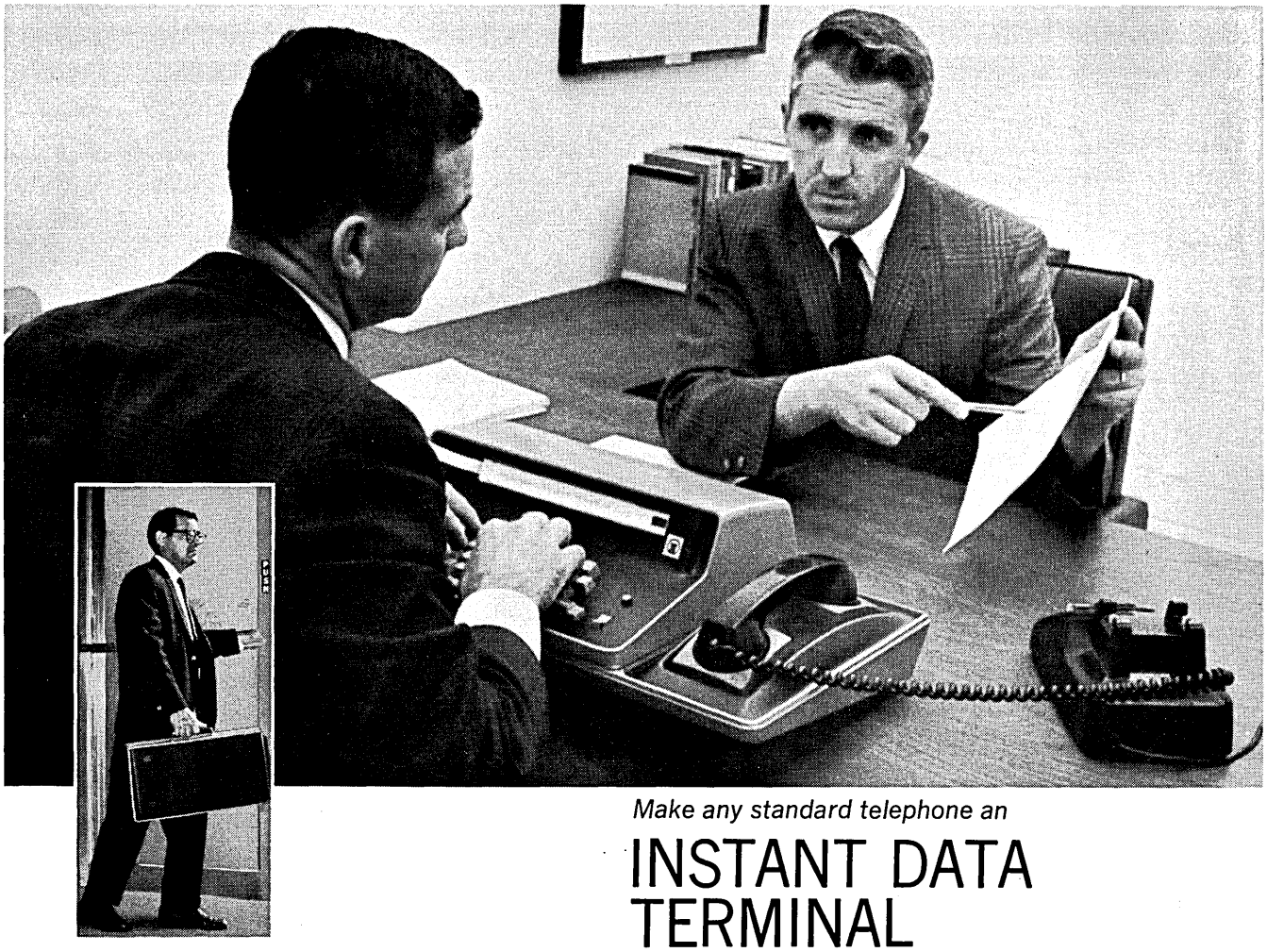

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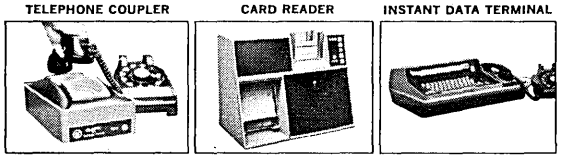

CIRCLE 53 ON READER CARD

puter-generated holography, holomicroscopy and bandwidth reduction.

Of special interest to the computer industry is a process that is still experimental: high-density optical storage on photographic or other photosensitive materials. If the full potential of photosensitive crystals could be utilized, approximately five million pictures of TV quality could be stored in a single crystal one cubic centimeter in volume.

According to the authors, the use of holograms in displays has been enhanced by many developments in laser technology and the development of bandwidth reducing techniques which make the transmission of holographic data practical.

Leith and Upatnieks also reported that the area of computer-generated holography, now in an early stage of development, may help solve display problems because mathematical functions can be displayed as 3-D holographic reconstructions.

GAO TRIES OUT PROGRAMS TO RELIEVE AUDITING LOAD

GAO is testing at least four computer programs designed to partially automate the auditing of federal agency records. Whatever program is finally blessed probably will be acquired by all other federal auditing groups. There is at least one of these in each executive department and in most of the independent agencies.

When GAO's evaluation will be completed is a mystery, but Comptroller General Elmer Staats is reportedly giving the project his personal attention.

One of the test programs was developed in-house. Another is an updated version of Haskins and Sells' "Auditape." Another, reportedly, was supplied by Price Waterhouse. Several other firms—notably Arthur Young & Co.—are developing additional auditing programs.

In a related development, GAO has hired Research Management Corp., Bethesda, to evaluate cost effectiveness and other methods of analyzing Office of Economic Opportunity programs. Peat, Marwick & Livingston, Washington, is evaluating OEO's management info system.

FEDDER PLANS FRANCHISED SATELLITE DP CENTERS

Fedder Data Centers, Inc., Baltimore, aiming to establish "one of the country's largest computer networks," has announced plans to franchise 17 CPA firms throughout the country as operators of satellite dp centers during the next two to three years. The first five centers, supplementing Fedder's existing 11 locations, are scheduled to be in business by this fall, and the others should be open by year's end.

The ultimate plan calls for three regional computer centers. The company now has one, equipped with a 360/30 tape and disc system, an NCR 315 and NCR 420-2 optical journal reader. Fedder plans to switch to NCR 200's at all three locations, which may make it the first commercial service center operator to use this configuration.

The satellites, initially sales and service offices, will ultimately receive NCR 100 systems and be tied by phone line to the regional centers. Fedder plans to operate this network in a batch, on-line mode at first, and expand into olrt later on. It will continue selling business-oriented applications—e.g., preparation of financial statements, processing of accounts receivable, and retail merchandise control.

CHICAGO WILL TRY OUT CONTROL SYSTEM FOR BUSES

In an attempt to prevent robberies on buses, the Chicago Transit Authority is undertaking an experiment involving a computer communications system.

The four-year pilot program (two years for manufacture and installation of equipment and two years of testing) will cost $2 million; $1.5 million is being furnished by the Dept. of Housing and Urban Development.

The program calls for a computer control center to be established at CTA headquarters; electronic wayside equipment located throughout the city will notify the computer center as buses pass. Each bus (500 are in the test program) will carry standard two-way radios as well as a silent, button-activated signal to call for help. Activation of this button automatically transmits an alarm signal; bus, run numbers and location will then appear on the control center's crt.

A bus which is late in passing a checkpoint will be similarly crt-identified; when necessary, the center can notify police to intercept the bus. According to the CTA, this is the first computer-monitored system for bus operation in the world.

SPECIALIZED LAW SERVICE UNDER WAY IN WASHINGTON

Computer Retrieval Systems, Washington, D.C., a new information source for lawyers representing regulated utilities and regulatory agencies, is sched-

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CIRCLE 54 ON READER CARD

uled to begin answering queries June 1. The firm has developed a "lexicon" retrieval system that generates in-depth data systems from queries prepared either in narrative form or with the use of designated index terms; the user needs no prior training or specialized knowledge to prepare his query. CRS also markets the lexicon system as a proprietary package to other information retrievers.

The firm is a subsidiary of H. Zinder & Associates, engineering and economic consultants. All three principals of CRS formerly worked for the Federal Power Commission. Zinder, president, headed the commission's rates division; Arnold D. Berkeley, executive vp, was a supervisory trial attorney; and Edward B. Marsh, vp, was the FPC's chief hearing examiner for many years.

HOSPITAL TO USE COMPUTER IN OUTPATIENT SCHEDULING

"A hospital clinic ought to be an active force for health in its community, but it can't be that if it is mired in a paper swamp," says Dr. Leonard W. Cronkhite, general director of Children's Hospital Medical Center in Boston, where 54 outpatient clinics each year receive over 150,000 visits from approximately 40,000 children.

In an effort to drain the swamp, Children's has initiated a three-year pilot study of on-line appointment scheduling of clinic outpatients under a $668,000 grant from the U. S. Public Health Service; they already have an on-line system for patient location control.

The system is now processing the vital statistics and histories of 15,000 new patients. When fully operational, it is expected to facilitate effective appointment routines and make medical data more readily available, thus enabling hospital staff to provide more personalized and comprehensive care.

The system comprises a Honeywell Model 1200 with a 65K core, 12 crt terminals with input keyboards, three Teletype printers, one 650-lpm printer, three disc drives of 9.2 million characters each, an 800-cpm card reader and a card punch.

The computer is leased and none of the hardware was financed by funds from the grant, which will be used for software (Children's has its own staff of programmers), personnel, operation, and the preparation of a continuing series of reports on the progress and performance of the system.

The terminals are in various reception and administrative areas in the 350-bed, 11-story outpatient center, and each has direct access to the computer. Children's plans to have nine on-line functions programmed for the crt's: admit, update, appointments, appointment cancellations, clinic cancellations, inquiry, medical record request, attendance, and schedule change.

In the planned scheduling procedure, admission data is keyed, verified, and displayed on the crt with a record number that becomes a permanent part of the patient's file. The computer accepts and transmits all the data necessary for scheduling at any of the twelve stations. Phone calls between clinics to check on available appointment times are eliminated. Instead, the clerk asks the computer for the next scheduled dates of a particular clinic and the crt displays the next 40 working dates. A day convenient for the patient is selected and the crt displays the available unbooked time slots for that day. The clerk keys the patient's medical number and the preferred time slot, and the appointment is on record without any possibility of duplication.

At the end of each clinic day, the computer prints out a master log, listing all patients who have appointments for the next day, for the clerk at the main reception desk. Each clinic gets a listing with the child's name, appointment time, and any specific instructions for the medical team. Finally, a printout is made listing appointments two days in advance for the medical records library. This is used by the library to assemble the applicable records, which are shipped by conveyor belt to the proper floor.

On appointment day, the clerk at the main reception desk checks the child's name against the master log and sends them to the designated clinic and floor. Subsequent appointments are scheduled by the clerk and crt on that floor. The computer keeps an index file on all patients actively using the clinic. This is a 200-character locator file containing the patient's medical record number, vital statistics, and relevant personal information.

The computer also will be used to supply information on vaccination periods and other preventive medication procedures, and to determine the reasons for the high rate of no-show at Children's, sometimes 30 to 40%, compared with an average 4% in private practice.

Children's plans to add another Honeywell 1200 later to handle the hospital's financial and statistical data.

ASSOCIATION FOR MAKERS OF PERIPHERALS PROPOSED

Bryant Computer Products recently sent out inquiries to over 50 independent manufacturers of various dp hardware to test their interest in forming an association of independent peripheral makers to push for getting a chance to bid on government contracts.

So far, a 20% response indicates that half are enthusiastic while the other half applaud the effort but say that their product line would not be applicable to such an association. R. O. Wilson, vice president of Bryant Computer Products, a division of Ex-Cell-O Corp., feels that this type of association might also become home for those software houses which would also like a chance at some of the government business.

Bryant people welcome comments from all. Write to R. O. Wilson at Bryant Computer Products, 850 Ladd Road, Walled Lake, Mich. 48088.

ITT DATA SERVICES TO OFFER T-S THROUGH RTS

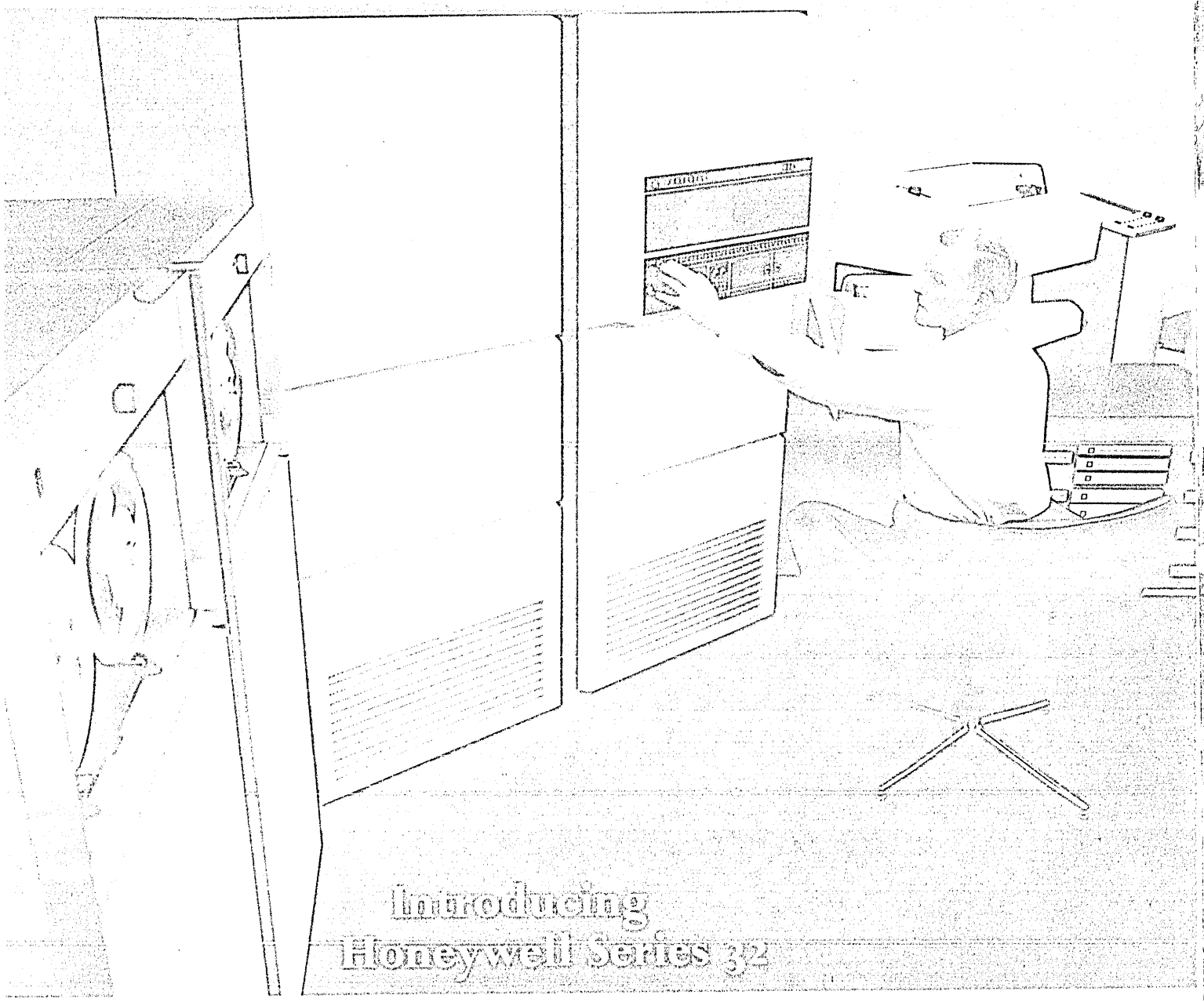
ITT Data Services recently announced that it will put centers in 20 more cities within 24 months. Most centers will get DDP-516 concentrators, which will be upgraded to computers as demand requires. Now, we learn, the services will include time-sharing. ITT has developed its Reactive Terminal Service initially for scientific applications; through TTY 33 and 35, IBM 2741, and 1050 terminals, users will have access to FORTRAN G. COBOL and BASIC are in development, first for the 360/50 and 65. (ITT has 360's in seven cities now.)

BRANDON WILL OFFER NEW SOFTWARE PACKAGE

A new dp resource management system—designed for users spending $500K or more annually on equipment and personnel—is being unveiled this month by Brandon Technical Services, NYC.

The new software package, named RMS, will sell for around $10K and will also be leased. It forecasts, schedules, cost-allocates, and evaluates system development and programming activity, as well as dp runs.

The software, written partly in COBOL and partly in BAL, will be suitable initially for IBM and RCA systems. Modifications for other makes will be added as demand develops. The potential market for RMS is "about 400 customers," reports Dick Brandon, president of Brandon Ap-



Introducing Honeywell Series 32

Computer systems with the golden touch . . . that work for pennies

First member of the Honeywell Series 32 family of 32-bit real-time I/C computer systems, the H632 is 850 nanoseconds fast. A high performance system for real-time scientific and control applications, like ground support/checkout, trainers/simulators, hybrid computation, message switching data retrieval, and general purpose scientific.

It not only costs less per instruction than any other medium-scale machine, but has an advanced concept of modular system integration and design that makes it shine in multiprocessor/multiprogrammable configurations. Of course, its software package is extensive, and a complete line of peripherals and [illegible]

The H632 can grow with [illegible] a minimum 8K memory with one central processor and one input/output processor to a maximum system of 131,072 words of memory, four central processors, and four input/output processors. I/C construction throughout adds to system reliability (we're I/C people from way back).

Because the H632 does so many [illegible] that works for pennies. Want to [illegible] more about the H632? Write for our new summary brochure. Honeywell, Computer Control Division, Old Connecticut Path, Framingham, Massachusetts 01701.

Honeywell

COMPUTER CONTROL DIVISION

plied Systems; BTS is a BAS subsidiary.

Initial RMS users will pay slightly more—for the privilege of tailoring the instructions to their own needs. They will then be entitled to royalties on Brandon's sales of their modified packages.

BTS expects to release a new payroll package next month. It will include routines for calculating all applicable local and state taxes as well as all federal deductions.

Edward J. Reitzel, formerly a national accounts rep with RCA-EDP, recently joined BTS as manager of marketing in the New York area.

SCHLUMBERGER MERGES EMR INTO WESTON INSTRUMENTS

Electro-Mechanical Research, Inc., has been merged by Schlumberger Ltd. into Weston Instruments, Inc., another Schlumberger electronics firm, in a move that is expected to have no effect on the basic organization, charter, or business operations of the two companies. The reorganization is probably a move to more thoroughly integrate instrumentation, data acquisition, computing and data reduction into special systems for the seismic and telemetry markets EMR has been concentrating upon for the past two years.

ADAPSO SURVEYS MEMBERSHIP ON SOFTWARE PROTECTION

ADAPSO is surveying its members to find out how they protect proprietary software against misuse by their customers and employees. A major aim is to develop better ways of preventing employees, when they move to new jobs, from walking off with customers and/or software.

The survey is scheduled to be finished this month. ADAPSO, which represents about 40% of the service center industry, plans to issue a report containing a tally of the answers to its survey and offering "general recommendations as to the nature of (desirable) contractual provisions."

SPECIAL IFIP CONGRESS FLIGHTS STILL OPEN

Charter and group flights for IFIP Congress 68 may still be available by publication time. Charters include: 31-day charter, July 11-Aug. 10, NY-Zurich, Prestwick, Scotland, $279; Aug. 2-12, NY-Prestwick, $230. Deposits of $115 must be sent to Thos. Cook & Son, 587 Fifth Ave., NY 10017. Although deadline date was April 12, IFIP officials say some seats may still be open. Cook also has NY-London group flights: July 29-Aug. 19, $245; July 22-Aug. 12, $300; July 25-Aug. 15, $300 (all BOAC); and Aug. 3-22, $331, TWA. A NY-Paris TWA flight for July 25-Aug. 12 is also available, $331. A $75 deposit is due on group flights. Generally, 14 and 21-day excursions to various cities are also available on most lines for about $200 less than peak season fares.

Cook's also has prepared special three-week escorted tours for IFIP Congress 68. Each one includes two four-day stops in various cities in Europe, and possibly technical visits at some points for the dedicated.

NCR PLANS TO TAKE OVER COMMUNICATIONS COMPANY

NCR will bolster its communications capability by buying Electronic Communications, Inc., of St. Petersburg, Fla. An agreement in principle calls for an exchange of one share of NCR common stock for two of ECI stock.

ECI is a 3000-employee firm, which grossed $49.4 million and netted $1,226,000 in fiscal '67. Two thousand of the employees are in the St. Petersburg division, which develops and produces communications (primarily UHF radio) systems for such defense and space programs as SAC and the Navy and Marine Tactical Data Systems. This division also makes analog flight control computers for the Saturn Apollo project, and space telemetry transmitters. It is this division that NCR hopes will help in development of communications systems and interfaces for on-line computer projects, as well as expand NCR's capabilities in the government market.

ECI also has the Benson Manufacturing Division in Kansas City, Mo. (metal-worked products from beer barrels to water tanks in lunar landing vehicles), Standard Precision Division in Wichita (cockpit and flight instruments), and Scott Electronic Corp. (electronic components, such as magnetic amplifiers, transformers, filters, etc.).

CDC CUTS RATES WITH NEW LONG-TERM LEASES

A new long-term lease plan has been initiated by Control Data for all standard CDC products and systems. It replaces the five-year extended term plan under which add-ons and replacement prices depended on how long the contract had to run and required contract extension.

Now a customer may add new equipment or upgrade the cpu under the original contract (if it still has 18 months to run) without lengthening the contract period. For example, upgrading the 6400 cpu to 6600 specs under the original contract saves 5% on a three-year lease, 7% for four years, and 10% for five years.

Long-term lease prices of the new plan yield savings over the one-year lease prices. For example, a 3300 leasing for $20K a month short-term would be $18K a month under five-year contract. Equipment installed under the three-, four- and five-year contracts is not subject to price increase during the term of the contract.

A single contract will cover all leases, with privileges to convert from shorter to longer term at any time or to purchase. Under the purchase option the user receives 60% of the first year rental and 40% of the second year's rental toward the purchase price. The new system is expected to give savings over purchase and system flexibility not available under third party lease.

URISA HEARS EDP MASTER PLAN FOR CALIFORNIA

Charles Smith, of Gov. Reagan's Office of Management Services, presented the strategy measures to implement a state-wide master plan for edp to the Southern California Chapter of URISA.

The Urban and Regional Information Systems Association is an international organization established to stimulate and promote an interdisciplinary and multi-professional approach to planning, designing, and operating urban information systems.

Smith was concerned with the present over-all administrative efficiency and effectiveness in the use of computer capability.

The failure of prior attempts to legislate a master edp plan can be attributed to neglect of the need to consult with other levels of government within the state. The current effort has sought to provide representation and consultation with appropriate levels through the Intergovernmental Board on ADP. Since August of 1967 a dialogue has been established between the state, CSAC, League of California Cities and other offices. The result of this discussion is the following policy statement: "More effective utilization of edp is needed to meet the legal, administrative and management requirements for state agencies to improve policies,

planning, coordination and implementation procedures. Edp should be performed at the minimum cost consistent with the level of service required by state agencies."

To the extent practicable, this means a functional consolidation to facilitate the interchange of meaningful information among state agencies. The interests of the state as a whole are paramount.

The plan considers:

- Participation by top level elected exempt and civil service officials
- Cost-benefit analysis of edp operations
- Work-load balance
- Seasonal agency requirements
- Optimal utilization
- Role of outside consultants
- Disposition of excess equipment
- Training and transfer of excess personnel

A 12-step procedure is intended to insure that optimum implementation of the master plan is accomplished.

Some typical administrative barriers to be overcome are:

The goals displacement phenomena: where the means of accomplishing assigned tasks become the end results.

The bricks and mortar syndrome: individuals want concrete proof of their importance—little surpasses a computer as proof of importance, and nothing less than on-line, real time.

The penny-wise and dollar-foolish syndrome: characteristic of short-sighted planning is the tendency to minimize dollar expenditures without consideration of the effect upon benefits. In many situations a greater than proportional increase in benefits results from increased expenditures. Awareness of the cost-benefit relationship is essential to any planning and budgeting endeavor.

Economic justification is not enough to penetrate the bureaucratic thicket. Consideraton must be given to the existing political realities and the power of the civil service in the state.

Future activities of URISA include a panel discussion on regional models, social indicators, and data needs for regional decision makers, both public and private.

The annual URISA conference is scheduled for Sept. 5-8, 1968, and will include social and urban indicators, computer graphics, federally sponsored urban grants, and functional information systems.

For information contact Bob Smith, Management Department, California State College at Long Beach, Long Beach, Calif. 90801 or George Pilmanis, Touche, Ross, Bailey & Smart, 3700 Wilshire Blvd., Los Angeles, Calif. 90005.

LAWYER SEES COMPUTERS AS AID IN HANDLING CASES

Computers may help lawyers analyze judicial opinions, prepare their cases, and also predict the probability of success. At least, this may be possible before Courts of Appeal where the facts are well cooked and frozen, according to Reed C. Lawlor, noted patent attorney and research associate at the University of Southern California.

He advanced the proposition at a recent ACM Los Angeles Chapter meeting. His remarks are based on his studies, partially supported by the National Science Foundation, to discover patterns of judicial behavior in the judicial decision making process. This work might lead to a prediction reliability level high enough to warrant use of the computer in the analysis and prediction of actual court cases that are still to be decided.

Basic to such a study, said Lawlor, is a concept of personal *stare decisis*, that is, how precedent is applied by

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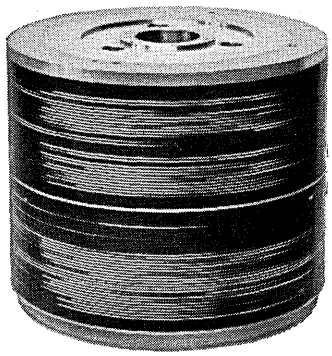

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CIRCLE 56 ON READER CARD

individual judges. The study involved about 40 cases involving the right to effective counsel and about 30 cases involving the question of involuntary confessions admitted into evidence—all of which were decided by the U. S. Supreme Court over a period of several decades.

According to traditional *stare decisis,* a new case having the same fact pattern as an old case should be decided the same way. But identical fact patterns seldom appear. The problem is to evaluate new patterns of old facts. It might be assumed that the same facts evaluated by different judges would produce the same decision each time. However desirable this might be according to some standards, regretfully it is not so, said Lawlor.

He compared a judge to a computer —a black box behind the black robe— with the facts as input and the decision as output. Legal precedent, the law and the judge's experience and background constitute the judge's program. The arguments of lawyers, the research of court clerks, and the political, economic, and social climate also influence the judge's program and his decision. In an attempt to discover the degree of consistency of judges, Lawlor uses a tight logic in which the facts are represented by mathematical symbols. The facts are polarized for Boolean interpretation—the fact was present or absent or not mentioned. The "not mentioned" facts are converted to present or absent facts by means of presumptions as to what the judges mean by their silence.

Generalized fact descriptors applicable to the specific facts in the different cases are given weights between 0 and 1. These weights vary from one judge to another. These weights are calculated from the fact patterns of the cases as seen by each of the judges and the decisions handed down by each of the judges. The weight of a case is the sum of the weights of the facts. Accordingly, the weight of a case depends upon the judge. But if the case weight exceeds a threshold, the case will probably be decided one way and if it falls below that threshold, it will probably be decided the other way. For a group of 11 judges, the probability of the decision being one way or the other is a smooth curve when plotted as a function of the case weights calculated for all of those judges.

The fact descriptors are polarized to favor one particular side when present and the other when absent. Facts are also ranked. Both fact polarization and fact ranking produces a ranking of the cases and the judges.

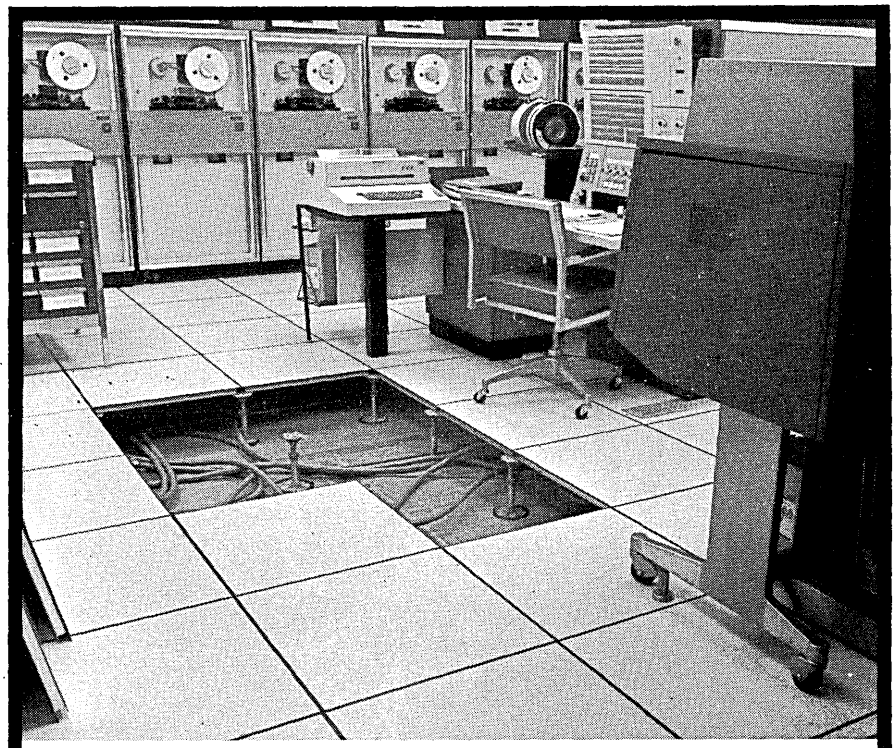
A classification lattice of patterns of polarized fact patterns was presented. Lawlor contended that with proper application, the lattice could be used to predict the majority of decisions of related cases in the lattice with a high degree of reliability.

Lawlor's polarization logic, and ranking logic, and his lattice technique, can be used by lawyers in their reasoning about cases, and in their arguments before judges, and can also be utilized in computer programs that simulate the judicial decision making process. In fact, Lawlor says these methods simulate, in a formal way, reasoning processes that are used by lawyers and judges, though rarely described by them explicitly. Analyses of the type described may help us in understanding the judicial decision making process better and in making recommendations as to whether or not to proceed with a case; thus they may help in reducing the backlog of our courts.

COMPUTER COURSES ARE OFFERED

Univ. of Calif. Ext., 6266 Boelter Hall, UCLA, Los Angeles, Calif. 90024.

June 24–28, Introduction to System Optimization Techniques, $275.
July 8–19, On-Line Computer Control



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Westinghouse Raised Flooring, Westinghouse Electric Corporation
Architectural Systems Department, 4300 36th St., S.E., Grand Rapids, Michigan 49508—Phone (616) 949-1050

CIRCLE 57 ON READER CARD

Fortran is faster now because two memories are better than one.

FORTRAN in interacting, overlapping and simultaneous operations characterizes the IC-4000. It is this calculated cross-talk between separated main and control memories which makes the IC-4000 capable of greater speed / volume / throughput than machines costing twice as much. Truly the scientists' and engineers' computer, the IC-4000 was specifically designed to optimize the potentials of FORTRAN. Besides emulation capabilities of the 1130, the 7044 and the 7094, the IC-4000 features total integrated circuit construction and a 500 nanosecond control memory which slams through highly used FORTRAN routines.

Standard Computer Corporation

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news briefs

Systems, $375.
July 8–19, Hybrid Computation, $375.
July 22–Aug. 2, Computer Methods of Network Analysis, $375.
Aug. 19–23, Philosophy and Development of Programming Languages, $275.

Univ. of Santa Clara, School of Engineering, Santa Clara, Calif. 95053.

Aug. 5–23, Mathematics, Computer Programming and Analytical Techniques for Electric Power Networks, $400.

Univ. of Southern Calif., Noncredit Programs Office, University Park, Los Angeles, Calif. 90007.

June 8, 15, 22—Fortran Programming, $75.
June 8, 15, 22—Cobol Programming, $100.

Univ. of Colorado, College of Engineering, Boulder, Colo. 80302.

July 22–26, Logic Systems, $200.
Aug. 19–23, Computer Control of Processes, $200.

Georgia Inst. of Technology, Dept. of Continuing Education, Atlanta, Ga. 30332.

Oct. 21–25, Project Management with CPM and PERT, $150.

Illinois Inst. of Technology Research Inst., 10 W. 35 St., Chicago, Ill. 60616.

June 10–14 and Dec. 2–6, Advanced APT, $300.
June 17–28, Aug. 5–16, Oct. 7–18, APT Workshop, $400.
Sept. 26–27, Introduction to Symbolic Control, $100.
Oct. 28–Nov. 1, Basic APT Part Programming, $250.
Nov. 11–13, Basic Numerical Control, $150.

Purdue Univ., Div. of Conferences and Continuation Services, Lafayette, Ind. 47907.

Sept. 16–25, Short Course in Digital Process Control Systems, $250.
Sept. 30–Oct. 4, Computers and Modern Process Control—A Course for Engineering and Production Managers, $150.

Massachusetts Inst. of Technology, Director of the Summer Session, Cambridge, Mass. 02139.

June 11–21, Systems Analysis for Marketing Management, $800 (May 15 registration deadline).
July 8–19, Management Information Technology, $600.
July 22–Aug. 2, Management Information Systems, $600.
Aug. 19–30, Information Technology, $400.
Sept. 9–13, Operations Management, $500.
Sept. 9–20, Management Science in Marketing, $600.

Cleveland State Univ., Fenn College of Engineering, Cleveland, Ohio 44115.

July 8–19, Theoretical and Computational Aspects of Optimization, $350.

The Univ. of Wisconsin, 725 Extension Bldg., 432 N. Lake St., Madison, Wis.

June 3–14, Hybrid Computation, $450.

National Defense Education Inst., 11 Arlington St., Boston, Mass. 02116.

May 20–24, Configuration Management, $275 NSIA members, $300 nonmembers.

Brunel Univ., Dept. of Computer Science, Uxbridge, Middlesex, England.

July 29–30, Symposium on Computer Graphics.

ILTAM, 27 Keren Hayessod St., Jerusalem, Israel. (Courses held at the Hebrew Univ. of Jerusalem.)

July 7–Aug. 2, International Seminars on Advanced Programming Systems, $600. (July 7–19, Basic Course, $350. July 21–Aug. 2, Advanced Course, $350.)

CALL FOR PAPERS . . .

Users of Automatic Information Display Equipment Annual Meeting, October 28–31, San Francisco, Calif. Technical papers on aspects of graphic output on computer-controlled display and recording devices, planned for approximately 20-25 minutes of oral presentation, are invited. One-paragraph abstracts are due before July 1 to: Harold O. Casali, 4501 Arlington Blvd., Apt. 526, Arlington, Va. 22203.

ACM Symposium, "The Application of Computers to the Problems of Urban Society," October 18, New York, N.Y. Papers on computer applications in urban information systems, education, traffic control, law enforcement, city planning and other related areas are requested; abstracts (about 500 words) should be mailed before June 10 to: Justin M. Spring, General Chairman, Computer Methods Corp., 866 3rd Ave., N.Y., N.Y. 10022.

International Telemetering Conference, October 8–10, Los Angeles, Calif. Technical papers are invited in the fields of aerospace, earth sciences, military, industry and life sciences. Of special interest are papers relating to the conversion of L- and S-bands, data quality assurance, and new or special telemetering products. Title and brief description of paper are due immediately; finished manuscript is due June 1. Dr. M. H. Nichols, Program Chairman, ITC/USA/'68, 2682 Idle Hour Lane, La Jolla, Calif. 92037.

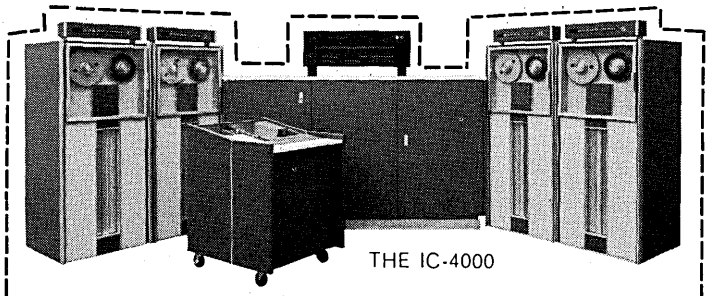
Third Hybrid Microelectronics Symposium, October 28 and 29, Chicago, Ill. Papers on basic investigations on materials and solid-state mechanisms, materials processing, assembly methods, process control equipment, equipment and systems applications and many other fields are requested. A 300-word abstract is due June 1. Dr. A. H. Mones, IBM Corp., E. Fishkill Facility, Route 52, Hopewell Junction, N.Y.

● "Easy to use reader, punch, and printer I/O support" is reportedly provided by a newly developed control system offered to IBM 1401 and 1460 users by Trivalent Enterprises, Ltd., White Plains, N. Y. The system, named TELMCS, is being licensed on a single-fee basis for $600. It consists of five macros, written in Autocoder, which feature streamlined coding and "exhaustive" error recovery procedures. For information:

CIRCLE 236 ON READER CARD

● Printing Industry Computer Associates, a consulting firm specializing in computerized printing and publishing systems, was recently formed in Princeton, N. J. President is Max Biller; vp is Paul Grieco. Biller was a marketing rep to the printing industry; Grieco has had various management positions related to graphics arts. Both were formerly with RCA.

● Data-Phone 50, new Bell System switched message service, is now available between Chicago, Los Angeles, New York and Washington. The service permits transmission of data and facsimile at rates of up to 50 kilobits per second (50K bps) with voice coordination—25 times the speed of present Data-Phone service. Monthly charges are $275 per station terminal for the transmission of either sequential non-synchronous or synchronous



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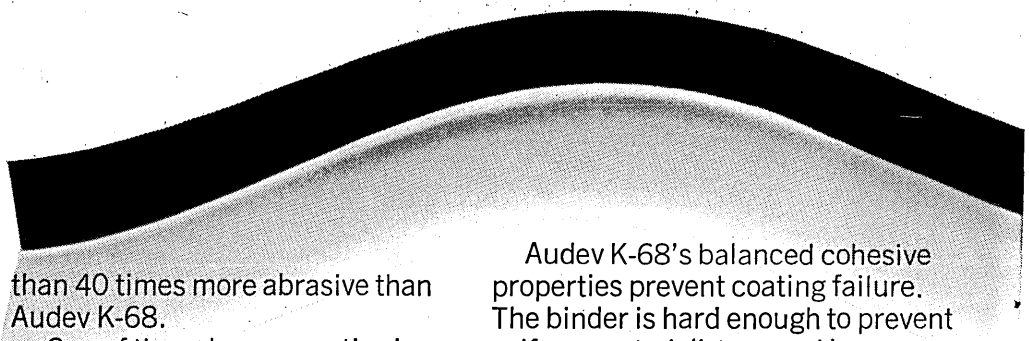
CIRCLE 58 ON READER CARD

At last! The computer tape that's not "too good to be true."



Some tapes are. That is, certain of their properties are made "too good." Often at the expense of other, equally important characteristics.

Outstanding tape durability can be gained at the expense of increased head wear; remarkable coating adhesion could mask inherent internal weakness (and result in premature breakdown); "high-powered" magnetic properties may cause the tape to be electrically incompatible with your computer system.

Because magnetic tape properties are frequently interdependent, often conflicting, we make no boasts of specific superiorities for our new Audev K-68 computer tape.

Instead, we deliver a premium tape in which all the critical characteristics have been *balanced* to provide a high initial quality that will not deteriorate with storage or hard use.

What do we mean by balance? Read on.

It's a dirty shame what some "clean" tapes do to your heads.

To begin with, we know what happens when balance is lacking. There is, for example, one computer tape on the market that is excellent in its freedom from dropouts. It makes a remarkable "first-pass" impression. Yet, an imbalance in key properties makes this tape more than 40 times more abrasive than Audev K-68.

One of those key properties is friction, both static and dynamic. And one way to reduce friction is by lubricating the surface of the tape. But this "trick" solution is short-lived and tends to distort start/stop performance.

In Audev K-68, we attacked the problem differently. Carefully combining binder ingredients, processing and surface treatment for proper static and dynamic frictional balance, we've produced a wear-resistant surface that will not break down on high-speed transports.

But, you might ask, couldn't a really hard binder accomplish pretty much the same result? We say...

Don't get stuck by the "sticky tape" test.

Take one of those tough tapes and torture it. No amount of pulling, scratching or stripping off with pressure-sensitive tape will cause the surface to flake or shed oxide.

But this, too, may be an imbalance. What you may not see is a stiffness and brittleness which could make the edges particularly vulnerable to damage.

Audev K-68's balanced cohesive properties prevent coating failure. The binder is hard enough to prevent self-generated dirt caused by abrasion, yet tough enough to keep the edges from deteriorating.

At the same time, K-68's smooth, non-sticky coating provides few anchoring possibilities for ambient dirt or oxide redeposit. And its low resistivity virtually eliminates electrostatic pull on floating dust.

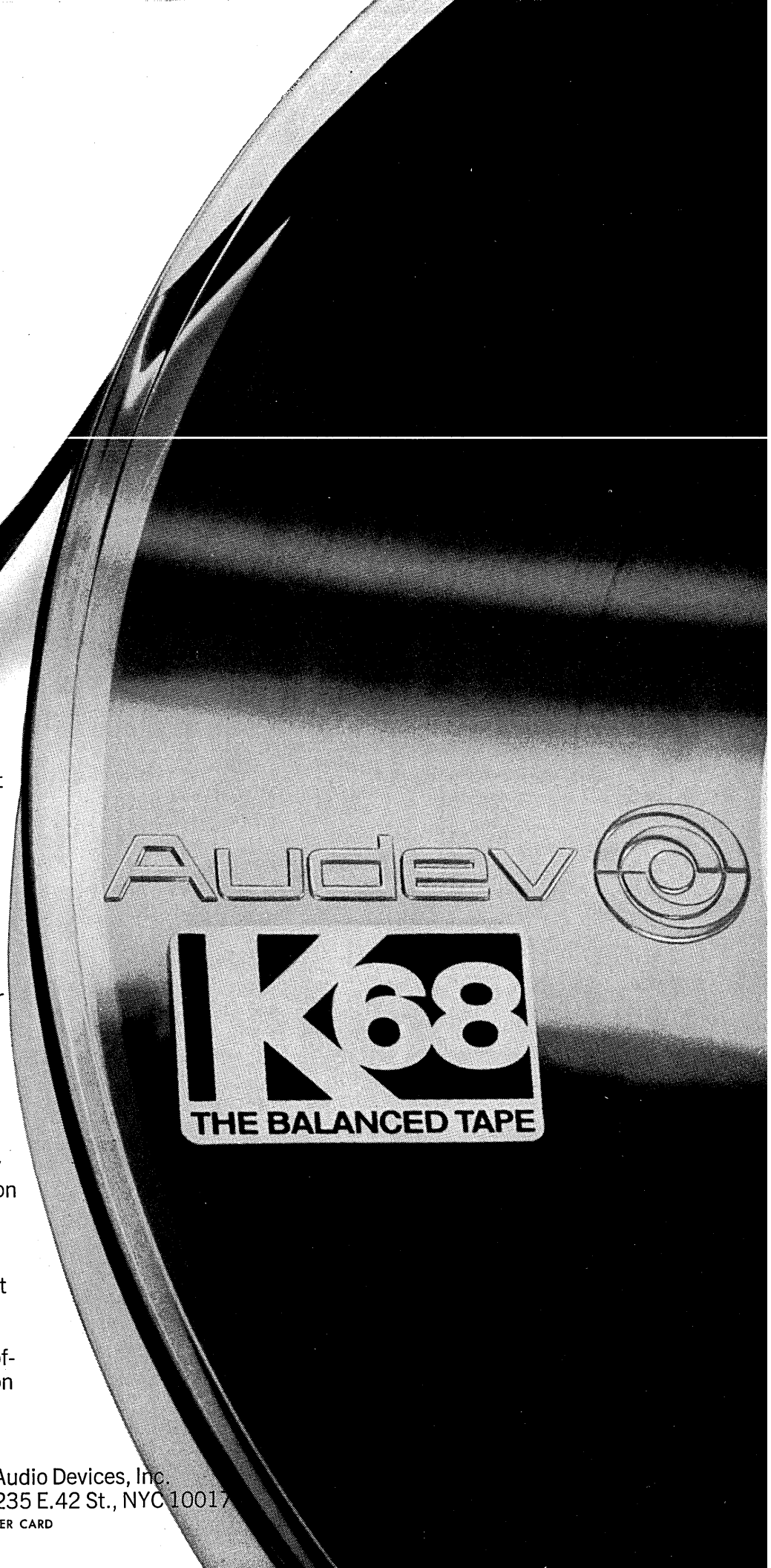
Balance also affects a tape's electrical characteristics.

We do our bit for today's high densities.

The higher bit densities of today's computer systems make demands that previously acceptable tapes can no longer meet. Use of a marginal tape in such circumstances often results in a gradual deterioration of quality. Dropouts increase; costly computer time is lost.

Audev K-68 takes these new, stringent conditions into consideration. Its magnetic properties, coating thickness and surface smoothness are balanced for total compatibility with all computer systems and for equal performance at densities from 556 bpi to 3200 fci and beyond.

How? A balanced interplay between low loss magnetics, precise



coating thickness and surface smoothness reduces pulse crowding, peak shift and dropout sensitivity without changing output or write current requirements.

K-68's balance also contributes to its environmental stability.

Keep cool. K-68 can take the heat.

Some tapes are as perishable as ripe tomatoes. They react poorly to temperature extremes in storage or transit; they "bruise" easily when moved from transport to transport.

Not Audev K-68. Base and coating properties have been balanced to provide uniform dimensional behavior. Cupping, curling and edge ripples caused by differential expansion or contraction of coating and base have been virtually eliminated.

Nor is Audev K-68 prone to skew-produced, time-displacement errors. Precision slitting, together with the scientifically designed Audev reel—and the low moment-of-inertia of the tape/reel combination—provide smooth tape motion on any transport.

Test a sample reel on your transport. For a change, try a balance, not a compromise.

Audio Devices, Inc.
235 E.42 St., NYC 10017

CIRCLE 59 ON READER CARD

news briefs

signals, or $300 for the transmission of both. In addition, there is a per minute message rate based on mileage. Customers in other states can obtain the service by subscribing to interstate foreign exchange service to any of the four cities. The customer can use private line channels (either Telpak or the 8000 series).

● UNESCO will sponsor a Latin American symposium on operation research and its applications this August in Panama. Specialists from a number of different countries will present papers. Inquiries may be directed to Prof. Sergio F. Beltran, Director of the Latin American Institute for Information and Computer Sciences, Apartado Postal 70273, Mexico 20, D. F. (Mexico).

● The Ohio State Bar Association's on-line legal information retrieval system, said to be the first of its type in the country, is scheduled to begin operation this month. State supreme court cases back to 1853 will be accessible through remote terminals used by OBAR members in the Columbus area. The system uses Data Corporation's Data Central program package, which, according to the company, is the only one capable of searching structured and unstructured data files completely. Variable length fields and file-independent retrieval time are other features of the system, which runs on any of several computers having minimum 65K core.

● Louisiana's Dept. of Public Safety has initiated a system which will eventually put every one of the state's 4,000 working law enforcement officers within seconds of a master file of vital police information. The information system is maintained and operated by a Univac 418 real-time computing system; law enforcement agencies will communicate with the 418 via a Teletype network. The computer will store registration information on the state's 1,600,000 vehicles; a list of 80,000 stolen cars; historical information for all Louisiana's 1,800,000 licensed drivers; a list of all "wanted" persons in Louisiana; and a list of describable stolen property. The leased computer is expected to more than pay for itself by automatically preparing driver violation reports for insurance companies which, under state law, charge more to insure drivers who commit moving violations.

● The U.S. Geological Survey has put an earth science computer network into operation that connects its Washington, D. C., data processing center with USGS facilities in Arizona, California, Colorado and Missouri. Three 360/20 computers and a 360/30 in the field offices are connected by leased long-distance telephone lines to a 360/65 in Washington for quick answers to questions raised by USGS research programs, which include mapping of the moon and instructing astronauts for lunar exploration. The network will also provide computer service for the Department of Interior.

● A computer-assisted instruction system is now operating in 16 New York City schools to teach reading, mathematics and spelling to 6,000 students in the first through sixth grades. The system, based on teleprinter terminals in the classroom linked to a central RCA Spectra 70/45 computer, has been financed by a $2.5 million three-year grant from the U.S. Office of Education under Title III of the Federal

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news briefs

Elementary and Secondary Education Act. Each terminal is used in rotation by about 30 pupils each school day; the student may receive from five to 20 minutes of instruction. The system is now being used only for drill and review purposes. Curriculum material has been prepared by several textbook publishing firms working in cooperation with educational consultants Dr. Patrick Suppes and Dr. Richard Atkinson of Stanford Univ., and Dr. Duncan Hansen of Florida State Univ.

● Stockholders of Amphenol and Bunker-Ramo voted approval of the merger of these firms, and thus squashed Solitron's dreams of gathering Amphenol to itself. (March, p. 99). Solitron had publicly offered to trade one of its shares for every five Amphenol shares and did obtain 800,000 of the 2.9 million Amphenol shares—not enough to gain control because the stockholder vote was 1.9 to 1 million. The Bunker-Ramo vote was 90% for the merger. But the troubles aren't over, since Amphenol stockholder Bernard Brummer has filed suit in the Wilmington, Del., Federal Court to block the merger. A Bunker-Ramo spokesman felt this suit would not block or hold up the completion of the agreements and plans.

● The Universidad Central de Caracas in Venezuela has formed a new Dept. of Computer Sciences that will grant academic degrees at the master's level. The only previous attempt, by the National Polytechnical Institute in Mexico, was unsuccessful because of lack of enrollment.

● The ACM has chartered a Special Interest Committee on Language Analysis and Studies in the Humanities (SICLASH). Anyone engaged in computer-aided language analysis, humanistic studies, or the development of hardware and software for such research is invited to become a member. SICLASH hopes to provide a focus within the ACM for computer-aided language studies and a forum where people working in different applications and humanists who have need of computer technology can share information and research. An organizational meeting will be held May 3 in Atlantic City, N.J., following the Spring Joint Computer Conference. Further information can be obtained from SICLASH

[QUESTION:]

What are the "hang-ups" with high speed A to D converters ?

That's a question recently addressed to a group of engineers by Canoga. The response: "It's hard to test the unit before you actually hook it up to a computer—and then if you have any trouble, it really costs money in computer down-time." Another typical response: "you never know when you are over-range." A third: "They never meet accuracy or speed specs quoted and they are tough to adjust and service."

Answer: The new Canoga high speed Analog to Digital Converter. It overcomes all of these problems and is now commercially available. The Canoga A to D Converter can be checked and the linearity can be verified with just a sine wave generator and an oscilloscope. This built-in self test reduces worry about potential computer downtime. Problems of over-range data are eliminated with a unique alarm indicator and output data line which indicates whenever full scale is exceeded.

Using a patented design with simple building blocks, this converter easily meets all accuracy and speed specifications and is easy to adjust or service. Solid state and modular in construction, the Canoga A to D converter combines the speed advantages of parallel comparison with the implementation ease of successive approximation.

If you would like a demonstration, please write, wire or phone Mr. C. W. Smith, General Manager, at the address below.

FEATURES:
- Built-in self-test
- Two step conversion with error correction
- Continuous tracking
- No linearity adjustments

Model	No. bits*	Conversion time	Max. sampling rate	Analog accuracy
109	9	900 ns	800 KC	±0.1%
112	12	3 μs	250 KC	±0.02%
115	15	3.5 μs	200 KC	±0.01%

*including sign

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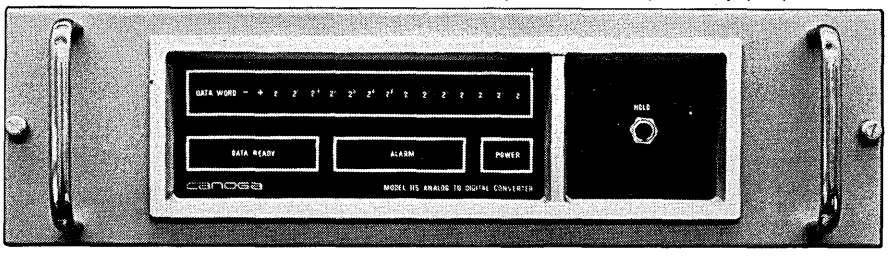
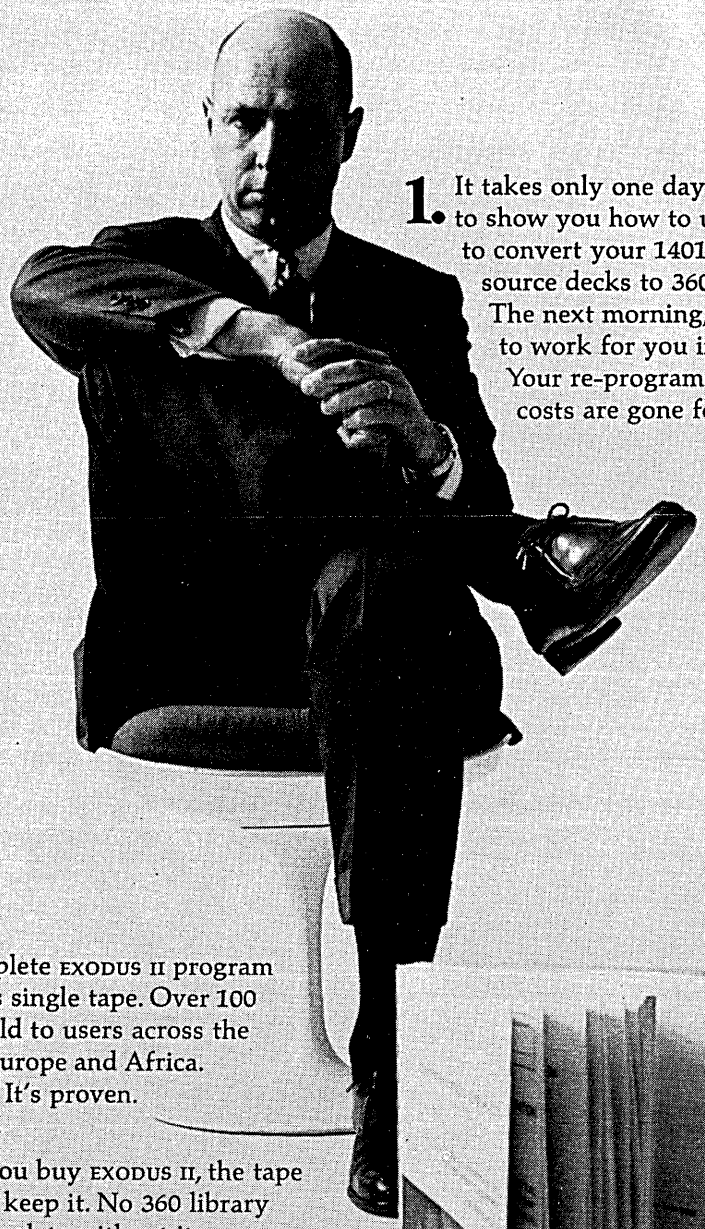


CIRCLE 63 ON READER CARD

To the fence-sitters who need three more reasons to buy Exodus II.



1. It takes only one day for a CSC expert to show you how to use EXODUS II to convert your 1401 Autocoder or SPS source decks to 360 Assembly Language. The next morning, EXODUS II goes to work for you immediately. Your re-programming time and costs are gone forever.

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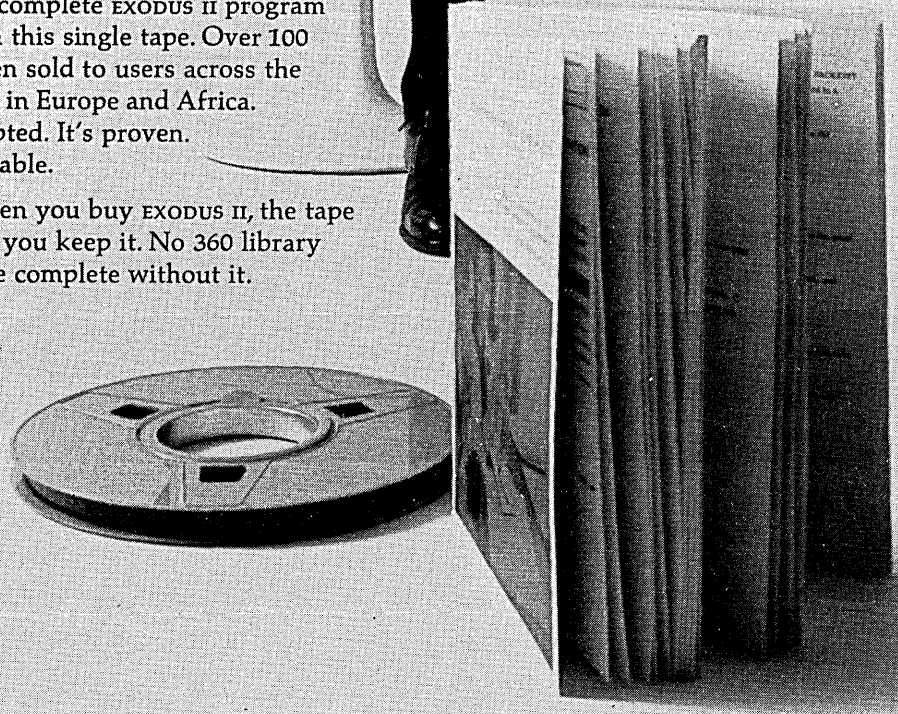
Also, when you buy EXODUS II, the tape is yours, you keep it. No 360 library would be complete without it.



3. Anytime down the road you want to patch the program, or do any kind of maintenance, fine. Here's the book to tell you how. There are no secrets, no interpretive routines. Change it around any way you want.

If you don't remember all the other compelling reasons, write for our brochure. Then contact Charles Sullivan, Manager, Systems Programs, to arrange for a demonstration.
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Computer Sciences Corporation

CIRCLE 62 ON READER CARD

news briefs

chairman, Sally Y. Sedelow, ACM, 211 E. 43rd St., New York, N.Y.

● Planning Research Corp. has made its serious debut in commercial work in Europe in conjunction with Systems Programming Ltd. of London. PRC is the prime software contractor for a job at the London Airport to analyze volume and types of cargo. The system, with a target installation date of 1970, will eventually include remote communications terminals in the customs and cargo areas that will be connected to a central computing and data storage complex. The contract has been awarded by the British Government Post Office's National Data Processing Service, which is advising on this type of government installation.

● Purdue University engineers, working in the NSF-funded LARS (Laboratory for Agricultural Remote Sensing) program, have developed remote sensing and pattern-recognition techniques which can be used to gather information on crops from the air. The system entails sensing and recording of infra-red reflections from plants, and could be used with a low-level satellite (such as a Tiros) equipped with a spectrophotometer and a tape recorder. From the tape input, the computer recognizes signal patterns and maps the area, designating, for example, what crops are grown in each field. This technique reportedly could be modified to aid such projects as water and oil explorations, planet fly-bys, and icecap and drought investigations.

● The merger of Standard Computers, Inc., with Computer Leasing Co., was approved last month by the stockholders of both companies. Under the agreement, Standard shareholders will receive 1.8 shares of CLC common stock for each share of Standard. CLC is a subsidiary of University Computing Co. and leases computers, peripheral equipment, and related communication devices. Standard, founded in 1965, is engaged in substantially the same business as CLC.

● At the April meeting of the Los Angeles chapter of the ACM, the AFIPS award for the best paper presented at the Fall Joint Computer Conference was given to David Owen and Philip Hartman, both of SDS, for their paper "How To Write Software Specifications." While each clutched his plaque and check (one each for each), Owens commented that it was interesting to note what could develop from an in-house memo. The two men are scheduled to repeat their presentation at the June meeting of the LA chapter.

shortlines . . .

Computing and Software, Panorama City, Calif., has acquired International Tabulating Institute of Washington, D.C., and the three Solar Electronic Schools of southern California to bring to 18 the number of educational facilities now operated by the company. Computing and Software already operates programs at 14 southern California locations of West Coast Vocational College. . . . Industri-Matematik AB, European subsidiary of Mathematical Applications Group, Inc. (MAGI), White Plains, N.Y., is now in operation in Stockholm, providing consulting services in applications software development, information retrieval systems, and operations research under the direction of Dr. Martin Leimdorfer. . . . Hurricane Beulah, the worst storm in southern Texas history, is being rerun daily by the International Boundary and Water Commission in El Paso on an IBM 1130 to study improved flood control measures for the Rio Grande. Data for the simulation was supplied by the U.S. Weather Bureau and 19 floodway stations along the river. ■

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CIRCLE 70 ON READER CARD

"CURRICULUM '68"

The Curriculum Committee on Computer Science of the Association for Computing Machinery has functioned since 1962. The current report (235 typed pages) is the first since "An Undergraduate Program in Computer Science – Preliminary Recommendations" appeared in September, 1965. Twelve outstanding members of the academic computer community* prepared the report, with help and advice from 36 consultants and 28 others; of these, 13 were from industry.

All these people deserve the highest praise for their detailed and meticulous work.

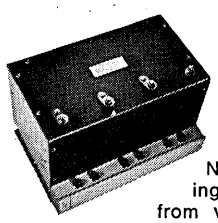
The task of organizing any set of courses in any discipline, so that there is an evident plan and goal and a visible rejection of Monte Carlo techniques in planning, is far from easy. This committee was charged with developing a cohesive program that would fit—with some give and take—any four-year school that wished to offer a degree (bachelor's and master's) in computer science. The side issues that immediately arise are endless. The first of these is "What is computer science?" and the second is "Shouldn't we call it something else?" and the first four committee meetings can go by in philosophical discussion before a single course is selected.

The report opens with a brief defense of "computer science" as a distinct discipline; the subject is then subdivided into three logical parts: information structures and processes; information processing systems; and methodologies. The end result of the report is a flow diagram of the relations between 22 courses that are proposed, plus lists of prerequisites, catalog descriptions, detailed outlines, and annotated bibliographies for all 22 courses. It is a monumental piece of work. Along the way, the committee offers good advice to those just starting:

". . . the practical problems of finding qualified faculty, of providing adequate laboratory facilities, and of beginning a program in a new area where there are few textbooks are severe." ". . . schools should exercise caution against the premature establishment of undergraduate degree programs." ". . . there is some critical size of faculty—perhaps the equivalent of five fulltime positions – which is needed to provide a reasonable coverage of the areas of computer science . . ." "It is entirely possible that an undergraduate degree program might require as much as four hours of computing on a medium-sized computer per class day."

The committee apparently decided that "computer science" as a discipline leading to a degree (or degrees) implied scientific computing; that is, that business data processing could not be formalized as yet to lead to

*William F. Atchison, Univ. of Maryland (Chairman); Samuel D. Conte, Purdue; John W. Conte, Purdue; John W. Hamblen, SREB and Georgia Institute of Technology; Thomas E. Hull, Univ. of Toronto; Thomas A. Keenan, EDUCOM and the Univ. of Rochester; William B. Kehl, UCLA; Edward J. McCluskey, Stanford; Silvio O. Nararro, Univ. of Kentucky; Werner C. Rheinboldt, Univ. of Maryland; Earl J. Schweppe, Univ. of Maryland (Secretary); William Viavant, Univ. of Utah; David M. Young, Jr., Univ. of Texas.



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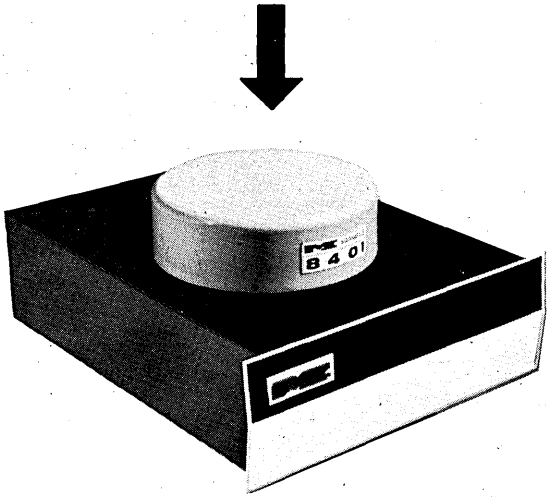
CIRCLE 75 ON READER CARD

DATA STORAGE



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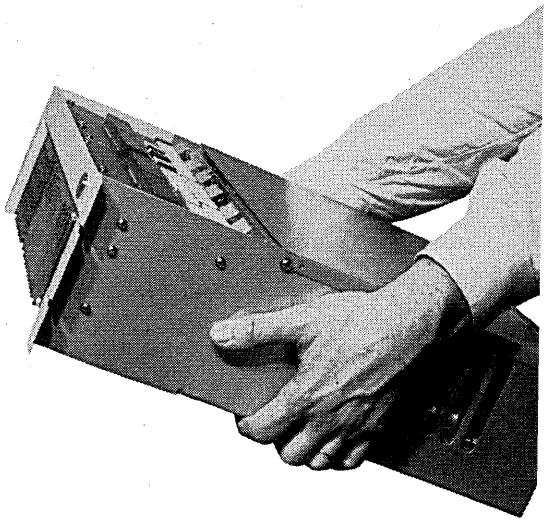

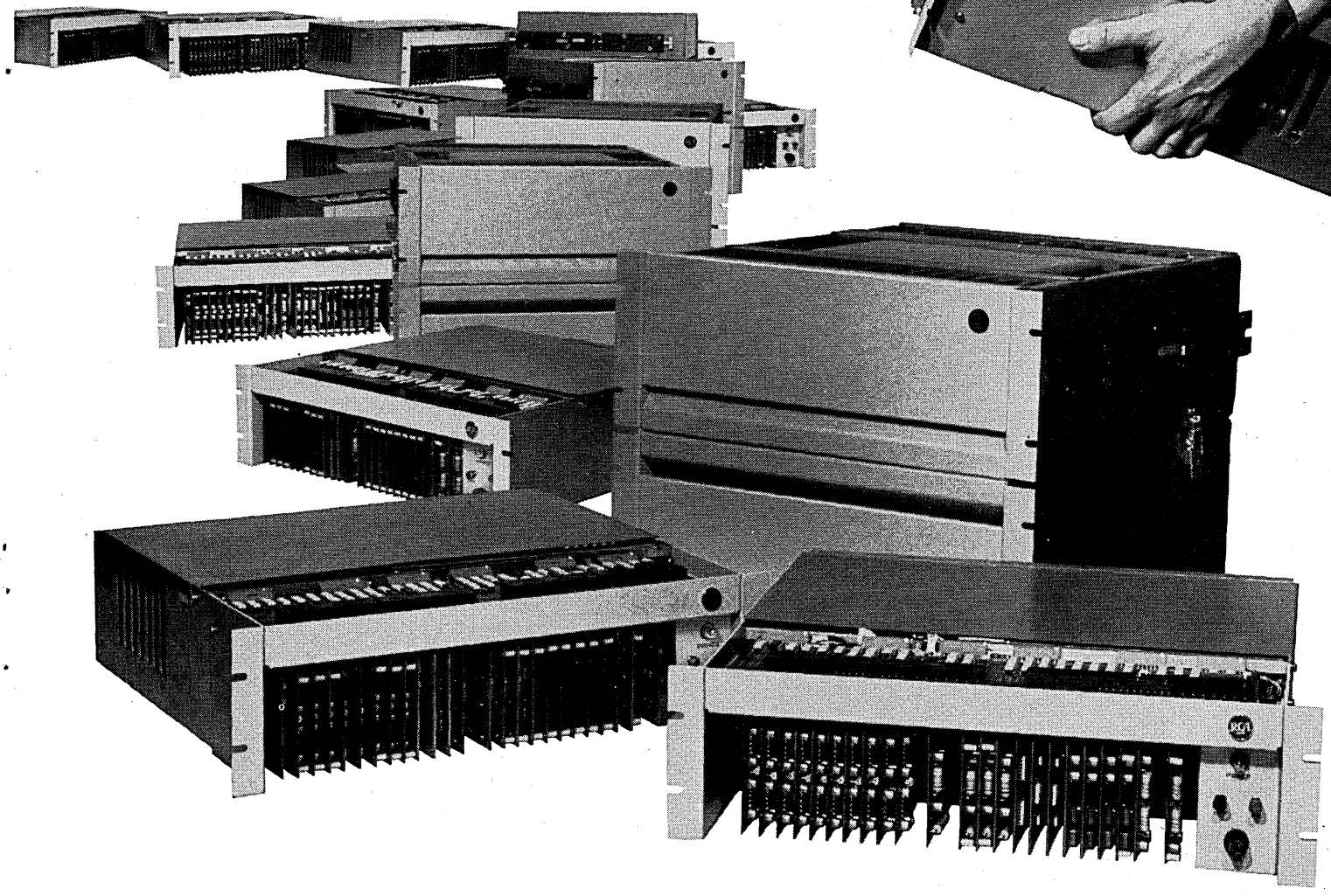

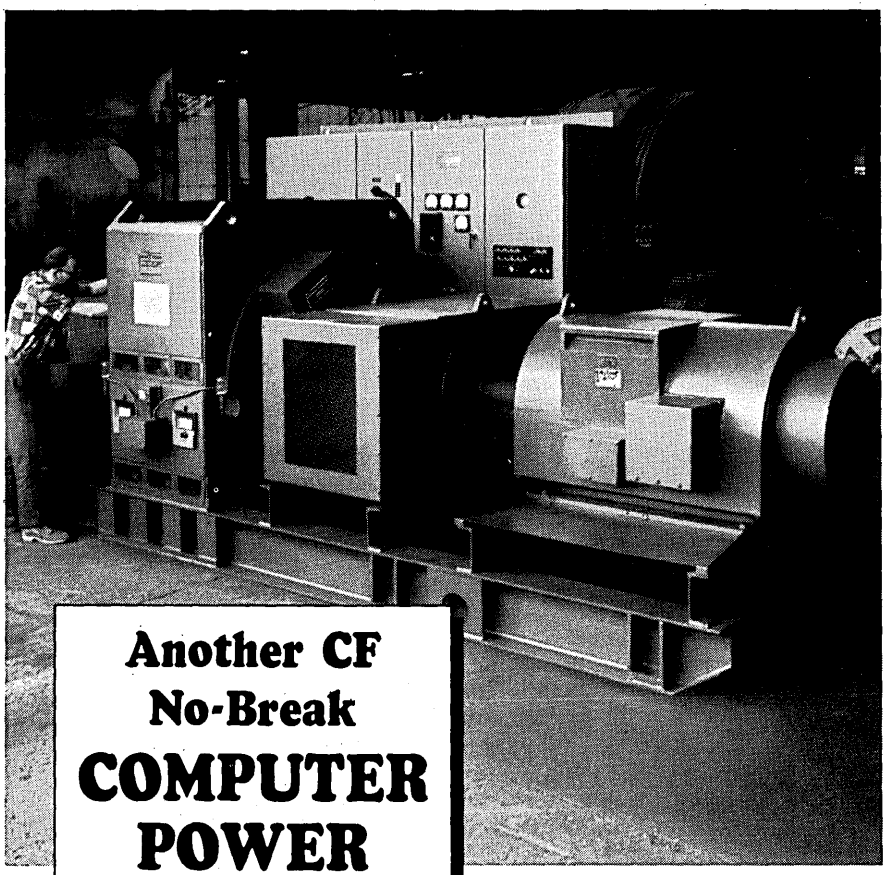

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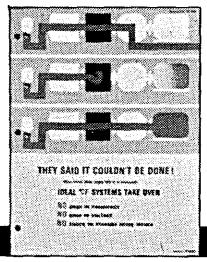
TELEPHONE COMPANY BILLING COMPUTER in a large West Coast City is isolated from incoming power transients, fluctuations and failures by this Ideal Electric CF (Constant Frequency) System. It is shown above with its control panel before shipment from the factory.

CF Systems can be fitted to the needs of many types of computer installations and other critical load applications including communications, refining, missile and satellite support systems.

Computers will not operate dependably if there is the slightest disturbance in the electric power supply. So if you want **No-Goof** computer performance, you need an Ideal Electric **No-Break** CF Power System.

These patented systems supply regulated voltage and constant frequency—**without batteries or other external power**—to carry over short power interruptions up to 30 seconds or more, or to provide time to transfer from preferred power to auxiliary or stand-by power. They are available in two basic types with several variations, and in ratings from 2.5 KW through 1000 KW.

If your computer gets its orders on-the-spot, an Ideal Electric CF System can save valuable time. If data is transmitted to your computer from remote locations, it can prevent disaster. Whatever your special power problems might be, we invite you to use our abilities and experience in solving them.



For more information on how we can serve you, and for a copy of our bulletin on CF Systems, telephone us at (419) 522-3611 or write The Ideal Electric & Mfg. Co., Mansfield, Ohio 44903.

IDEAL ELECTRIC

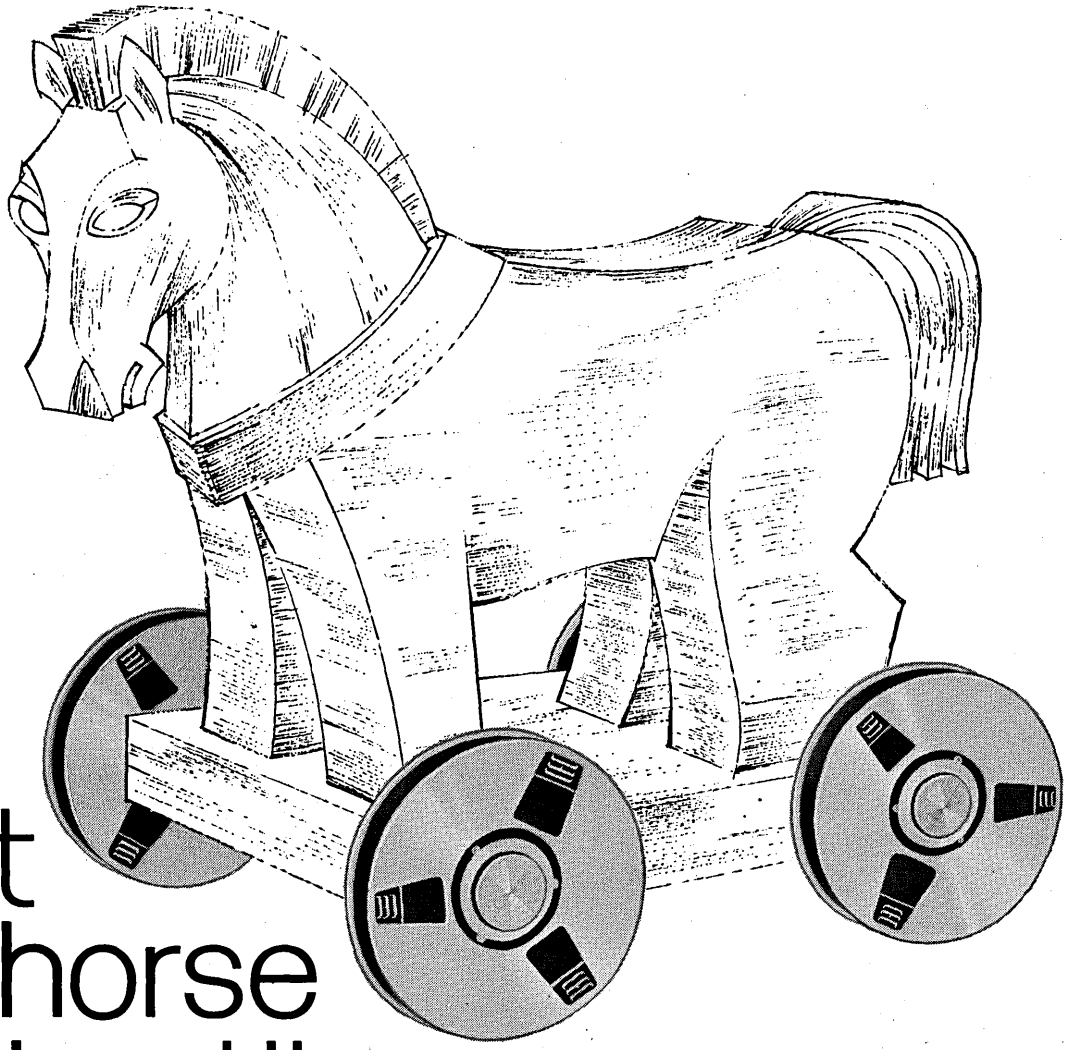
CIRCLE 74 ON READER CARD

a degree. The 22 courses are heavily loaded with mathematics (indeed, five of the twelve core courses *are* mathematics courses), and topics in file management, sorting, report generators, etc., are tucked away in advanced courses which would have to be approached along a road lined with algorithms, numerical analysis, and syntactic recognition. "Computer science as a discipline requires an understanding of mathematical methods and an ability to use mathematical techniques beyond the specific undergraduate preparation in mathematics recommended . . ."

The committee's viewpoint may be entirely correct: that the mathematics route *is* the way to develop a computer scientist. Freezing out the business administration student seems somewhat arbitrary, however, and it is doubtful that any business-oriented student would submit to the curriculum given. Surely there are many respected computer scientists today who would be frightened by a double integral.

This is a matter of interpretation, though. Having made their decision, the committee followed through with a detailed plan and, for good or bad, it will dictate the curriculum at many colleges for years to come. Here again, a dilemma had to be faced. The report sets a standard, and a standard tends to freeze progress. So be it; the standard we now have is a good one, arrived at by sober and responsible citizens, and is infinitely preferable to the crazy mishmash of courses now cluttering many college catalogs. The bibliographies alone (though they will rapidly go out of date) represent a significant contribution towards stabilizing higher education in computing.

Almost coincidentally with the appearance of the ACM report there has been published "Computers and the Schools of Business," a 97-page printed book by J. Daniel Couger, Associate Professor of Management at the Univ. of Colorado. The area that is neglected by ACM is thoroughly covered by the Colorado report, which was prepared under a grant from IBM. It, too, presents an undergraduate and graduate curriculum, leading primarily to an MBA in business data processing. The report includes book lists, film lists, and budgets for computer training. As with the ACM report, the material collected by Professor Couger is up to date, correct, and well presented. As an outgrowth of the work at Colorado, there is now a serial publication, *Computing Newsletter for Schools of Business.* ■



First workhorse for hostile environments

CEC's new W-3 Wideband Analog Tape was designed for conquering the most elusive data under the worst possible conditions.

W-3 will achieve what previous instrumentation tapes never have been able to do before. Namely—record in temperatures as high as 200°F, *dry*, with no softening of the binder system or oxide delamination.

So durable is this new tape, dropouts have been virtually eliminated—even up to 100 plays. *Sensitivity* at 0.06 mil wavelength is +15.0 db. *Uniformity* between reels at 0.06 mil wavelength is ±2db. The specifications were measured using a commercial wideband recorder with ac bias adjusted for optimum short-wavelength performance. Sensitivity is referred to standard tape qualified under MILSPEC WT-0070/4. It all adds up to a more stable signal within a reel and reel-to-reel.

W-3 wideband precision tape is supplied on reels with a 1 mil polyester base. (MILSPEC WR-0070/5)

For less severe environments, select CEC's W-2 wideband tape. (MILSPEC WT-0070/5)

Ample supplies of the new analog tapes are now available through all CEC Field Offices. For further information, write Consolidated Electrodynamics, Pasadena, Calif. 91109. A subsidiary of Bell & Howell. Ask for Technical Bulletin 1729 X-1.

CEC/INSTRUMENT MATERIALS

BELL & HOWELL

Forget it!

Larry Frisbie* still has a stack of tapes to print, the computer is busy with an engineering sequence, it's 4 o'clock, his boss wants to see what's on that tape . . . and his wife wants him home for dinner.

Larry...go off-line with a

data products

off-line print station!

With a *data products* off-line print station to free your computer of time-consuming print chores, your computer isn't print-bound, and your printer isn't computer-bound. Best of all . . . the *data products* LINE/PRINTER† will give you printing speeds of over 1300 lines-per-minute, the straightest lines in the industry, upper and lower case characters, and print quality better than any competitive system you've ever seen before.

WRITE FOR THIS NEW BROCHURE
. . . but hurry, we're saving one for Larry.

*Fictitious name with a true-to-life problem

†Trademark of *data products corporation*

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8535 WARNER DRIVE, CULVER CITY, CALIFORNIA 90230
Phone: (213) 837-4491 / Cable: DATAPRO / Telex: 674734

CIRCLE 71 ON READER CARD

"No business is an island"

A storm of protest, stirred by the marketing abuses of a small minority of companies, is sweeping the mainland of American business.

As the disturbance advances, it whips up waves of customer distrust and produces an outpouring of proposed consumer legislation.

Business is charged with insensitivity to the consumer's interests—with false and misleading advertising, selling, packaging and labeling. Even some of the most respected industries are accused of "victimizing consumers," especially the poor.

It may seem that the tempest is focused only on certain types of enterprise, and that others, like distant islands, can carry on unperturbed—isolated from the turmoil.

One Business Mainland

But all commerce and industry in this country today are bound together into one inseparable community; and the winds of criticism that lash against some who sell in the consumer marketplace will be felt *throughout* the business world.

If mounting customer doubts and unduly burdensome legislation or regulation curtail sales or profits of any type of consumer goods, it will hurt not only those who manufacture and retail these products but also those who *supply* these companies, including firms that sell only to business and industry.

And the more accustomed that the American people grow to the regulation and control of one segment of business, the more natural it will seem that *all* industry should be equally regulated.

That is why the Better Business Bureaus say to every responsible businessman in America, even those in kinds of business never accused of abusing customers:

> "Join with us in helping lift the ethical standards of all advertising and selling through self-regulation. Join in helping business improve its relations with consumers and government, in helping protect all buyers, all honest business and the enterprise system."

Every Business Benefits

Every company, manufacturer as well as retailer, needs flourishing communities where fair dealing and customer confidence prevail. *BBBs help create such communities.*

Every company wants to safeguard employee buying power, and prevent the firm itself from dealing with dishonest merchants or fraudulent "charities." *BBBs help provide such protection.*

And every responsible company wants the public and government to know the truth about customer-business relations—such as the fact that nine out of ten customer calls to Better Business Bureaus today are inquiries, not complaints. *Increasingly, the BBB National Expansion program will communicate these facts.*

Already this program has activated the BBB Research and Education Foundation to conduct studies on subjects of consumer concern, and has opened an Office of National Affairs in Washington, D.C., to provide government as well as business with reliable data based on more than three million consumer contacts made each year by BBBs.

What You Can Do

Since it is indeed true that "no business is an island," every company has reason to back the BBBs.

To see how you and your firm can help produce a new high tide of confidence in the entire business community, call the manager of your nearest BBB, or contact the Association of Better Business Bureaus International, Chrysler Building, New York, N.Y. 10017.

BBB®

Is JCL GIGO bugging you?

Try Colt-360 error disposal & debugger.

Colt-360, Aim's new COntrol Language Translator, arms you with an automatic control capability for the 360 (OS), utility program and sort/merge program. It's designed for your precise objectives.

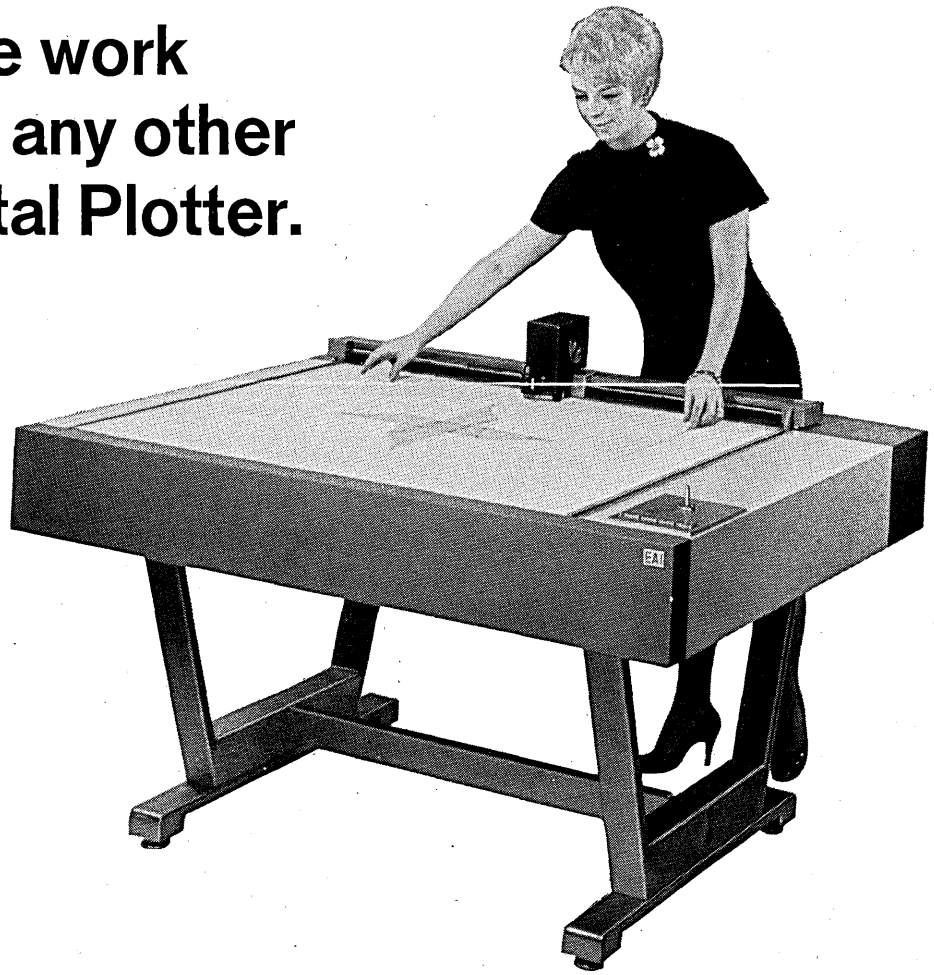
Forget about those free, maze-like programmers' manuals. They cost a fortune in time. Forget about GIGO (garbage-in-garbage-out) and debugging hang-ups. Get diagnostics, JCL card listings and the cards themselves without wasting programmer and computer time. And, forget about changing JCL cards for new configurations.

The days of "let's-run-it-and-see" 360 job control are over. In sum, Colt-360 saves everyone's time and money! Write for Aim's detailed Colt-360 brochure today. If it doesn't grind up your problems, nothing will.

Automatic Information Management, 16033 Ventura Boulevard, Encino, California 91316. Aim is a broad-capabilities software organization.

Aim Colt-360

Does 5 times more work than any other Digital Plotter.



That's the NEW EAI Series 430 DATAPLOTTER®

The new Series 430 DATAPLOTTER has a writing speed up to 20 inches per second... and it always works at maximum possible speed. When curves are plotted, the 430 DATAPLOTTER looks ahead, determines the highest possible velocity for the radius involved, and continues to operate at optimum writing rate.

Line quality and accuracy aren't sacrificed to get this high speed. In fact, since the servo-drive is analog, there is a clean, smooth high quality line at all times.

When it comes to accuracy—the feedback system is digital with .002" resolution. The result is better accuracy, better line quality at 5 times the competitive speed. The digital input can be derived from 7 or 9 track mag tape with densities up to 800 bpi.

A straight line? All you need is two points to describe it, (they can be 30 inches apart) and the 430 DATAPLOTTER draws the line at 20 in/sec. It's an unbelievable sight.

The 430 DATAPLOTTER will warm the heart of an EDP Manager back-logged with data to plot. Because it can print, scribe, point plot, free run, curve fit or draw any length single stroke straight lines. It has the latest LSI high reliability circuitry and last but not least—its cost is competitive with any other 30" x 30" digital plotter on the market.

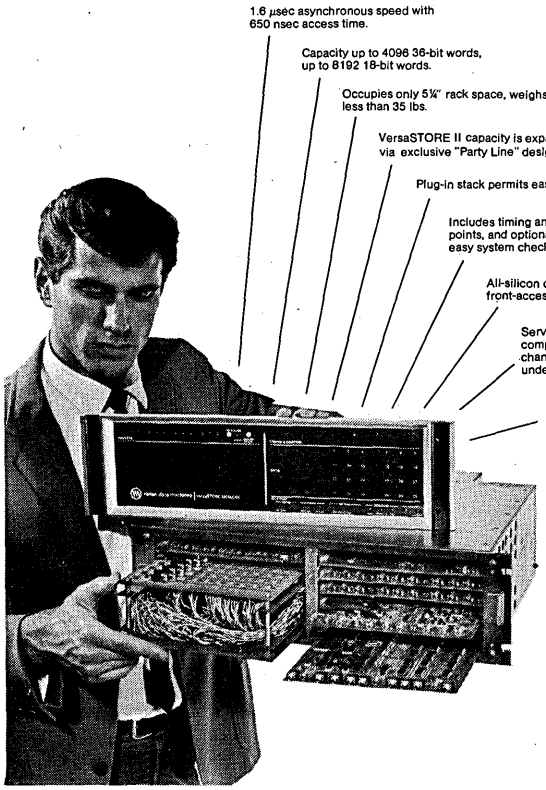
May we lay it on the line for you?

Call 201-229-4400—or write to DATAPLOTTER Marketing.

EAI® *Electronic Associates, Inc., West Long Branch, New Jersey*

CIRCLE 38 ON READER CARD

The new VersaSTORE II core memory system can give you all the speed, capacity, and convenience you'll ever need.



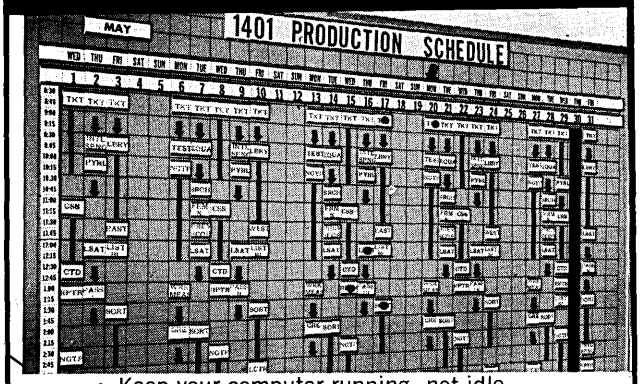
It can also save you a few bucks.

varian data machines
a varian subsidiary
Formerly Decision Control, Inc.
1590 Monrovia Ave., Newport Beach, Calif.
TEL. (714) 646-9371 TWX (910) 596-1358

We need Senior Development Engineers and Programmers. Write to Mr. Bruce Ferris.

CIRCLE 29 ON READER CARD

COMPUTER SCHEDULED MAGNETICALLY



- Keep your computer running—not idle.
- Schedule in 6, 10, 15 & 30 min. cycles, for daily, weekly or monthly periods.
- Know in advance when slack periods or heavy work loads are coming.
- Make changes & additions immediately.
- Every hour saved saves you $20-$40-$60.

Write for FREE 28 Pg. Illustrated Catalog—DA 5

METHODS RESEARCH CORP.
70 Willow Ave., Staten Island, N. Y. 10305

CIRCLE 77 ON READER CARD

A little BIT of LOGIC for COMPUTERS

Maintenance Service by RCA For Computer Peripheral Equipment

Reduce downtime and service headaches—with a planned service program from RCA's specialists on communications, control, and data processing equipment maintenance. Select the leading service; it even can help you close the sale!

- Nationwide facilities
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Contractual plans for the account of the manufacturer and large user. Emergency and per-call service, too. Write or phone for details.

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CIRCLE 78 ON READER CARD

$30,000—you can't buy more speed or capability.

790 nanoseconds—the 16 bit SEL 810B

With prices now 20% less than before, you can't do better. Compare with the other computer companies. Fixed point execution times are: cycle time, 790 nanoseconds. Add/subtract, 1.58 microseconds. Multiply, 4.74 microseconds. Divide, 6.32 microseconds.

And check these SEL-810B design features: 8K basic core memory circuits. All integrated circuits. Two levels of priority interrupt. Memory expandable to 32K. I/O typewriter. High-speed hardware multiply and divide. Real-time I/O structure. And the software package of the SEL-810B is compatible with the field proven SEL-810B.

So call us at Systems Engineering Laboratories today. Area Code 305/587-2900. Or write: P.O. Box 9148, Fort Lauderdale, Florida 33310.

Systems Engineering Laboratories

CIRCLE 30 ON READER CARD

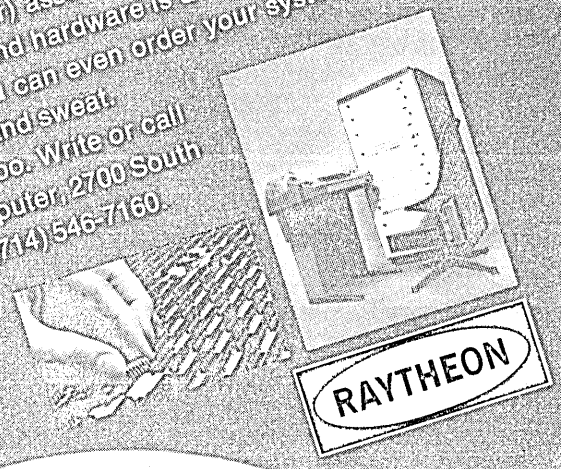
The Raytheon 703 Computer finds its own faults. And you can fix them while you're having coffee.

The $15,000 IC Systems Computer with $1,50 spares. The 703 is the only small systems computer built like third-generation million dollar computers. The CPU is wire-wrapped with plug-in IC's on one motherboard. A unique CPU self-diagnosis solves its own circuit malfunctions. When necessary, you can simply plug in a new IC. Time: about 30 seconds. Cost: about $1.50

The 703 is like larger computers in other ways. It's a 16-bit machine with 1.75 usec cycle time and is expandable from 4K to 32K. It has word and byte manipulation instructions, a real-time priority interrupt system and hardware multiply-divide option. Software includes an executive and real-time FORTRAN IV.

The 703 interfaces with all standard peripherals, including disk. Beyond this, Raytheon computer offers extensive and compatible IC analog instrumentation like the MINIVERTER™ (multiplexer, sample-and-hold, and A/D converter) assembled from IC analog and digital modules. The complete line of modules and hardware is available for easy system design to your particular requirements. And you can even order your system Wire-Wrapped, to save you more time, money and sweat.

You'll find our sales engineers compatible too. Write or call today. Ask for Data File C-151. Raytheon Computer, 2700 South Fairview St., Santa Ana, Calif. 92704. Phone (714) 546-7160.



Raytheon Computer...
the company that gives you a break.

and regular sales reps are still being worked out.

An indication of IBM's seriousness in getting an effective group going for the new era of cooperation: the western regional manager chosen is a former branch manager—others are said to be from still higher echelons.

Reasons for the switch, other than general benevolence, are a matter of speculation. One lessor thinks that the purpose of the department is to ensure that the IBM sales effort doesn't hamper the third parties so much that they would have to cut prices drastically in the secondary market.

While most say that third-party leasing is still a small enough part of the market that there won't be a price war, there are some signs of special deals with high discounts on returned systems. One user took on a "used" mod 40 (cpu only) on a 24-month lease at over 20% off IBM rental (10% is about average).

NEW TRANSPORTATION CONSULTANT UP, UP AND AWAY

Seeking to mount a broad frontal systems attack on transportation problems, Walter Brandenburg, a 19-year veteran of United Air Lines and most recently Mgr., Reservations Systems Research there, has formed a new consulting firm, Brandenburg & Assoc., in Chicago.

Associated with Brandenburg & Assoc. will be five other firms with such specialties as airport and facility planning, passenger flow simulation, software, communications, reservations systems and leasing. The companies are: Aries Corp., McLean, Va.; An-Tec., L.A.; Avtech, Inc., Chicago; T-Scan Ltd., Toronto; and Computer Processing Unlimited, Chicago.

SOFTWARE INDUSTRY FINDS A VOICE

You can stop holding your breath. The long-awaited software association is a reality: eleven programming service companies have formed the Association of Independent Software Companies to promote the interests of their segment of the industry.

Founding members are Applied Data Research, Aries Corp., Auerbach Corp., Computing & Software, Computer Applications, Inc., Computer Usage Corp., Comress, Informatics, The Merle Thomas Corp., Planning Research Corp., and Wolf Research & Development.

AISC says it will "concern itself" with such topics as competition from not-for-profits, proprietary program protection and separate hardware/software pricing. Software firms wanting to join must be one year old, be able to kick in $1K/yr., should contact AISC, P.O. Box 4548, Wash., D.C. 20017.

STATE-LOCAL GOVERNMENT EDP EXPENDITURES DUE FOR SHARP RISE

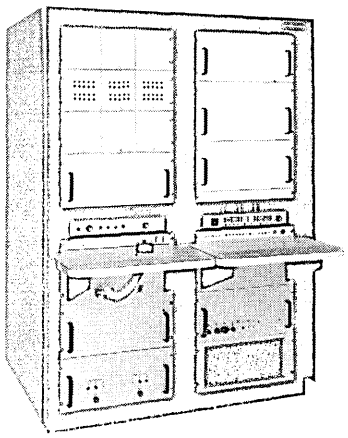
In 10 years, hardware-software expenditures by state and local governments will equal those of the federal government today. So says a knowledgeable industry source; several recent developments support his prediction.

The Office of Economic Opportunity has begun assembling the nation's first federal-state-local data bank; West Virginia and New Jersey will be the first contributors, Arkansas and Pennsylvania are likely to be next. For some time, OEO has been providing technical assistance designed to help the states tie in with the agency's existing data bank, which contains federal program data. It periodically generates detailed analyses of expenditures, by purpose, for each county and state.

The Budget Bureau is planning a government-wide

← FOR RAYTHEON CIRCLE 79 ON READER CARD

Fairchild has these fond memories of Librascope



Unlimited programmed testing with flexible test sequencing is one reason why. That's the advanced state-of-the-art job called for by the programming unit of Fairchild's new Series 4000M Automatic Integrated Circuit Testing System. Librascope's Series L100 Disc Memory got the call. Each stores 900 test programs—grouped in sequences of 25—and runs up to 60 per second. The same testing line accepts a variety of devices for high-speed processing. A simple keyboard programs the disc—no accessory hardware needed. And an entire sequence is reprogrammed in minutes. Proven reliability (over 600 L100 units in use) stems from conservative, no-compromise design. Yet the L100 is probably the lowest-cost disc memory on the market.

Thanks for the memory order, Fairchild—reputations are made of this. For the brochure detailing the longest line of discs in memory, write: General Precision Systems Inc., Librascope Group, Components Division, 808 Western Avenue, Glendale, California 91201.

GENERAL PRECISION SYSTEMS INC.

LIBRASCOPE GROUP

A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

CIRCLE 80 ON READER CARD

management info system based partly on state- and locally-supplied data. BOB has asked Congress for $141K to add 9 information specialists to this project's management staff. Last month, an intergovernmental task force, which included BOB, called for establishment of information systems at federal, state, and local levels.

The Library of Congress has a good chance of launching development of a legislative information retrieval system in FY '69, and the clerk of the House of Representatives is reportedly planning along similar lines. More than a dozen bills proposing the use of systems technology are pending in both chambers. Out of this activity may come enough votes to support federal aid for state and local adp programs.

ROUND ONE TO REAM

Norm Ream, special assistant to the secretary of the Navy, reportedly has won an in-house battle over replacement of an IBM 7090 at the Navy information center; the upshot is that competitive bids will be sought for the new gear. Ream's victory is significant because Navy plans to replace several other systems over the next few years. A massive re-programming effort is also planned. Existing Navy software consists largely of machine-dependent first and second-generation assembly languages.

PRIVATE ENTERPRISE TO THE RESCUE

While the poverty program struggles with bureaucratic and financial woes, a few concerned dp people in west coast companies are parting the water without federal or state monies. On their own time—at their own expense—they are instructing people in computer skills. The Automated Information Service's staff of the Economic and Youth Opportunity Agency (EYOA) of Greater Los Angeles (whose regular function is to handle dp for that branch of the poverty program) has volunteered several nights a week for a year to train people from underprivileged areas in keypunching, computer operations and programming. There is no cost to the student: supplies are donated, and machine time for hands-on experience is on EYOA's 360/30 TOS/DOS. Success. Students who were school dropouts have returned to school (some at night while working during the day); nearly all have been placed in jobs as trainees. Placement has not been easy however; EYOA systems specialist and volunteer instructor, Bernard Brady reports that although top-level management is usually cooperative, personnel managers are consistent obstacles. (Other mysteries: How many people anywhere have 2 years' experience in 360 programming? And why do state and federal agencies only hire programmers with college degrees?)

Persistent believers in the triumph of good ideas, Advanced Data Systems in San Francisco (the ADPAC people) trained and placed 20 students in keypunching and programming last year, and are now ready to start new "classes" (they'll instruct anyone at any time for as long as he wants to take). Nearly strangled in well-meaning OEO red-tape, ADS has now shaken free, and, like the AIS staff, wants to go it alone.

(Continued on page 131)

Let's get to the bottom of the disc

Is an error-free disc pack essential? After all, you can always program around the errors. Or IOCS them. But why should you have to?

The Memorex Mark I is a superior disc pack. All around. Designed for the 2311, not just the 1311. Fully compatible. And most important, error-free.

But the Mark I is more than just error-free. It's a disc pack that's superior all-around. Superior because that's the kind of product design, coating formulation, and quality control that produced it.

Have you looked at the error labels on the bottom of your IBM disc packs? Isn't the Memorex

MEMOREX

pack situation.

Mark I the kind of disc pack you should replace them with? And since you can —at no extra cost—why not do it now? (Write or call for a free trial: Memorex Corporation, Memorex Park, Santa Clara, Calif. 95050.)

CIRCLE 81 ON READER CARD

Computer Sciences Corporation has established COMPUTER SCIENCES INSTITUTE to provide updating courses for professionals in the information sciences

You're a systems designer moving up to project management. An accountant who wants to know about auditing automatic systems. Someone who wants to improve his skills in a higher language like COBOL. Or a manager who needs more background in operational systems analysis and systems design.

Whether you want to upgrade your skill, update your knowledge, or move up to a more demanding level of computer technology, Computer Sciences Institute provides that training.

The Institute is a service of Computer Sciences Corporation, largest systems engineering and computer programming organization in the information sciences. As such, the Institute is equipped to cover the total spectrum of the field, irrespective of hardware or software orientation. With the unique Structured Learning Technique, subjects are learned deeper and faster.

Further, you learn to use what you've learned on the job: How to get that line manager to go along with your new system. How to explain computer programming to a V.P. How to understand your function better so you may be better understood.

Updating doesn't stop with the course. Once you're back on the job, you'll get follow-up material at regular intervals.

School starts May 1st. Classes will be held at Computer Sciences Institute facilities in Los Angeles and New York City. Some of the courses include:

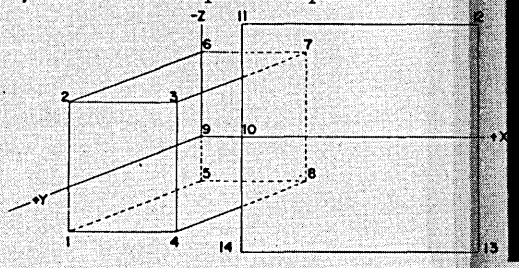
Systems Analysis & Systems Design: analysis, design, implementation of systems for manual, batch processing or real-time processing; final week on individual Systems Planning Team projects, solutions to be evaluated for presentation, content and logic; heavy emphasis on systems applicable to government and business management problems. 3 weeks.

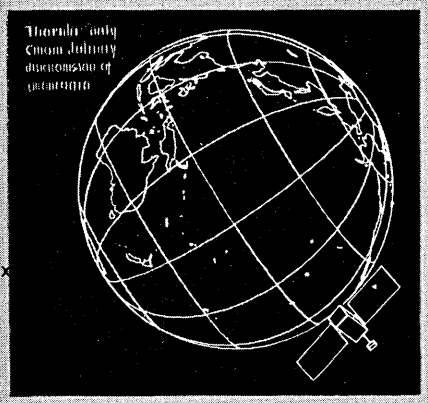
Software Project Management: to upgrade technical and managerial people in management techniques and methodology; performance, profit, productivity; costs, contracts, financial management reporting systems; personnel and customer relations. 1 Week.

Basic Assembly Language & COBOL: to upgrade and expand existing language capability; covers flowcharting techniques, math systems, coding techniques; writing & testing programs (including IBM 360); COBOL; rewriting basic assembly language in COBOL; documentation techniques. 3 weeks.

For complete details on course fees, transportation and accommodations—for further information on the Institute's Executive Seminar and Management Symposia—write for brochure TA-3 today. Courses are being filled **now** on a first-come basis.

Computer Sciences Institute,
650 North Sepulveda Boulevard,
El Segundo, California 90245.
Or 330 Madison Avenue,
New York, New York 10022.





IF CHGCODE = 12 MOVE NRDEPENDENTS TO

Computer Sciences Institute

look ahead

THE CASE OF THE CREEPING ASCII

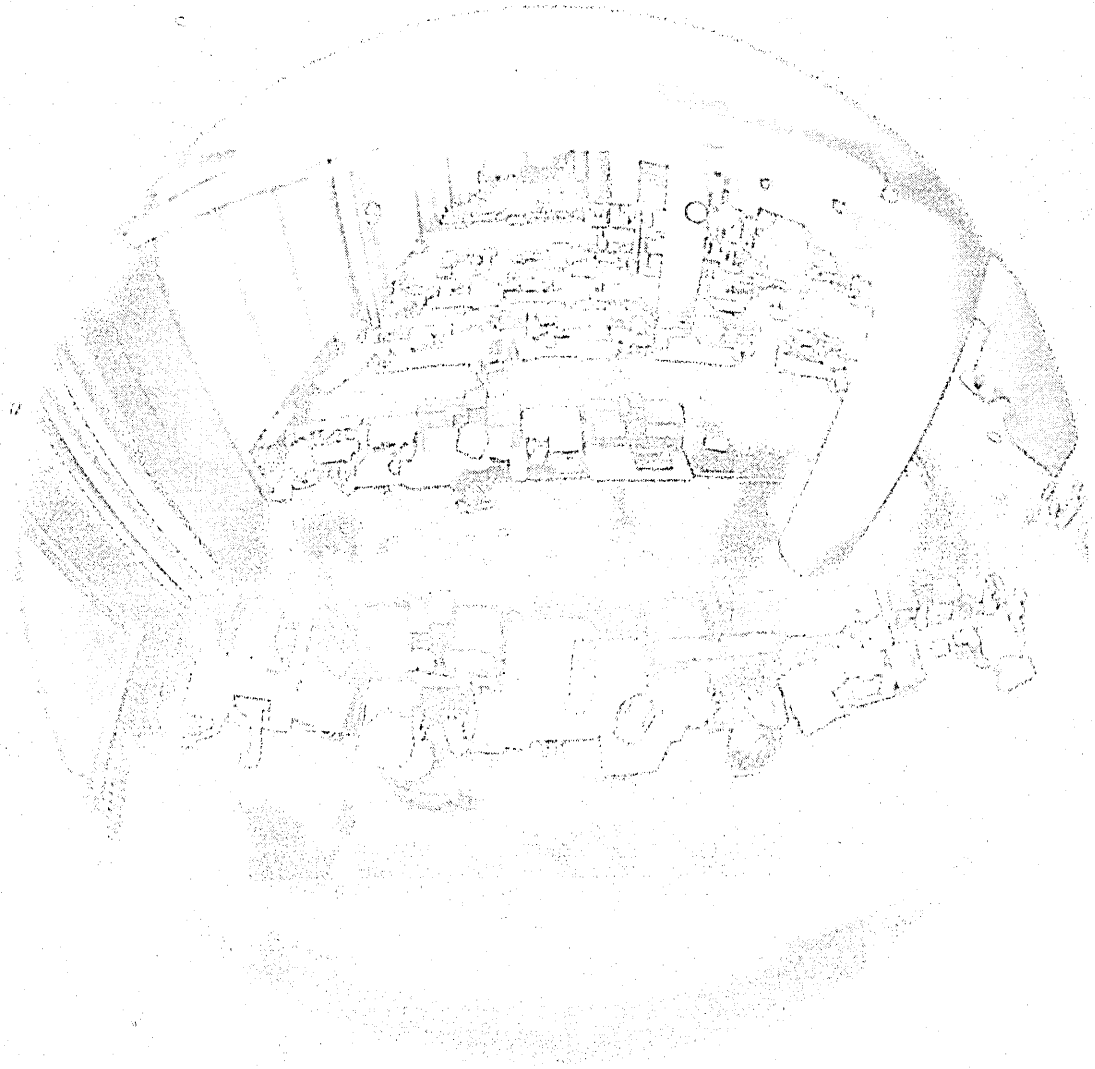
Now that the Feds have adopted ASCII as a standard (see April, p. 153), NBS wants to extend the domain of that code to installation files.

NBS wants a forthcoming letter which will explain how the standard is to be implemented to recommend that any federal installation planning interchange of information and planning a conversion should also plan to set up files in ASCII.

Answering fears that the federal standard will force manufacturers to an internal ASCII code, the Budget Bureau says it won't tell makers how to design their equipment. Another fed source thinks that growth of communications networks will force the industry to develop internal operating systems that are "directly or indirectly compatible. Code-insensitive cpu's, which may appear in the 4th generation, would be another answer," says he.

RUMORS AND RAW RANDOM DATA

The name of Tom Rowan's new mystery software house announced in these pages last month (p. 17): EDP Technology, Inc. . . . Time-sharing afficionados are wondering if IBM really will announce a new t-s system rumored to be the 58. Reason is a black box (hardware and software) called the hyperviser, which will partition main memory into two equal sections: one for OS and one for another control system such as time-sharing. So far it only works with a 512K memory on model 65 and up. . . . Troubles with Scientific Data Systems 940 time-sharing software have sent customers scurrying for help to commercial time-sharing service bureaus using the 940. They're also trying to make their own improvements, which they are not making available to SDS. . . . Look for Burroughs and RCA to announce PL/I compilers this year. . . . We hear RCA is readying a new system the size of the unheralded 70/15, but with more and better bells and whistles. . . . Communitype Corp. will announce a 9-channel 800 bpi tape drive compatible with the 360 series this summer; it's designed for use in tape-to-tape transmission. They also already have installed 12 of their 100SR data communications systems announced in November and have a 6-month backlog. . . . There's more evidence of Western Union slowing down in its information services efforts. They apparently aren't bidding on the National Association of Securities Dealers job after showing early interest. . . . We hear MAI has plenty of used punched-card equipment if you're looking for a bargain. . . . Another approach to nibbling at IBM's revenue: the maintenance business. RCA Service Corp. is said to be bidding on a job to take care of a nationwide system, terminals and all. . . . Allen-Babcock Computing will offer a Fortran-to-PL/I converter in July. Jim Babcock boldly predicts that the only languages still around in the 1970's will be PL/I and Cobol. . . . Leasing firms, already busy acquiring software houses, are now hot after peripheral makers in such areas as disc drives and packs, tape drives, optical scanners, and other data acquisition and I/O devices. Mac Panel has been approached several times, but opted instead to form Mac Leasing Co., which will buy Mac Panel discs for lease to the end user.



This is an overhead view of overhead Keypunching.

Our service is short, sweet and to the point, eliminate it. Your [illegible] there is a better, faster, more accurate and [illegible] way to feed your computer: the Digitek [illegible]

[illegible]

[illegible] computer.

We are dedicated to solving problems found at interface [illegible] Keypunch [illegible] problem. But if [illegible] account for [illegible] of the total cost of your computer operation [illegible] delays.

[illegible] printed source documents.

Optical Scanning Corporation

[illegible]

Announcing RTS

An honest, yet immodest, look into the nuts-and-bolts of ITT's Reactive Terminal Service, the most advanced computer time-sharing service you can buy. With a handy offer at the end.

---

1 Most time-sharing services offer second generation computers. We have third generation computers. System/360 computers.

2 We offer you more core storage than anyone else. You get 60K bytes of core memory plus four logical work file areas of unrestricted size. Another advantage to remember.

3 How many time-sharing services have O/S compatible FORTRAN-G? One. Us.

4 Input response time at remote terminals averages only 2 to 3 seconds. Which is great for you. Because the faster we are, the less you have to pay. We're the fastest.

5 We have a simple 25 statement command language. Easy to learn, even easier to use. Three steps put our third generation computers to work. 1. Identify. 2. Describe activity. 3. Activate. That's all there is to it.

6 We don't make hardware. So we won't try to sell you hardware.

7 You can have your pick of many terminals. There are Teletypes 33 and 35, the IBM 1050 card/tape reader and punch, and the IBM 2741. Add portable terminals to the list, too.

8 Compilation in FORTRAN is at 1500 statements per minute. You can't beat that.

9 RTS lets you debug your programs on a line by line basis.

10 Nobody can get at your data but you. Your personal identification number and security codes allow only you to use your programs.

11 You have access to ITT's program library, too. Including 350 scientific sub-routines, Linear Programs (40 x 100 matrix), and ECAP (Electronic Circuit Analysis Program).

12 You get unlimited on and off-line data storage in both source and object language.

13 If there's any communications or other hardware malfunction, you won't lose one scrap of data. Our special system checkpoint (we call it 'fail-save') and restart feature maintains your file until you're back on the air.

14 There's no delay at the terminals, either. Our system gathers and buffers information to get all it can out of the I/O channels. Which means you're on the air when you want.

15 You can arrange high-speed printout at a Data Services' center near you. Whenever you want it. And soon you can have printout anywhere you want it.

16 We've set up a simple, yet effective system priority scheduler, too.

17 There are plenty of other reasons our Reactive Terminal Service is so good. Like the backup provided by ITT Data Services' network of centers. And all the new things we're adding to RTS. Things like larger computers and new languages.

18 Now here's the handy offer. We'll give you a personal demonstration of RTS whenever you want. So clip out this coupon, and, by one means or the other, get in touch with us.

RTS Department
ITT Data Services
488 Madison Avenue
New York, New York 10022

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I must know all. Your RTS may be the best invention since the abacus. Please send me your brochure.

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ITT
DATA SERVICES

CIRCLE 84 ON READER CARD

De-bug? Before compiling? Makes sense, doesn't it?

Wouldn't it be nice to have a tool that allows the kind of precompilation analysis that results in a running start into compiling and testing? The kind of tool that would ▪ pinpoint data definition errors ▪ *and* graphically display output formats in their final form ▪ *and* allow desk checking of an accurate and detailed flowchart ▪ *and* flag simple coding errors such as unassigned tags . . .

and the same tool you will use to produce your final documentation package—the ARIES AUTODIAGRAMMER II.

ARIES' new AUTODIAGRAMMER II produces six different outputs (including a paragraph level logic chart) in addition to a detailed flowchart to provide a full range of COBOL documentation, and all with a single pass of your COBOL source deck. (Basic assembly language and/or FORTRAN capabilities are also available.)

This first truly complete documentation package generator can be seen in free demonstration, on your premises, using your hardware, with your source deck—today—all with no obligation to you.

But write today to schedule *your* free demonstration.

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CIRCLE 85 ON READER CARD

new products

service computer

Then Sentry/100 is an on-board service computer, a remote data capture terminal designed to "close the loop" between maintenance management policies and the field use of individual heavy vehicles. The electronic unit has no moving parts; it is a small real-time analog computer which is mounted directly on the vehicle to continuously measure engine operating time and compare this with servicing schedules programmed into the unit. When a vehicle needs service, a light goes on. Between-service intervals are from 50-300 hours; reprogramming can be accomplished by replacing a plug-in component. Checklists of servicing instructions, coordinated with the visual signal, are pre-printed on a set of sequenced cards held in a cartridge within the Sentry/100. The cards provide a hard-copy record of servicing history, and are pre-punched for data processing by a central computer in order to compile status reports, maintenance schedules and statistical analyses. Built-in circuits furnish data on the amount of time a vehicle is operated beyond a prescribed interval, and accumulated total operating time. A readout unit displays overtime or total time accumulations in hours. BISSETT-BERMAN CORP., Santa Monica, Calif. For information:

CIRCLE 177 ON READER CARD

message switching system

The 861/EMS message switching system is designed for a user with "relatively few" Teletype circuits (less than 40 or 50). It can receive, store and forward messages on 2-14 (5-level) half-duplex circuits on multi-station communication networks. It can receive and send messages on any mixture of transmission speeds—at 60, 75, 100 and 150 words per minute. The 861 EMS interfaces directly with existing Teletype line termination equipment. In operation, the stations are polled continuously by sending transmitter start codes (TSC) in a programmed sequence. The polled stations holding messages respond to their TCS. One level of message priority may be provided. Incoming messages are sorted in queue fashion; system programming adjusts the send-receive ratio to maintain optimum queue size. The system can handle up to 14 circuits each with a 4K capacity. TEXAS INSTRUMENTS, INC., Dallas, Tex. For information:

CIRCLE 178 ON READER CARD

credit card service

MIRA (Merchants Instant Response Authorization) is an on-line credit authorization system designed for use in Continental Bank & Trust's credit card charge program. Now being marketed nationally on a service bureau basis, MIRA consists of a system of display units and automatic typewriter stations linked to a 65K 360/50. The system authorizes charge card purchases, answers inquiries, and updates customer status files. As a by-product of the updating, MIRA generates file maintenance records; the information appears on the display or typewriter unit. Continental is also installing an automatic message switching system to distribute calls evenly among the authorization clerks. According to the bank, the system is capable of handling 15,000 calls a day. CONTINENTAL ILLINOIS NATIONAL BANK AND TRUST CO., Chicago, Ill. For information:

CIRCLE 179 ON READER CARD

low-cost program controller

The SPC-12 is a compact stored program controller designed for communication, data processing, and control applications. Although it can function as a general purpose computer, the unit seems better suited to subsystem operation in real-time, on-line communication and telephone line systems.

The basic SPC-12, priced at $6,400, is a binary, parallel, single-address processor with 4,096 words of core and a cycle time of 2.16 usec. It contains three index registers, control panel, real-time clock, priority interrupt control with interrupt line, serial data transmission interface for telephone and Teletype communication, enclosure and power supply.

It has a new design feature called Shared Commands, which the company claims will increase storage efficiency to 30%. The software provided with the unit includes a conversational one-pass assembler system, a basic utility system, and a library of mathematical programs, I/O drivers, and

PRODUCT OF THE MONTH

The 9100A calculator, designed for scientific and engineering work, is capable of computing the full range of trigonometric functions: sin, cos, tan and arcsin, arcos, arctan, in all quadrants, including angular values greater than 360°, in either degrees or radians. It also has an internal extended arithmetic unit which performs computations involving vectors or complex numbers. The conversion from rectangular or polar coordinates or vice versa can be made with a keystroke. Hyperbolic functions are also on the keyboard. The calculator can perform operations on a digit range from 1×10^{-98} to $9.999999999 \times 10^{99}$. The machine has a core memory with a 1.6 usec access time; and a 2 msec cycle time for addition or subtraction operations. A sequence of up to 196 steps can be programmed into the memory; programming is accomplished by setting the calculator to the PROGRAM mode, and pressing the keys (labelled in English and common math symbols) in the desired sequence. Any stored program may be recorded on a small magnetic card; the program can be reentered by inserting the card into a built-in reader. All operations on the calculator are performed in floating-point notation, but numbers may also be displayed in fixed-point. Computation routines are stored in a 32K-bit read-only memory. Small crt display is above keyboard. Deliveries are expected to begin in fall '68. HEWLETT-PACKARD, Palo Alto, Calif. For information:

CIRCLE 180 ON READER CARD

As of now, the economic rules of the game have changed for scientist-engineers, civil engineers, accountants and a couple of other professions we're not quite ready to reveal as yet. The Decade 70 solves problems for businesses or professions with a need for a small computer. Such as: fast (1 μ), cost (low), operator training (about three days), obsolescence (designed out), maintainability (designed in), and profitability (a natural consequence). The scientific user, by the way, may want the processor all by itself (which is O.K. with us). All together now. Revolt!

Decade Computer Corporation
7457 Lorge Circle
Huntington Beach, Calif. 92647

Please send me additional information on the Decade 70.

Name_____

Company_____

Address_____

equipment test and verify programs.

Also available are a generalized real-time monitor that may be tailored to specific applications, and a compatible line of more than 20 functional systems modules to interface the SPC-12 with system hardware. The company estimates that by using multi-function rather than single-purpose modules, the cost of implementing a typical system interface could also be reduced by 30%. AUTOMATION PRODUCTS, Orange, Calif. For information:
CIRCLE 181 ON READER CARD

program display unit

The PD-3 is a program display unit for use with Clary Datacomp Systems model DE-600 digital computer. The PD-3 displays the same algebraic symbols and decimal numbers used in operating and programming the computer; thus, it is not necessary to translate from machine language when using the display to debug programs. The display shows the program step number, the operation being performed, and the memory locations and registers involved. On program steps which include I/O and shifting, the PD-3 displays word-length and decimal-point control data. CLARY DATACOMP SYSTEMS, INC. San Gabriel, Calif. For information:
CIRCLE 182 ON READER CARD

badge reader

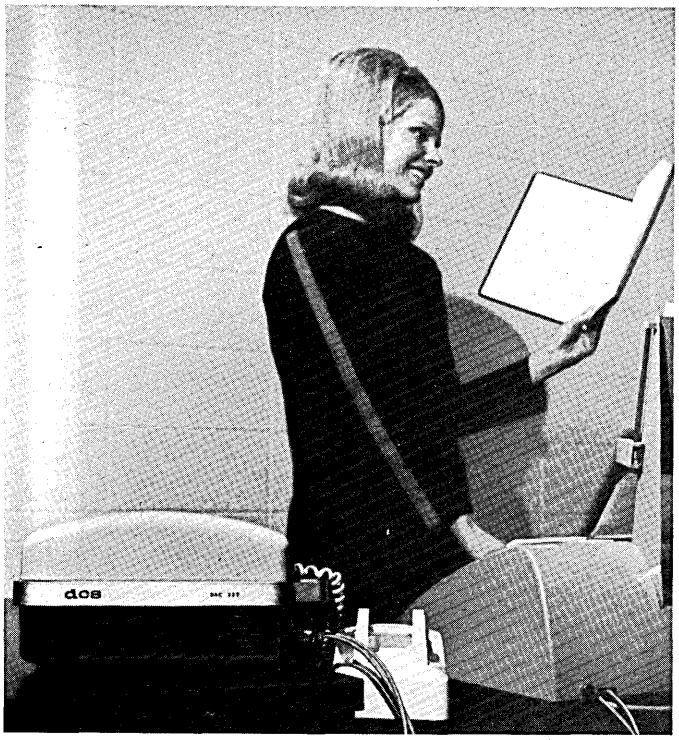
A badge reader has been added to the C-Dek source data entry equipment. The reader accepts standard 22-column identification badges; the information on the badge is read out in any code specified by the user and recorded at a multiplexor. The reader also has error checking and warning capabilities. The basic C-Dek system consists of a modular data entry keyboard and accessories for multiplexing, card data entry, local readout, etc. COLORADO INSTRUMENTS, INC., Broomfield, Colo. For information:
CIRCLE 183 ON READER CARD

mag tape transmission

The T500SR mag tape transmission system will receive and batch mag tape data and translate it to computer-compatible codes recorded on mag tape. It will also send data to mag tape systems located in branch offices at a rate of 1,200 bps. The unit has been specifically designed for use with the company's 100SR data communication system—a system that consists of a double pedestal office desk incorporating a Selectric typewriter, and magnetic tape recording and electronic equipment. The T500SR reads and writes on 7-channel tapes at a density of 556 bps. Its 10½" reels have a capacity of 14 million characters. A 9-channel, 800 bpi version for use with the 360's is currently under development. First deliveries begin this month. COMMUNITYPE CORP., New York, N.Y. For information:
CIRCLE 184 ON READER CARD

chromatographs analyzer

The GasChrom-8 system, based on a PDP-8/I computer, is designed for the analysis of data from multiple gas chromatographs. Besides the computer, GasChrom-8 has a chromatograph interface, conversational software and a Teletype. It is capable of detecting peaks and shoulders, calculating peak areas and peak retention times, allocating overlapping peak areas, correcting baseline drift, and calculating component concentrations. The system also allows parallel operation of a strip chart recorder and atten-



The DAC 337 ACOUSTICAL COUPLER...

to interface a remote terminal for transmission over voice grade communications lines for conversation with a computer

1. **Packaging design and unique filtering circuits gives superior noise rejection.**
2. **An audible check on circuit performance is provided by an assurance speaker with volume control. This also allows for emergency line interrupt.**
3. **Standard EIA (RS232B) interface or readily adaptable to others.**
4. **Only 10"x6"x6" and 5½ lbs with cover and carrying handle for maximum portability.**
5. **No delays waiting for expensive permanent installation.**

dcs

DATA COMMUNICATIONS SYSTEMS, INC. • 4230 CENTRAL AVE. N. E. • MINNEAPOLIS, MINNESOTA 55421 • (612) 788-9295

CIRCLE 87 ON READER CARD

tuation switching. The software, developed by Digital Applications, Inc., includes standard maintenance and assembly programs, as well as programs for the on-line acquisition and analysis of data. A 32K word disc memory is also a part of the basic system. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 176 ON READER CARD

file and report software

Two new versions of the SCORE (Selection, COpy and REporting) system are for the Spectra 70 and Honeywell 200 computer series. SCORE uses nonprocedural language and requires no knowledge of programming logic. The "Select" options allow searching of the input file for any parameter; "Reporting" options allow for up to nine lines of heading information, unlimited editing capability, and control breaks on up to five control fields. Copy options provide for copying of either selected or complete input records. PROGRAMMING METHODS, INC., New York, N.Y. For information:

CIRCLE 185 ON READER CARD

portable data recorder

IBM Information Recorder 3000 is a portable information recorder that can be adapted on site for direct entry of data to a computer by changing the format of an overlay attached to its top and using a stylus to punch through the proper opening. Prices range from $90 to $153 depending on options. IBM, Princeton, N.J. For information:

CIRCLE 186 ON READER CARD

plotter

The 6030-XY coordinate plotter operates on-line at speeds up to 10"/second, or off-line from punched-card, paper tape or mag tape input. Each coordinate with its sign is displayed in 5-digit configuration (with the operation being performed and the internal function position of the program director) on the front panel. The plotter is capable of straight line drawing at .001" increments with replaceable printed circuit boards; the control electronics, coordinate display and operator controls are housed in the one-piece table that offers a 40" x 60" drafting area. Features include a choice of three formats: standard, machine tool and FORTRAN; manual input and manual slew controls. AUTOTROL CORP., Arvada, Colo. For information:

CIRCLE 187 ON READER CARD

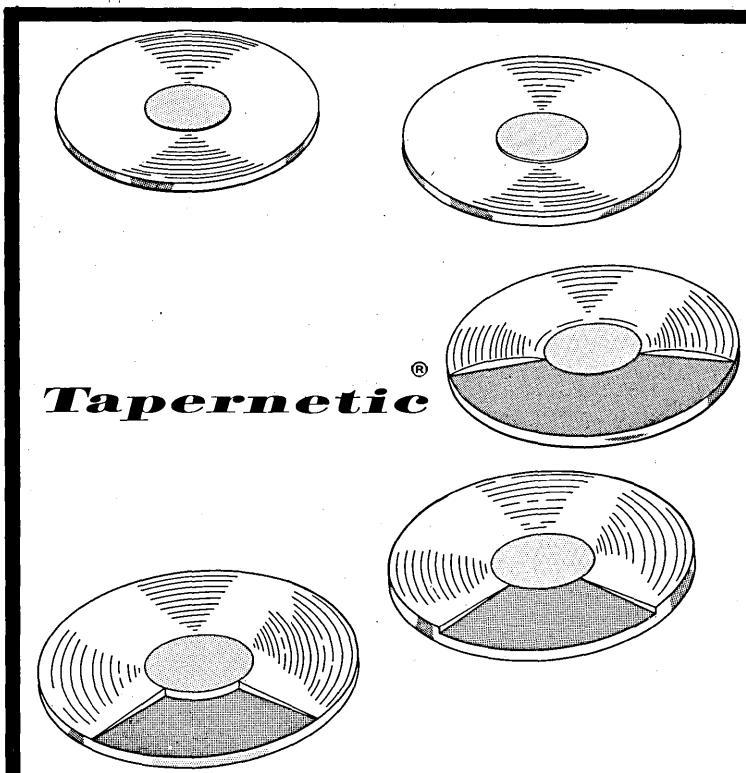
modified computer

The DDP-516 computer, a 4K (16-bit) word system with a cycle time of 960 nsec, has been "ruggedized" for use in military environments, such as aircraft, shipboard or van-mounted applications. Internal bracing has been added to secure logic cards in tilt-out drawers; the control panel is an integral part of the cabinet assembly; and a blower system inside maintains a positive internal pressure. Operating temperatures range from 0° to 50° C; humidity levels, up to 100%. All maintenance can be performed from the front of the computer. MTBF is 4,000 hours. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 188 ON READER CARD

logic trainer

Computer Lab is a device for teaching computer logic; it comes with a 10-experiment workbook (approximately 50 hours of laboratory training). The Lab



Tapernetic®

Available for the first time, through a revolutionary new process, a tapered magnetic film for use in rotating memory equipment.

The Tapernetic® Film, processed by Consolidated Technology, Inc., gives the design engineer a new parameter in controlling resolution and head output over the recording band from the outer to the inner diameter. Coercivities ranging from 100 to 700 oersteds with a plating tolerance of 5% are available, and should different coercivities on the same disk be desired it can be provided.

Superfinishing of the disk substrate to better than ½ fringe is accomplished by a proprietary lapping technique and diameters up to 24 inches are presently in production. Larger diameters handled on request.

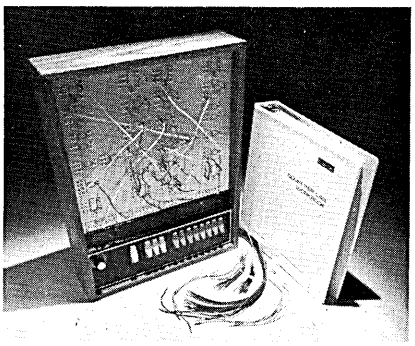
For information call or write:
Charles J. Miller, Vice President

CTI

CONSOLIDATED TECHNOLOGY, INC. DEPT. D58
3005 WEST FAIRMONT, PHOENIX, ARIZONA 85017 (602) 264-0231

CIRCLE 88 ON READER CARD

takes the student through four general levels of computer fundamentals: logic gate operation; counters, equality detectors and shift registers construction;



digital subsystems (such as adders, code converters and BCD counters); and actual problems of computer design. The Computer Lab panel has 18 NAND gates, four AND-NOR gate combinations, eight J-K flip-flops, and a variable-frequency clock. It also includes one 8-bit switch register, eight indicator lights and three manual pulser switches. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 189 ON READER CARD

flexible 3-d core memory

The Model 3DM-750 core memory is expandable in both number of words and word size. With a 3-D configuration and 750 nsec cycle time, the unit capacity can be altered by addition or delection of circuit cards. Word size varies from 4 to 40 bits and words from 4K to 16K. By adding modules, word capacity can be increased to 64K. The 3DM-750 is 5.25 inches high and fits into a standard 19-inch rack. It can be delivered with an optional power supply and memory tester, both the same size. Price range is from $12,000 to $250,000 and deliveries will begin in September. AMPEX COMPUTER PRODUCTS DIV., Culver City, Calif. For information:

CIRCLE 190 ON READER CARD

microfiche reader

Two models of microfiche readers are for viewing microfiche and jacket cards. Microfiche to be viewed are inserted between two glass flats of the holder; positioned stops aid in proper positioning and alignment. The readers accommodate microfiche and jacket cards measuring 3″ x 5″, 4″ x 6″, and 6″ x 4″, and all other sizes up to 6″ x 6″. The two models, 4315-19 and 4315-25, differ only in image magnification (19X or 25X) as indicated in the model numbers. The 21-pound units measure 11¾″ x 15¼″ x 23½″, and sell for $162. EUGENE DIETZGEN CO., Chicago, Ill. For information:

CIRCLE 191 ON READER CARD

paper tape punch

Model 1560 operates asynchronously at rates up to 60 characters per second and records data in 5- through 8-level code. Unit features in-line tape loading, solenoids requiring no lubrication, and is available in four package styles. Optional are tape supply reel and take-up winder. DIGITRONICS CORP., Albertson, Long Island, New York. For information:

CIRCLE 192 ON READER CARD

mag tape system

The TS-8 magnetic tape system is for use on the PDP-8, -8S and -8I computers. IBM-compatible, the units are available in 7- or 9-track versions, with packing densities of 200, 556 or 800 bpi. Standard 6″ or 7″ reels are accommodated. Supporting software—including read, write and control routines, and hardware diagnostic programs—is supplied with the unit. INFOTEC, INC., Rye, N.Y. For information:

CIRCLE 193 ON READER CARD

desk-top tabulators

The Rolltec 175 and Rolltec 180 tabulators have particular application in inventory control, batch balancing, payroll balancing, accounts receivable balancing, monthly billings, and time-plan payments. The Rolltec 180 adds, subtracts, subtotals, and totals any required information punched on standard 80-, 51-, or 22-column punch cards. It processes at 150 cpm, and holds 450 cards in the delivery hopper. Information from the cards is printed onto 2¼″ tape; printout is 10-digits list, 11-digits total. Rolltec 175 offers a comparing mode in addition to features listed for 180. It provides progressive subtotals or totals from selected groups in a stack of punched cards by comparing a set of digits punched on the cards. ROLLIN MANUFACTURING, INC., South San Francisco, Calif. For information:

CIRCLE 194 ON READER CARD

file maintenance software

Data I is a software package designed for use with IBM 360's and RCA Spectra 70's to reduce file maintenance programming costs and to eliminate one-time programs for data and file manipulation. It can update tape or disc files from cards, tapes or discs in any format, and can also generate tape, disc or card files. Data I requires a 64K core, and the company says it will operate under DOS with any combination of disc and tape I/O. Immediately available. ATLANTIC SOFTWARE, INC., Philadelphia, Pa. For information:

CIRCLE 195 ON READER CARD

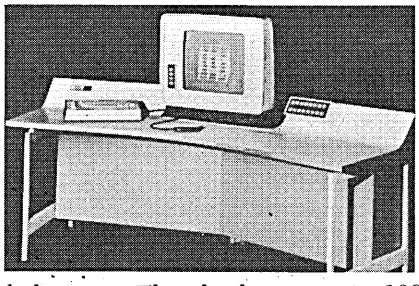
mass storage units

Digital Equipment's DECtape and DECdisc are now being sold as separate units, for use in any computer system, or for special data handling systems which may not include a computer. However, necessary interfacing, when required, must be developed by the user. The DECtape TU55 magnetic tape transport uses 3½″ reels with a 3 million bit capacity on 260′ of tape; recording density is 350 bpi; tape speed is 97 ips. The DS32 disc file has a total capacity of over 425K bits, organized into 32K (13-bit) words on 16 data tracks. Transfer rate is 66 usec; average access time is 16.67 msec. Delivery is 90 days ARO. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 196 ON READER CARD

display

The 7580 graphic display unit, for use with the Sigma 5 and 7 computer systems, consists of a 21″ crt, four display generators, a 64-character alphanumeric keyborad, 16-character function keyboard, four action switches and

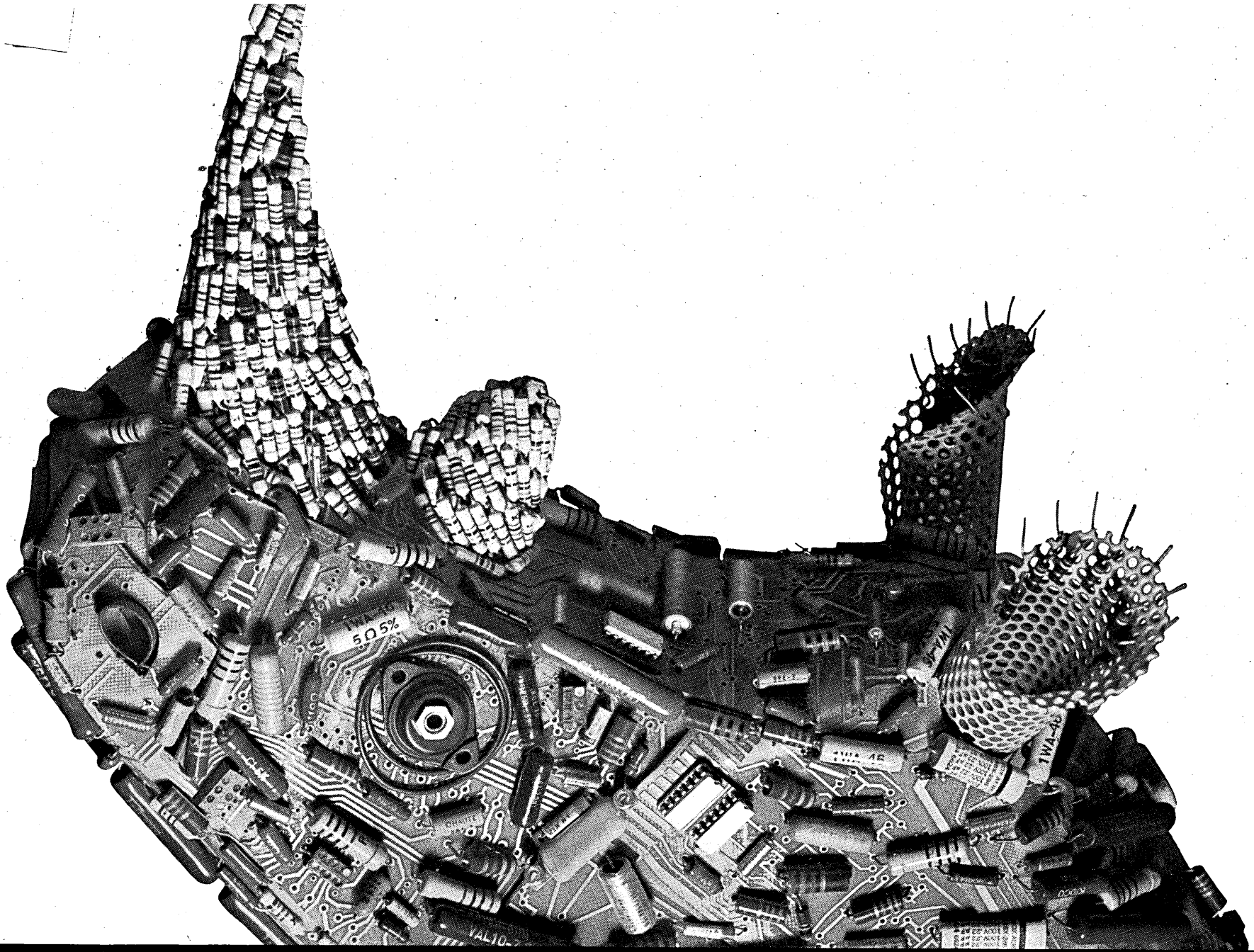


light pen. The display area is 100 square inches, accommodating 1,024 divisions along both the x and y axes. Within the 10″ x 10″ work area, resolution is 0.01″; plotting rates exceed 140,000 points a second. The display is scheduled for delivery in mid-'68. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For information:

CIRCLE 197 ON READER CARD

reel container

The Tiltshelf Reel Box is made of heavy-duty, waterproof corrugated board; it can be used as a reel rack, shipping module or a storage device for computer tape. Two models offer either 8- or 12-reel capacity; the standard size holds 2400′ reels of ½″ or 1″


5Ω 5%

Just when you think you've picked the right computer, Honeywell butts in.

As long as you pick a "third-generation" computer, you're all right, right?

Not necessarily.

You see, different computer companies have different ideas about what a "third-generation" computer is. We have one idea; they have another. And you should know the difference.

We think a third-generation computer should have integrated circuits. It should be able to do several operations at the same time. And communicate with remote locations.

It should be easy to program, easy to use. A computer that's unnecessarily complex takes people that are unnecessarily expensive to run it.

It should be part of a compatible family of computers. So you can grow without a lot of costly re-programming and re-training.

It should convert your second-generation programs to third-generation programs easily — not just run your old programs the way your old computer did.

All in all, a third-generation computer should give you *more useable computing power per dollar* than you could ever get before.

Do we seem to come on awfully strong about all this?

Maybe so. But if we didn't, we couldn't very well sign this ad the way we do...

The Other Computer Company: Honeywell

CIRCLE 91 ON READER CARD

new products

tape; a slim canister holds ½" tape only. The reels are placed in the box in a removable tray. RECORD SERVICE CENTER, Houston, Tex. For information:

CIRCLE 198 ON READER CARD

paper tape reader

Model 2060 reads any EIA standard 5-channel to 8-channel punched paper tape and operates at speeds up to 60 characters per second. Drive features solenoids that require no lubrication. A tape handler for feeding and collecting tape is optional. DIGITRONICS CORP., Albertson, Long Island, N.Y. For information:

CIRCLE 199 ON READER CARD

opinion polls software

Tally is a software package that tallies, cross-correlates, and reports answers to statistical surveys and opinion polls. On a single pass through a 360, an unlimited number of responses—each containing 1,920 data points—reportedly can be processed. The company says the number of cross-correlations is limited only by core storage; at least 64K is required, plus DOS. The responses can be recorded initially on Porta-Punch cards and then either input directly through a binary card reader or transferred to mag tape. Responses containing 50 data sets can be processed at a speed of 1,000/min. APPLIED DATA RESEARCH, Princeton, N.J. For information:

CIRCLE 200 ON READER CARD

drum memory system

Model 8401 is the first in a series of head-per-track memory systems and is priced under $1,000. It offers expandable data storage capabilities from 5K to 500K bits, with 8.5 msec average access time. MAGNAFILE, INC., Phoenix, Ariz. For information:

CIRCLE 201 ON READER CARD

jovial compiler

A JOVIAL compiler, fully integrated with OS/360, operates on 360 models 40, 50 and 65 and provides capability to use the full OS/360 library as well as the JOVIAL library. Now being marketed, this compiler was adapted under contract to the Defense Communications Agency for use by the National Military Command System Support Center, where it is now operational. It allows automatic interraction with non-JOVIAL routines, and is a compatible subset of the Air Force programming language (JOVIAL J3). SYSTEM DEVELOPMENT CORP., Santa Monica, Calif. For information:

CIRCLE 202 ON READER CARD

fire vault

The Data-Bank fire vault carries the Underwriter Laboratories' 150° two-hour label for storage of edp records, and will hold interior temperature and humidity "well below" the 150° F, 85% R. H. limit. Internal storage configurations are available for tape in tape-seal belts, tape in canisters, or 4" and 6" disc packs. WRIGHT LINE, Worcester, Mass. For information:

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PERT, information retrieval, and systems planning. Sponsored by the Systems and Procedures Assn., the course is authored by Richard C. Rawlings, coordinating director of North American Institute. NORTH AMERICAN INSTITUTE OF SYSTEMS AND PROCEDURES, Newport Beach, Calif. For information:

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computer room cooling

A 15-ton EDPAC (Electronic Data Processing Air Conditioning) system is offered in four system types: closed circuit, water cooled, air cooled and chilled water. It has been designed, according to the company, to "meet the exact requirement of dp rooms for accurate control of temperature, humidity and air distribution." The system also includes an Everclean Humidifier which facilitates humidifier scale removal. A. C. MANUFACTURING CO., Haddonfield, N.J. For information:

CIRCLE 205 ON READER CARD

increased memory capacity

An increase in bit capacity in the Braid-Pak read-only transformer memory systems has been announced. The LBS series of braided memories offers bit capacity from 32K to 262K; NDRO cycle time of 33 nsec; and access time is 250 nsec. The buffered I/O is compatible with DTL/TTL levels. Operating temperature is 0°C to +50° C. Options include output data register, sequential address counter, interface level shifters and power supplies. Prices start at $2,500 for the 32K bit capacity. Delivery is 60-90 days ARO. MEMORY TECHNOLOGY, INC., Waltham, Mass. For information:

CIRCLE 206 ON READER CARD

teletype carrying case

The TC-1 Teletype carrying case houses the mod 33 KSR Teletype (TC-2 is made to handle the ASR version). Both have handles at each end and in the middle; a set of four wheels is optional. With cover removed, the Teletypewriter can be operated without removing it from the case. The cases can also be supplied with a connection cable to the company's portable acoustic data coupler; with the Teletype and the coupler, the case can be used as a portable remote terminal. ANDERSON JACOBSON, INC., Mountain View, Calif. For information:

CIRCLE 207 ON READER CARD

paper tape reader

The 1282 paper tape reader reads 8-level 1" paper or mylar tape; other models are available for 5-, 6- and 7-level narrow tapes. The unit offers positive interrogation of tapes, including ones that are damaged or exceed tolerances. Tape is advanced and sensed at up to 30 cps asynchronously. The 4" × 3¾" × 1½" size of the reader permits it to be mounted on the same plane as the tape spools; no separate mounting plate or rear mounted driving motors are necessary. NAVIGATION COMPUTER CORP. Norristown, Pa. For information:

CIRCLE 208 ON READER CARD

micr reader/sorter

The 232 MICR reader/sorter for banks can be operated as a free-standing unit or on-line to any Honeywell series 200 cpu. The unit reads documents at speeds up to 600 a minute, and sorts them into 11 different pockets (10 accept and one reject). The input hopper has a capacity of 1,750 documents; each sort pocket holds up to 225. Precoded accounting packages available are demand deposit, savings, mortgage loan, improvement loan and installment loan. The reader/sorter will be

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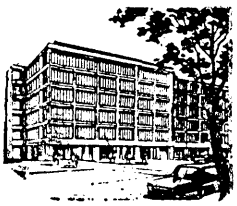

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CIRCLE 209 ON READER CARD

tape readers

The model 110 tape reader reads all standard 11/16" to 1" paper and mylar 5-, 6-, 7- and 8-level tapes. The 19" × 14" × 9" unit operates at a speed of 110 cps, reading bi-directionally. The smaller (19" × 4" × 9") model 110A also differs by having no reels; the 110 accommodates 5½", 6½", 7½" and 8½" reels. Both units use a photoelectric read head; tape moves through the head by means of a constant velocity capstan drive. STAR PARTS CO., So. Hackensack, N.J. For information:

CIRCLE 210 ON READER CARD

data recorder

The model HM is a digital or analog data recorder that occupies 830 cubic inches of space; the unit can handle tape reels up to 2300 feet in length and either 0.5 or 1.0 inches wide. Flutter content is less than 0.9% p-p (within 2 limits) over a bandwidth of 0.2 to 10,000 Hz at 30 ips speed. By using an auxiliary ground playback set, the recorder may be used as a sealed cartridge, eliminating the necessity for opening the unit and possibly contaminating the tape. The recorder meets the requirements of MIL-E-5400, MIL-STD-704 and MIL-T-5422. KINELOGIC CORP., Pasadena, Calif. For information:

CIRCLE 211 ON READER CARD

data acquisition

The 2021 data acquisition system includes, in its basic "A" configuration, a scanner, digital voltmeter and digital recorder. The scanner connects up to 200 three-wire inputs to the voltmeter for measurement, one at a time. Over 14 channels a second can be scanned and recorded with five-digit resolution plus sixth-digit overrrange and 152 dB suppression of 60 Hz common mode interference. The 2021B model uses an output coupler which interfaces the voltmeter to recording devices such as mag tape recorders, teleprinters, electric typewriters, and card and tape punches, as well as the digital recorder. The coupler can operate another recording device simultaneously with the digital recorder. Deliveries are scheduled for about eight weeks after receipt of order. HEWLETT PACKARD, Palo Alto, Calif. For information:

CIRCLE 212 ON READER CARD

paper tape digitizer

The 303P paper tape digitizer is for reducing analog graphical data to punched paper tape for computer processing and analysis. The unit has computer-compatible paper tape output, and the Variable Interval Programmed (VIP) digitizing method, which stores the movements of the operator's manual tracing styles, and outputs them as often as the paper tape punch is free to accept them CALMA CO., Santa Clara, Calif. For information:

CIRCLE 213 ON READER CARD

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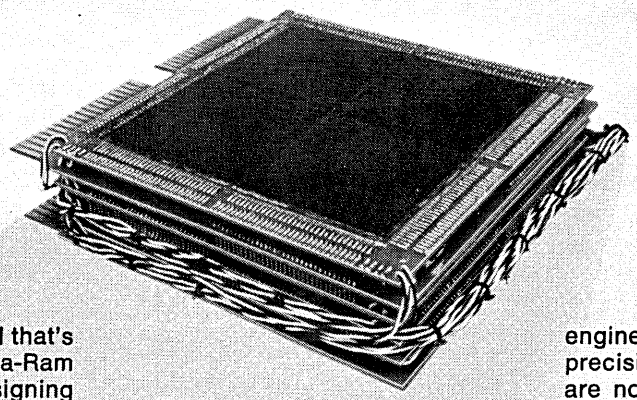

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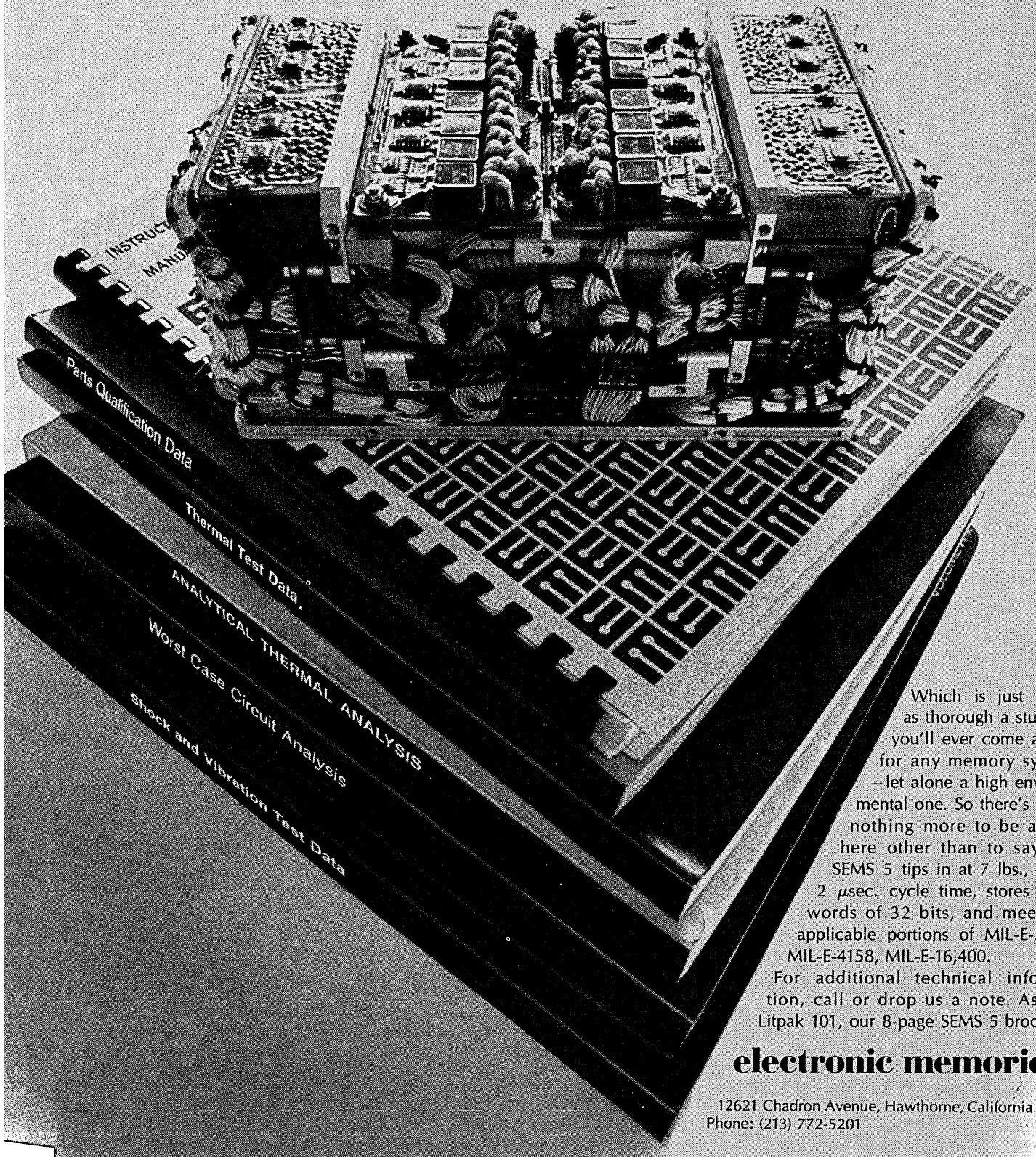

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new literature

TIME-SHARING LANGUAGES: Users' manuals describe two conversational languages for use on a direct-access time-sharing computer. The first is a matrix manipulation language; the second is designed to simulate linear dynamic systems and to solve the associated Riccati equations. AD-664 221. 53 pages. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

CIRCLE 215 ON READER CARD

OPERATING RATIOS SURVEY: Statistical report is the result of a service bureau survey conducted in late 1967 denoting size of operation, type of operation, and type of equipment used in relationship to sources of revenue, total revenue and operating expenses in an effort to determine measurements for profit and loss. Cost: $15. ADAPSO, 420 Lexington Ave., New York, N.Y. 10017.

CIRCLE 216 ON READER CARD

INFORMATION RETRIEVAL SYSTEM: 20-page introductory manual describes the first stage of implementation of the basic PDQ information retrieval system, which operates under DOS on IBM 360 (model 30 and larger), requiring a minimum of 24K storage and one disc drive. This product will be fully compatible with the second stage of implementation, which will operate under DOS or OS. The second stage will have on-line and batch processing capabilities, additional retrieval options, and output editing features. APPLIED DATA RESEARCH, Princeton, N.J. For copy:

CIRCLE 217 ON READER CARD

FILM DIRECTORY: 1968 edition lists films and filmstrips available from more than 150 industrial, educational, governmental and other sources, in addition to ISA, each classified by title, description, source, producer, and abstracts of the film's content. The 92-page compilation is organized into eight major interest categories: measurement, analysis, automatic control, computers, nuclear science, aerospace, science and basic scientific principles, and general interest. Cost: $2.75 for ISA members; $3.50 for others. INSTRUMENT SOCIETY OF AMERICA, 530 William Penn Pl., Pittsburgh, Pa. 15219.

POWER PLANT OPERATIONS: 16-page booklet describes PEIR-9 computer-based data acquisition and control system for power plants which is designed to handle monitoring, alarming, data logging, performance calculations and automatic turbine start-up. THE FOXBORO CO., Foxboro, Mass. For copy:

CIRCLE 218 ON READER CARD

CAI: Feasibility study assesses the potential of using advanced training concepts for training flight controllers. Report reviews and analyzes existing CAI systems and determines their applicability to flight controller training, develops functional requirements for an optimum system for flight controller application, specifies functional requirements for an initial system and recommends a design that could function as the initial CAI system, and evaluates costs incurred by programmed instruction to determine if CAI is a cost-effective method of training flight controllers. 445 pages. Cost: $3; microfiche, $.65. N68-13897. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

SYSTEMS MANUAL: 400-page manual for use with the DATA 620/i systems computer contains information on the features and operation of the computer, a system reference, a programming reference, FORTRAN reference and operating instructions, subroutining descriptions, and interface reference. VARIAN DATA MACHINES, Newport Beach, Calif. For copy:

CIRCLE 219 ON READER CARD

MAG TAPE RECORDER: Six-page brochure describes the model 1400 incremental magnetic tape recorder and includes data on the 9-track, 300 bpi, 360-compatible model 1439. DIGI-

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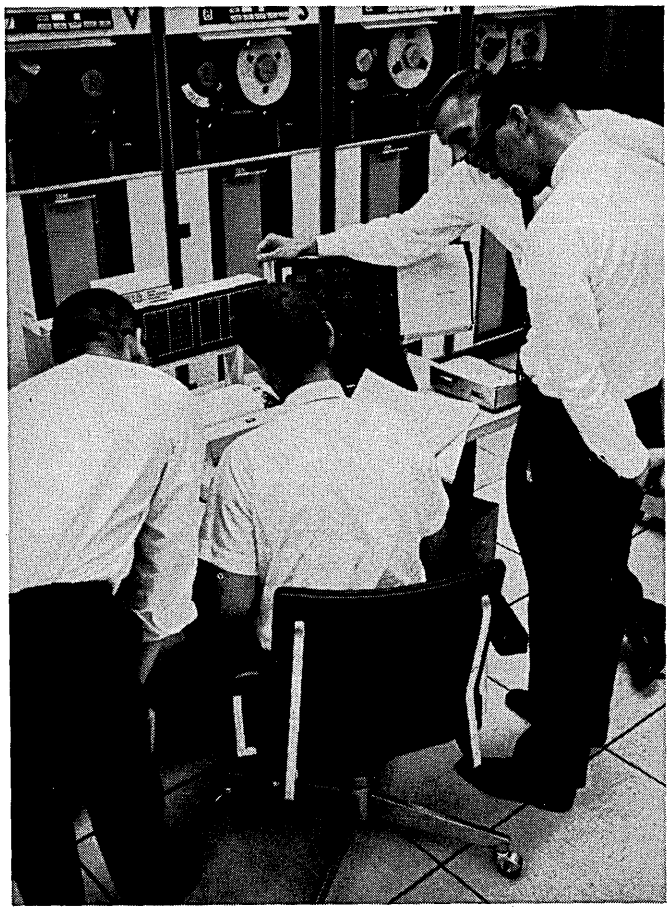

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DATAMATION

new literature

DATA CORP., Bladensburg, Md. For copy:

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STATISTICAL ANALYSIS PROGRAM: Publication describes computer program for performing a statistical distribution analysis using FORTRAN IV linear programming code. The program accepts a given list of data (a column vector of floating point numbers) and provides a plotted output of a histogram and a cumulative frequency diagram of the data. It records 18 statistics on the plot, all calculated from the raw observations. INFOTEC INC., New York, N.Y. For copy:

CIRCLE 221 ON READER CARD

URBAN PROBLEMS: Latest issue of USAGE contains an article on computers and urban problems, including traffic congestion, crime, taxes, air and water pollution. This quarterly publication is available to subscribers on request. COMPUTER USAGE CO., Mt. Kisco, N.Y. For copy:

CIRCLE 222 ON READER CARD

SIMULATION OF ORGANIZATIONS: 61-page report is a compilation of annotated references dealing with simulation of complex social organizations in three principal areas: man-centered simulation, man-machine simulation, and machine-centered simulation. AD-664 861. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

HAPPINESS IS A COMPUTER: Fifty cents will buy you a book of humor devoted entirely to the world that computers have helped to create. MC MOY ASSOCIATES, Box 9163, Washington, D.C. 20023.

DATA SET: 12-page brochure describes 26C data set that processes serialized digital data signals at speeds of 150, 300, 600, 1200, or 2400 bps for transmission over a standard 3 kHz voice channel. The set is particularly suited for one-way or two-way data communications between computers or business machines. LENKURT ELECTRIC CO., San Carlos, Calif. For copy:

CIRCLE 223 ON READER CARD

INFORMATION RETRIEVAL: 26-page brochure describes a computerized system for retrieving infrared spectral data.

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CIRCLE 309 ON READER CARD

new literature

Included is an explanation of the retrieval method used, the nature of infrared prism spectra search systems, and information about other computer systems with which it is compatible. The system reportedly searches 50,000 infrared records in 30 minutes and handles 20 searches simultaneously. Using tapes, larger computer systems can search 50,000 records in less than 3 minutes and handle over 200 searches simultaneously. SADTLER RESEARCH LABORATORIES, Philadelphia, Pa. For copy:

CIRCLE 224 ON READER CARD

ELEVATED FLOORING: 20-page brochure includes specifications, detail drawings, and photographs of the company's line of elevated flooring systems for computer rooms, communication centers, offices, laboratories, and other areas where convenient access to utilities and wiring under the floor is a necessary or desirable design feature. LISKEY ALUMINUM, INC., Glen Burnie, Md. For copy:

CIRCLE 215 ON READER CARD

BUSINESS DP GROUP: Brochure explains objectives and activities of and offers membership in the Special Interest Group on Business Data Processing of the Association for Computing Machinery. ACM, New York, N.Y. For copy:

CIRCLE 225 ON READER CARD

BUFFERED TAPE MEMORIES: Four-page brochure gives description, specifications, and applications of model BTM series of buffered magnetic tape memories. Basic system includes a digital tape recorder, magnetic core memory, control logic, operator control panel, dc power supply, and equipment cabinet. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 226 ON READER CARD

DP LABELS: 16-page catalog lists data processing labels, tags and specialties suitable for printout to be used for addressing, numbering, inventory, etc. ALLEN HOLLANDER CO., Bronx, N.Y. For copy:

CIRCLE 227 ON READER CARD

FEDERAL CHEMICAL INFORMATION SYSTEMS: 134-page report is the result of a survey to collect data regarding: 1) present usage of chemical information and data in the Federal community;

2) techniques and equipment now used in acquisition, storage, retrieval, transmission, and display of information and data; and 3) direction of plans for future chemical information and data services at ongoing systems. PB-177 092. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

DATA COMMUNICATION SYSTEM: Eight-page brochure describes 100SR data communication system which includes Selectric typewriter, Dataphone, steel desk, and magnetic tape cartridge. Optional address memory unit retrieves up to 80,000 characters. Variable length records stored in the removable magnetic tape cartridge can be transmitted in original format to most standard computers, computer-compatible tape drive, or another of the company's units. System requires no leased or private lines and eliminates keypunching. COMMUNITYPE CORP., New York, N.Y. For copy:

CIRCLE 228 ON READER CARD

DISPLAY TERMINAL: Six-page technical brochure describes Data-Screen display terminal which shows both fixed and variable information. Capacity is 128, 200 or 512 characters. Electronic keyboard is optional. TRANSISTOR ELECTRONICS CORP., Minneapolis, Minn. For copy:

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COMPUTER COURSE: Prospectus describes an 8-volume, 20-lesson home study course on the fundamentals of computers, including an introduction to programming. The subscriber can submit his own programs or actual case studies which are run for him on a computer. COMPUTER RESEARCH INST., Riverside, Calif. For copy:

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A/D-D/A CONVERTERS: 28-page brochure describes the company's line of conversion devices from individual conversion circuit cards to complete conversion systems and is illustrated by photographs, curves, schematics and diagrams. Typical converters described include those used in aircraft navigation and control and weapons delivery computer systems, monitoring, camera control, command, data annotation, data processing, and flight management systems. KEARFOTT GROUP, GENERAL PRECISION, Little Falls, N.J. For copy:

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world report

EUROPEAN GOVERNMENTS FIGHT COMPUTER IMPORTS

There has been a hardening of national policies in Continental Europe against importing equipment. The German government is throwing every incentive in to encourage buying in favour of Siemens equipment. A recent sales drive by Honeywell almost petered out as desperate salesmen saw contracts snatched from their grasp. The tales of losses are becoming legion even for the computer industry. In France the story is repeated now that de Gaulle is determined that Plan Calcul should bring at least 25% of the market under national control within five years. But slow development of hardware and software under the CII group, which is an umbrella for French machine companies, is yielding bad forecasts of the cash situation within two years (when returns are expected to show a healthy position). With Gallic perverseness, the originators of Plan Calcul clucked their delight over Bull-GE's success in selling a manufacturing license for the Gamma 140 to the Czechs against British competition. Although mon Generale stormed when GE took over the lumbering Bull Machines, his advisers have great hopes for developing a burgeoning trade to the east in computers.

BURROUGHS GOES AHEAD WITH SCOTLAND PLANT

Following National Cash Register's lead, Burroughs is to start manufacturing computers in Scotland at Glenrothes. $10 million is to be invested in a plant to be delivering its first systems by the second quarter '69. With the exclusion of the B8500, which has defence restrictions tied to it, all the product range will be made. The initial emphasis will go on discs for a hungry European market. Orders worth $25 million are already a near-guarantee for the UK on an OEM basis. The biggest customer is International Computers Ltd., the company formed by Plessey, English Electric and ICT and which comes formally into being in July. Relations between Burroughs and the UK company are certainly cordial. And there is more than a vague suspicion of something in the wind other than an arrangement on discs. ICT has the mammoth Project 51 up its sleeve for providing universities and research centres with a big time-sharer and the specifications have changed to a very Burroughish looking animal.

SOFTWARE HOUSES– COMING AND GOING

The European software house scene is still in a state of flux. In the Netherlands, CEIR NV has been reshaped. It was set up as a joint company between CEIR Inc. and the now wholly-owned subsidiary of British Petroleum, CEIR Ltd. Following the takeover move in the States, Control Data has now acquired CEIR NV completely and CEIR Ltd. is planning a new operation for the Dutch area. In the UK the government has recognized that government software contracts merit first hand attention rather than leaving it to hardware men to subcontract a job as and when. The Swedish house, Data Logic, is spreading its wings with new offices opening this year in Switzerland, Germany, Denmark and Britain.

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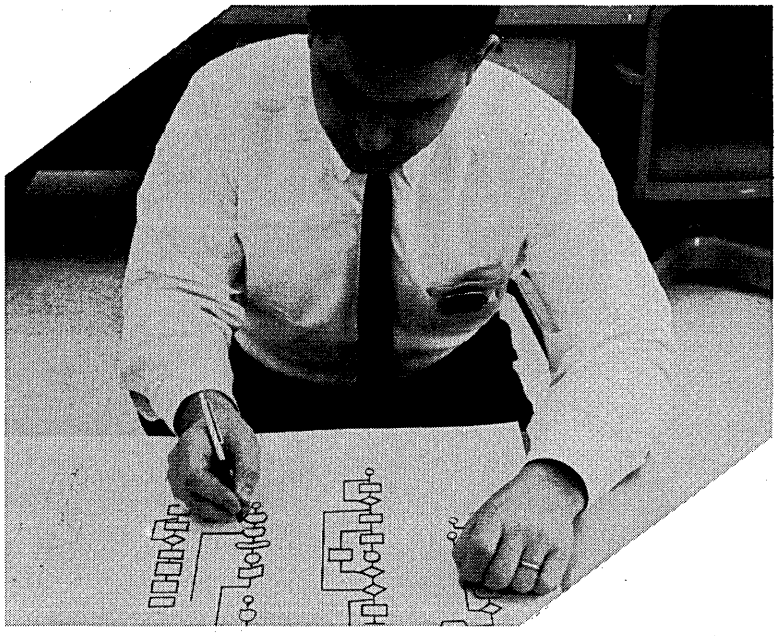

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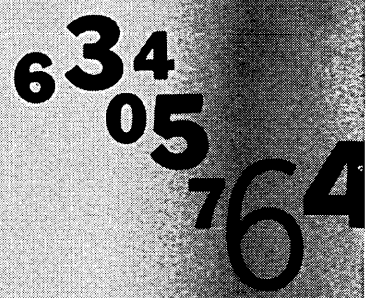

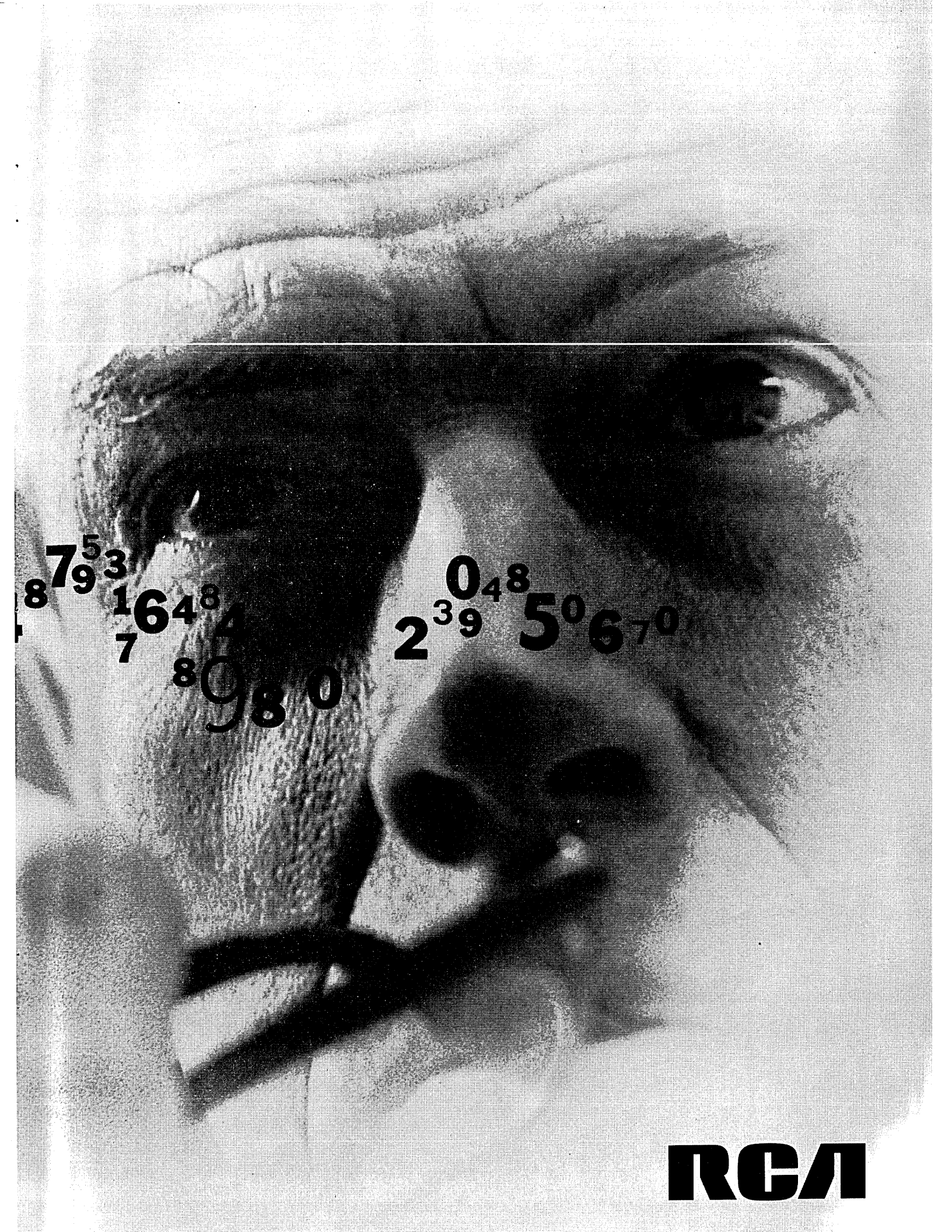
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books

***Computer System Selection—A Management Guide or How to Pick a Computer*, by W. A. Weimer. Business and Real Estate Trends, Inc., Bloomington, Indiana. $12.50.**

This small book of 75 pages pretends to provide management with information which will be helpful in the selection of a computer.

It starts with a five-page management checklist. When answered, this list of 58 questions supposedly gives management an understanding sufficient to make an appropriate decision. Unfortunately, the list is incomplete and many of the questions are shallow in their meaning and unanswerable at computer selection time. As an example, one of the questions asks—"Has sufficient data and program storage been specified?" Asked in that context, it is very difficult to give any reasonable answer that would be helpful to management.

Each of the following 22 sections of the book reviews various aspects of the computer selection process in an attempt, I assume, to answer the checklist questions. Unfortunately, the book falls far short in this attempt. For management of a company which already has a period of experience with computers, the questions and their explanations lack depth and are over-simplified. If the management is taking its first look at computers, the explanations are inadequate and misleading. Let's take as an example the section entitled: "Evaluating the Programming System." It starts by noting that such an evaluation is an imprecise task. Indeed, it certainly would be with this book as the guide. In this 6½ page section, the words FORTRAN, COBOL, etc., are never mentioned. In the appendix these terms are defined, but so vaguely that the reader could not recognize a compiler if he were provided one. In the definition of PL/I, it is noted as having a high degree of programming efficiency, and is superior to most high-level languages. No currently implemented version of PL/I even closely approaches that statement.

This section also states that the most important consideration in the evaluation of a programming system is its power, which in the author's words is synonymous with turnaround time. Turnaround time is then defined as the time period from the beginning of a task to be programmed until the sucessful running of that program in production. This phraseology, while perhaps meaningful, conflicts with other accepted definitions in the computer community. As a result of this type of terminology, this book can only serve to broaden the gap in communication already existing between the computing world and upper management.

Asking similar questions—such as "How clear was the documentation produced by the programming system?"—can only lead inexperienced computing management into total confusion since only a small fraction of documentation is produced in any automatic way from current computer systems. Systems like ADR-Autoflow are excellent, but are not confined to any one system, and in addition represent only a fraction of the total documentation required in most installations.

I can only conclude that even though certain areas in the book may stimulate management thinking in an attempt to understand more fully the various intricacies of the computer selection process, the general result can only raise the noise level in the communication channel between management and computing personnel.

—ROBERT R. BROWN

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book briefs

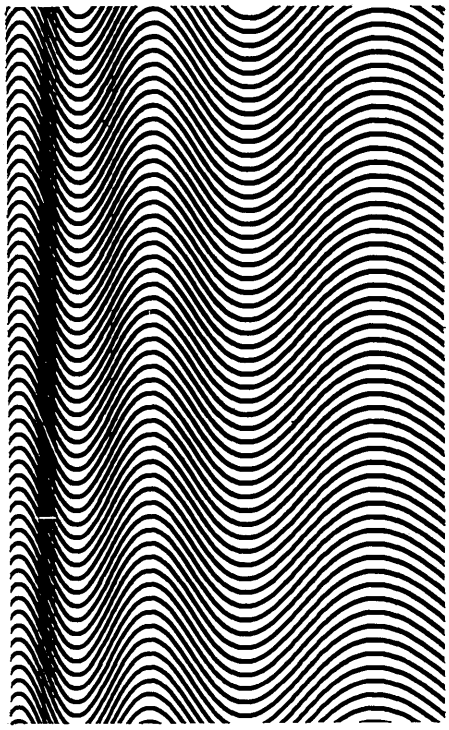
(For further information on the books listed below, please write directly to the publishing company.)

***Punched Card Equipment: Principles and Applications*, by Joseph Levy. McGraw-Hill Book Co., New York, N.Y. 1967. 161 pp. $8.95.**

A simplified explanation of the more common business machines, with operating instructions presented in textbook format: questions and illustrations follow each chapter.

***Proceedings of the Third Australian Computer Conference*, Australian Trade Publications Pty. Ltd., Chippendale, N.S.W. 1966. 530 pp. $7.50.**

Reprints of the papers of 28 sessions and an invited paper by Robert M. Gordon on "Applications and Automatic Systems."



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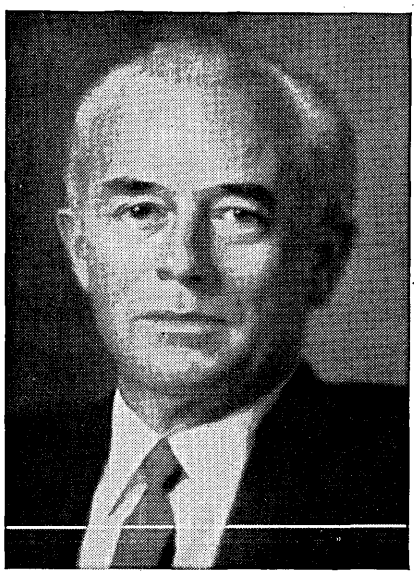

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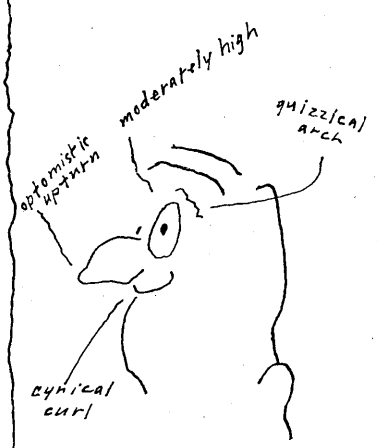

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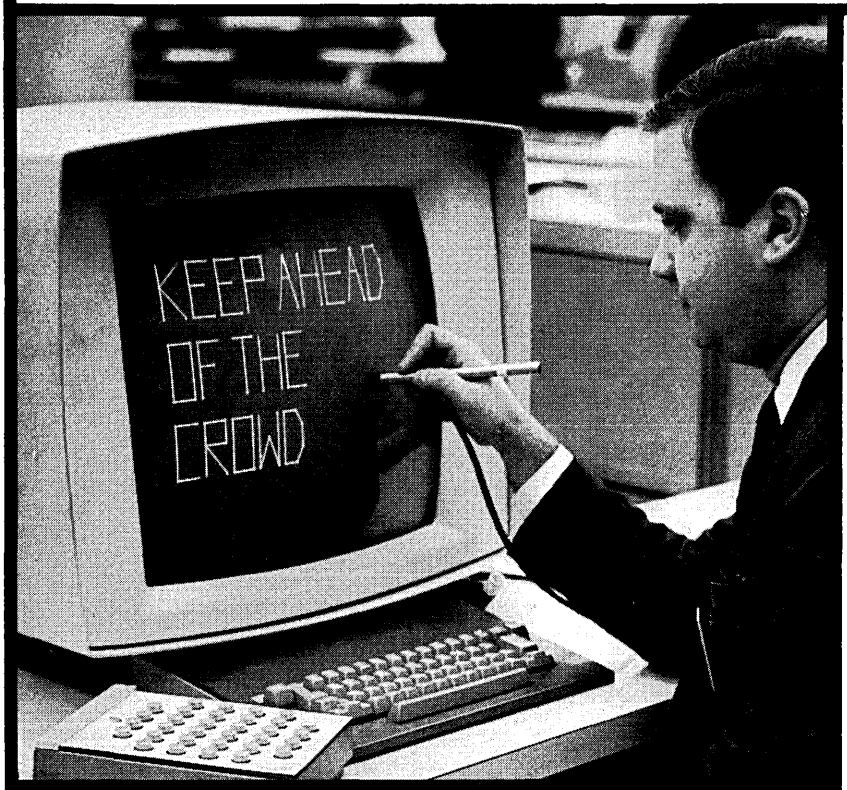

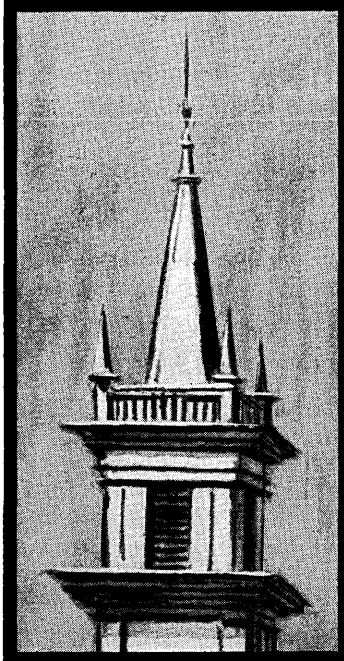

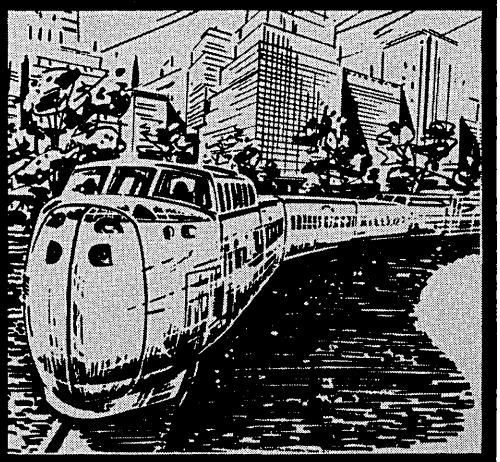

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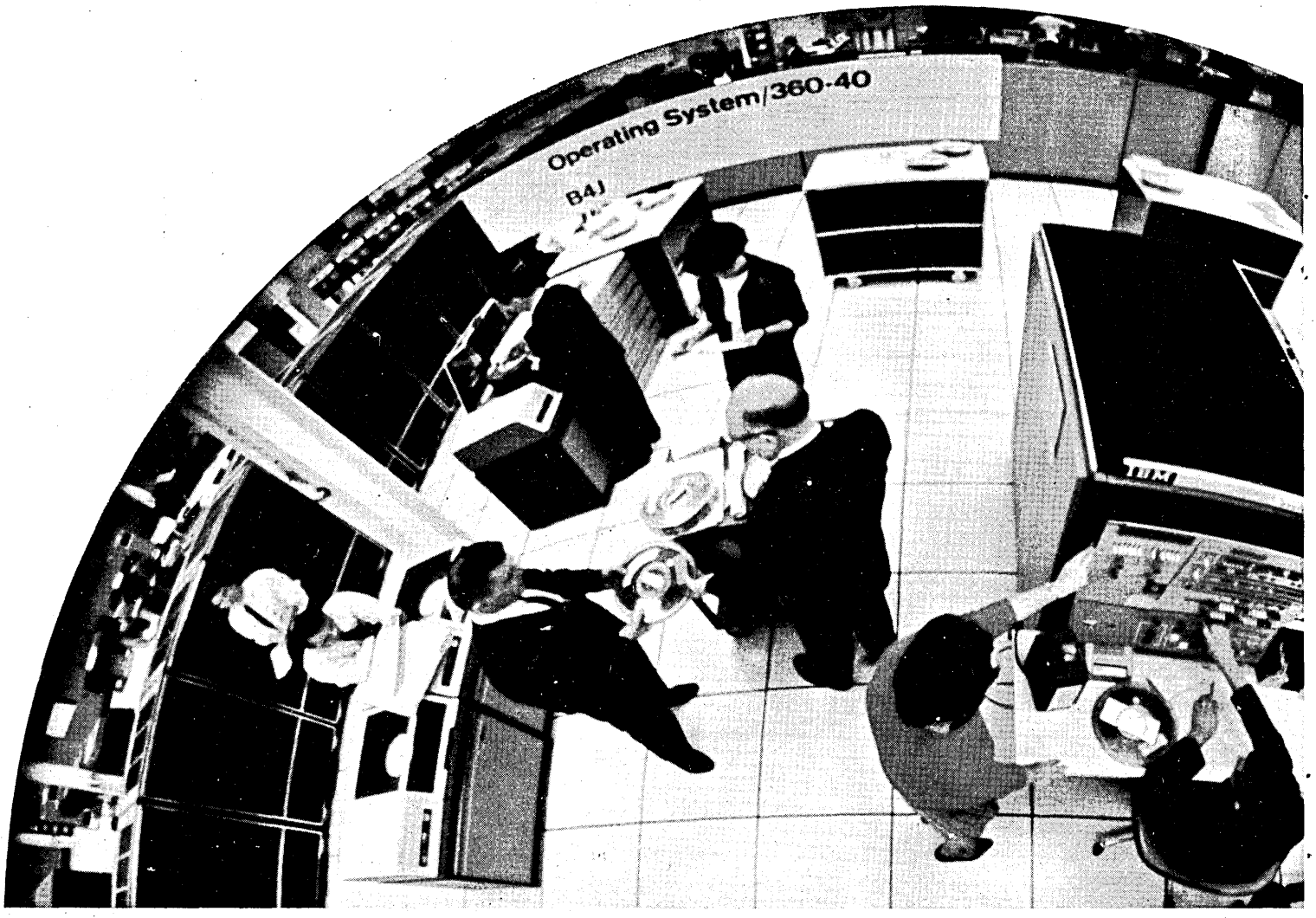

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washington report

COPYRIGHT REVISION OUT FOR THIS YEAR

Senator John McClellan (D., Ark.) has abandoned hope for a general revision of the copyright act this year —he will opt instead for another interim extension of expiring copyrights, the fourth since 1962.

Ripples from the Senator's decision may jar loose legislation to set up a national commission to study new technological problems involving copyrighted material, including use of such material in computer systems. House Judiciary members had been reluctant to act on this proposal—cleared last year by the Senate—until the fate of the general bill became clearer.

Industry and association representatives are generally agreed on the commission idea. Some would like to put a temporary copyright moratorium on new technological uses until the commission's studies are completed. Another suggested amendment would include computer-industry reps in any study panel.

TELPAK RATE INCREASE HELD OFF ONCE MORE

The FCC last month suspended a proposed increase in Telpak C and D rates until Sept. 1st, but warned users that this would be their last reprieve. The commission also authorized a hearing into the justification for the increase. That proceeding promises to be lengthy because one, and probably two, related questions must be answered: whether present Telpak sharing limits should be altered, and whether rates are compensatory.

The immediate question is whether the commission will issue an accounting order between now and next Sept. 1, entitling users to rebates if the proposed increases are rejected. (See related News Brief, p. 94).

ACT WOULD ALLOW LOANING OF KEY EDP MEN

The House probably will pass the Intergovernmental Manpower act this session. It would permit computer technicians and other critical manpower to be switched among the various levels of government. Similar legislation already has Senate approval. Administration confidence that the measure will become law shows up in a $20 million budget request for fiscal '69.

Title III of the bill endorses the temporary assignment—up to two years—of federal technical personnel to state and local governments. Another feature authorizes training fellowships for state and local employees.

CAPITOL BRIEFS

Curtis Fritz, onetime adp manager at the State Dept., who later transferred to the Office of Science and Technology, has set up his own shop in Washington —Information Systems Corp.—with Dave Loeb manning his northeast regional office in Hartford. Loeb was formerly with United Aircraft . . . Sen. Gaylord Nelson's bill to liberalize tax loss write-offs for "technologically-oriented small business" has met a stone wall in the Senate Finance Committee; Nelson may now try to work the idea into the patent bill pending in Senate Judiciary . . . The General Accounting Office scolded the FAA last month for purchasing air traffic test equipment from basic systems contractors instead of buying it directly from independent manufacturers. The report emphasizes a possible government policy shift away from committing add-on purchases and maintenance to basic systems suppliers. (See related News Brief, p. 81).

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Reorganizations at Information Management, Inc., San Francisco software house: **Howard Bromberg** moves up to exec. vp; **Sol Pollack** replaces him as vp, plans and programs; and ex-RCA marketeer **Vasco Leitao** joins firm as director, package services. Meanwhile, **Stan Naftaly** and **Mike Cohen** have left IMI to join the staff of **Norman J. Ream,** special assistant to the Secretary of the Navy. . . . **Dr. Lawrence M. Kushner** has replaced **John Eberhard** as director of the Institute of Applied Technology at the National Bureau of Standards. IAT is the home of the Center for Computer Sciences & Technology, headed by **Dr. H.R.J. Grosch.** . . . **Richard E. Monahan** has been elected president and treasurer of Management Methods, Inc., new Cambridge, Mass., computer management consulting firm. . . . **Dr. Ronald L. Wigington**, former division chief in the R&D organization of the National Security Agency, has been named director of research and development for Chemical Abstracts Service, Columbus, Ohio, information arm of the American Chemical Society. . . . Brown Univ.'s new Center for Computer and Information Sciences will be headed by **Dr. Walter F. Freiberger,** director of the Brown computing lab. The center is expected to encourage research in a number of areas in the computer sciences. . . . **Earl Masterson** has been appointed director of the peripheral equipment div. of Honeywell's EDP Div., Waltham, Mass. . . . **James R. Mellor** has been appointed vp and assistant gm of the data systems div. of Litton Industries. He had been vp of advanced programs. . . . **Dr. James Roberts** and **Irv Learman**, both formerly with the medical information systems dept. of TRW, have formed Medical Systems, Inc., L.A.-area software firm specializing in applying computer technology to hospitals and medicine. . . . **Roland R. Eppley, Jr.,** has been elected president of Central Information Processing Corp., a new company formed by Commercial Credit Co. and RCA to establish and operate computer centers in major cities for time-sharing and other dp service. Eppley is president of Commercial Credit Computer Corp. and will continue in that post. . . . **Walter M. Johnson III** has been named president of Computer Usage Education, New York City. **Nate A. Newkirk**, previously manager of data processing education research and planning for IBM World Trade Corp., has been appointed vp and managing director. . . . Recent reorganizations at Systems Engineering Labs, Ft. Lauderdale, have resulted in the following appointments: **Ken Harple,** director of operations; **Bill Landis,** director of finance; **Dallas Talley,** director of marketing. . . . Data Products' new Data Equipment Group, which includes line printers, disc files, card readers and punches, and core memory products, will be headed by **Graham Tyson** as group vice president. **Robert Harlan** is vp, marketing, for the group's OEM Marketing Div. **Robert F. Allen**, former head of sales at Uptime, will become the division's national sales manager. . . . **Emil Valherac,** most recently head of mass memory development for GE computer, is now president of Magnafile, Inc., new Phoenix disc and drum makers. . . . **Saul P. Steinberg,** founder of Leasco Data Processing Equipment Corp., has announced his move to board chairman and chief executive officer and the appointment of **Bernard L. Schwartz** as president and chief operating officer for the company. . . . **Philip N. O'Hara,** former director of computer and communications at the Toronto Stock Exchange, has been appointed assistant vp, Electronic Systems Center of the New York Stock Exchange, where he will head the application system and real time systems divisions. . . . **W. Porter Stone** is president of U.S. Time Sharing, Inc., new Washington, D.C., edp consulting firm. . . . **Dr. M. I. Montana,** formerly vp, has been appointed president of Computer Sciences International, S.A., Brussels, to succeed **Arthur E. Speckhard**, who will join the senior staff at Computer Sciences Div. headquarters in El Segundo, Calif. . . . Standard Computer Corp. has named **Frank W. Keeney** vp, finance and administration. He had been vp and gm of dataStation in New York. . . . **Robert R. White** is now manager/MARK IV system engineering for Informatics. . . . Former director of marketing **George J. Vasilakos** has been named executive

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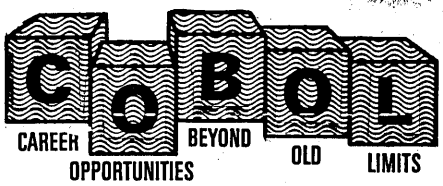

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vp with Information Development Co., Santa Ana, Calif. . . . **Jim Tupac** has been elected president of PRC Computer Center, Inc., McLean, Va., new wholly owned subsidiary of Planning Research Corp. which will provide computing service for all PRC divisions and subsidiaries, as well as some outside service bureau work. Tupac had been with The RAND Corp. for 15 years, the last nine as manager of computer services, and was last year's SHARE president. . . . **Eugene Gertler** has left Ultronic Systems Corp. to join Computer Test Corp., Cherry Hill, N.J., as manager of the company's Dacom Div., which produces communications equipment for the international common carriers and users of time-shared computers with remote terminals. . . . **Carl V. Shannon**, former gm of the data products division of Stromberg-Carlson, San Diego, was named president of Stromberg Datagraphics, Inc., when SC's San Diego facility became a wholly owned subsidiary of General Dynamics last month. **Meade Camp** came from McDonnell Automation to fill the post of director of marketing. **Bob Knapp**, of General Dynamics' New York HQ, will be responsible for Stromberg Datagraphics' activities within the corporate framework. ■

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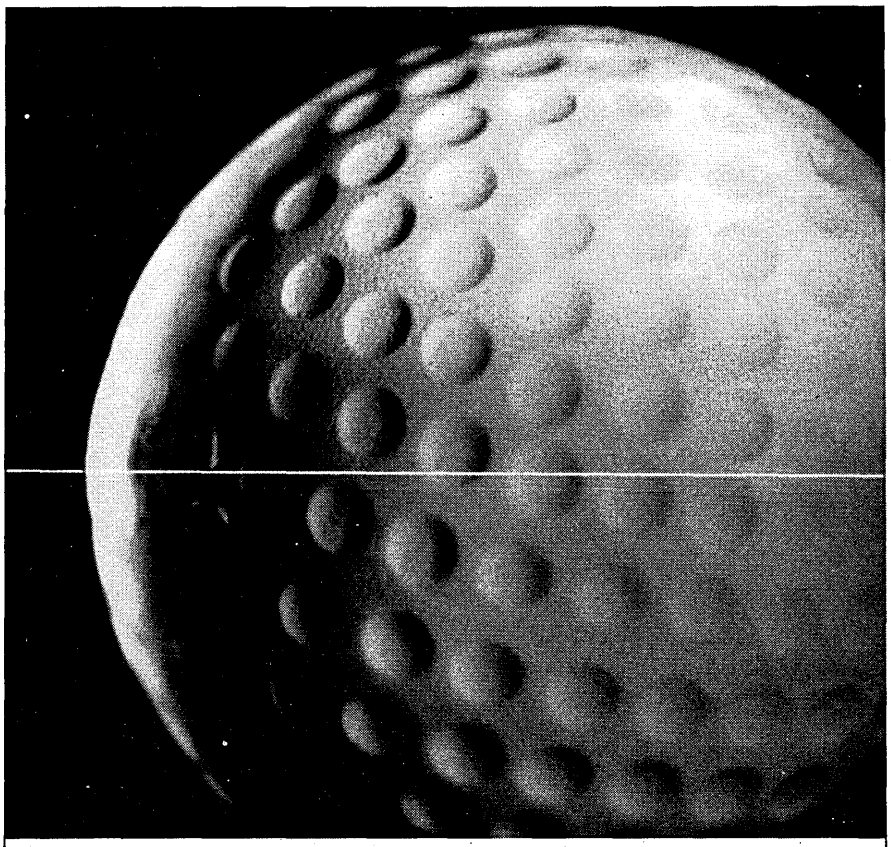

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Noted international consulting firm seeks systems professionals having creative and meaningful experience with advanced equipment in the development of sophisticated Management Information Systems and various commercial applications within the functional areas of planning, accounting, manufacturing, etc. Require above average industrial achievements and capability to project proper professional consulting image in communicating with client company management. Prefer engineering degree plus MBA but flexible to consider other academic disciplines. Age to 38 with starting base salaries to $20,000 — SW, W, MW, and NE.

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NO FEE

The above openings are only a small sampling of the exceptional hardware and software opportunities within the activities of systems design/programming, process control, scientific/commercial applications, etc. as well as marketing. Operations Research, and other associated activities of our client companies in various domestic and international locations — both jr. and sr. positions available. Send resume in confidence or request our resume form. A call to our Houston Director — J. L. Gresham, BChE, MBA — for further information is also invited.

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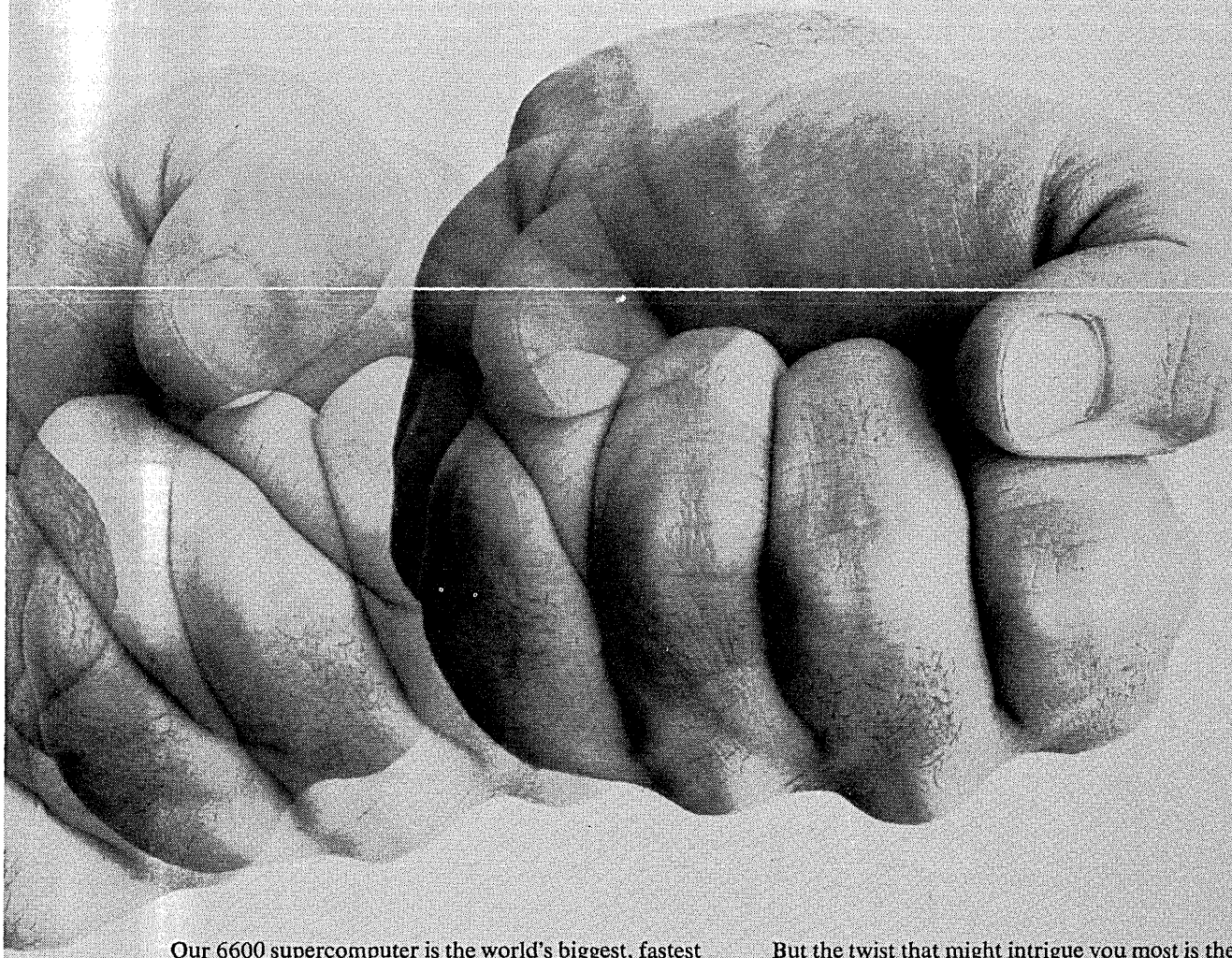

Our 6600 supercomputer is the world's biggest, fastest and most powerful. And it's fully operational. No computer going (or even coming) can touch it. Just as nothing has ever approached the market potential for it.

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CONTROL DATA
CORPORATION

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. . . or improve it. That's what you'll be expected to do at Honeywell's EDP Technology Center. We're responsible for planning, designing and developing computer systems. To perform these responsibilities we need highly motivated programmers and analysts with a desire to prove and improve their state-of-the-art. To prove the importance which we attach to this task, you will find over 20 computers in our Technology Center — computers whose only function is to be at your disposal. Are you ready to improve your career potential?

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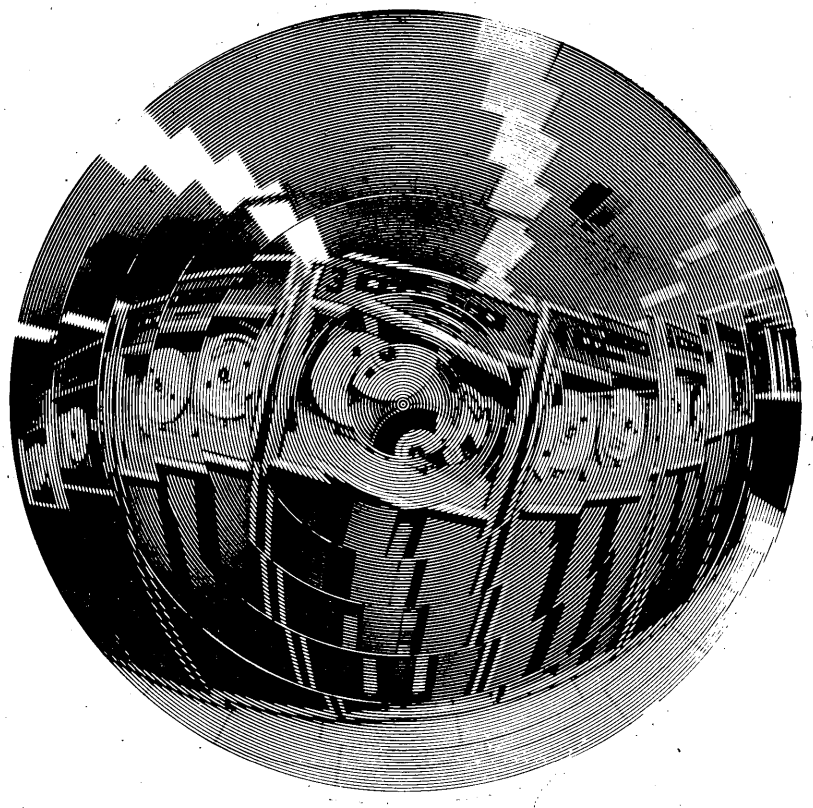

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SYSTEMS ANALYST

Management information systems, production systems, operational control systems and information handling systems need to be conceived, designed and implemented by qualified analysts working out of our corporate administration offices. Some of the qualifications we feel are required for the position to be filled include a minimum of 18 months experience in business systems and procedures as well as a BA or BS degree. The remaining qualifications are intangibles which merit discussion with you, but which include creativeness, aggressiveness, and desire.

PROGRAMMER

A successful computer installation is a direct result of the caliber of people involved with and responsible for its operation. The individuals we feel are qualified to fill the positions currently available in our data processing department must have formal training and 18 months to three years experience. They must also have intangible qualifications which should be discussed but which include creativeness, aggressiveness and desire.

Our compensation program includes a base salary, cash bonus, deferred profit sharing and stock options. Benefits include hospitalization and life insurance. We pay relocation expenses.

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Corporate Employment Manager
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For the professional who realizes the importance of RIGHT TIMING to career development, this is both the RIGHT COMPANY as well as the RIGHT TIME to join us.

For prompt reply, send resume in confidence to:

Mr. Herbert J. Cooke
Director of Personnel

Data Pathing Incorporated
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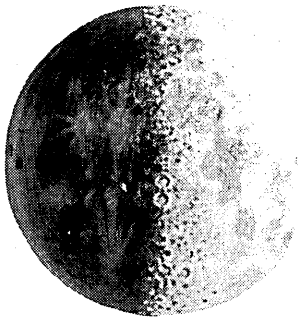
You recognize this, of course,



but have you ever thought how computers can be used to get there and beyond?

Bellcomm, the systems engineering contractor for the National Aeronautics and Space Administration, has openings for imaginative computer specialists interested in contributing to manned spaceflight.

We need people who can:

☐ analyze data processing requirements of advanced missions

☐ determine functional requirements for the next generation of spaceborne computers

☐ study optimal computer organization for reliability (hardware and software)

☐ define computer systems for supporting launch and flight operations of multiple missions

☐ develop management procedures for controlling computer resources

☐ define ground network for distribution of data transmitted from space

☐ evaluate data management systems

☐ determine impact of new programming techniques for all of the above

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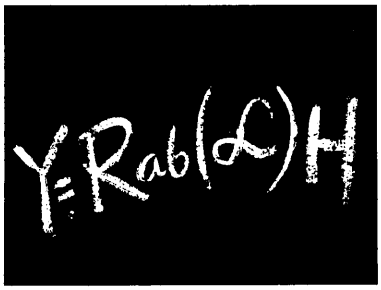

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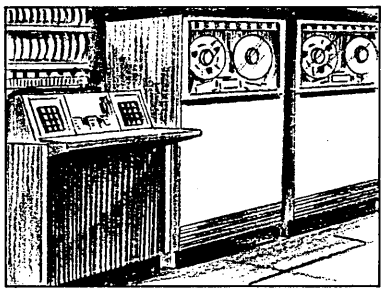

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CIRCLE 305 ON READER CARD

the forum

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

VILLAIN OR SCAPEGOAT?

With each passing year since the development called ENIAC, man has been increasingly making computers and automation the whipping boy for his own deficiencies. I have been working in this field for over 15 years and have watched in silence as unemployment, dehumanization, big brother, invasion of privacy and, finally, the very destruction of the fibre of our society have been blamed on my chosen field. I no longer can remain silent. It is time we put our critics and their criticisms in perspective. It's not our computers—to err is human!

Let me cite some examples. Several years ago, I was associated with a project which attempted to provide computer assistance to medical X-ray interpretation. Most, if not all, of the doctors to which the project was described offered the universal argument against computers—but you cannot automate the years of study and value judgment which must be based on years of experience. Does it sound familiar? A series of X-rays, from the case history of a patient who died, was presented to trained physicians and the computer. In all cases the physicians missed the vital interpretation until the malady could no longer have been arrested. The computer sensed an irregularity early enough, so we were advised, that corrective action could have started. Perhaps a life could have been saved. I know that if I were the patient I would have wanted all assistance, even from a non-medical-graduate computer.

Several years ago we learned about a terrible plane disaster over New York, in conditions of poor weather, too many planes, too few controllers, and sloppy

surveillance. Computers with proper radar inputs would never relax their programmed vigil. Human controllers argue with the usual indignation that machines cannot provide that little something that man brings to this complex job. Yes indeed, as skies become more crowded, as planes fly faster, I too worry about that little something that man brings to bear on the problem. Remember—to err is human!

I prefer the impartiality and continuous stolid approach of a computer to my income tax return each year rather than the erratic and highly subjective analysis of a human examiner. If we cheat we should have equal likelihood of getting caught as well as equal protection of the law. I want each of us to get identical treatment and this automation guarantees. I am happier knowing that we traffic violators will be treated equally by computer as far as ferreting us out, fining us, revoking our licenses, rather than some of us getting away with something simply because we know someone. I sleep better knowing that a large part of our country's defense is in the able, tireless and unchanging programs of computers.

Finally, let us examine the arguments of some politicians against an automated national data bank. Is it true that data from unscrupulous sources can be perpetuated and can wreck lives? Can certain individuals gain access to files which will provide them with limitless power? Will our privacy really be invaded?

Computers are tools, not gods! Are not computers themselves man's handiwork? If we are afraid of automation and its possible effect on our society, we are really saying we fear our own intellectual development. To answer the questions posed in the previous paragraph: Yes, data that is either incorrect or damaging can be put into a system —but doesn't this occur even in manual systems such as that of the FBI? Individuals can gain access to files that they should not, but this is really a human problem, not a machine's. The fact that someone with an aberrated mind can assassinate a President doesn't mean that the President's office should be abolished. As far as privacy goes, data banks and information retrieval programs simply offer an ability to gather already available information in a central location. This is no expansion of invasion of privacy. If privacy is the problem, let us go to the source of the danger and eradicate all current programs that provide data—social security, income tax, census—in fact, most governmental functions.

Again let me assert my own view that automation, instead of tearing a man down, really offers him a vehicle to truly uplift him and hopefully make the world a better place in which to live.

—JULIUS HONIG

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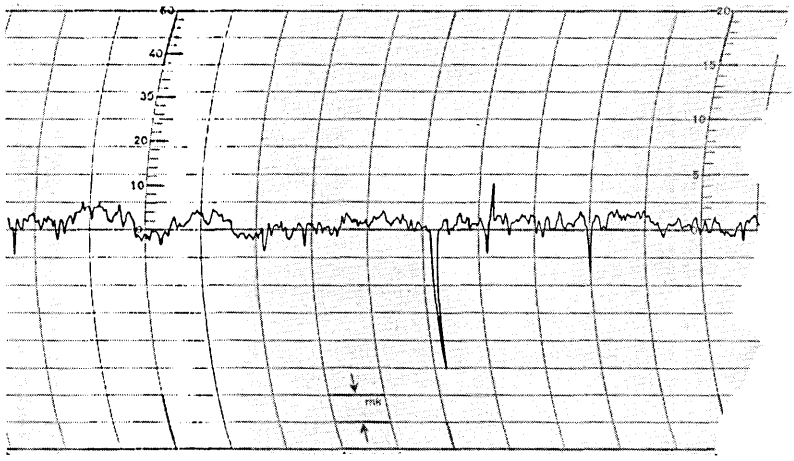

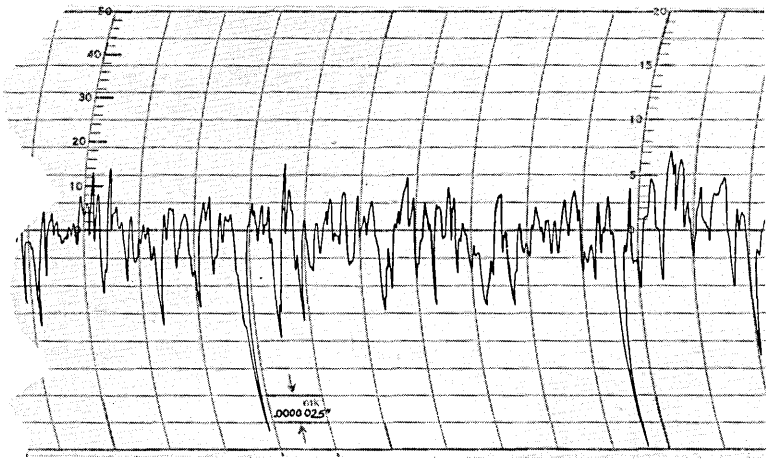

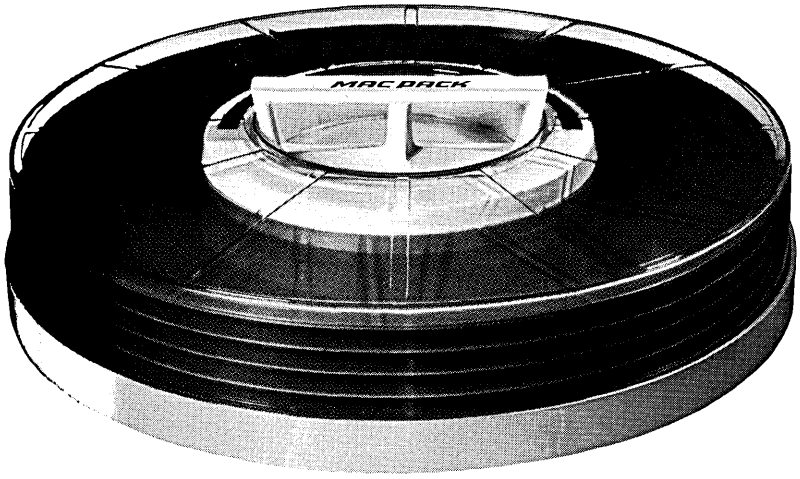

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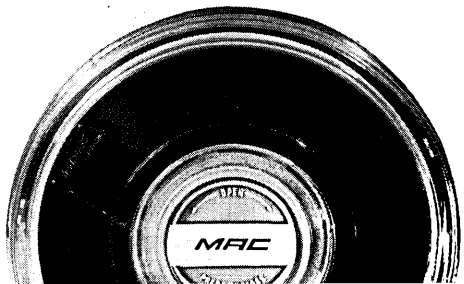

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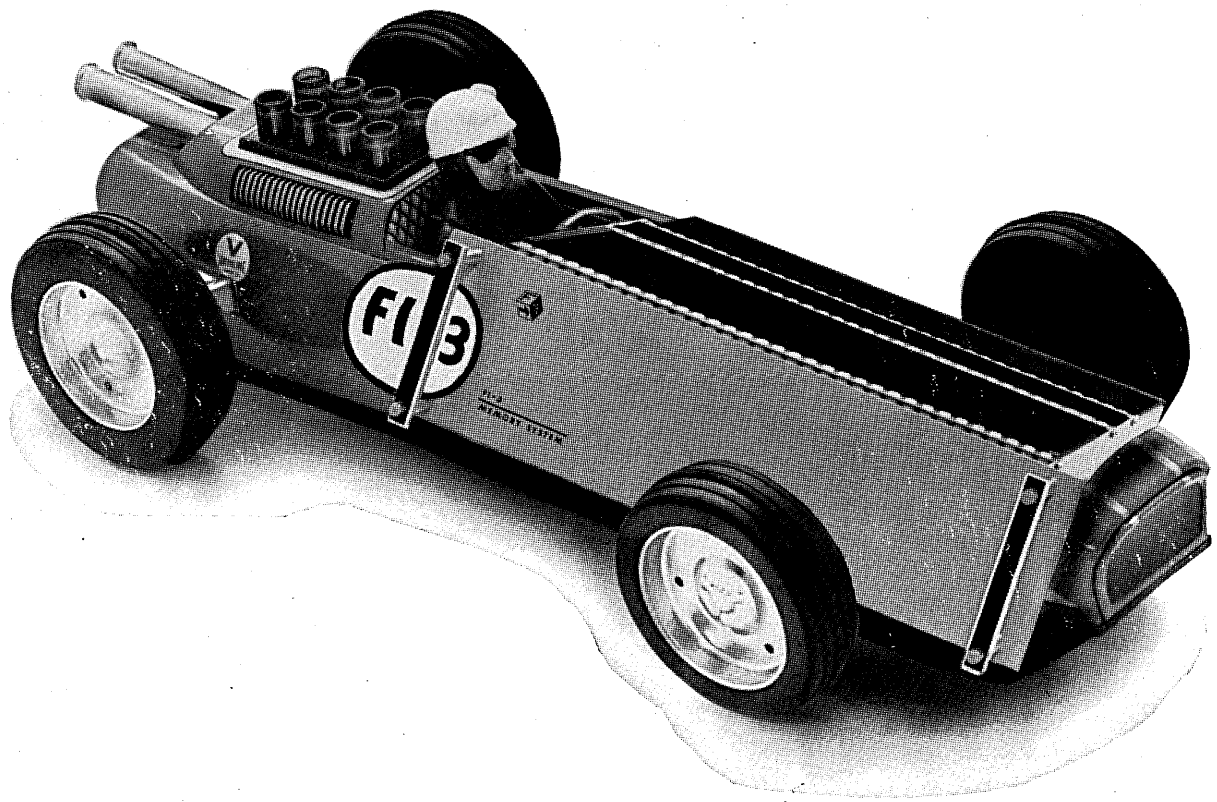
Systems Division, Englewood, Colorado



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