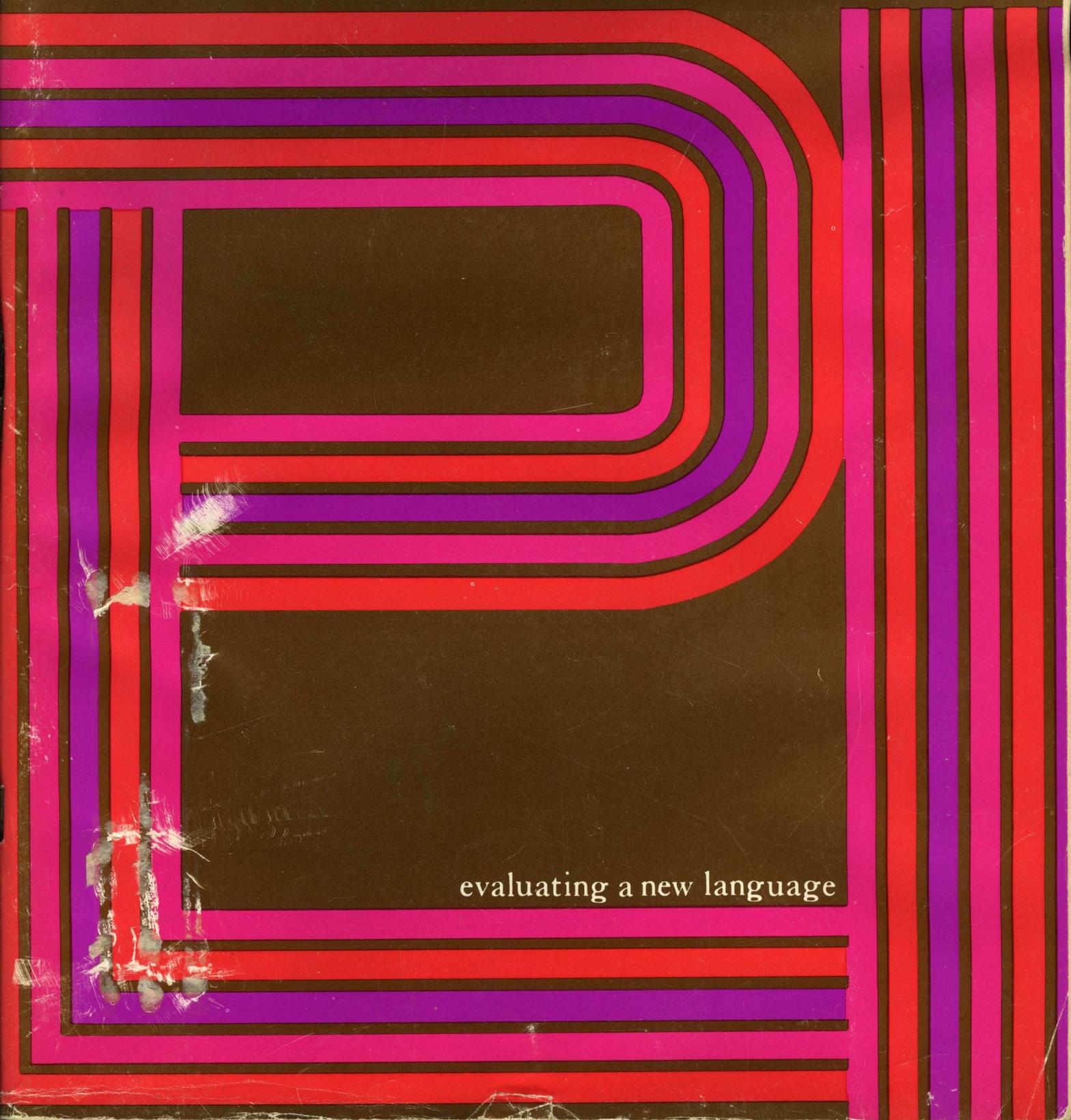


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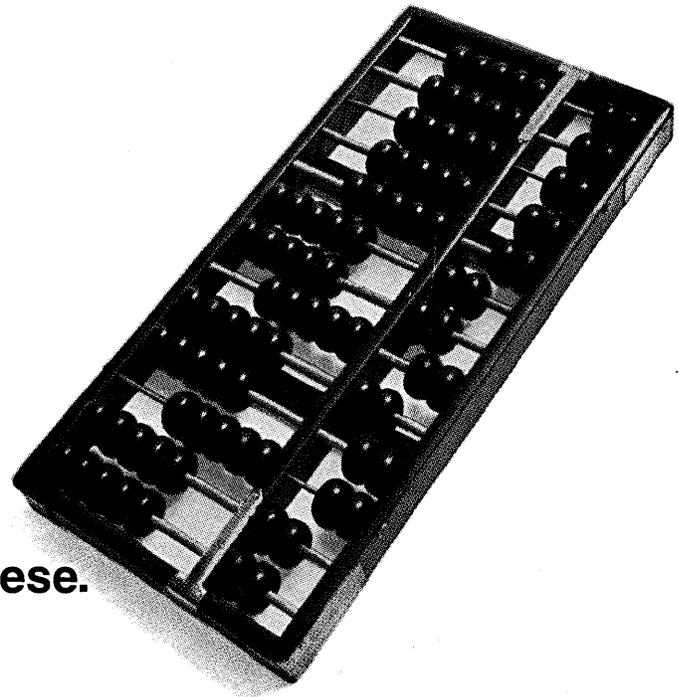
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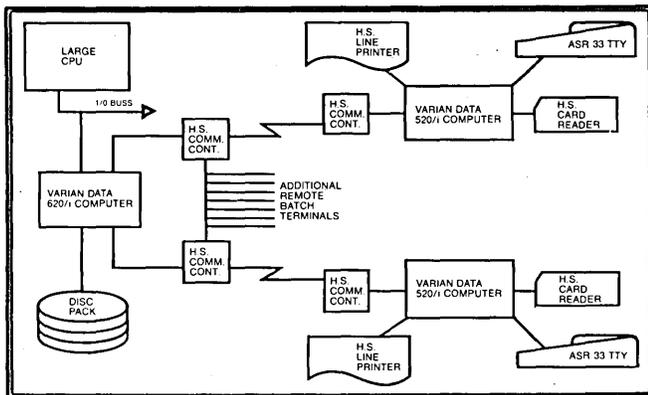
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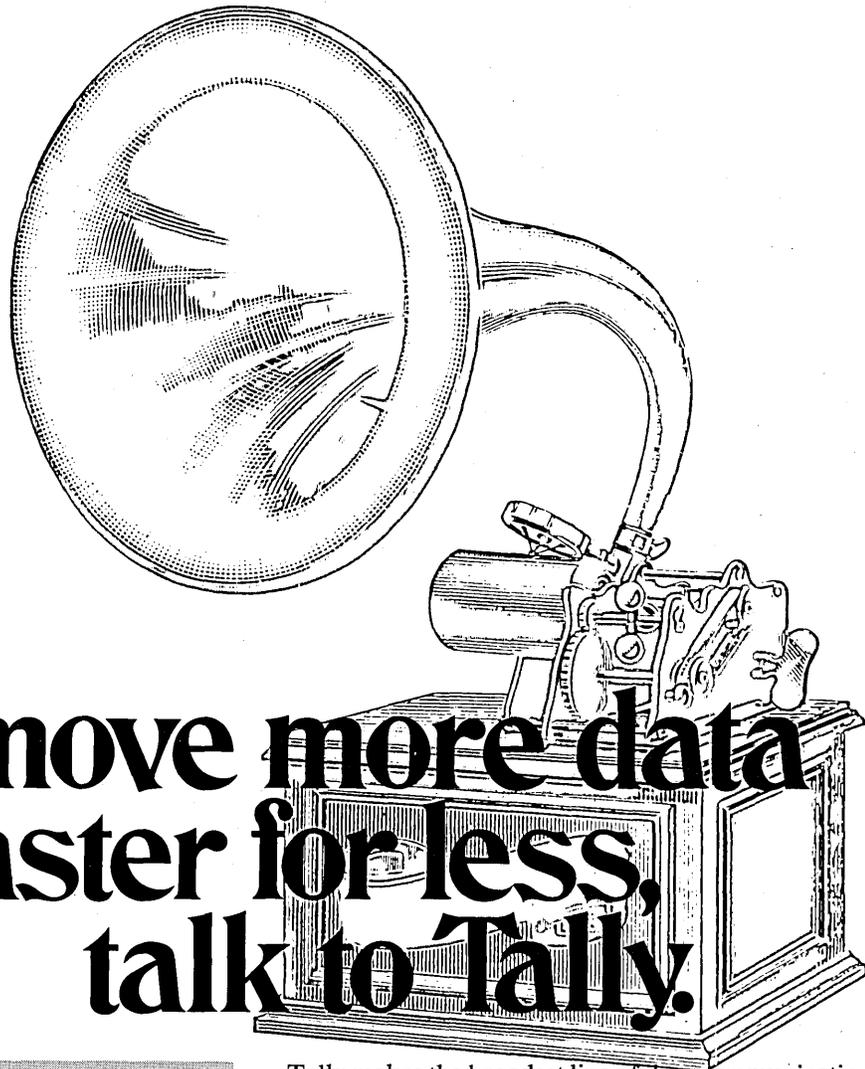
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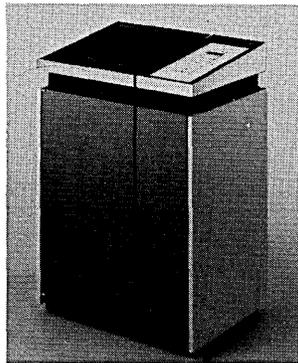
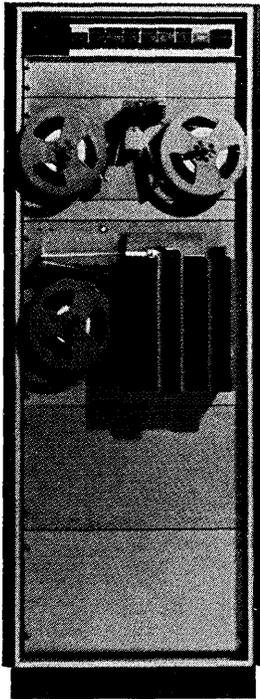
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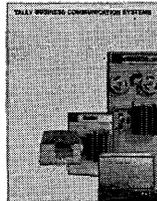


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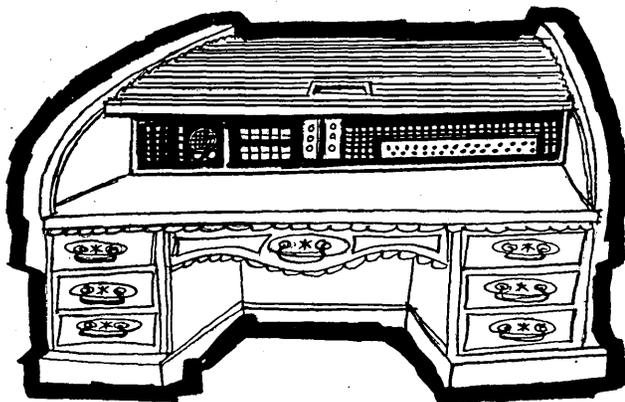


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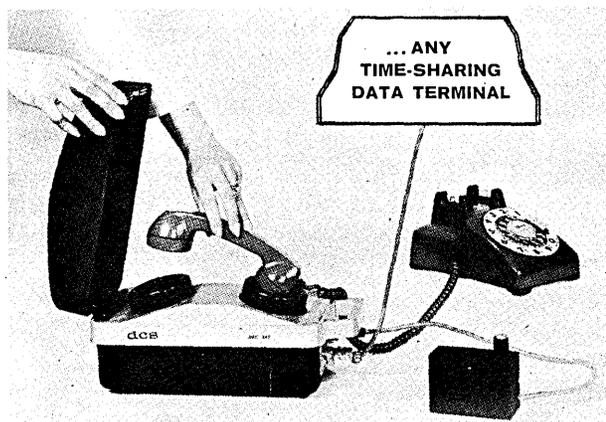
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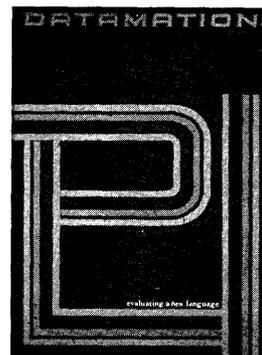
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CIRCLE 6 ON READER CARD



december

1968

volume 14 number 12

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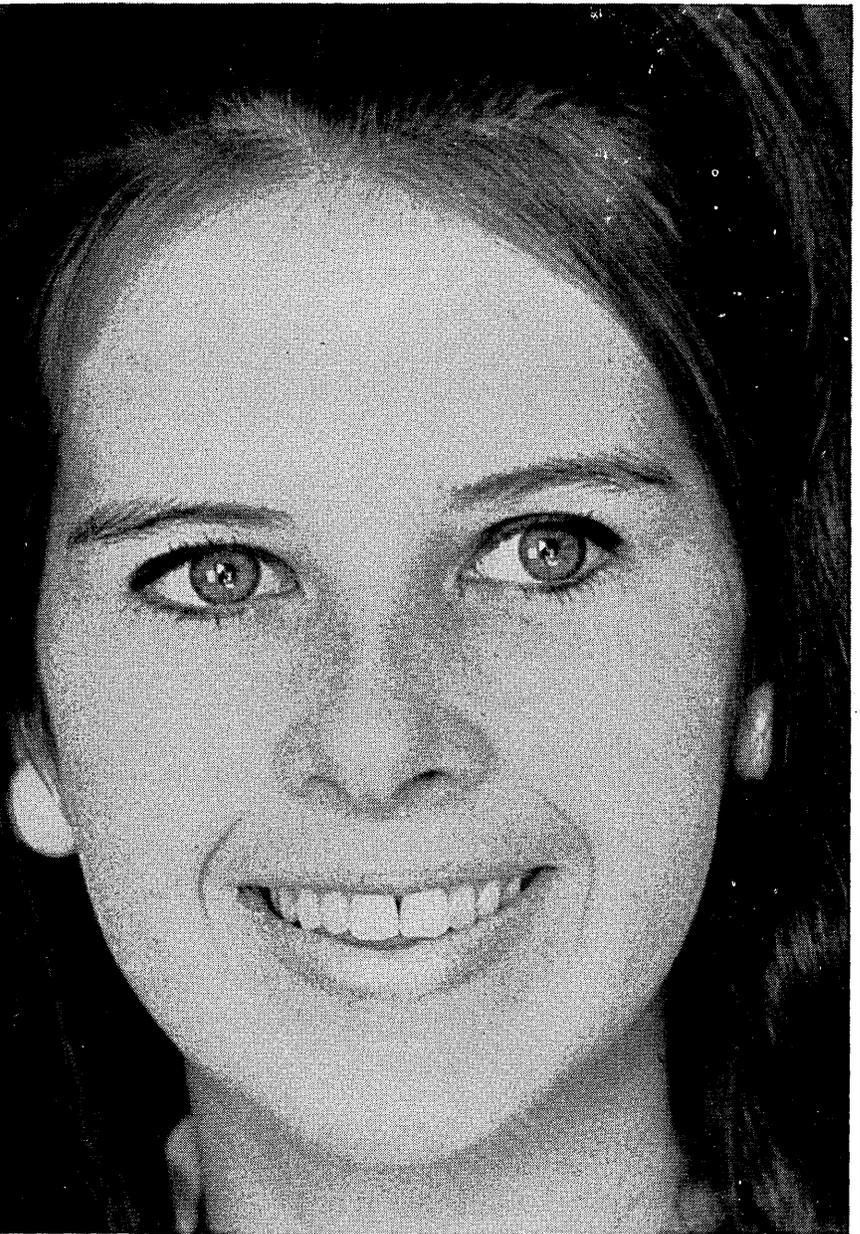
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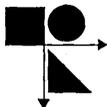
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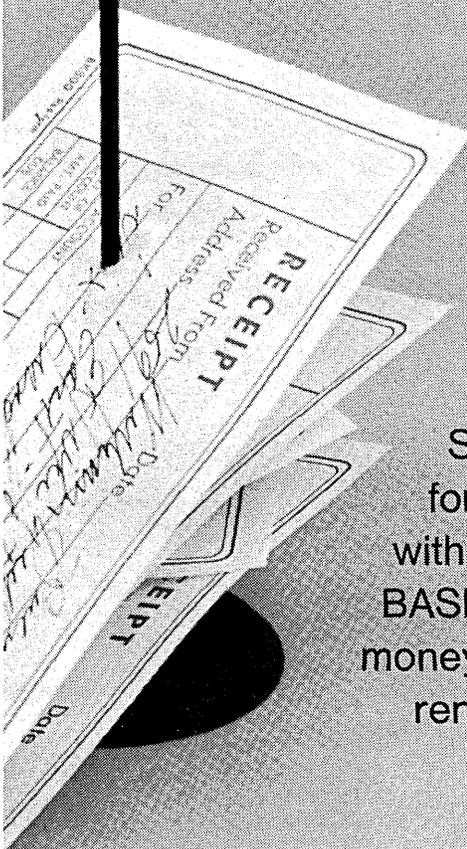
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DATA MATION ⁶⁸ N[®]

december

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volume 14

number 12

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Techniques for determining the accuracy, timeliness and completeness of input data will also trace the source of errors.
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- 95 **NEWS SCENE**
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Hughes Aircraft has an Adage AGT/10 that they are using

for automated PC-board production. N.U.W.C. is using its display terminal for simulating submarine tracking and intercept guidance systems. Biochemists at N.I.H. are viewing and testing mathematical models of large drug molecules; the Adage terminal frees them from tedious, drawn-out laboratory testing required by classical methods.

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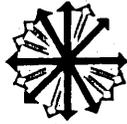
The AGT's we've sold have been used both as stand-alone systems or tied either directly or via dataphone to central computers. Some of the computers linked are IBM 360/50, 360/65, 360/67, 360/75; Univac 1108; SDS 940; CDC 6600.

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COMPUTER GRAPHICS

CIRCLE 9 ON READER CARD



calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Jan. 15-17	2nd Annual Simulation Symposium	Tampa	Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601
Jan. 15-18	Winter Meeting	Las Vegas	National Soc. of Prof. Engineers, 2029 K St., N. W. Washington, D.C. 20006
Jan. 21-23	15th Annual Reliability Symposium	Chicago	IEEE, 345 E. 47th St., New York, N.Y. 10017
Jan. 30-31	3rd Annual Statistics Symposium	Los Angeles	ACM/Business Adm. Ext. Seminars, Rm. 2381 GBA, UCLA, Los Angeles 90024
Feb. 13-14	Mgt. Conf: Expanding the Service Center Markets	Las Vegas	ADAPSO, 420 Lexington Ave., New York, N.Y. 10017
Mar. 24-27	Int'l. Convention & Exhibition	New York City	IEEE, 345 E. 47 St., New York, N.Y. 10017
Mar. 26-29	16th Int'l. Meeting	New York City	Inst. of Management Sciences/B. Mayer, SBC, 1350 Ave. of the Americas, New York, N.Y. 10019
March 30-Apr. 2	Graphics Conference	Urbana, Ill.	W. J. Poppelbaum, Univ. of Illinois, Urbana
Apr. 1-3	6th Annual Meeting & Technical Conference	Cincinnati	Numerical Control Society, 44 Nassau St., Princeton, N.J. 08540
Apr. 14-17	1st International Automated Manufacturing/Processing/Production Exposition & Conference	Cincinnati	Amer. Soc. for Metals, Metals Park, Ohio 44037
May 5-6	Symposium: Theory of Computing	Marina del Rey, Calif.	ACM, 211 E. 43 St., New York, N.Y. 10017
May 7-9	International Joint Conf. of Artificial Intelligence	Washington, D.C.	ACM/Rebecca Prather, Hycon Co., 700 Royal Oaks, Monrovia, Calif. 91016
May 14-16	Spring Joint Computer Conference	Boston	AFIPS, 345 E. 47 St., New York, N.Y. 10017

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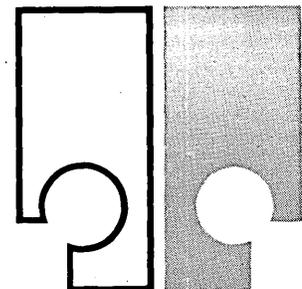
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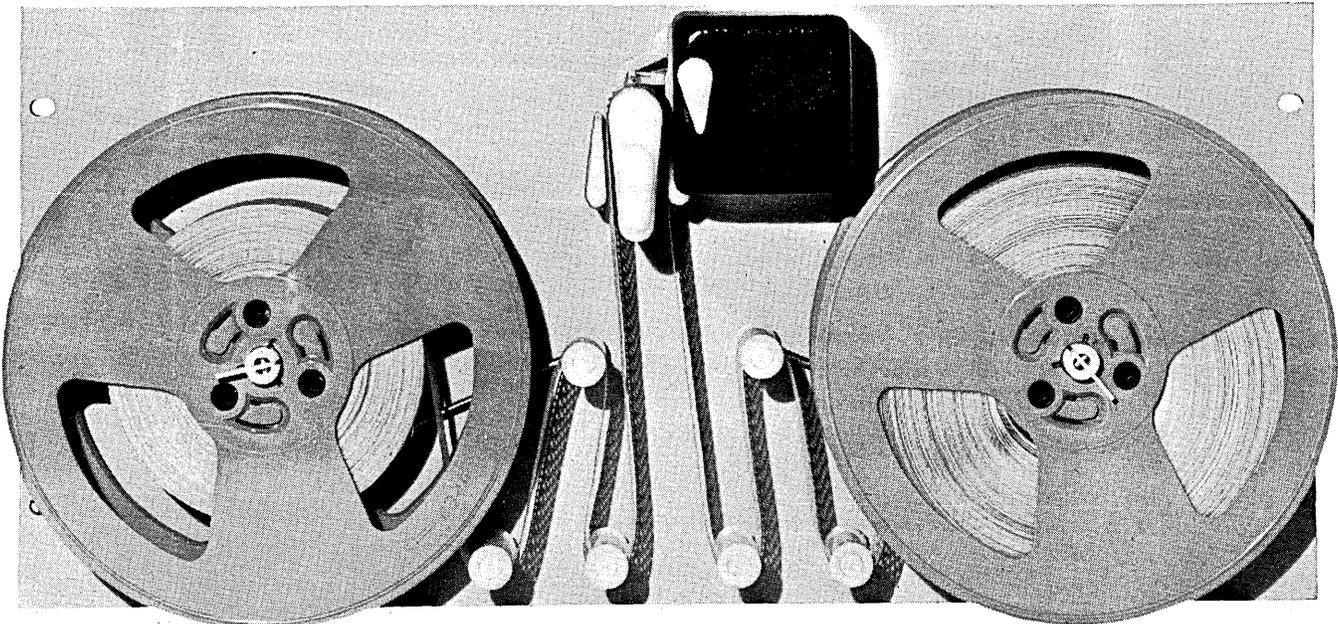


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letters

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Sir:

With all of the questions we have been getting, I would like to let people know that the University of Michigan Computing Center is now running its Michigan Terminal System on a duplex version of the IBM 360/67. At this point, although we have 58 telephone lines available, this number of users does not tax the capability of the system. The language processors include FORTRAN IV, WATFOR, the G level assembler, SNOBOL4, PIL, PL/I, GPSS, LISP 1.5, PL360, a PDP-8 assembler, and others. It turns out that for about 80 per cent of our batch jobs, we can offer 15 minute turn-around. If anyone is interested, our 700 page manual may be ordered from the University of Michigan Press, Ann Arbor, Michigan.

Bernard A. Galler
University of Michigan
Ann Arbor, Michigan

transmission figures

Sir:

In your "News Scene" article of the September '68 issue Mr. Shubert, of McCall's, seems to have his comparative figures for transmission over a 3,000 mile link of Telpak D vs. satellite a bit confusing. For Telpak D, using a 960 KH bandwidth, he uses 920 Kilobits/sec while for the satellites with the 5MH bandwidth of a TV channel he assumes a 15.75 Megabits/sec transmission rate. Using bandwidth compression techniques one may be able to get the equivalent of 15.75 Megabits per second out of a 5 HH channel (about a 3:1 compression ratio); however, if bandwidth compression were to be used for one transmission medium it should be compared against the same techniques in the alternate transmission mode.

Comparing the two techniques on an equal basis of bandwidth compression and resolution should yield a difference that approximates the channel capacity. Therefore, if Mr. Shubert's 150 pages take 90 minutes to transmit for a cost of \$337.50 the satellite on an equal basis should approximate $960\text{KH}/5,000\text{KH} \times 90 \text{ minutes} = 17.28 \text{ minutes}$ or at $\$3.70/\text{minute} = \63.93 . This, of course, is still a substantial \$273.57 difference between Telpak D

and the minimum satellite cost.

Parenthetically, your article states the difference at \$217.82, which appears to be a misprint since it should have read \$317.82.

Bernard Silverman
Moorestown, New Jersey

exorcising demons

Sir:

I read with interest Mr. Joseph Kanner's article on "CAI—The New Demonology?" in the September "DATA-MATION." The following observations seem pertinent:

1. No single medium is adequate for all kinds of education or types of material (Mr. Kanner seems to be disappointed that this is true at the same time that he is reminding us that he told us so).

2. There has been a tendency to incorporate the worst of old media into new. How many times have you seen lectures taped for TV? (Mr. Kanner notes this himself in his discussion of TV.)

3. In spite of the fact that no single medium has been able to replace all of the others, the use of multiple media has found wide acceptance. There is a vast difference between the classroom of today and the one in which Mr. Kanner and I received our educations. There is also substantial evidence that these classrooms are more effective.

4. Unlike all of the aids to which Mr. Kanner has compared it, CAI is not a medium. It is rather a means of controlling the presentation of information via media. It provides a means of coordinating between and/or selecting from various media in a manner not possible by other means.

5. CAI provides a kind of feedback that is not available in any comparable system. This feedback can be used to control remedial material in the presentation, and facilitate the independent progress of students. It can also provide valuable data about the learning process (of which, Mr. Kanner points out, we know so little), data to improve its own presentation, and data to facilitate the evaluation and validation to which Mr. Kanner says previous systems did not lend themselves. The same data can be used for the objective administration that is so badly needed in this era of mass education.

As I understand Mr. Kanner, he would, as he says, "like to encourage and offer my best wishes for success to those who are engaged in the exploration of computer-assisted instruction." But on the other hand he urges that their research be rigorous, and he suggests standards for ensuring that it is. He suggests that CAI be compared to

the same amount of effort conventional teaching methods.

Since this point is valid in itself, will not take issue with the way which it is made (which smacks of that notorious conservatism that has hindered innovation in education since before Socrates). I would, however, like to point out that by Mr. Kanner's own admission "our knowledge of human learning is primitive." Indeed it is so primitive that there are no measures available for those "long-established alternative methods of teaching" with which he would have you compare CAI.

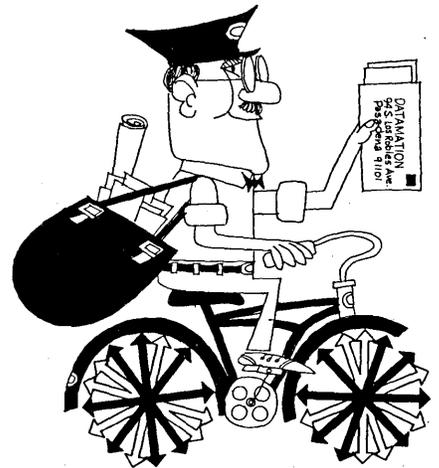
I too would urge caution; I too would urge that the proponents of CAI restrain their enthusiasm, and that their listeners use the proverbial grain of salt. But I would further urge that we evaluate research in CAI not by how it compares economically with other methods of presenting material, but on the light that it sheds on that mysterious art called "teaching."

William Hugh Murray
Hartsdale, New York

Mr. Kanner replies: I would like to provide the following brief comments on Mr. Murray's letter.

They are brief because I enjoyed Mr. Murray's comments and some of his conclusions are provocative, although I may not agree with him.

With regard to the five major points he develops, I would agree with his statements in



No. 1 and 2 except that I am unaware of any personal disappointment. With respect to statement No. 3, surveys which have been conducted in both civilian and military classrooms would indicate little use of multiple media, reflecting a general lack of knowledge by many teachers of the use and applications for these media. Having recently visited university and high school classrooms, I also find it difficult to accept that they were vastly different from the ones in which I received my education, nor have I seen any objective evidence that they are superior to the ones I sat in. In his point No. 4, I have seen descriptions in which television could be substituted for CAI and represented as a means for "controlling the presentation of in-



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letters

formation." In other words, I do not find his attempts at differentiating CAI from the other media as being successful.

In his observations about the potentials of CAI in paragraph 5, all I can say is "Maybe." If this description is accurate, then CAI should provide information on teaching and the learning processes which the other approaches have not achieved. But this was one of the original points in my article — that CAI proponents make these claims and that at some stage we will soon know whether the claims have been fulfilled.

Mr. Murray has used my statement about the primitive nature of their knowledge of human learning to conclude that there are no measures available for comparing CAI with other forms of instruction.

I think he is throwing the baby out with the bath water. We do have test procedures which may be primitive but represent all that we have for measuring achievement. Perhaps they need improvement and this improvement will be one of the tasks of the educator. But they are the only tools we have. At one time I understand the Italian physicist, Volta, judged the strength of electricity charges by feeling them, but then he had no voltmeter and he worked with whatever tools were available to him.

Again, CAI may shed light on that "mysterious art called teaching." But if the light is feeble and is expensive to obtain I suspect it will have to meet the test of the market place which I have previously suggested, i.e., how does it compare with other light producers of equal value, with respect to cost?

minislip

Sir:

I appreciate the many kind things you said about Information Management Incorporated's DETAP "Decision Table Processor" in the "Software Packages: Users Speak Out" article in the October 1968 issue.

Unfortunately, there was one little slip that I feel needs correction. In the article, you stated that the DETAP system costs \$14K per year. The fact of the matter is that the DETAP system can be purchased outright for \$14.5K. This includes on-site training, installation, and maintenance of the system for one full year.

Solomon L. Pollack
San Francisco, California

library slip

Sir:

In the News Briefs section (p. 102) of your September issue of DATAMATION, there was an article about our firm which was accurate except that the Book Catalog System mentioned is for Los Angeles County Public Library rather than Santa Barbara. We would appreciate it very much if you would correct this in a future issue.

By the way, that program is in pro-

duction and we expect many libraries with similar requirements to have interest in it.

Robert E. Roth
Vice-President, Marketing
Computer Center of Santa Barbara, Inc.
Santa Barbara, California

overworked claim

Sir:

I have noticed the recent advertising campaign being undertaken by Leasco which includes full page ads in your publication as well as in The Wall Street Journal and Business Week,



wherein Leasco claims to be "the world's largest independent computer services organization." Surely the claim "the world's largest" is one much overworked in this day and age and especially, so it would seem, in our industry.

I also enjoyed Angeline Pantages' excellent article in the News Scene section (Oct. p. 70) which describes the Leasco operations. Somewhat surprising is the fact that no matter how one juggles the figures that make up the components of Leasco, it is impossible to even approach the claim that they are in fact "the world's largest software services organization"—by a long shot. Even if for some strange reason total revenues, no matter what their source, were added together and Leasco's activities in life insurance and containerization were included, Leasco would still fall somewhat short of some of the other conglomerates that have an information services capability such as ITT with their Data Services Division, and IBM with their Federal Systems Division.

For those people who enjoy the numbers game and who feel that "the world's largest" is an important con-

sideration, Computer Sciences Corporation is, to the best of my knowledge, still the largest independent software company. This is based on our current staff which numbers over 3,000, all devoted to the information sciences, and a sales volume last year of \$53,214,000.

Our industry could use a little more "truth in advertising." The harried user has enough to worry about now without the claims and counterclaims bandied about by suppliers of both hardware and software.

Michael D. Calandra
Manager, Plans and Programs
Computer Sciences Division of CSC
New York, New York

software tailors

Sir:

The editorial in the October issue of your magazine stirs me into some comment.

The state of the art in software packages reminds me of the ready-made clothing industry in the beginning of this century (as you may know, the ready-made clothing industry proliferated in Holland after the first world war).

It appears to me that so many software producers today are like a tailor who has successfully completed his 8th suit and is now contemplating going into ready-made's.

The step from a good tailorshop to a clothing industry, however, is not gradual; it involves a complete change of methods, standardization and industrialization. For example: in the clothing industry a completely new measuring system was developed.

I am afraid that your Guru will not appear before another ten years pass by.

G. C. Nielen
Philips Gloeilampenfabrieken
Eindhoven, The Netherlands
P.S. Incidentally, we use the word "programmature" where you use "systems software" and "programming" where you use "application software." I am sorry to say we offer no further distinction, but I do agree that it is high time we found some new division of the concept "software."

pro and conway

Sir:

I believe Dr. Conway has done a great service in clearing the air of certain confusions which exist in the area of separate pricing for software and hardware. The article is as lucid and well-written a presentation as I can recall reading on the subject.

However, I must take issue with

letters

two assumptions which Dr. Conway makes; the invalidity of either of them would serve to invalidate his conclusion that if pricing is separated, total system cost to the user will rise significantly.

First, I question whether we can assume that "each dollar of product cost is responsible for bringing in the same profit" (page 30, column 1). One thing some software houses seem to believe is that the manufacturers are making much more profit per dollar invested in software development than per dollar invested in hardware. If this is so, the saving in monthly cost might be much more than the figure Dr. Conway reaches (\$333.).

In addition, I question the implicit assumption that in the separate pricing situation the user would get the "same" computer. With competition in the software market, the user might well get a much more potent system; he might be able to drop down to a smaller model and still get the capability necessary to handle his problems. So even if the price of a given system did increase, a given user's costs might decrease. Dr. Conway makes it clear (page 30, column 2) that he is excluding the effect of competition on quality from his analysis, but I believe the point I make here must realistically be mentioned.

David Bender
George Washington University
Washington, D.C.

Sir:

If one were to follow Dr. Conway's theory (*DATAMATION* article—October 1968—"On the Economics of the Software Market"), one would conclude that it would benefit the computer industry if IBM had 100% of the market. Computer hardware/software development, manufacturing and marketing costs could be amortized over 100% of the market, thereby reducing hardware, as well as software, costs. Dr. Conway has illustrated, using software as an example, that in a monopolistic environment costs are minimized. The Anti-Trust Division of the Justice Department has stated its position for many years regarding this issue. But, what about the selling price? Dr. Conway had little to say about that.

The main argument for separate pricing of software and hardware is to introduce competition into an area that currently is monopolized. Competition can only be achieved if the threat of "free software" is removed so independent companies can invest in new software developments and products. Currently, the threat of new "free

software" makes investments very risky.

Secondly, the goal of separate pricing of software/hardware is to reduce computer related activities, namely programming costs. This can be accomplished with better and more effective software; whether the cost of software is initially higher or lower is immaterial. However, history has shown that competition reduces prices. Current statistics indicate the cost of software/hardware is about 20% of computer related activities for the average company.

Lastly, manufacturing costs for hardware are estimated between 10 and 20% of the market price. Thus, a hardware copy, while perhaps considerably higher than a software copy, contributes only a small cost when compared to the market price. Using Dr. Conway's formulas, but allocating 3% of the price to software, 15% to hardware, and 82% to marketing, research, development, pre- and post-sales support, and profit, will produce significantly different conclusions than those Dr. Conway has arrived at.

Other points to consider are these: (1) Most IBM salesmen sell the software capabilities of their computers, rather than the hardware capabilities. This is evident, since many of their competitors' computers (i.e., RCA, Honeywell, CDC, SDS and others) can execute more instructions per dollar than IBM computers can. So, perhaps Dr. Conway should allocate the greater part of IBM/360 marketing



costs to software rather than to hardware. (2) There are generally post-sales support personnel (systems engineers) supplied free by the manufacturer, while hardware support (maintenance engineers) is paid for separately. Has Dr. Conway considered these software costs in his computations?

Since the sale is based on software, perhaps IBM should give the hardware away free and sell the software and its support.

Martin A. Goetz
Applied Data Research, Inc.
Princeton, New Jersey

ascii expansion

Sir:

Phil Hirsch's *News Scene* report on Federal agency use of ASCII (October) was most interesting, but his closing comments on ASCII "expansion" are a little misleading.

ASCII itself is a 7-bit, 128-character code, and has no "spare" positions. An 8-bit "expansion," having the basic 128-character set as a simply-related subset, is defined implicitly by the provisions of the USA Standard(s) covering recording of ASCII on ("8-bit") magnetic tape, but an explicit description of the standard "expansion" is still the subject of work by USA Standards Institute Subcommittee X3.2. Mr. Hirsch's detailed remarks on the "expansion" read quite accurately on the "expansion" proposal now before that group.

D. A. Kerr
Member USASI X3.2
Middletown, New Jersey

oversight

Sir:

The article "Software Package Acquisition" by Messrs. Head and Linick in the October issue should have contained an acknowledgement that the article was based upon a report prepared by the authors for the American Banker's Association under its Automation Planning and Technology program. This report, titled "Guide to the Review and Acquisition of Software Packages," provides a more extensive treatment of the subject of software packages as they apply to bank edp operations.

Robert V. Head
Los Angeles, California

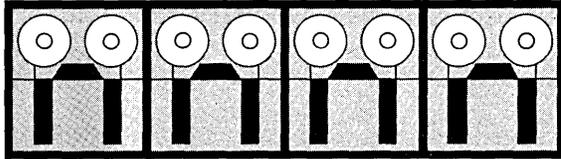
computer economics

Sir:

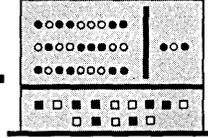
I would like to offer a few comments on the ACM conference "Managing the Economics of Computer Programming" discussed in the October issue under "News Scene."

I do not understand how a conference on this topic could exclude a discussion of the Air Force Electronic Systems Division (ESD) efforts to manage computer program development. Over the last five years ESD has effectively applied the concepts of project management to the development of command and control systems. A number of ESD documents and technical reports have been published describing the ESD efforts including four papers that were presented at the 1967 sjcc.

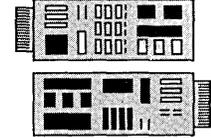
The project management approach
(Continued on page 205)



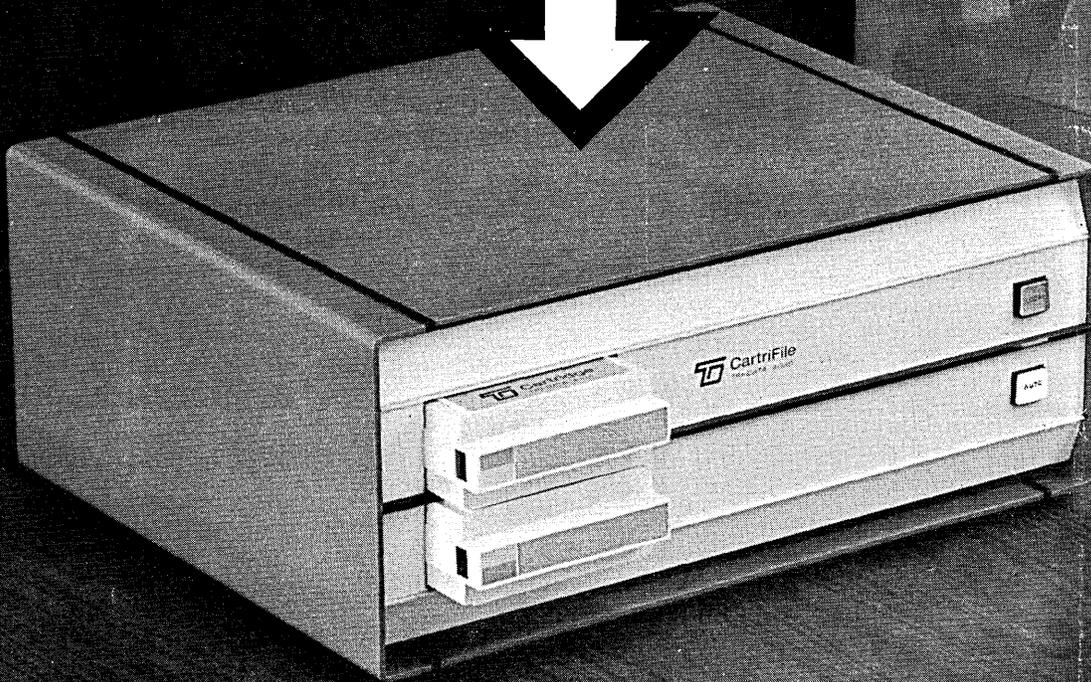
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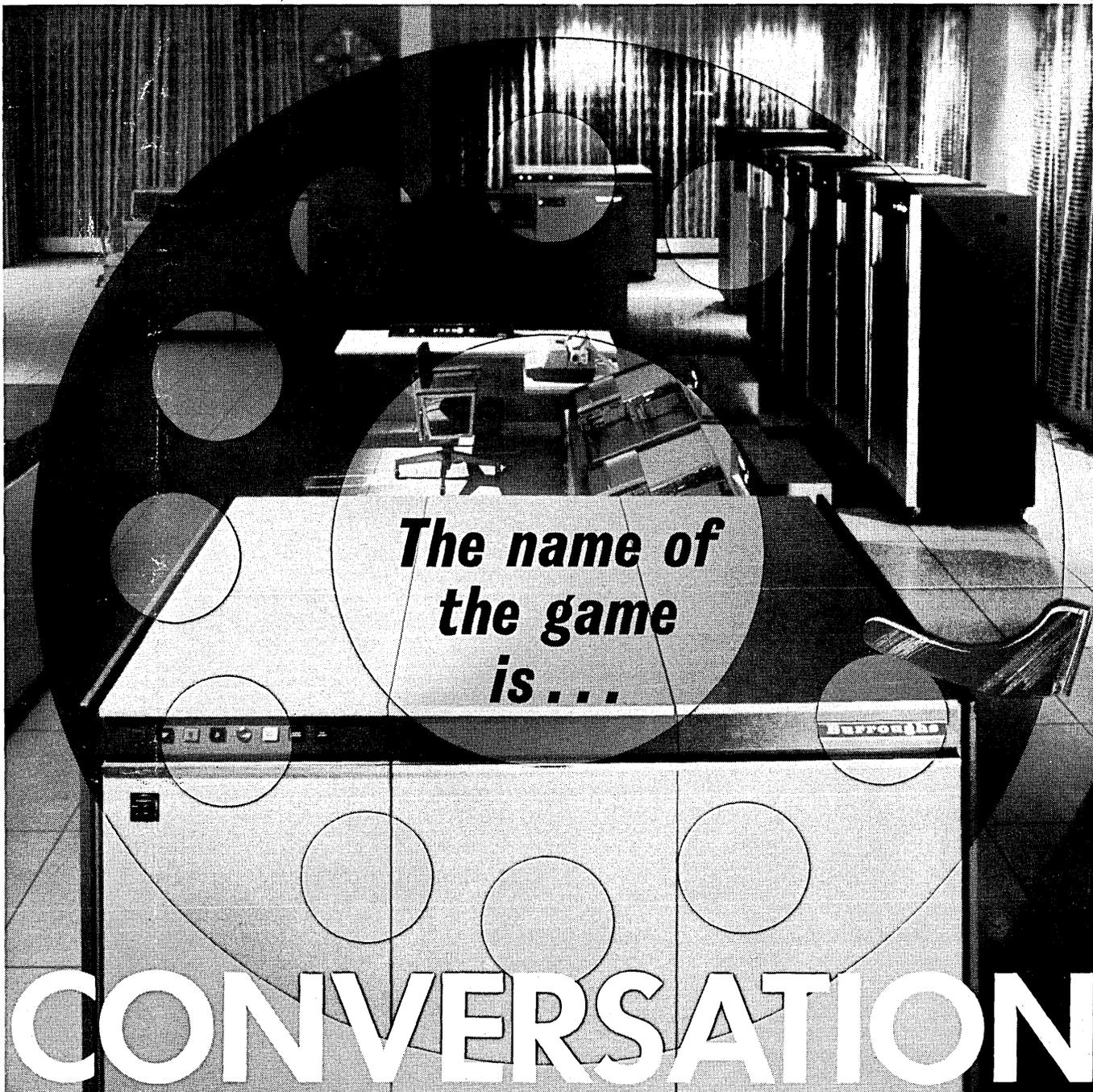
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look ahead

USERS CAN PLAY THE MEASUREMENT GAME

It's the season for language measurement, with much seminar time and editorial space given to PL/I vs. Cobol vs. Jovial vs. etc. Now the users are getting into the game, one being Ducommun, Inc., L. A. metals firm.

They coded and ran equivalent programs in PL/I and Adpac, the product of Peter ("we'll bury Cobol") Harris's Applied Data Systems. They have a 256K 360/40 with a 2314 and two tapes; the routine was a time card explosion program that takes 18K bytes of tables. Two separate PL/I programs were written, since Version 4 was released in the middle of the project. Results: Adpac compiled about five times as fast as Version 4, almost seven times as fast as 3. In execution, Adpac was 23% faster than 4, 35% faster than 3. Execute module sizes: Adpac, 40K; Version 3, 54K; Version 4, 50K. Linkage editor modules showed a similar ratio, while Adpac took nine compiles and either PL/I version 13 compiles. Real significance to the customer: saving 2.33 hours of cpu time in running this one program.

EX-IBMERS READY DISC DRIVE FAMILY

Disc drive makers should start looking over their shoulders at a young mystery San Jose company formed a year ago by 12 IBM defectors who called themselves the "12 Angry Men." Rumors are that Information Storage Systems--which has raised about 4.5 megabucks--will announce soon a family of disc drives with significantly faster access time than anything now available. One of them at least will undoubtedly be IBM plug-plug compatible. The company moves to new 35K sq.-ft. facilities soon.

PUTTING THE TINY BUSINESSMAN ON-LINE

Direct Touch-Tone input for business data processing is now a reality in the Los Angeles area--even though phone companies there haven't yet introduced Touch-Tone phone. Touch-Tone "pads" are available, however; these are 12-button boxes that can be attached to the regular dial phone for alphanumeric input. And Geran Applied Systems of Encino, Calif., has arranged for these to feed into a modified Honeywell military computer through a patented high-speed scanner that can handle up to 260 calls simultaneously without a busy signal.

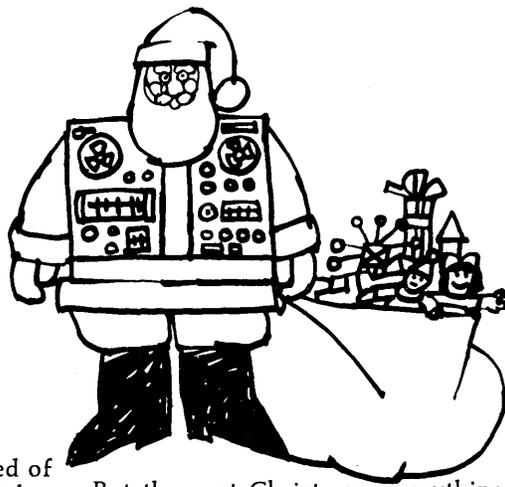
The result is a really low-cost service. Payroll, the first application, goes for 35 cents a check up to 50 employees and the price declines to 20 cents for over 250. The Touch-Tone pad is \$7 a month; calls are toll free. And Geran says they set up the files and handle the systems work for free. If there's no change in the payroll, three automatic dialer cards handle the job; if there is, the customer uses the keyboard for the new input. The deal includes printed payroll summaries, W-2 forms, and all the usual paperwork. Checks are delivered by United Parcel

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The year they tried to program Christmas



And so St. Nick said, "I'm tired of trying to match up billions of wishes with what's available and keeping track of them all in my little red book. It's not efficient. It's just not good business."

He called in a consultant who wrote a program spec and he sent that out to all the software firms in the world. The bidder's conference was held in Soldier's Field, Chicago. Then, one by one, the software salesmen journeyed to the North Pole to make their presentations. Slides. Flip charts. Curves. Statistics. Some even had real people in their employ.

St. Nick listened to all of them. He asked questions about who had the most experience with children and did they really understand reindeer. He finally selected a firm with previous experience in elf simulation, and they went to work.

There were problems, of course. For openers, nobody could find the consultant who wrote the spec. The software company determined that the computer couldn't hack the job, so naturally the manufacturer recommended installing a second one, but they couldn't make delivery until February. And, of course, St. Nick decided to change the spec "just a little bit." And, oh, that first Christmas.

There was the toy store in Oshkosh that wouldn't use the standard inventory form. And thousands of boys and girls who folded, mutilated and smeared peanut butter and jelly on their carefully punched order cards. George Hansen (A41K9134) asked for a stereo hi-fi for his New York penthouse apartment and got a lovely I-H baby tractor complete with rototilling attachment (A41H9134). Shimu Hatsumoto of Kyoto, Japan, received a complete American football uniform, while her wheel chair was sent to the first string quarterback of the Green Bay Packers. Shimu was 87 the day before Christmas. Little Billy Schultz of Duluth got no present at all. But that wasn't the fault of the system. He ate his order card.

But the next Christmas, everything was debugged. All the children filled out their cards with the proper stylus. All the stores cooperated. All the adults did too. And on that glorious morning of December 25...zap! Each and every person in the world got the gift he wanted in the right size, the right color, the right everything.

And it was wonderful. Complaint departments at stores all over the world closed down. Floorwalkers took up stamp collecting. Manufacturers tore up pads of "Returned For Credit" forms. Everybody was happy.

Except for a few malcontents. There are always those. A few old fashioned grouches who couldn't help remembering how much fun it was to pick out a gold tie for Uncle Gus even though they know good and well that the old geezer never wore anything but black bows. A few sloppy sentimentalists who enjoyed unwrapping a gift without knowing what would be in it. A few nuts who really enjoyed going back after Christmas with the green and purple sweater from Aunt Mabel and exchanging it for something they really wanted. Money.

And slowly the disgruntled minority grew in number. They were vociferous. They wrote letters to editors. And to merchants. They threatened consumer strikes. They painted signs that said "Santa Claus is a THINK." They made speeches on college campuses.

Until finally St. Nick had to admit defeat. And you have to hand it to the old boy. He did so very graciously. "There are some things that simply shouldn't be efficient," he told the boys from Associated Press. "And I guess my business is one of them."

To all of you from all of us, a joyous and totally unprogrammed holiday season.

informatics inc.
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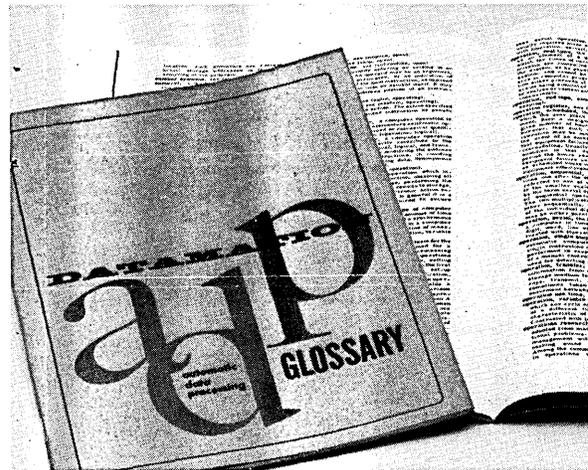
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The company started as a pilot operation in Seattle, now has about 20 people, more machines on order from Honeywell, and big plans to move into other major cities.

MUSSON TERMINATES, GOES INTO TERMINALS

Richard Musson has left his post as corp. dir. of marketing of advanced technology group at Republic Corp. to form his own firm, Data Computer Systems, in Santa Ana, Calif., where he'll be, simply, president. The company's first product is a "fourth generation" remote communication terminal, CP-4, which is compatible with all time-sharing or batch multiprocessing computers, and contains internal format control for ASCII, ASCII-8, and EBCDIC, enabling users to use new software from computer makers without the terminals becoming obsolete. The CP-4 is a 4-wire, full-duplex system that allows simultaneous operation of four functions: Read a card (or any input), transmit a character, receive a character, and print on printer (or any output device). Data compression is achieved without computer control by placing a format header card in front of the data cards to be transmitted. When the compressed data is received by the central computer, a small routine unpacks the data and restores it to its original form, resulting in faster transmit time and reduced costs. Musson claims the system is capable of operating at speeds up to a 240Kb rate in the full duplex mode. The price of the CP-4, which will also be leasable, is \$42.5K with the line printer. It will be available the end of the first quarter, '69.

NEW ADMINISTRATION TO ESTABLISH DPE OFFICE

Management of federal dpe will be altered drastically by the Nixon Administration, we hear. Key advisers to the new President want to establish an Office of Executive Management in the White House; it would take over dpe procurement and utilization responsibilities now lodged in GSA, and assume BOB's present role as dp policymaker, and as court of last resort for inter-agency conflicts. Reportedly, there is bipartisan support for this move. It wasn't identified, but probably is centered in the Senate GovOps Committee; Sen. Joseph Montoya, a member of GovOps, introduced a bill in the last session of Congress that proposed such an Executive Branch agency, but his legislation didn't go very far, even though it carried the blessing of Committee Chairman John McClellan.

BIGGER, FASTER MICROFILMER

Information International will be introducing a large-scale, stand-alone microfilm recorder this month called the FR-80. This system is designed for the big user who wants to produce plots quickly (at 9 frames/sec), or to produce filmed listings (at 2 pages/sec), or to do graphic designing with a light pen on-line at its 11-inch crt monitor.

FR-80 will churn through 220K 18-bit words/sec to plot at a rate up to 100K points/sec. The standard software included will read input tapes written in CalComp, Stromberg-Datagraphic (4020, 4660, or 4400), 360, or 1401 format, and stash the decoded printing or plotting commands into a 4K buffer provided by a built-in modified PDP-9/L.

High-level resolution is realized through 16K x 16K programmable spot positions on the crt (through 4K x 4K rasters). Spot sizes used may be as small as .0007 inches; and each spot can have eight

(Continued on p0

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editor's read ut

PL/I AT THE CROSSROADS

Casually buried in press releases announcing the IBM System/360 over four and one-half years ago was the mention of a new programming language.

Developed specifically for the 360 from specifications established by a select "3 x 3" committee from IBM and SHARE, the language has survived a name change (from New Programming Language to Programming Language/I), substantial modifications, attacks by Congressman Brooks, and the lethargy of users and competitors to become the dominant if dark-horse entry in IBM's software stable.

Designed deliberately as a "universal" language, PL/I was built on the premise that one language could serve the needs of both business and scientific information processing. Undoubtedly a corollary was that it is cheaper to develop software for one language than for two (or more). And despite the anguished howls of COBOL-oriented GUIDE members, IBM has stuck pretty well to its one-language dream . . . although GUIDE has pressured IBM to pay more than lip-service to this older, beleaguered but widely used language.

Enthusiastically supported by a small but vocal and influential group of SHARE users, PL/I today stands at another crossroads. The question—raised at a recent United States of America Standards Institute information processing committee meeting—is "Should PL/I be standardized?"

The seemingly innocent topic is a bag of snakes, folks, a wild combination of technical and non-technical questions, all of them confused by charges and counter-charges of selfish, vested-interest lobbying and voting.

Simplified (over?), the matter boils down to two general types of question, one technical, the other not. On the primary technical question—the adequacy of PL/I as a replacement for or sufficient advancement over currently available standard languages—the jury is still out.

The second question wonders if the PL/I user/application group is big and representative enough to warrant the substantial investment—estimates range from \$300K to 1½ megabucks—required to develop a standard.

Pro-PL/I-standardization spokesmen claim that there are 400-450 SHARE installations using PL/I as their primary programming language. One of them, upon investigation, appears to have written 1% of its programs in PL/I, and we wonder if others are not equally far (?) along. An independent survey indicates that 1% of all U.S. installations are programming in PL/I. One dispassionate observer labels this a "fairly sizeable" user community.

We disagree. Not only do we feel the size of the group is too small, but it has two built-in biases which prevent it from being representative. First of all, SHARE, as a sponsor, co-developer and blesser of PL/I (and as a subtle adjunct to the IBM marketing effort) has a rather suspect objectivity. Secondly, SHARE is dominated by large-scale scientific users, whose needs may or may not be typical of the user community at large.

One of the biggest deficiencies in the standardization effort is that the broad user community is inadequately and unevenly represented. Until the small- and medium-scale business and scientific user community is adequately represented, we believe that it behooves USASI to move with extreme caution in identifying language standardization candidates. We're glad the move to start standardization work on PL/I was tabled by USASI's X 3 committee.

PL/I will have its day. More users will try it, more manufacturers will implement compilers for it . . . improvements will be made. Time is needed to allow more users representing a broader machine and application base to evaluate its usefulness.

A COMPARATIVE EVALUATION OF PL/I

by RAYMOND J. RUBEY

Choosing which programming language to use very often involves looking only at the surface, considering the wealth of features each language provides rather than its practical utility.

Logicon recently performed a comparative language study for the Air Force (Electronic Systems Division) to obtain practical data in support of their subsequent evaluation of PL/I for future Air Force programming. What we did was to code and check out seven benchmark problems representing five application areas, implementing each problem in PL/I and one other higher level language.

Full particulars about the evaluation method and results are given in ESD-TR-68-150 (available from the Defense Documentation Center, Arlington, Virginia). The study was an experiment; it had a limited sample size and was influenced by what compilers were available at the time. Different results might very well have been obtained with different benchmark problems, different programmers, and a different time frame in terms of the language compilers utilized. The results do, however, fill in some of the gaps concerning the practical aspects that should be considered in selecting a programming language.

method

Table 1 (p. 23) summarizes the evaluation scheme. Each problem was programmed twice by the programmer assigned to it, once in PL/I and once in the comparison language. The order of implementation was varied to minimize the influence that prior knowledge of the problem might have on the second implementation. All of the programmers are professionals in the field. Each is a college graduate and two hold master's degrees, one in mathematics and the other in information sciences.

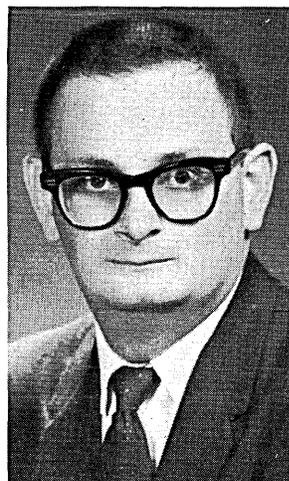
Naturally, COBOL was the comparison language for the business application area. GROSS PAYROLL is a dollars-and-cents problem involving the computation of earnings and tax deductions and the generation of weekly reports by personnel and charge numbers. ALOREP2, which is more concerned with business data management, involves the processing of air cargo data files and their editing and updating based on input information. It also checks the input information for validity and correctness.

The comparison language for the next three problems was FORTRAN. In the interactive programming area, MMI (Man/Machine Interaction) involves the development of a simple on-line system in which the user enters equation statements, directives to control their sequence of execu-

tion, and other directives to output the results of equation evaluation. TSME (Throughput Simulation in a Multiprogramming Environment), representing the simulation and gaming area, involves input and execution queues; the scheduling algorithms, job mixes, and resources required by the jobs may be varied by the user. In the scientific area, VIG (Vehicle Impact and Guidance) involves computation of a vehicle's terminal state position and requires many matrix and vector operations, the standard trigonometric functions, and various limiting and quantizing operations.

In the data management application area, there was actually only one benchmark problem, SPP (Simulation Post-Processor). This problem, which involves the extraction of data from a file, its formatting, and the printing of selected quantities based on input criteria, was programmed once each in JOVIAL and in PL/I by two different programmers to gain information about what effects implementation sequence and programmer differences might have on the results. These two programmers were selected for their close similarities in total years of experience, in their education (mathematics), and in the nature of their programming backgrounds.

Each programmer remained with his own organizational



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group; he was not assigned directly to the project team. While each knew that his was an evaluation problem, his instructions were to proceed just as if it were a normal problem from a customer within the company. A detailed programming specification was provided for each problem so that the programmer needed to devote minimum time to thinking about just what to solve and what kind of program to develop.

A separate evaluation study group was established to gather all the quantitative and qualitative data resulting from the benchmark problem implementations and to interpret the results. The members of this group did not try to tell the programmers how to approach their problems and

form which, like the first, contained questions applying specifically to the problem:

"Overall, which language is more suitable for this problem?" and more general questions: "Which language is more suitable for large problems in this application area?" and questions directed to specific language features: "Which language is easier to use in coding of complicated logic control?"

This second questionnaire solicited a direct comparison of the two languages. It requested the programmer to make a choice where he could and to state, briefly, his reasons.

With all of the quantitative and qualitative data in hand, the members of the evaluation study group then themselves

Application Area	Benchmark Problem	Languages		Programmer Experience (Years)
		First	Second	
Business	GROSS PAYROLL	COBOL	PL/I	3
Business	ALOREP2	PL/I	COBOL	1
Interactive	MMI	PL/I	FORTRAN	9
Simulation and gaming	TSME	FORTRAN	PL/I	10
Scientific	VIG	PL/I	FORTRAN	4
Data management	SPP-A	JOVIAL	PL/I	6
Data management	SPP-B	PL/I	JOVIAL	6

Table 1. Evaluation Scheme

did not suggest which language features they could use to advantage; assistance was provided, where necessary, by the programmer's own supervision. The members of the evaluation study group were available to help in solving any particular system problems or unique implementation-dependent problems that arose, but not to assist in programming the benchmark problem. They did maintain daily contact with the programmers to assess their opinions about the languages and to keep track of progress so this could be factored into the analysis.

Each programmer's time was recorded for four programming phases: learning and reviewing the language; designing the program (this included understanding the programming specification, redefining it in the light of the language to be used, and constructing any flow charts necessary to program the problem efficiently); coding (the time starting when the programmer actually began to write code and ending when he was able to make his first debugging run); and last, checkout. The recorded times were not strictly calendar or clock times, but the actual number of hours that the programmer devoted to the problem. Non-productive time spent waiting between computer runs or for keypunching was not counted. A record was kept of time lost because of problems with the compiler or the operating system so that their effects could be factored out.

Quantitative data about the runs submitted by each programmer were recorded on daily run logs. These data included the compilation and execution times for each run, the number of statements of each type in the source program, and descriptive comments about the results of the run. Error logs were also maintained; when an error was discovered during debugging, this fact was recorded and the error was classified according to its type.

After finishing his first implementation, the programmer completed a qualitative language evaluation form which required 24 subjective essay responses concerning the language he had just used. He turned these over to the evaluation study group and then reprogrammed the same problem, this time in the second language. Again, all the pertinent quantitative data were gathered and the programmer completed the qualitative evaluation form, but without reference to his answers for the first language, which were no longer available to him. Finally, several days later, the programmer completed a qualitative language comparison

responded to the second questionnaire. The complete set of results for each problem, including detailed tabulations of the quantitative data and all qualitative responses, is presented in ESD-TR-68-150. The remainder of this article summarizes these results.

quantitative results

The total number of statements in each source program is shown in Table 2. The PL/I source program had fewer statements than the comparison language program in all

	PL/I	Other Language
GROSS PAYROLL	453	502 (COBOL)
ALOREP2	214	355 (COBOL)
MMI	690	1032 (FORTRAN)
TSME	703	846 (FORTRAN)
VIG	324	295 (FORTRAN)
SPP-A	437	594 (JOVIAL)
SPP-B	456	726 (JOVIAL)

Table 2. Total Number of Statements

cases except for VIG, and here most of the difference in size between the two versions was due to the fact that there were fewer comments in the FORTRAN program. While for some problems the PL/I program was smaller because it had a substantial savings in executable statements, for others it was smaller because of a savings in nonexecutable statements. In one area—data, file, and format description statements—the PL/I program was consistently smaller, sometimes by ratios of 15 to 1.

Turning now to the programmer time used in coding and debugging the source programs, Table 3 (p. 24) shows that five of the seven problems were coded more rapidly in PL/I than in the comparison language; the two exceptions are VIG, also the exception with regard to program size, and SPP-B. However, the debugging time actually spent shows quite the opposite trend: the PL/I programs generally took longer to debug even though they were the smaller programs. The two exceptions here are ALOREP2 and SPP-A, for both of which there was a rather substantial difference in favor of PL/I.

Naturally we were concerned that the programmer's knowledge of the problem gained during the first imple-

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mentation might have a considerable influence on the second in terms of programmer time and source program size. By studying all the variables in combination, however, we found that knowledge of the problem did not have a significant effect; the PL/I programs were generally smaller and took less time to code but more time to debug regardless of the order of implementation.

	PL/I	Other Language
GROSS PAYROLL	13/118	14/60 (COBOL)
ALOREP2	10/28	16/74 (COBOL)
MMI	22/70	33/60 (FORTRAN)
TSME	46/44	54/33 (FORTRAN)
VIG	10/14	6/10 (FORTRAN)
SPP-A	35/75	42/120 (JOVIAL)
SPP-B	36/165	26/120 (JOVIAL)

Table 3. Coding Time/Debugging Time (hours)

The longer debugging times for the PL/I programs were simply the result of the fact that the programmers made more coding errors with that language in spite of the smaller size of the PL/I source programs: 214 errors for PL/I compared to 140 for all of the other languages combined. By categorizing errors according to the language elements in which they were made, we found that, considering the small number of benchmark problems, the distribution was remarkably similar for all of the languages. Only in two categories were fewer errors made in PL/I: computation and assignment statements (9 errors for PL/I vs. 21 for the other languages) and labels (8 vs. 20).

The two predominant error categories were punctuation (67 vs. 21) and data, file, and format description statements (68 vs. 51). The large difference in the punctuation category is at least partly due to the fact that the programmers were not as familiar with the PL/I punctuation rules as with those of the comparison languages. With regard to the data, file, and format description statements, PL/I showed a substantial savings in the total number required; and it can be expected that with experience in using these superior capabilities of PL/I, which are evidently a little more complex, the number of errors of this type will decrease. The general large difference in debugging time is probably the result of less experience in using PL/I.

qualitative results

We hardly expected the abandon with which the benchmark problem programmers welcomed the chance to explode from the confines of a coding form. Their complete responses, and those of the evaluation study group, are presented in our final report; only the barest of summaries is possible here.

We looked first at suitability to the particular benchmark problem. PL/I was preferred for all except GROSS PAYROLL, the dollars-and-cents business problem, and VIG, the small scientific problem. For general suitability to the application area, PL/I was the choice regardless of problem size except for the business application area. Here, COBOL was considered more suitable than PL/I for small and medium-sized problems, while there was no preference for large business programming problems.

Generality is one of the most important gross language characteristics that enter into determining suitability to the problem and application area. PL/I was chosen as more general than FORTRAN or JOVIAL. However, no preference between PL/I and COBOL was stated for business programming even though PL/I is usually considered a more general-purpose language than COBOL; the reason given was that

PL/I has serious deficiencies in this area, particularly its lack of built-in sorting and report-writing capabilities. For conciseness, everyone except the programmer of the VIG problem chose PL/I, and for naturalness to the particular problem, PL/I was preferred to FORTRAN and JOVIAL. In the comparisons between COBOL and PL/I, however, neither language was found more natural than the other for the ALOREP2 problem, while COBOL was preferred for the GROSS PAYROLL problem. When it came to evaluating the balance between the two conflicting characteristics of conciseness and naturalness, PL/I was chosen almost unanimously as providing the best blend.

programmer preference

Suitability to the programmer is no less important than suitability to the problem. We considered that there are two fairly distinct kinds of programmers, the professional who is interested in the details of programming and the nonprofessional who is interested in programming only to obtain the answers he needs for his primary field of interest. The nonprofessional normally programs infrequently, and then only in a restricted application area.

All of the programmers and analysts who participated in the evaluation are professionals in the field, and all have extensive experience in assisting nonprofessionals. While PL/I was the unanimous choice of these professional programmers for their own use, there was almost complete agreement that COBOL was more suitable for the nonprofessional in the business area and FORTRAN for the nonprofessional in the areas represented by the MMI, TSME, and VIG problems. PL/I was recommended for the nonprofessional in preference to JOVIAL for data management applications.

Next we looked into some of the characteristics that enter into making one language more suitable than another for a particular user. Almost all responses were that the comparison language—whether COBOL, FORTRAN, or JOVIAL—was easier to learn, while PL/I was generally considered easier to use. The essay answers explain what might appear to be a contradiction between these two conclusions. Although FORTRAN, for example, is easier to learn than PL/I because it is a more limited language, the FORTRAN programmer may have to resort to many programming tricks and in some cases assembly language to solve the same problem that the PL/I programmer can solve with ease using the more extensive capabilities available to him. Indeed, when the combined attribute of ease of learning and using was considered in terms of the particular benchmark problem, PL/I was preferred for all but GROSS PAYROLL and VIG. With regard to ease of writing and reading statements in the language, PL/I was preferred to FORTRAN and JOVIAL but not to COBOL. Parenthetically, one of the most prolific of the essayists commented unfavorably about the tedium involved in coding in COBOL.

In responses about several language aspects that enter into ease of use, PL/I's logic control and unit (bit, character, and byte) manipulation capabilities were considered superior to those of COBOL and FORTRAN, while no preference was stated between PL/I and JOVIAL. Finally, for ease of statement modification—that is, ease with which a statement can be corrected when an error is found—PL/I was the unanimous choice.

compiler- and system-dependent aspects

Although the primary purpose of the study was to evaluate PL/I as a language, it was necessary to consider compiler- and system-dependent aspects so that we could factor their effects out of the analysis. The computers and associated compilers utilized during checkout are identified in Table 4. For completed programs running test cases, we found that each COBOL program was compiled in about the

same time as its PL/I counterpart, but that GROSS PAYROLL was link-edited and executed in about two-thirds of the time and ALOREP2 in one-third the time required for the PL/I versions. GROSS PAYROLL in COBOL produced an object program about one-third the size of the corresponding PL/I program—that is, required but one-third as much computer memory—while ALOREP2 in COBOL produced an object program about half the size of the PL/I version.

The two FORTRAN Level H programs, MMI and TSME, took from two to three times longer to compile than their PL/I counterparts, were link-edited and executed in slightly less time, and produced approximately the same amount of object code. The VIG FORTRAN program, originally checked out on the Univac 1108 under EXEC II, was subsequently run for comparison on the GE 635 under GECOS and on the IBM 360/65 using the Level H FORTRAN compiler. The FORTRAN 1108 compilation time was about three-fourths of the PL/I compilation time; the FORTRAN 1108

with PL/I and the generally longer time required for the individual runs in PL/I. We encountered a great number of system errors with all four languages; nearly a third of the total number of runs made during checkout of the GROSS PAYROLL programs, for example, were unproductive because of system trouble. The VIG FORTRAN program was the only one on which no system errors occurred. The high proportion of system-type errors is probably indicative of the state of compiler and operating system development for the newer computer systems.

conclusions

It seems evident that the improvement obtainable in changing from any of the comparison languages to PL/I is not as significant as that gained by going from assembly language to FORTRAN, for example.

PL/I is more difficult to learn than any of the comparison languages. None of the programmers had particular trouble

Language	Benchmark Problems	Computer System	Compiler
PL/I	All	IBM 360/65 ASP	Level F Version 2
COBOL	GROSS PAYROLL ALOREP2	IBM 360/65 ASP IBM 360/65 ASP	Level F Level F
FORTRAN	MMI TSME VIG	IBM 360/65 ASP IBM 360/65 ASP Univac 1108	Level H Level H FORTRAN IV
JOVIAL	SPP-A SPP-B	GE 635 GE 635	Version 36 Version 36

Table 4. Computer Systems and Associated Compilers

loading and execution time was but a tenth of the PL/I link-editing and execution time, and the comparable times consumed on the GE 635 were even shorter.

The Level H FORTRAN compilation time obtained for VIG on the IBM 360 was about quadruple that obtained for the other two FORTRAN compilers but entirely compatible with the FORTRAN compilation times obtained for the MMI and TSME programs. Link-editing and execution times could not be determined for the VIG FORTRAN program on the IBM 360 because several compilation errors involving features present in the other FORTRAN compilers but missing from Level H were encountered. Object program size produced by the 1108 VIG FORTRAN program was one-half that of the PL/I program, with the GE 635 object program intermediate between the two.

Turning now to the data management problem implemented once each in PL/I and JOVIAL by two different programmers, each JOVIAL program required about twice as long to compile as its PL/I counterpart, but both were loaded and executed in one-twentieth of the time required for link-editing and execution of the PL/I versions. That the programmer is a significant factor is illustrated by the SPP-A and SPP-B results. For example, the PL/I version of SPP-B took twice as long to compile as its SPP-A counterpart (0.96 vs 0.49 minute), and the object program was twice as large (64,402 vs. 32,522 decimal bytes).

We made a fairly detailed breakdown of the computer time expenditures. For all of the benchmark problems but TSME, development of the PL/I version took more computer time. The relative differences were not substantial, however, except for VIG and SPP, in these cases PL/I requiring roughly three times more computer time than the FORTRAN and JOVIAL counterparts. Again there was a considerable difference between the SPP-A and SPP-B programmers; debugging of the SPP-A program used 45 minutes while debugging of the SPP-B version used 117 minutes.

The longer computer time expended on the PL/I programs is attributable to the greater number of errors made

in this area, however, so it should not be classed as an extremely difficult language to learn. The extra capabilities of PL/I indicate that it is a good investment for the professional programmer to spend the extra time to learn it.

The new PL/I user can probably effect a savings in coding time right away. However, debugging time will be longer than that for any of the comparison languages until the programmer becomes experienced in debugging with PL/I.

The VIG benchmark problem indicated that PL/I probably complicates simple mathematical problems.

The nonprofessional programmer is probably going to be better off with simpler, more specialized languages.

The results of the SPP-A and SPP-B implementations indicate that the difference between any two languages is less than the difference between two programmers who, based on their background and experience, would be considered equivalent; the programmer is a greater influence on the problem than is the language.

PL/I generally requires fewer statements to solve a given problem than does COBOL, FORTRAN, or JOVIAL. The size reduction is particularly significant in the data, file, and format description area.

Programmers tend at first to make more errors when writing PL/I programs than when using the comparison languages; this is especially true of punctuation errors. Errors in data, file, and format description were the most common errors for all of the languages used in this study. In this area PL/I's better capabilities should eventually favor it relative to the other languages.

Finally, compiler and operating system considerations can completely override other factors in choosing a language. This is particularly important if the user is especially concerned with the time it takes both to compile and to execute his programs and the amount of system troubles he is likely to encounter. It is in this area that improvements are most urgently needed, for both PL/I and the comparison languages. ■

PL/I FOR C & C?

not yet

by CHRISTOPHER J. SHAW

□ The question of programming languages and language standards for military command and control systems has excited controversy for years and many a study has been funded. And until recently, it looked as if JOVIAL would become the de facto language standard in this field. The Navy had officially adopted it, the Air Force had established it as a standard, and even the Army seemed on the verge of choosing it. PL/I has changed this outlook considerably, and it is worth examining why, and to what extent.

Any discussion of the utility of PL/I for command and control programming—its advantages and weaknesses—must be fairly academic, since no command and control programs have as yet been written in the language. Nevertheless, the command and control application area is now more than ten years old; the kinds of programming tools required for it are well known, as are the demands it makes on a programming language. And PL/I is available for study and use, so it is possible to form some relevant opinions on the question of whether PL/I is really suitable for command and control programming.

In the most general terms, it is clear that the answer to this question is "yes." PL/I is a very broadly applicable language, and command and control is a very wide application area, so there is bound to be some overlap. But this observation is essentially trivial. What is needed are some practical guidelines for looking at a particular command and control system to determine its programming language requirements, and for looking at the various alternatives—including dialects of PL/I—to make the best choice by matching the requirements against the alternatives.

There are presently only two practical alternatives to PL/I for command and control programming: assembly language and JOVIAL. No detailed guidelines are given here on how to choose among these alternatives; that is a topic for another paper. This paper deals with a few, more basic topics. First, what is command and control? We must agree

on a definition before we can talk about the kind of programming language you need to write a command and control system, and how well PL/I meets these needs. Finally, some comments on the question of PL/I's prospects in command and control are presented in conclusion.

command and control

A military command and control system can be defined as an information processing system that is intended to provide military personnel with direct computational support in conducting an actual or anticipated battle. This definition includes all of the well known command and control systems, but it excludes many military systems that are not used in fighting battles, such as payroll accounting systems, and it also excludes systems that do not have a man-machine interface, such as weapons guidance systems. These



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exclusions, however, do little to delimit the kind of language needed for command and control programming.

Looking closely at the command and control field, you find it covers a more or less continuous spectrum of applications. This spectrum is often said to consist of only two major categories. These have had many names applied to them over the years—names like tactical versus strategic systems, or real-time versus nonreal-time systems. For convenience, let us call them: surveillance and control-oriented versus command-oriented systems.

This kind of distinction is commonly made, but it is the basis for the distinction that is important, and hard to pin down. Perhaps it is the degree to which the system is automatically linked to the outside world that it must sense and affect. Now this is something you can measure. You can measure the ratio between the system inputs that come from people, and the inputs that come from some kind of automatic sensor, like a radar. And you can measure the ratio between the system outputs that go to people, and those that go to some kind of automatic control system. So you actually do have a spectrum.

At one end of this spectrum, there are surveillance and control systems, such as the Ballistic Missile Early Warning System (BMEWS) and the Sentinel anti-ballistic missile system, which sense and affect their environments almost completely automatically. At the other end, there are command post information systems like the U.S. Strike Command's STRICOM system, and the Air Force Headquarters' 473L system, which sense and affect their environments manually. In a surveillance and control system, response time and reliability are the key things, and human interaction tends to be minimized and fairly rigid. For many reasons, such systems usually cannot afford too much computational inefficiency. In a command post system, there are still response-time problems, but they are not nearly as important. (A missed deadline does not automatically mean a system failure, it just means an irritated commander.) Human interaction is the main thing in this kind of system, so a lot of computational flexibility is needed.

Then, in the middle of the spectrum, there are command and control systems where the surveillance, control, and command functions are combined. Perhaps the SAGE air defense system is the best-known example here.

the software

Let us consider briefly the kinds of computer software necessary for a command and control system—or any system, for that matter. Workers in the command and control field currently use the labels “functional” and “nonfunctional” software. This is unfortunate, because it will be hard to get managers to buy “nonfunctional” software, even though it forms a vital part of a system.

For most purposes, software is better categorized as utility, application, or support software.

A utility program is a programming tool used for producing, testing, or installing other programs. Examples are compilers and assembly programs, debuggers, test data generation programs, and the like.

Operational or application programs are those that help the military users do their command and control job. Nobody doubts the need for this kind of software.

Finally, there is the vital yet sometimes overlooked category of support software, used in training and exercising the system, particularly its human operators, or in analyzing and evaluating the system, in both live and exercise situations. A support program necessarily deals with the whole system, including the people. A program used to exercise and evaluate just the hardware or just the software would be a diagnostic or a utility program, rather than a support program. Some examples are environment simulation programs for producing exercise inputs, and operational re-

coding and analysis programs for auditing or determining how the system is doing.

These three categories of software impose their own requirements on a programming language, in addition to the requirements of any particular type of command and control system. Let us look at some of these requirements, at least the unusual ones—those that are not satisfied by languages like ALGOL or FORTRAN—and try to see why they are almost always necessary.

command and control language needs

Aside from the ordinary features every programming language needs, the essential requirements of a command and control programming language are few. They include the capability to specify text processing, bit processing, fixed-point arithmetic, arbitrary data origins, varying table entries, and preset data. Interestingly enough, these requirements all have to do with data types and structures.

Text Processing. A command and control programming language must be able to handle text processing, by which I mean arbitrary manipulations on arbitrary character strings. In most command post information systems, at least part of the data base is textual; text is what the command staff puts into the system, and hopefully what they get back out of it. Even in surveillance and control systems, there is usually some textual communication with the operators, even where most of it is by function push-button or light-pen actions and graphic displays. In addition, communication between the utility and support systems and their users is largely by means of text.

These systems can be programmed in a language with a very rudimentary text-processing capability. Languages as elaborate as SNOBOL, for example, are not really necessary, although extra features are always helpful if the user can afford what they cost. What is necessary is the ability to declare textual variables of arbitrary length—up to some reasonable maximum. The ability to declare textual variables up to the length of at least a print line is useful, because this simplifies much of the programming. But textual variables limited to the length of a computer word, say 6 or 8 characters, are adequate. Other requirements are the ability to assign new values to textual variables, denote constant textual values, and compare two textual values for equality and alphabetical order. A concatenation operator is useful, though not vital. However, it is essential to be able to designate, as a textual variable, any dynamically specified substring of another textual variable.

The following examples show how PL/I expresses some of the text-processing functions I have mentioned.

```
declare TEXT character (500) varying;
substr (TEXT,1,3) = '(' || A || ')';
if 'M' <= substr (TEXT,1,1) then . . .
```

Fixed or varying length textual variables can be declared in PL/I. In the examples, a variable named TEXT is declared to have a maximum length of 500 characters. (In the IBM “F-level” compiler, variables up to 32,000 characters in length can be declared.) Textual substrings can be dynamically specified in PL/I. In the example (second line), the three characters beginning at the Ith character are being assigned the value: a left parenthesis, concatenated with the (presumably single) character designated by the textual variable A, concatenated with a right parenthesis. The third example shows the Ith character being compared to see if the letter “M” is less than or equal to it.

Of course, PL/I has other text-processing features. In particular, it has a very useful string searching procedure named **index**, and another one named **length** that indicates the current size of a string. But these are extras, not really essential for command and control programming.

Bit Processing. Just as text-processing features are needed

to write programs that communicate with people, so bit-processing features are needed to write programs that communicate with the remote sensors, control devices, and other systems that a command and control system must interface with. Since these devices tend to communicate in strange codes and formats (that language designers evidently have never heard of), it is necessary to manipulate individual bits. However, this is not a universal requirement, because in some command post systems the interfaces may all be textual. But it is common enough, and if new equipment requiring new formats is added to an existing system, it is useful to be able to program for it.

In essence, the bit-processing capabilities required are identical to the text-processing ones, except they are applied to bit strings rather than character strings. In addition, it is desirable to do logical operations on bit strings—that is, treat them as Boolean vectors. But again, this capability is not vital. Here are some examples of bit processing, dealing with a 32-bit string named X.

```
declare X bit (32);
substr (X,1,J) = ¬ (A & B) | C;
if substr (X,I,I) = '1'b then . . .
```

In PL/I, bit strings are handled like character strings, with the same operations. In addition, all the logical operations on bit strings can be used, such as “not” (¬), “and” (&), and “or” (|). In the second example, the first J bits of X are set to the results of “and-ing” the bits in A and B together, taking the complement of that, and “or-ing” it with the bits in C. The third example tests the Ith bit of X, and shows how awkward the PL/I notation can be, when compared with the nearest equivalent Algol expression, shown below.

```
if X[I] then . . .
```

fixed-point arithmetic

A capability for fixed-point arithmetic is mandatory for command and control, mainly because of the economy in execution time and storage space it provides (compared to floating-point). In most computers, fixed-point arithmetic is much faster than floating-point, and this can make a vital difference in a real-time system. In any kind of system, it takes a lot less space to store, for example, 5,000 fixed-point numbers each 18-bits long, than it does to store 5,000 floating-point numbers each 36-bits long. Also, less time is spent managing this data, moving it in and out of core. While this difference may be unimportant in a prototype command post system, for example, where floating-point numbers are acceptable for sample files, in any real system, floating-point numbers may be a luxury the user cannot afford.

To do fixed-point arithmetic, the only essential requirement is the ability to declare fixed-point variables of arbitrary size and scaling. That includes the ability to declare part-word variables, but not necessarily multi-word variables, and the ability to declare the radix point to be anywhere inside—and even outside—the field boundaries of the variable. Also, of course, it is necessary to be able to denote constant fixed-point values. Naturally, when arithmetic on fixed-point values is specified, the compiler should automatically take care of the scaling.

PL/I has almost all the facilities for doing fixed-point binary or decimal arithmetic, as shown in the following examples.

```
declare (X binary, Y decimal) real fixed (8,5);
X = 1.1b; Y = 10 + (3/2);
A: if X = then go to A;
```

The first line of code declares X and Y as 8-digit, fixed-point variables, each with 5 fraction digits—binary in the one case, decimal in the other. The “5” in the declaration could have been just about any positive or negative integer. (In the IBM “F-level” compiler, binary variables can be declared up to 31 binary or 16 decimal digits long.) Still, there are some minor but very real annoyances. For instance, all fixed-point variables in PL/I carry sign bits, and a positive, unsigned variable can not be declared without a sign bit (although an unsigned binary integer can be declared as a bit string). Even though it looks as if part-word variables could be declared in PL/I (such as X, which is nominally just 8 bits plus a sign bit long), the “F-level” compiler does not really allow this, because it allocates storage for fixed-point variables in full-word units.

Another problem concerns the fixed-point scaling rules in PL/I, which sometimes produce curious results. The second line of code in the examples above sets X to the binary constant one and a half (1.1b), and Y to the formula $10 + (3/2)$, which—incidentally—could just as well involve variables with the same precisions and values. Then, barring any conversion errors I have not bothered to account for, you will find that X does indeed equal Y, because the division (3/2) gives you the maximum number of digits, but only one integer digit. To add the ten, you must truncate something, and the PL/I scaling rules demand truncation of the most significant integer digit, rather than the least significant fraction digit.

Arbitrary Data Origins. Another command and control language requirement is the ability to declare origins for data elements. That is, the programmer must be able to say that a certain item starts in bit so-and-so of word such-and-such, both in absolute terms, and relative to some other location, and with provision for overlaps and gaps. The command and control programmer needs this so he can deal with the irregular data formats in the unusual places he is sure to encounter, particularly in a real-time system. At times he must be able to get at data that is wired into certain bits in core memory.

One way the programmer might use PL/I to get at any given string of bits is to declare an array that takes up all of core memory, which a “smart” compiler could assume was

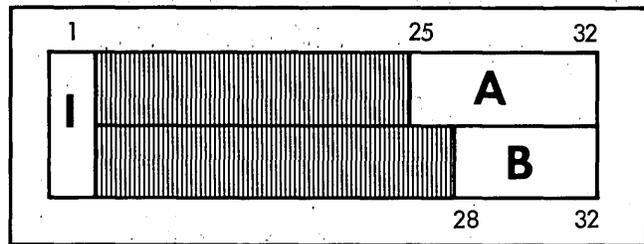


Fig. 1. A Simple, One-Word Data Format

supposed to overlay everything else, including the program. Here is an example of this:

```
declare WORD (32768) bit (32), FIELD bit (20)
defined WORD (639) position (8);
```

Assume you have a computer with a core memory of 32,768 words, each 32 bits long, and you want to get at bits 8 to 27 of word 639. The first part of the example above declares the WORD array; the second declares a 20-bit FIELD, defined to start right where you want it.

One problem with using defined overlays is that the only thing that can be defined on top of a bit string in PL/I is another bit string. The same holds true for the other data types. Now, let us say you want to describe the format of a word, as shown in Fig. 1, where the first bit is an indicator (named I) that tells you whether the rest of the word con-

tains a regular 8-bit character (named A), or a character (named B) from some special, 5-bit alphabet such as the Baudot teletypewriter code.

The format in Figure 1. can be declared by the following "cryptogram."

```

declare
1 NULL1 packed,
  2 I bit (1),
  2 NULL2 cell,
    3 NULL3,
    4 NULL4 bit (23),
    4 A character (1),
  3 NULL5,
    4 NULL6 bit (26),
    4 B bit (5);

```

Notice that this simple data format is declared in PL/I as a four-level data structure, with half a dozen null names (which have to be there, and have to be unique—at least those at the same level have to be unique) even though we will never use them in the program. At the first level, we declare the whole word as a packed data structure (NULL1), which means there is to be no unused storage between adjacent data items. (Unfortunately, this only applies to string items in PL/I.) At the second level, we declare a 1-bit indicator (I), and we also declare a cell (NULL2), which is an area of storage with several alternative formats. Ours we declare as a pair of third-level structures (NULL3 and NULL5). One (NULL3) consists of the character item (A), preceded by a 23-bit filler item (NULL4), which we need so that A will start at the right place. The other (NULL5) consists of a filler item (NULL6) followed by the 5-bit character item (B), which we have to declare as a bit string, though we will probably process it as an integer.¹

The previous example shows it is possible to declare rigid data formats in PL/I, even though the language really is not designed to make this easy. It is also possible, though awkward, to declare tables with varying entries in PL/I.

Varying Table Entries. A typical data structure in command and control applications is the table with variable size entries. An example of this is a table of flight-plan data, where each flight plan has a variable number of checkpoints. Fig. 2 shows a very simplified example of an entry in such a table.

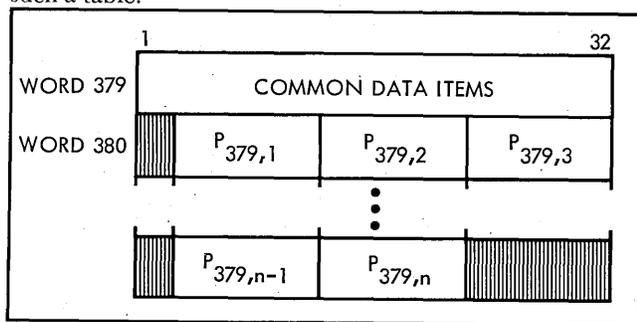


Fig. 2. A Variable Size Table Entry

It assumes that the common data items for each flight plan fit into one 32-bit word. The n checkpoints ($P_{379,1}$ to $P_{379,n}$) are each ten bits long, and are stored three per word. Presumably, they are indexes to some other table (of location identifiers.) The flight-plan table itself would be indexed by word so that $P_{379,3}$ would refer to the third checkpoint of the flight plan entered at word 379 of the table.

There are ways to avoid the varying table entry, but it is so common and useful a structure that any command and control programming language should be able to handle it. PL/I can handle it, in fact, though not, as you might ex-

pect, with the varying attribute, which results in the allocation of a fixed, maximum amount of storage. One way this can be done is shown in the next "cryptogram."

```

declare
1 FPT (2500) packed cell,
  2 NULL7,
  3 . . . ,
  . /*common data items*/
  .
  3 . . . ,
  2 NULL8,
  3 NULL9 bit (2),
  3 Q (3) bit (10),
P (2500,3) bit (10) defined Q(1+1sub+floor(2sub/3),
1+mod(2sub,3));

```

This names the flight-plan table FPT, and allocates 2,500 words to it. It is a packed cell, with two alternative, second-level formats. (Unfortunately, this is a coding mistake. For some reason, you cannot declare a packed cell in PL/I; the two attributes are incompatible. But you can easily get around this restriction by inserting another structure, with the *cell* attribute, between the first-level structure and the two second-level, alternative structures.) The first one (NULL7) contains the word full of common data items, which are not spelled out. The other (NULL8) contains a 2-bit filler (NULL9) and three checkpoints, which were given a dummy name (Q), since they cannot be indexed properly, as described above. Thus, P is declared as a separate array, with dummy (but hopefully adequate) dimensions, defined onto Q. The complicated subscript expression after Q gives the functions for mapping the subscripts of P—which are referred to as *1sub* and *2sub*—onto the subscripts of Q.

Preset Data. The last requirement on the list is the need to initialize data within the program at compile time. This is a common requirement, and not just for command and control programming. There are many uses for such things as tables of constants, and while there are other ways of making them available to a program besides having the compiler generate them, these are usually rather cumbersome in actual practice.

PL/I has a reasonably good mechanism for initializing data values. The following example gives the declaration for the rather picturesque character array shown in Fig. 3 (p. 30).

```

declare TAB (8,3) character (1)
initial ('A', 'B', 'C',
(18) (1) '*';
'Y', 'Z', ' ');

```

A repetition factor of 18 (on the third line above) is used to get the 18 asterisks. But to avoid producing a single, 18-character string, another repetition factor of one must be inserted.

The PL/I initialization feature has only two relatively minor annoyances. The first is that a multi-dimensional array must be initialized with a one-dimensional list of values; the second is that when a table is initialized, each item in it must be initialized with a separate list. Thus, the initial values for each entry can not be grouped together in the natural way. But, again, these are minor problems.

other language features

The list of requirements presented thus far may seem rather pedestrian and unexciting. Perhaps the most interesting part is what is left off the list—and why.

As mentioned before, the list excludes all the ordinary

¹ It would often be very convenient if PL/I allowed programmers to define arbitrary alphabets, but it does not.

features found in most high-level programming languages—things like machine independence, loops, and subroutines. These features are also required, of course, but are not worth discussing here.

Also excluded are almost all of PL/I's powerful and exciting new features—things like the compile-time facilities, list processing, automatic and controlled storage allocation, recursive procedures, array and structure expressions, and so on. These features are all very useful, but are not essential requirements. The user decides whether he can afford them by trying to figure out how much they will add to the cost

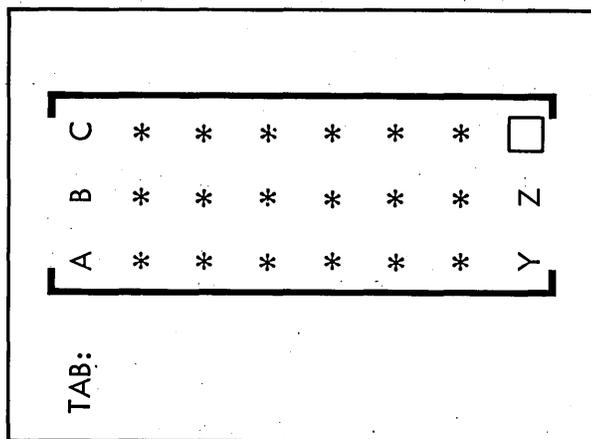


Fig. 3. A Preset Character Array

of acquiring, operating, and maintaining his compiler, versus how much they will save in programming costs.²

Of more interest, however, are the features missing from the set of requirements that might reasonably be found in a list of command and control language needs. These other language features include: input/output and file processing, priority and interrupt processing, parallel processing, and machine-dependent processing.

There is certainly a need to do input/output and file processing in any command and control system, as well as the need to do priority and interrupt processing. Like it or not, some machine-dependent processing is usually required, and since most command and control systems involve at least an additional back-up computer, some kind of parallel processing is often necessary.

Except for the capability for machine-dependent processing, PL/I has all these features. But they are not included among the essential requirements because there are perfectly acceptable ways of getting along without them in the language. Input/output and file processing, for example, may just as well be done by calling on library subroutines, and any necessary machine-dependent processes can also be library subroutines.

Language features are really needed only for functions that are best performed in the system's individual subprograms by open or in-line code. If a function is best performed centrally, in the executive, or as a closed subroutine, there is little need for a special language feature to express that function. Such functions are invoked in the subprograms, if this is necessary, by calls to library or executive subroutines, or by leaving messages for the executive in

communication tables or queues. Furthermore, avoiding special language features for these functions happily simplifies the compiler and minimizes the usual awkwardness of the interface between it and the operational executive.

command and control processor needs

In addition to the programming language requirements that have been discussed, the command and control application area imposes fairly severe requirements on the language processor. It must be "compool" sensitive to allow reference to predefined data elements and thus facilitate interprogram communication; it must interface with various other programs, such as executives and loaders; it must be economical of implementation, operation, and maintenance; and it must produce reliable, efficient target code. These requirements are harder for a compiler to meet than an assembler, and they have considerable impact on the utility of PL/I for command and control programming, because they can be met only by picking a specialized command and control subset of PL/I, and custom-building a compiler for it. However, there is no question as to the feasibility of doing this—it is undoubtedly a practical approach.

Compool Sensitivity. To get down to specific requirements we must ask: What is a compool, and why should a compiler be sensitive to it? A compool (which is an abbreviation for "communication pool") is just a central file of data descriptions—a dictionary of data names—that are common to a set of programs. By referencing a compool, a generalized utility program, like a compiler, can translate back and forth between the names used by the programmer and the internal address codes used by the computer, and also between the external and internal representations of data values.

This is a vital function, but it is the centralization that is the key part of the compool concept, because it means each programmer can use the same dictionary, so they do not have to spend all their time trying to coordinate definitions. When a change has to be made, it can often be made once, in the compool, thus eliminating the need to look through numerous separate programs and make thousands of individual changes.

PL/I has two very useful language features that may sometimes be combined to make a compool unnecessary. One is the **include** statement, which allows the programmer to insert a string of PL/I text from a library file into his program. The other is the **external** attribute, which allows him to declare data elements that are common to more than one program. By including external declarations in a program, the programmer can get almost all the power and convenience of a compool. But there are some differences. There is usually information in a compool that cannot be expressed in a PL/I text—for example, auxiliary and alternative storage locations. Also, a compool is a binary file, not a textual file, so it is much more compact, and this makes searching and maintaining it much faster. In a command and control system with thousands of common data names, this difference can be significant. For such systems, and where space must be conserved by precise allocation of primary and secondary storage, a compool is needed.

Compool Interfaces. Large command and control programs are not compiled as single programs; they are constructed out of many individual subprograms, compiled separately. The compiler must therefore produce code that can be handled by the programs that file these compiled subprograms away, link them together and load them for execution. The compiler must also produce code that the operational exec-

² Experience with *Jovial* for command and control programming seems to indicate that even all the features of that relatively modest language are seldom warranted, much less the additional features of a language like PL/I.

utive can run, and it must itself run under control of the utility executive, which is frequently different from the operational executive.

Economy. A major command and control compiler requirement is for economy of implementation, operation, and maintenance. This requirement is imposed not so much by the tyranny of a fixed budget, as by the tyranny of a fixed schedule. A compiler for a "big" language like PL/I takes a lot of time to build—as IBM has found out—and since a custom-built rather than an off-the-shelf compiler is usually required, this can have a great impact on the over-all schedule for a system. A big compiler for a big language is almost necessarily a slow compiler. Although economy of operation is always desirable, when there are, say, 100 programmers frantically trying to debug their programs at the same time, a slow compiler can mean they get many fewer shots at the computer—even a time-shared computer—and this can have a great impact on a schedule. Economy of maintenance does not affect schedules as much as it does budgets, but it is still a worthwhile goal.

Reliable, Efficient Target Code. Because of the exceptional difficulty typically encountered in debugging on-line, real-time systems such as command and control systems (this is largely due to the difficulty of selectively replicating the circumstances preceding a malfunction) it is especially vital that a command and control compiler produce reliable target code. Anything that adds to the system debugging chore, like code from a new and unreliable compiler, must be avoided or at least taken into account.

So far as efficient target code is concerned, there may be extreme cases where the computer is so big and fast in relation to the job that just about any code will do, or where the computer is so slow and small that it can not solve the problem no matter how well it is coded. However, compilers can be built that turn out code that is good enough for most command and control systems. Since the computational requirements for most systems are almost always underestimated, it is typically just barely possible to do this. Thus, efficient target code is often the most stringent requirement, to which everything else—such as compiling speed and non-essential language features—must be sacrificed.

All these requirements can be met by a good compiler for a suitable subset of PL/I. But it would be unwise to try to include too much in that subset—aside from the features that are obviously needed in any programming language, and the features mentioned earlier that are needed for command and control. Again, any additional features should be implemented only if they will save time or money.

pl/i's command and control prospects

My comments on PL/I's prospects in the command and control field will probably be unsatisfactory because they boil down to this: Your guess is as good as mine—at least for the long term. But for the short term, say the next three or four years, I think PL/I's prospects are surprisingly poor for becoming the standard command and control programming language. I say surprising, because the language (or rather a dialect of it) can meet all the requirements I have set forth—any awkward coding, as in the examples, can be handled in the library or by the compool—and is thus quite suitable for command and control, and also because a great many people, supporters and detractors both, think it is the wave of the future, and this by itself generates considerable demand for its use.

There are many reasons why this demand will not soon be widely satisfied in command and control. One reason is simply inertia. The Air Force has only recently established JOVIAL as the standard computer programming language for Air Force command and control systems, and I do not anticipate an early change in this policy. The Navy adopted

JOVIAL several years ago as the standard language for its strategic (i.e., shore-based) command and control systems, though it uses CS-1 for programming its tactical (i.e., ship-borne) systems. Only in the Army, which seemed until recently on the verge of choosing JOVIAL as its standard command and control language, are there any prospects for the use of PL/I. Dialects of PL/I are being developed for the Sentinel antiballistic missile system and for the Tacfire artillery fire control system. In addition, there are signs of a reluctance, at certain high levels within the Department of Defense, to encourage the use of any programming languages but COBOL and JOVIAL.

Another factor that will slow the acceptance of PL/I for command and control programming is the lack of an established and suitable dialect. Nobody has implemented or even announced a command and control dialect of PL/I yet. The Army's projects are evidently still under development. An IBM project to develop a military subset of PL/I is still at an early stage, and a small SDC project has only recently begun to look into requirements.

For the long term, however, if PL/I ever does become the universal programming language, supplanting FORTRAN and COBOL for scientific and commercial applications, then it would clearly make a lot of sense to use it for military applications too. Some say this is sure to happen. Others say PL/I will remain a toy, like ALGOL. At any rate, I would not recommend changing the Air Force command and control programming language standard from JOVIAL to PL/I until somebody can demonstrate that a lot of time or money can be saved by doing it. ■



PL/I COMPILE TIME FACILITIES

getting better

by RICHARD L. GAUTHIER

Currently, the PL/I compiler is the only major compiler in wide use that provides a useful compile time facility. Compile time, as used here, is defined to be that time during which a source program may be altered (preprocessed) prior to the generation of object code. The majority of programmers using this compiler have not used the compile time facilities to any great extent. The major reasons for this are:

1. Lack of understanding of this capability.
2. Lack of clear documentation describing this capability.
3. Cost in extra compile time is too great.
4. Significant additional capabilities are limited.

The majority of programmers using compiler languages, as well as many programmers using assembly language, are not familiar with macro capabilities common to assemblers. This, coupled with the fact that compile time facilities are a set of relatively new concepts, explains why there has been relatively little use made of this capability. As additional facilities are added, adequate documentation generated, and user procedures established, programmers will tend to take advantage of these new concepts when using PL/I. Those programmers who have used the existing compile time facilities have found that they are well worth the effort.

compile time facilities

Compile time facilities are those provided by a higher level language to modify programs written in another higher level language (PL/I in this case), prior to the compilation of these programs. Although the compile time facilities are a part of PL/I, the modifying "Compile Time Language" may conceptually be separated from the rest of the language and is almost unaffected by changes to the rest of the PL/I compiler.

The following sections describe what compile time fac-

ilities are, how they are currently being used, the reactions of users and various problem areas encountered during their use.

The compile time facilities as defined in the PL/I language may consist of a preprocessor stage that is executed prior to the compiler stage plus the normal compiler execution. The compile time facilities provide the programmer with the capability of manipulating a source program prior to compilation.

In Fig. 1, input to the preprocessor is a source text which consists of a mixture of compile time statements and standard PL/I statements. To differentiate the compile time



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statements from standard PL/I statements, they must be preceded by a percent sign (%). These compile time statements are executed by the preprocessor when encountered.

Output from the preprocessor consists of a newly created character string, called the program text, which contains the modified source program text. This serves as input to the compiler. This new text has been modified by the preprocessor according to the compile-time statements encountered in the source text.

These capabilities allow the programmer to accomplish

3. Incorporate strings of text into the source program, where the strings of text reside in a user or system library.

The syntax for the INCLUDE statement (used to incorporate strings of text into the source program) as currently defined provides the ability to include one or more data sets. Once the data sets have been included, control passes to the first included member. Unfortunately, the method of specifying data sets is implementation-defined. This should be completely avoided if language consistency is to exist

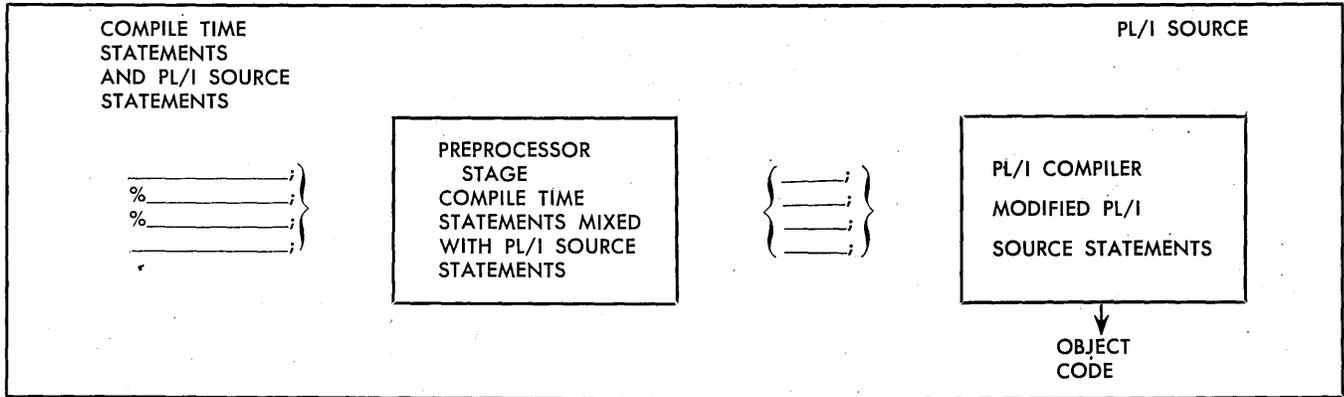


Fig 1.

the following:

1. Modify source programs for the purpose of changing variable names or for notational convenience. Modification is accomplished by replacing designated identifiers with desired character string text, where replacement identifiers appear in the pre-text to specify the points at which insertion of text is desired.

Example 1

```
% EMP__NO = 'EMPLOYEE__NUMBER';
NEW__NO = EMP__NO;
The program text produced is:
NEW__NO = EMPLOYEE__NUMBER;
```

The replacement shown in Example 1 could be used for notational convenience, allowing the user to expand various names making it easier to read.

Example 2

```
% WEEK = 'DAYS * HOURS';
% HOURS = 8;
TIME = WEEK;
The program text produced is:
TIME = DAYS * 8;
```

In Example 2, a variable name was replaced by an expression.

2. Conditionally compile sections of the source program. In other words, the user is allowed to dictate which sections of his program are to be compiled.

Example 3

```
% DCL TEST FIXED;
% TEST = 2;

% IF TEST = 1% THEN % DO;
```

```
SECTION
  1
```

```
% END;
```

```
% IF TEST = 2% THEN % DO;
```

```
SECTION
  2
```

```
% END;
```

This results in the single statement defining the value of TEST generating code (SECTION 1 if TEST = 1 or SECTION 2 if TEST = 2) conditional on the value TEST.

between computers.

Example 4

TEST is the name of a member of an (external) data set which contains the following source text:

```
% IF X = 'BIG' % THEN % OPCODE = '>';
% ELSE % OPCODE = '<';
IF X1 OPCODE X2 THEN IF X1 OPCODE X3
THEN X = X1;
ELSE X = X3;
ELSE IF X2 OPCODE X3 THEN X = X2;
ELSE X = X3;
```

The non-compile-time IF statement in the data set can be used to find the largest or the smallest of three values. The following program utilizes it to generate code to find the largest:

```
TEST__1: PROC OPTIONS (MAIN);
DCL (P, Q, R, BIG, SMALL) FIXED DEC;
GET DATA (P, Q, R);
% DCL (X1, X2, X3, X, OPCODE) CHAR;
% X1 = 'P';
% X2 = 'Q';
% X3 = 'R';
% X = 'BIG';
% INCLUDE LIB (TEST);
```

The following code is generated:

```
TEST__1: PROC OPTIONS (MAIN);
DCL (P, Q, R, BIG, SMALL) FIXED DEC;
GET DATA (P, Q, R);
IF P > Q THEN IF P > R THEN
BIG = P;
ELSE
BIG = R;
ELSE IF Q > R THEN BIG = Q;
ELSE BIG = R;
```

are compile time facilities necessary?

The same question has been asked about macro capabilities for assemblers. Compile time facilities are not only useful, but necessary. This necessity cannot be judged by what exists today because, as was pointed out in the introduction, it requires time to develop new ideas, from the standpoint of the user as well as those producing the compile time facilities capabilities. The facilities do, however, give a flexibility to the language which is greatly needed.

Although many programmers are merely experimenting

with compile time facilities, some have put them to useful work. Following is a list of functions currently being performed by compile time facilities:

1. Including the necessary declarations for assembler written subroutines.
2. Supplying additional character handling MACROS such as:
 EQUAL (variable name, label 'CON 1, CON 2, CON 3')
 INRANGE (variable name, lower limit, upper limit)
 OUTFRANGE (variable name, lower limit, upper limit)
3. Isolating text which is in the source program for debugging only.
4. Providing a tested binary search for which a programmer may supply his own variable names.
5. Providing a powerful capability to generate debug statements at any given time for any given compilation.
6. Modifying the text of FORTRAN programs in order to make them easier to rewrite.
7. Test case replacement. This capability allows a user to generate/not generate debug statements (ON CONDITIONS, etc.) by setting a single compile time switch.
8. Quick one-time program expansion.
9. Changing precisions of variables.
10. Including sections of code from an external source (by use of the INCLUDE statement).
11. Creating a more familiar syntax for string handling functions.
12. Generating code tailored to a given situation at compile time for efficiency at execution time.
13. Invoking a selected set of FORTRAN routines with FORTRAN calling sequences.
14. Replacing calls to FORTRAN routines which have a character string argument and/or a variable number of arguments with calls to an interface routine.
15. Replacing FORTRAN function names with PL/I function names.
16. Adding declare statements to the source program for the normal compilation to provide the correct attributes for the FORTRAN arguments. For example, an argument specified as a decimal integer constant would be passed in packed decimal format from PL/I unless declared to be FIXED BIN, the format FORTRAN expects.

problems with compile time facilities

Although there have been many practical uses of the compile time facilities, there are problems. A partial list of these includes:

1. Inadequate documentation and examples of usage (although they are improving with each new release).
2. Difficulty in lining up the printed output for reliability, especially if multilevel procedures are used.
3. Present system implementation does not provide the level of replacement needed.
4. Ability to generate code is limited because:
 - a. No way to format the listing to enable easy reading.
 - b. A blank is always inserted after the return from a function.
 - c. Numeric constants are equated to a character string (extra blanks inserted).

A = 'LAB' | | 3;

would generate

A = LAB ΔΔΔΔΔΔΔ 3;

Note: The result is not a legal identifier since it has embedded blanks.

- d. Multiple replacement feature does not allow the returned name to be the same as the original source name.

If the original source is

CALL RTN (argument list);

and it is desired to replace the original source with

CALL INTERFACE (RTN, argument list);
 then the returned value 'RTN' must be a different name from that in the original source to avoid multiple replacements to that level of nesting.

5. Lack of ability to hold text for a rescan before putting it into the stream. For example, an existing program contains the following statements:

CALL ABC (X, Y, Z)

CALL DEF (A, X, Z)

Currently, one CALL cannot easily be replaced without affecting the other CALL statements.

6. Comparisons between numeric constants and character string constants are not compatible (i.e., IF B = 0 is not the same as IF B = '0').
7. Necessity to force compilation following a macro process which noted a severe error. There is no way to override a condition code resulting from the compile time processing to force successive compilation in the same job step.
8. Recognizing a missing argument in a variable length calling sequence.

If source can be CALL RTN (A, B)

or

CALL RTN (A),

then, within the function RUN, the absence of B is recognized by 'IF B = ' ΔΔΔΔΔΔΔ 0' (7 blanks and a zero). This is not stated in the available documentation.

conclusion

As previously noted, compile time facilities are not only currently being used but, to a limited extent, used productively. In spite of the limited capabilities of the current compile time facilities, several useful applications have already been developed, only a few of which were previously mentioned.

Even with the additional capabilities under development, compile time facilities have one major disadvantage—the cost of using them. One timing study made on an IBM 360, Model 65, running under HASP found that the cost of compilation was increased by approximately 50%. This is primarily attributable to the design of the package, since the preprocessor stage requires a number of extra phases to be called in and requires an extra pass over the source text. This problem should be overcome with use of more optimum design techniques, such as the INCLUDE statement.

Users found that compile time facilities were relatively easy to write and debug. The major complaint reflected the fact that ground rules have not yet been clearly defined (e.g., differences between SUBSTR in compile time statements and SUBSTR in source text. They have the same name but different actions).

Compile time facilities are currently quite limited and must be expanded if more users are to be required. Since they are such valuable additions to the programmer's working tools, the current set should be used extensively in order to provide data necessary for a rational upgrading of the existing compile time facilities. ■

SABRE PL/I

by MARTIN HOPKINS

American Airlines is now using a PL/I subset compiler to write modules for SABRE 360, American's second-generation real-time ticket reservation system. One of the more interesting aspects of this project is its rationale. Why did American contract for a product that seems to be supplied by IBM? What particular features made the hand-tailored product desirable? And, finally, why PL/I? Answers to these questions also shed light on the basic problems one encounters in building large-scale, real-time, conversational systems which support hundreds or even thousands of terminals.

The SABRE system was basically installed by January, 1965. It used a highly modified IBM 7090 to make ticket reservations in real time through hundreds of terminals all over the United States. (There are now close to 2,000 terminals attached.) The program is extremely complex, having over 300,000 assembly language instructions and the system undergoes constant change. New facilities are constantly being added. Revisions in American Airlines and government practices also necessitate program fixes. Finally, there is constant work in progress to correct the bugs which are inevitable in a system of this size.

Even a large, competent programming staff finds it difficult to support maintenance work and the new projects which are underway. Performance is also an especially heavy burden. Airline boardings are increasing every year at a rate which generally exceeds sales forecasts. Thus the reservations system normally has to handle loads which were not anticipated for several years. The Christmas rush is an annual crisis for American. In 1967, there were periods when 2,800 messages per minute were being handled. In this sort of environment, program efficiency is an important factor. If a batch edp application takes 40 minutes instead of 25, few really care; but if the average cpu time per transaction on SABRE went from its current figure of 25 milliseconds to 40, there would be a disaster. This puts a high premium on good coding.

conversion problems

In order to handle the increasing work load, American decided on a System/360 Model 65 as their new computer. It was not possible to use emulation. Thus, hardware differences between System/360 and the American 7090 seemed

to mean rewriting the code for an entirely new reservations system. IBM is providing PARS (Program Airlines Reservation System) to all airlines which use System/360, but problems of cutover from SABRE seemed to make it very difficult for American to make a total switchover. (This came to be called "pulling the plug.")

The solution was a special hardware "black box" which made it possible for the System/360 to fetch and store data in the 7090. Thus the System/360 could "watch" request queues; and when a relevant request was encountered, it could perform the desired operations—then posting the completed event. This relieved the 7090 of certain repetitive functions and will allow for gradual transfer of program modules to System/360.

It was clear to American that such evolution was essential in operating a key area of their business. It just is not possible to "pull the plug" on an important area such as ticket sales without having chaos. While American decided to use some of PARS they were faced with the task of rewrit-



Mr. Hopkins is vice president of Columbia Computer Corp., White Plains, where he is working on the development of on-line applications and increasing programmer performance. Prior to joining the recently formed company, he has been a technical director of Computer Usage Co. for nine years.

ing much of their system over the next few years, but without the pain of a single cut-over.

There was some compensation for American in avoiding total dependence on PARS. PARS uses ACP (Airlines

Control Program) rather than OS/360, the standard large-scale System/360 monitor. ACP is designed for maximum throughput for the reservations application. Coding conventions and system macros for I/O, storage allocation, etc., reflect the high performance requirements necessitated by having thousands of active terminals working at once. However, the facilities for running batch operations are far

Fig. 1. A sample compiler listing with object code

```

*** SABRE*PL/1 ***** RELEASE*DATE**06/01/68 ***** RUN*DATE/TIME**265/88**17.49

BEGINNING OF SOURCE
TEST_CASE:PROCEDURE: /* CODE GENERATION IN VARIOUS CASES. */
                                PRINT NOGEN
                                STRT TESTCA
                                RENTS 13
                                LR RA,RD

    DCL (I,J,K)BIN(15),
        (XB8,YB8,ZB8)BIT(8),
        (XB1,YB1,ZB1)BIT(1),
        XC30 CHAR(30),
        (XC10,YC10,ZC10) CHARACTER (10);
    DECLARE 1 MESSAGE BASED(P),
            2 BYTE_CTR BIN(15),
            2 STRING CHAR(80);
    XC30=ZC10||'1234567890'||XC10; /*CONCATENATION */
                                MVC XC30$(10,RA),ZC10$(RA)
                                MVC XC30$+10(10,RA),$LIT+4
                                MVC XC30$+20(10,RA),XC10$(RA)

    LOOP: I=I+XB8-YB1; /* SIMPLE ARITHMETIC ON BIT STRINGS & BIN */
                                LOOPS$ DS OH
                                SR R1,R1
                                IC R1,XB8$(RA)
                                AH R1,I$(PA)
                                IC R0,YB1$(PA)
                                N R0,$LIT+40
                                SRL R0,6
                                SR R1,R0
                                STH R1,I$(PA)

    IF I<=10 | I>=5 THEN SUBSTR(XC30,J,2)='XX'; /* SIMPLE COND. */
                                C R1,$LIT+16
                                BNH $GEN0002
                                C R1,$LIT+20
                                BL $GEN0001
                                $GEN0002 DS OH
                                LH R2,I$(RA)
                                AR R2,RA
                                MVC XC30$-1(2,R2),$LIT+24
                                $GEN0001 DS OH

    SUBSTR(XC30,1,2)=SUBSTR(XC30,J,2); /* INDEX IS RELOADED. */
                                LH R2,I$(RA)
                                AR R2,RA
                                MVC XC30$(2,RA),XC30$-1(R2)

    SUBSTR(XC30,J+10,4)='1234'; /* INDEX IS NOT RELOADED. */
                                MVC XC30$+9(4,R2),$LIT+4

    IF XB1=1&YB1=0 THEN ZB1=-ZB1; /* BIT TESTING & INVERTING */
                                TM XB1$(RA),X'80'
                                BF $GEN0003
                                TM YB1$(RA),X'40'
                                BO $GEN0003
                                XI ZB1$(RA),X'20'

    ELSE XB8,YB1=1; /* SETTING OF SIMPLE BIT FIELDS */
                                B $GEN0005
                                $GEN0003 DS OH
                                OT YB1$(RA),X'40'
                                MVI XB8$(RA),X'01'
                                $GEN0005 DS OH

    CALL COUNT(ADDR(XC30),30);
                                LA R1,XC30$(RA)
                                ST R1,P$(RA)

```

less than those provided by OS/360. And its many data management services, applications packages, utilities and compilers cannot be used. American decided to use OS/360 but provided their own highly tailored system services to gain the performance which could not be obtained by the more generalized OS/360 services.

The outlines of this solution were clear by early summer, 1967. American would use the "black box" to offload the IBM 7090 and provide a mechanism for gradual transfer to System/360. The System/360 would use OS/360. This necessitated special service routines for efficiency, but will allow the execution of standard 360 programs to be accomplished in the background when the system is not heavily loaded, which turns out to be most of the time.

There was one objectionable factor. Once again the reservation application would have to be written in assembly language. The standard IBM compilers produce code which interfaces with standard OS/360 services but cannot be used by either ACP or an OS/360 system with tailored interfaces. Register conventions, storage allocation methods, and system service macro calls differ.

Another problem was the poor performance of standard compilers in doing the sort of task one encounters in real-time systems. FORTRAN compilers tend to be oriented toward the efficient handling of floating-point data in arrays. SABRE has no floating-point data and only single dimensional arrays. COBOL is oriented toward I/O and packed decimal arithmetic while all SABRE I/O is through system macros and packed decimal data is seldom used. PL/I has the required data types, but even the newer versions of that compiler could not produce code for a sizable procedure which would fit in the 1688-byte limit of a SABRE/360 module.¹

The American problem is universal. The general-purpose operating system is not efficient enough to support thousands of terminals; therefore, one must either construct a new monitor, such as ACP, or provide highly tailored interfaces to the standard system, such as SABRE/360. In either case, one requires object code which is not produced by standard compilers; and even if this problem could be surmounted by some expedient such as modifying the compiler, the quality of the object code produced by most compilers would not be good enough to support the application. It should be emphasized that this argument applies only to very large systems. Standard monitors, tele-communications systems and language translators may suffice if performance requirements are low.

choosing a language

The advantages of higher-level language programming are widely recognized, and American was well aware of potential benefits, especially in relation to the constant maintenance which the SABRE system undergoes. It was, therefore, arranged that the author would develop a suitable language specification and enough of a compiler design to project costs and object code performance.

Language design is a major task, so it was decided to use a subset of an existing language. As most SABRE data is in the form of character strings, binary numbers, bit strings, and pointers, which are all available in PL/I, that language was the choice over COBOL or FORTRAN, which are both deficient in at least some of these areas. PL/I was also the choice over JOVIAL, due to the flexible storage allocation of PL/I, which partly corresponds to that of the SABRE system, the existence of structures and pointer data and, finally, a generally better system of punctuation, made available by the new IBM 029 keypunch character set.

The PL/I language is, however, very large, and there was much that we did not need. McKeeman, et al., have pointed out that:

"It is worthwhile to note that the addition of features to a

language is not a linear process as far as the translator is concerned. Constructs interact with each other, and the addition of a *single feature* may, in a bad case, *double* the size of the translator."²

Another factor which makes it desirable to have a small language is that there is less for a programmer to learn and reports have indicated that full PL/I presents certain learning problems.³

A brief description of the SABRE PL/I language is in order here. There are the following data types:

1. Binary half and full word—BINARY (15) and BINARY (31)
2. Addresses—POINTER
3. Packed decimal—DECIMAL (n, m)
4. Character strings—CHARACTER (n) and PICTURE
5. Bit strings—BIT (n)
6. Label variables—LABEL

Data may exist in structures, and arrays of a single dimension are allowed. Abbreviations and factoring of data attributes reduce coding time. There is no I/O or name qualification. Compile time facilities are limited to INCLUDE. The assignment, IF, GO TO, CALL, RETURN, DO, END, ALLOCATE, FREE, EXIT, and PROCEDURE statements are allowed. All PL/I operators can be used in expressions as can programmer-defined functions and the built-in functions MAX, MIN, MOD, ABS, SIGN, SUBSTR, INDEX, and ADDR. Data types may be freely mixed for the most part, but some conversions whose effect is obscure and usefulness suspect are not permitted. Thus the PL/I conversion between bit string and character string, which results in the bits zero and one becoming the EBCDIC characters zero and one, respectively, is not allowed.

Differences with standard PL/I tend to be very minor, and, in most cases, could be replaced with a SIFT program. Typical of such minor differences is that SABRE PL/I allows hexadecimal constants, which could be replaced with bit strings. There is one major extension. SABRE system macros are allowed. Some SABRE macros have direct PL/I counterparts. The SABRE Get Core macro can be translated into a PL/I ALLOCATE, but for others, such as that which obtains a file address, there is no correspondence; and in these cases, the simplest solution was to allow the use of SABRE macros in line. SABRE PL/I is very small when compared to full PL/I, but most applications programmers find it an easy way to write their programs.

saving core space

Object code efficiency was a major concern in building the compiler. Different languages and applications have different criteria for efficiency. In SABRE and probably many other real-time systems it is generally more important to save space than time. (There are exceptions but these are candidates for assembly language coding.) The reasons for the importance of conserving central memory are pointed out in James Martin's excellent book "Design of Real-Time Systems." He points out that: ". . . an error in estimating core requirements can have far reaching effects that upset the balance of the system . . ." ⁴ He then shows, by example how an error of 33% in estimating application program size can seriously degrade an otherwise sound system and a somewhat larger error can make the system inoperable.

Other languages have different criteria which is a reflection of the applications for which they are intended. In

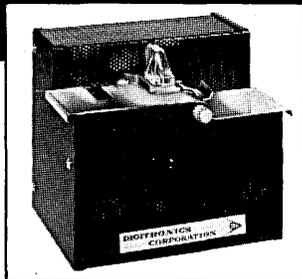
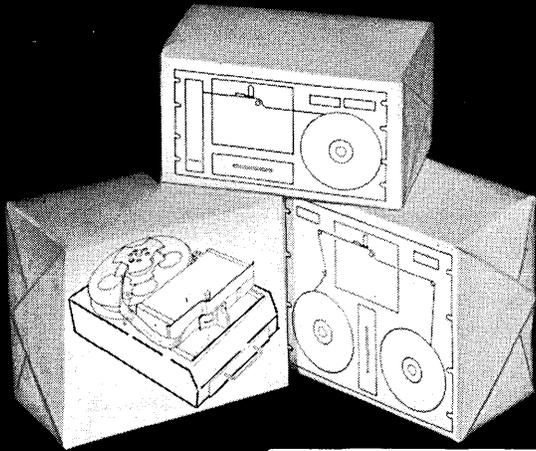
¹ The figure 1688 is an efficient size for the IBM 2314/2844 Multiplex Storage Control Feature, which is a modified IBM 2314 designed to satisfy the demanding requirements of the airlines.

² McKeeman, Horning, Nelson and Wortman. *The XPL Compiler Generation System*, paper delivered at FJCC 68.

³ Rubeg, et al., *Comparative Evaluation of PL/I*, Defense Documentation Center, DSA April, 1968.

⁴ Martin, J. *Design of Real-Time Computer Systems*, Prentice Hall, 1967.

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SABRE PL/I . . .

FORTRAN, efficiency normally implies pulling calculations out of loops, especially those related to indexing. This may result in more object code which will be executed faster as the inner loops are tight. COBOL, on the other hand, is normally concerned with record I/O performance and assuring that very large programs can be compiled without very large inefficiencies resulting. In SABRE, most statements are relatively simple. Bits are set on or off and tested. Data is moved and compared. A statement of average complexity is:

$$I = I + 1;$$

SABRE PL/I has a very large advantage over standard compilers. Since the maximum size of a SABRE module is 1688 bytes, the compiler, which operates as a standard job under OS/360, is compiling on a very large machine a program of rather small size. All data for compilation can reside in core, and repetitive examination of the source code and intermediate text is possible. The compiler is thus able to search for frequently occurring exception cases and give them special attention.

A sample compiler listing with object code is shown in Fig. 1. It illustrates the object code produced in a few situations. From this, it can be seen that simple operations are done reasonably well and that there is little administrative code to set up bases and perform similar functions related to the peculiarities of the computer in question. Finally, it should be pointed out that the object code is address free and read only, thus allowing dynamic relocation of code without special hardware and parallel execution of code by multiprocessors.

The compiler is a good tool for writing programs which scan characters, manipulate bits, perform simple arithmetic on binary, bit string and decimal data and handle data organized in lists linked together by addresses. It is easy to write programs in SABRE PL/I and the code is suitable for use in a demanding real-time environment.

Many compilers are designed to be used by inexperienced or even poor programmers. According to this philosophy, the true nature of what is produced is concealed to protect the programmer from himself. The approach taken with SABRE PL/I has been that those working on real-time applications are highly competent programmers who use PL/I because it is easier, not because they are unable to use assembly language. Thus all available information is provided, such as an assembly language listing. This respect for the skill of the average user is borne out by the experience at American. It probably also represents the hard truth about all such applications. An installation with very many inexperienced or incompetent programmers will just not get much work done and no magic language will help.

While no description of the inner workings of the compiler is possible here, it should be mentioned that the XPL compiler building system was used with great success. In the future more and more programming will be concerned with the production of large, high performance, on-line information systems. At this time, most compilers have not been built with the requirements of such systems in mind. (Even standard operating systems cannot normally handle hundreds let alone thousands of terminals simultaneously.) We will see more effort directed toward the needs of such users in the coming years. SABRE PL/I is another example of true pioneering in computer systems by American Airlines. The late Mal Perry of American, who was one of those largely responsible for the SABRE system, first suggested the construction of a compiler for SABRE real-time programming. His deep knowledge of the requirements and realities of such an environment reflected his great skill and broad experience. His early death has diminished us all. ■

ODES TO A NEW LANGUAGE

META-LANGUAGE

In the realm of metalanguage
I enjoy a daily stroll
Around the rim of PL/I's dominion;
Where the implementors struggle,
In a manner slightly droll,
To distinguish structured Form from mere Opinion.

SYNTAX

On the nature of its structure
These gentlemen are hot—
Each philogenic Plato lingual truth attempts to woo,
Drafting dactylic dialogues and painful panygyrics
On the Null-ness of the Not,
And the quintessential quand'ry
Of the Do-ness of the Do.

ALLOCATION AUTOMATIC

Oh, the Is-ness of the Wasn't
And the Was-ness of the Ain't,
And the Don't-ness of the Doesn't
Leaves my inner-vision faint.

DECLARATION OF ATTRIBUTES

Now, the "A-ness" of the B and the "P-ness" of the Q
Open dialectic vistas that the mind just can't see
through;
Whence vast waves of Meta-Language
And arrays of structures roll—
Each deducing from its "A-ness" the nature of the Whole.

SCOPE OF NAMES

Let me now compose a heartfelt Billet-Doux
To a name at once "contained in" (but *not* "internal
to")
A proper-nested block in a nest of proper nests.
Let this name itself be nested (a name within a
name)—
To then devise an easy rule (or a nest of valid tests)
To distinguish this name's name will be a simple game,
If you only will remember—its name is but
"contained-in"—*not* "internal-to."

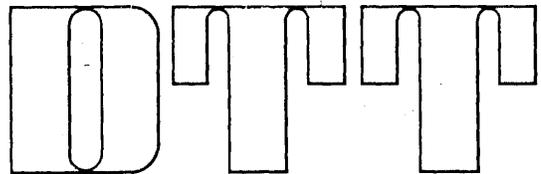
SPECIFICATIONS

Let me recommend this manual to those who rather
doubt
All appearances of Seeming and of Being.
If you really must interpret what-the-hell it's all about,
And phrase the awkward truth of what you're seeing:
Then you'll decorate your discourse with a dualistic
fringe—
Ambiguous, equivocal, and pause—
Then assert in every sentence that Reality *must* hinge
On this dratted awful business of the Do-ness of the
Does,
And the sempiternal Is-ness of the Was!

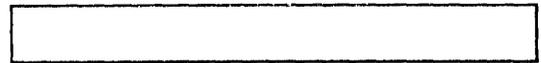
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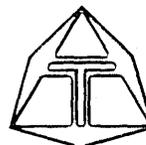


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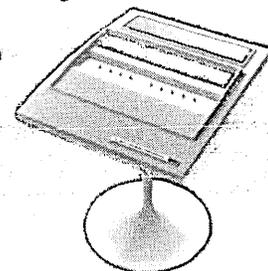
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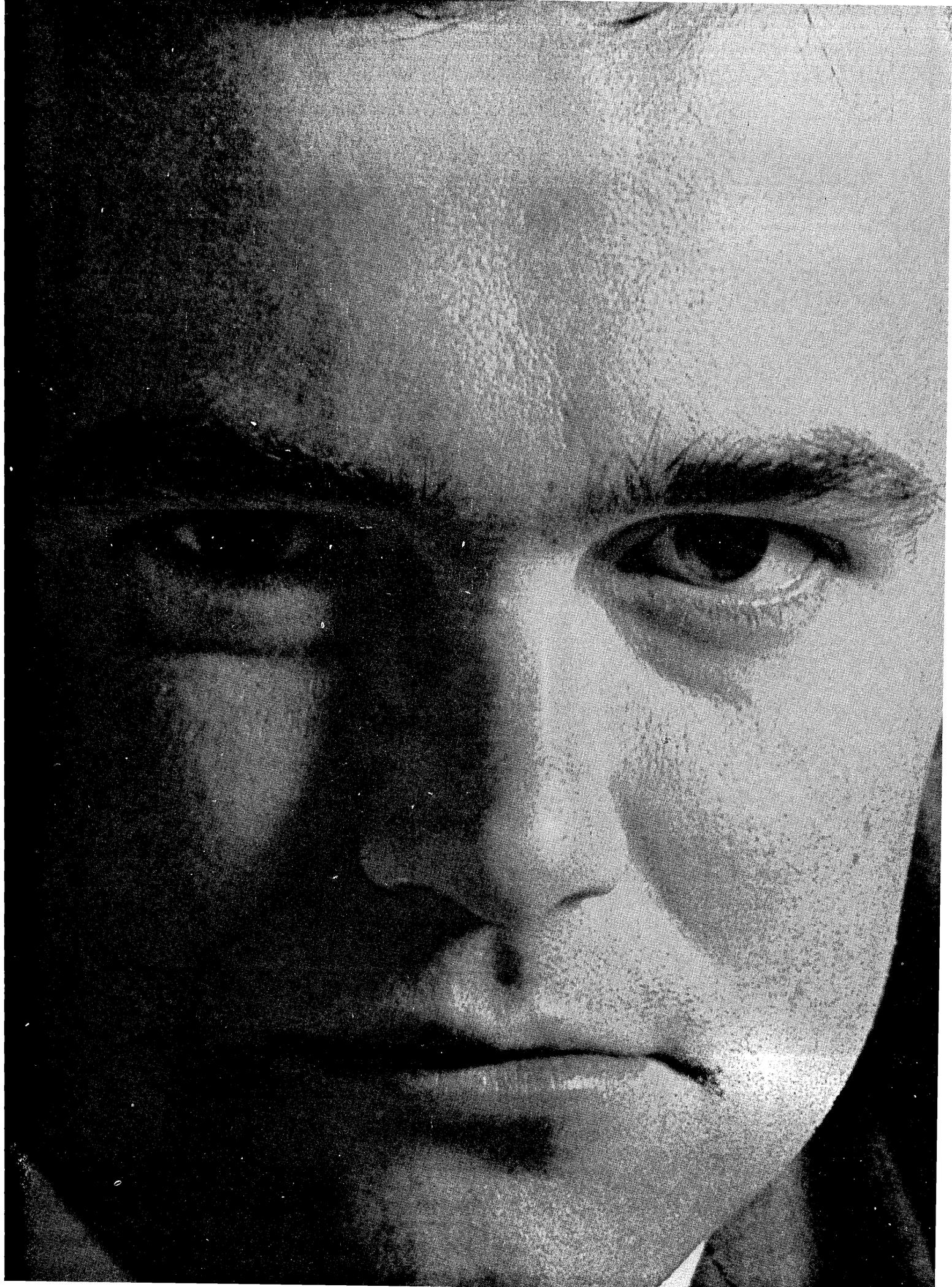
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NASCOM: NASA'S COMMUNICATIONS NETWORK FOR APOLLO

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by R. A. McLAUGHLIN

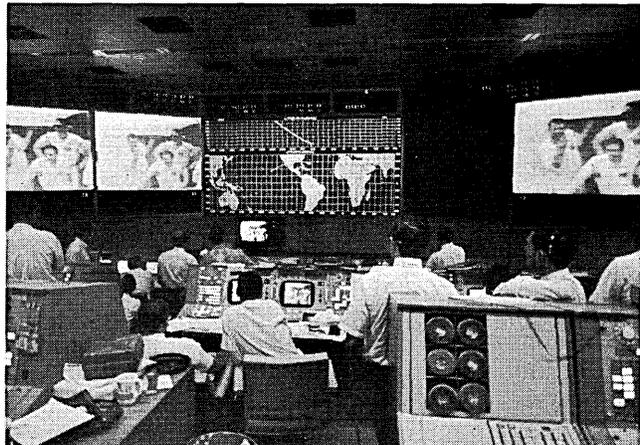
The introduction of televised programs perhaps caused the Apollo 7 astronauts to be monitored more closely than they wished, but the crew soon relaxed and flashed their now-historic messages, including "Keep those cards and letters coming in, folks." The cards and letters, if sent, did not make it, but almost every other form of communication did make the trip between orbit and earth. Direct tv and radio broadcasts were made between the ship and flight controllers; radar antennas tracked the craft over almost every inch of sky; and hundreds of data channels monitored spacecraft temperature, pressure, attitude, and even astronaut respiration and pulse rates. Long before the splashdown of Apollo 7, NASA's huge computer complexes began assimilating that data, grinding out trajectories, fuel loads, guidance commands, and engine burn times for Apollo 8. In some cases, back-up computers were simulating the Apollo 8 mission while the on-line systems which they supported still monitored the Schirra, Eisele, and Cunningham flight.

During a mission, 270,000 bits of information per second are captured at world-wide tracking stations, condensed, and relayed by the NASA Communications Network (NASCOM) through the Goddard Space Flight Center in Maryland to the Manned Spacecraft Center in Houston. That data is sorted, decoded, examined, and recorded; replies and reactions, human and automatic, traverse the communications network in reverse, spanning the thousands of miles to the Apollo capsule in a maximum of six seconds.

The vast message switching computer complex required

to shuttle these transmissions back and forth is composed of hundreds of components, which are, at one time, airborne, at sea, and land-locked in remote desert wastes across the globe. These components form three integrated systems: the

Ruggedized Univac 1230's (NASA M 642 B's), such as the system on the left, accept, process, record, and transmit data originating from the Apollo spacecraft ("down" data), and compute and issue commands back to the capsule ("up" data). Univac 1218's, as shown on the right, control the pointing positions of the radar station tracking antennas.



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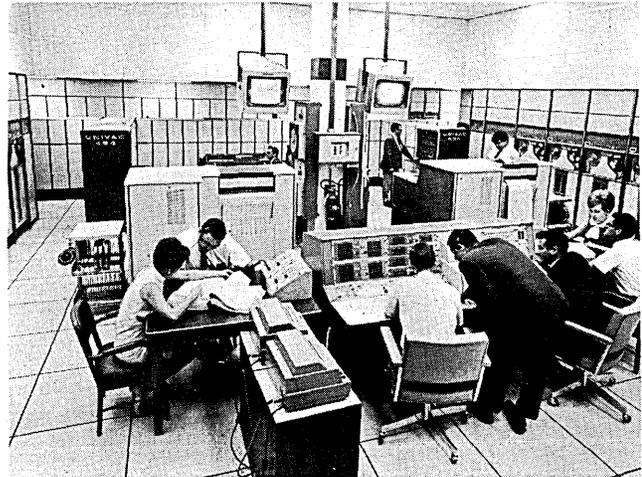
Remote Site Data Processing (RSDP) systems, the Automatic Data Switching System (ADSS), and the Command Communications and Telemetry Systems (CCATS).

Fourteen ground terminals and four shipboard installations take part in following the tiny target through space. The principal functions of these systems are to accept, record, test, condense, and relay data originating from the spacecraft ("down" data), and to compute and issue commands to the spacecraft ("up" data). "Up" data originates at toggles on the flight controllers consoles at the Mission Control Center in Houston, or is stored, pre-programmed in the remote site computer; it is communicated to the overhead craft over a UHF radio link (Apollo Unified S-band) at a rate of 2,400 bps. In the case of "down" data, sensors built into the ship constantly sample cabin pressure and temperature, the craft's position and attitude in space, and human factors such as heartbeat and body temperature, transmitting the data to earth at a rate of 51.2K bps. Two hundred parameters are sampled, at rates varying from several hundred to several thousand samples per minute. Depending upon the location of the receiving site, and upon the importance of the data collected, this information is relayed from the remote site by tty, high-speed telegraph lines, radio, satellite, or microwave.

Each of the eighteen remote stations has at least two Univac 1230 computers (NASA M 642 B's) to act as message switchers. (The ships have an additional 642 which is used to position the on-board antenna in finding and following the capsule, and in precision navigation.) The 642's are 400 nsec cpu machines with 2 usec memories providing storage for 65K 30-bit words. Each can handle 500K words per sec. One is used for "up" data; one for "down." One sifts the incoming signals, condenses them, checks them for va-

lidity, compares each parameter against a pre-established standard, and relays the formatted messages to the Automatic Data Switching System at Goddard. At the Goddard Space Flight Center, each message is again checked for validity, assigned a priority, and funneled to the Command Communications and Telemetry Systems located in the Manned Spacecraft Center in Houston. Should a message be garbled, the 642's are programmed to re-request it. Should a parameter be out of limits, an emergency condition is flagged and the appropriate data is given special routing.

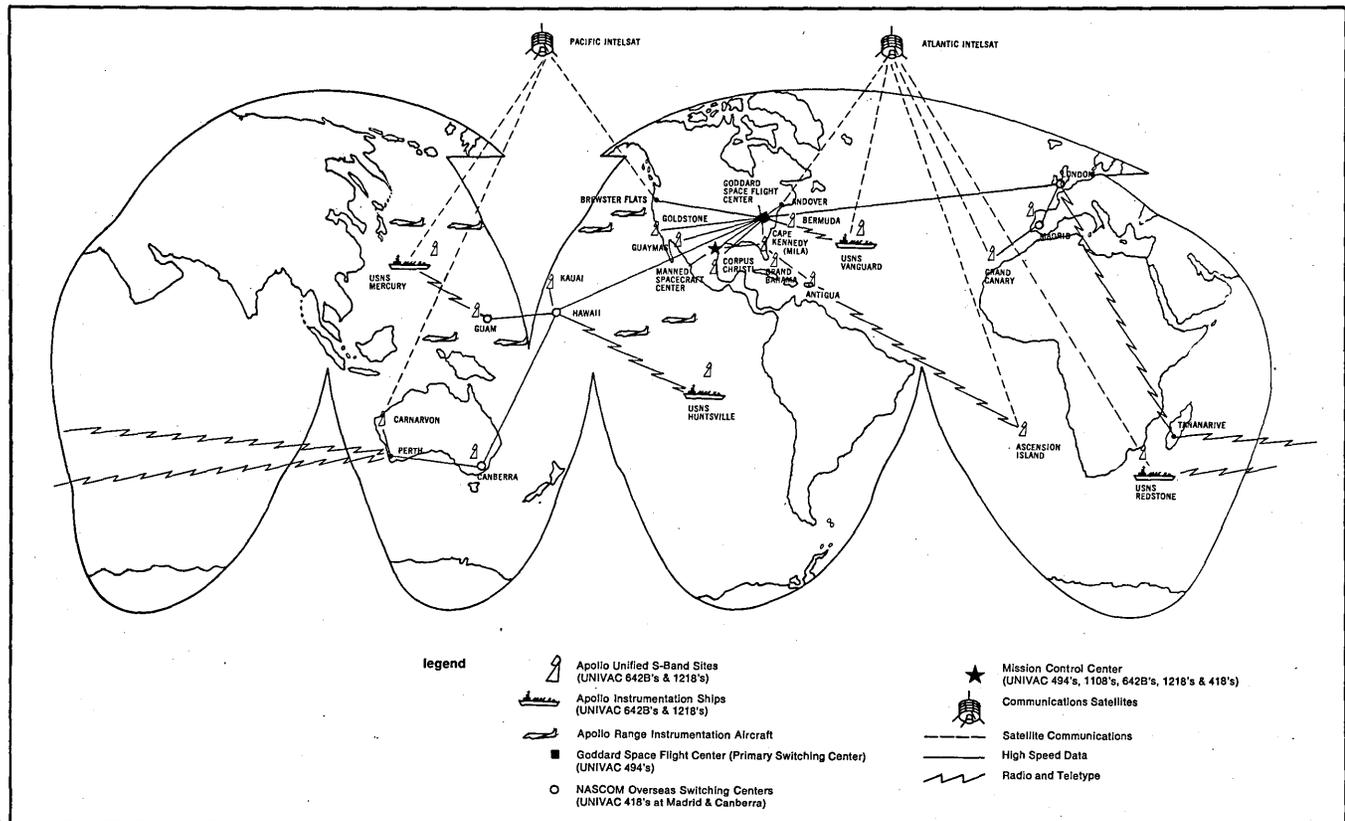
Input integrity is further assured by the transmission linkages themselves. In addition to checking the limits of each input signal, the remote site 642's encapsulate their



In addition to six of the Univac 494 Communications Processors such as the two shown above, the NASCOM network uses 48 Univac 1230 and 33 Univac 1218 computers.

NASA's Communications Network for project Apollo is composed of fourteen remote sites, intermediate switching cen-

ters in Madrid and Canberra, the Goddard Space Flight Center, and the Houston Manned Spacecraft Center.



message streams in 600-bit "envelopes," each of which is preceded by a 33-bit 33-degree polynomial identifier. The length and identity of each input frame is checked by the ADSS computers before it is transmitted to Houston. Any transmission in error is automatically recalled from the buffer of the remote station. Message numbers are also assigned to each transmission sent over Bell lines, to further insure line integrity.

In addition to the M 642 B's, each ground station has a Univac 1218 system which is used to position the 30-foot and 85-foot antennas. 1218's are used on the Instrumentation ships to buffer data directed to the shipboard flight control consoles. Thirty-three of the 1218's are used altogether, along with forty-eight 642's.

From launch minus thirty minutes to launch plus fifteen minutes, two 2,400 bps lines from Cape Kennedy pour in data from the Impact Predictor program which calculates the probable abort splashdown location from wind and trajectory parameters. The Cape keeps four M 642 B's operating, one for input, one for output, and two for back-up. Four 1218's act as interfaces to the communications lines.

During the mission, several tracking stations follow the progress of the manned vehicle at all times. Eighty-five-foot antennas at Goldstone in the California Mojave desert and in Canberra, Australia, stand like robots, purposefully shifting their mechanical gaze from southwest to northeast across the Pacific. Smaller 30-foot antennas in Carnarvon (Australia), Guam, Hawaii, Guaymas (Mexico), aboard the USNS Mercury, or at Corpus Christi copy the pattern of the bigger dishes. Thirty-footers at the Cape, in Grand Bahama, Bermuda, Antigua, and aboard the USNS Vanguard noiselessly come alive to follow from northwest to southeast across the Americas until the Grand Canary and Ascension Island 30-foot dishes and the 85-foot Madrid parabola catch "s'ight" of the speeding object. These, in turn, follow it until they lose it to the USNS Redstone, Carnarvon and Canberra again. Each player in the silent drama catches and relays the faint signals to Goddard, the primary message switching center, from where they are sped to Houston along 50K baud lines.

Some distant stations go through intermediate switching centers in Madrid or Canberra. These centers operate with Univac 418 real-time systems. The 418's have memories of 4 to 65K 18-bit words accessible in one usec augmented by two usec cpu's and two FH-880 drums. The drums have a storage capacity of 4.7 million characters each (accessible in 17 usec), and are used for low priority messages, traffic queues, and program storage. Each intermediate switching center picks up data from lines rated at 45, 50, or 75 bps and relays it along 1.2 or 2.4 bps lines. Only one of the 418's at each site is actually operating; the other is an idle back-up.

the automatic data switching system

Redundancy is the keyword in all installations. Should one tracking station fail, others are operating. At least five are actually transmitting to Goddard at one time, although not all of the five are transmitting "live" data. The most apparent redundancies are found at Goddard and at Houston, in the use of the Univac 494 Communications Processors which make up the heart of the NASCOM system. The 494 is a large-scale message processor, with a cpu time of 375 nsec, internal storage of 2 million bits, and external FH-880 drums. Each 494 has 24 full-duplex I/O channels: four are used for low speed communications (60 to 100 bps); four are used for high speed traffic (2,400 bps); sixteen are used for standard peripherals.

Although 50K bps are being input, only one 494 is actually needed. Three are used. One stands off-line, programmed but idle, sometimes processing data for the next shot, but always at the ready. Network inputs are fed simultaneously to the other two. Both process simultaneously, identically, but the output from one is shunted aside. Result: one off-line back-up, one on-line back-up, one working processor.

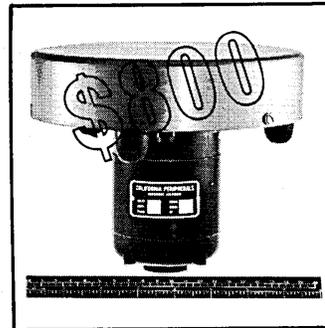
command communications and telemetry systems

In Houston, in the Mission Operations twin Control Rooms, rear-projection screens display television images, maps, and the constantly-moving bright line which is the spacecraft's wavering track across the world map. Here a three-computer configuration is used which is identical to the one at Goddard—one processor and two back-ups. Fed by four 50K baud lines from Goddard, this configuration, in turn, feeds the Real-Time Computer Center, where two IBM 360/75's process the input data and formulate a reply. The reply is finally returned to the 494's in Houston, to the 494's at Goddard, to the remote station nearest the craft, and to the orbiting body.

From the initial transmission of the Cape Kennedy computer's Impact Predictor program, thirty minutes before launch, to the final tracking of the re-entering capsule performed by the USNS Huntsville, NASCOM's remote stations keep pumping streams of information through the communications network to the Mission Control Center's displays. The NASCOM network constitutes the world's largest real-time communications system. Seldom used, it was constructed at a cost of \$50 million, and yet it is only a part of the computer complex which was created for the Apollo series, just one system which will be spotlighted during NASA's reach for the Moon. ■

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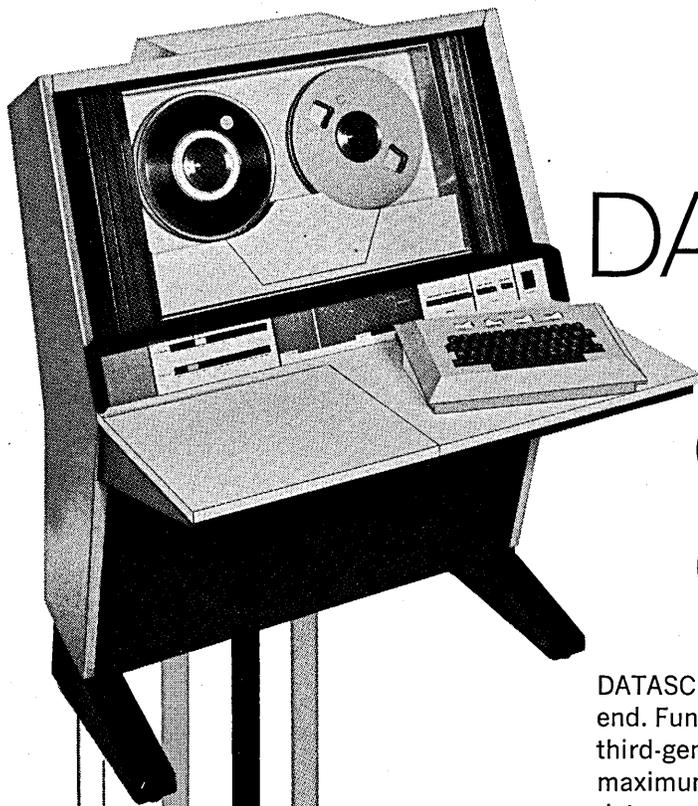


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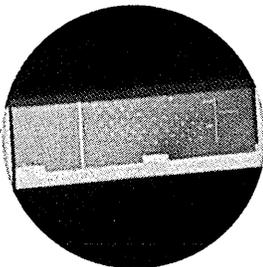
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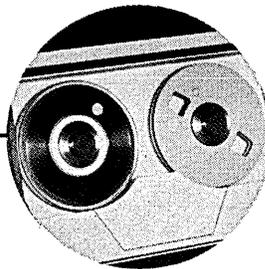


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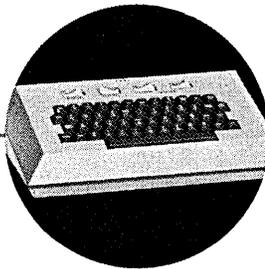
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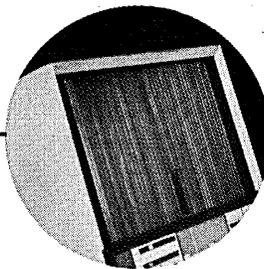
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COMPUTERS IN THE WORLD OF REAL PEOPLE

uncontrolled environment

by GEORGE GLASER

This article is based on a paper presented by the author at the Special Management Seminar sponsored by the ACM at the 1968 SJCC.

□ Rather than discuss computers, I want to examine the world in which computers live, a world where they are used and abused, loved and feared, worshipped and cursed—in short, the world of *real* people.

The term “real people” implies, of course, the existence of a class of unreal people. Unreal people may be identified by the following characteristics:

1. They are rational economic men.
2. Their actions arise from a value system that places mankind and social good first and their personal interests second.
3. They are intellectually curious and capable of understanding the most abstruse technical phenomena.
4. They are consistently well informed, and fully appreciate the implications and potential of technology.

Unfortunately, real people who fall far short of these admirable qualities are all about us. It would hardly be an exaggeration to say that the world is full of real people. We find them in industry, in universities, and in government. Each of us, depending on his present affiliation and his assessment of the people about him, has his own opinion as to whether the ratio of real to unreal people in his particular calling is high or low. But wherever there are people of any kind, there are bound to be a few real people to contend with.

Sadly, the reference manuals accompanying our computers don't say anything about people—real or unreal. This may be because—as even behavioral scientists and others who work in people-oriented disciplines will acknowledge—alarmingly little is known about people of either kind. And where real people are concerned, the gaps in our knowledge are appalling—particularly because the problems faced by those of us who are concerned with computers in the world of real people are so massive and so urgent.

common problems and common remedies

Computer technology can claim to have made possible a number of fantastic accomplishments. But, despite certain exceptions, there has been a disappointing lack of demonstrable results. I do not accept a handful of horror stories as

evidence that we are incompetent boobs. Yet the fact is that development times are, as a rule, agonizingly long, costs woefully underestimated, systems ill-conceived and poorly designed, businessmen skeptical or condescending, and computer professionals naive—or, worse yet, aloof.

These indictments have been leveled before and, all too often, the causes are traced to “lack of management involvement.” I am not really sure what “management involvement” means; it is rarely defined in a practical way by those who prescribe it. Certainly none of us wants the vice president's staff tying up all our keypunches when there is productive work to do. Yet it is fashionable to chide management for lack of interest or appreciation, to stew over the semantic difficulties that impede communication, and to tell ourselves plaintively that if management only understood us, it would love us.

Starting from this fuzzy assumption, various remedies are proposed and attempted. One popular approach is to urge managers to go to “computer school.” Having seen executives without previous experience or interest in the computer get highly excited about their ability to write FORTRAN programs after a two-day course, we know computer pro-



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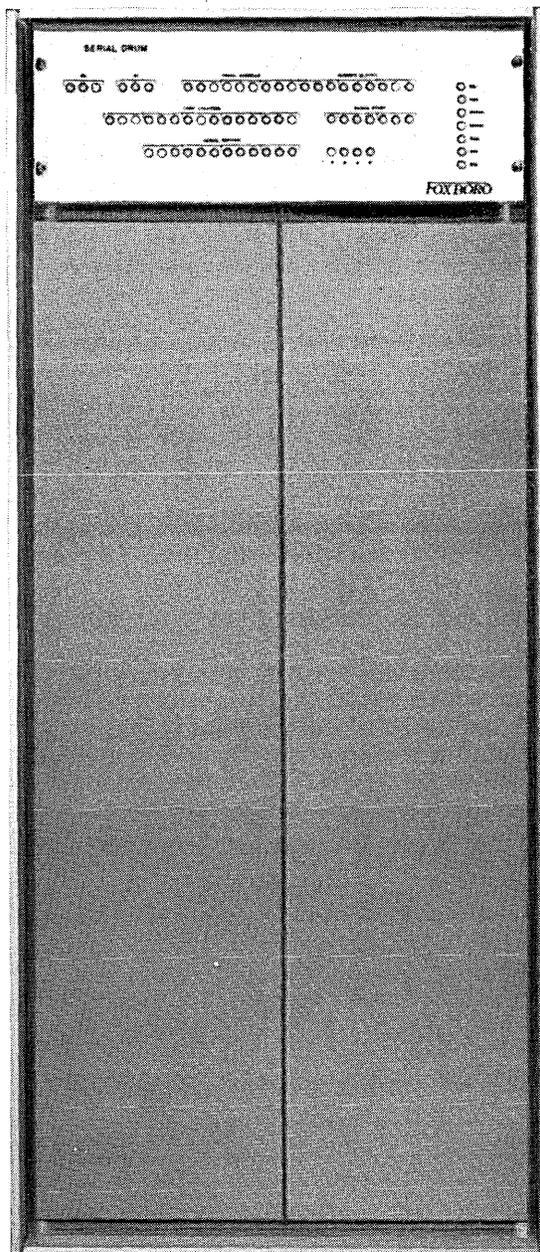
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gramming can be a seductive task; so we resort to seduction. These courses are in fact an effective way to stimulate interest—but *interest* alone is not enough.

Managers in computer schools are also exposed to the limitations of the computer. They learn that it is really a rather dumb beast and can only follow the instructions given to it. What they *don't* learn is suggested by Herbert Simon's apt remark that the notion that computers can do only what they are programmed to do is "intuitively obvious, indubitably true, and supports none of the implications that are commonly drawn from it."¹ Real understanding of the potential of the computer does not come from attending computer school; this is one reason why "computer appreciation" courses, while useful, have relatively little staying power.

Another tactic computer professionals commonly try to use on real people to make them more rational (that is, less real) is to impress them with the sheer beauty of the computer's technical achievements. Curiously, though, not all people are impressed by the same things. Some like girls, others like computers; still others are versatile enough to like both. But try showing a Rembrandt to someone who doesn't really understand or care about paintings. He will be totally uninterested. It is not that the painting is not good; but rather that, in the eyes of the man viewing it, it is not important whether it is good or not.

In a sense, nontechnical real people look upon technical achievement in much the same way. They feel inadequate to judge for themselves the meaning of a given achievement; given this inadequacy, they conclude (or rationalize) that it is not really very important whether one of our numerous "breakthroughs" is a genuine achievement or not. As achievers, we are understandably crushed by this indifference, for to be unappreciated is to be unloved, and even technical people would like to be loved. And so, we loudly bemoan the fact that management is not involved in what we are doing.

Now, how does one go about getting a person who is indifferent to Rembrandt involved in art? Before we urge him to attend Rembrandt School, he must be convinced that it is important to him to know something about art. Only then is he likely to gain an appreciation of Rembrandt and his works.

the underlying causes of difficulty

Consider the underlying causes of some of the specific difficulties we face.

Innovation and Conflict. First, and I believe foremost among these causes, is the conflict caused by innovation. Everybody knows that a price must be paid for change, but nobody wants to be the one to pay it. Will the computer obsolete middle managers, or eliminate staff departments, as Peter Drucker suggests? Will the proud profession of teaching be made obsolete by graphic consoles and programmed instruction?

Changes in the nature of work are almost a certainty. In viewing what an information processing factory will look like a few years hence, Herbert Simon has written: "When you visit either [a chemical plant] or a computerized office, you are struck first by the fact that the human workers are outside the direct work stream. The chemicals are produced untouched by human hands, as are the documents in the modern computer installation. The humans, in fact, can go away, at least for short intervals of time, without disrupting the work. They seem to be little concerned with doing the 'work,' much concerned with detecting unusual situations, performing preventive and corrective maintenance, and

considering how the system can be altered for its improvement."² This kind of change is all about us. To many real people, it is disturbing and disruptive; to some it seems a cause for despair.

Discussing the conflict caused by the innovator, Kahn and his associates³ point out that the innovator thrives on change, while the old guard attempts to protect the status quo that meets their needs for stability in day-to-day affairs. I found an interesting reference to change in a very old text—one widely read and respected: "Where no oxen are, the stall is clean. However, much increase is due to the strength of oxen." (Proverbs 14:4) Now, real people like things to be clean. And this is true of real computer professionals as well as of real managers in business. Consider the nervous laughter and strained attempts at humor that are heard when computer professionals discuss PL/I. It is interesting to note how they react to change. In this case, a new language—potentially more useful than its predecessors but not completely understood—is not something to be embraced and used to full advantage, but rather an object of uneasy derision. For it is new, it is unfamiliar, and it is innovative.

The Nature of Our Work. The second cause of many of our difficulties, which is related to the first, is the research nature of our work. In his book, *Technology and Change*⁴, Donald Schon remarks, "In the light of [corporate] experience, the notion of innovation as an orderly, goal-directed, risk-reducing process must appear as a myth." He points out that research is inherently a matter of probing, of false starts, of blind alleys—in total, a rather crude and inefficient process. For reasons closely related to their attitude toward innovation, the attitude of real people toward work of a research nature is one of apprehension, perhaps distrust.

It is easy to assert that the plans of the innovator are impossible of achievement. Many real people, who were considered wise in their day, did not trouble to conceal their scorn at the Wright brothers' venture that day at Kitty Hawk. "It will never fly," they said. Similar comments are offered today with regard to many proposed computer projects that show overweening ambition. Faith is needed, and faith may seem irrational. The odd miracle helps, and some of our successes in heuristics (programs that work the way real people work) have been little short of miraculous. These successes, in which the computer serves as a model of human processes, include tanker fleet scheduling, assembly line balancing, and trust officer portfolio management. Yet, where there are miracles there are skeptics. Many real people question our success and refuse to acknowledge that more of the same is not only possible but highly probable.

Even if real people can be forgiven (as we would all like to be forgiven) for their attitude toward innovation, there are still other difficulties, where innovation is not the central issue.

A "Show Me" Attitude. Even real people are unreal—that is, rational—to the extent that they occasionally exhibit a rather sensible "show me" attitude: they look for substance to help their unbelief. Nowhere is this attitude more clearly and appropriately manifested than in misgivings about the value of information. Dr. Sullivan Campbell seems to share this point of view when he says, "To the best of my knowledge, nobody has yet explored the consequence of providing instantaneous and accurate information to those who

¹ Herbert A. Simon, *The Shape of Automation for Men and Management* (New York: Harper & Row, 1965).

² Herbert A. Simon, "The Impact of New Information-Processing Technology (1) on Managers, (2) on the Economy," *Commercial Letter*, Canadian Imperial Bank of Commerce, October 1966.

³ Kahn, Wolfe, Quinn, Snaek, Rosenthal, *Organizational Stress: Studies in Role Conflict and Ambiguity* (New York: John Wiley & Sons, Inc., 1964).

⁴ Donald A. Schon, *Technology and Change* (New York: Delacorte Press, 1967).

make decisions.”⁵ And Russell Ackoff has challenged five assumptions commonly made by designers of management information systems:⁶

1. That the critical deficiency under which most managers operate is the lack of relevant information
2. That the manager needs the information he wants
3. That if a manager has the information he needs, his decision making will improve
4. That better communication between managers improves organizational performance, and
5. That a manager does not have to understand how his information system works, only how to use it.

If, as I suspect, Professor Ackoff's challenges are well placed, is it any wonder that managers shudder when purveyors of information systems attempt to provide them with *more* of something they do not know what to do with?

Information is probably a necessary condition for good decisions, but it is certainly not a sufficient condition—as many proposals to management imply. We should not be surprised that nontechnical real people are often skeptical, or that even enthusiastic sponsors of such projects are occasionally disappointed in their outcome.

The Ambiguity of Roles. This leads to the difficult problem caused by the ambiguity of roles—those of the manager and the specialist.

The upsurge in the use of computers has often been compared to the industrial revolution. There is, however, this fundamental difference: The new tools of the industrial revolution extended the laborer's physical capability, while the tools of information technology offer to extend the manager's intellectual capability. In the abstract, this is an exciting possibility, and there is extensive evidence that it will become a reality. Yet real people often have trouble distinguishing between the promise of extensions of capability—whether physical or intellectual—and the threat of replacement. Although the company president knows he is unlikely to be displaced by the computer, he may experience it as a very real threat to his pride if his managerial judgment and his long years of experience are suddenly devalued. And middle managers feel the threat of a real decline in the importance of their present role.

Imagine a three-act playlet. In the first act, a major computer project designed to “improve executive decision making” has been presented for the president's approval. Act 2 is very brief; it goes like this:

Hardnosed president: “Who's running this business, anyway?”

Computer professional: “You are, but you are running it wrong!”

Curtain.

I'll spare you Act 3; you know the script well.

Now, few company presidents are so direct in their questions—and, thankfully, few computer professionals are so tactless in their replies. Yet the message of this playlet is implicit or explicit in too many proposals to management. And management's reaction is predictable.

Inadequate Yardsticks. Another serious difficulty results from the inadequacy of the yardsticks used to evaluate the benefits and costs of using the computer. This fact might explain why “computer surveys” are best sellers. For there is a certain illusory comfort to be found in pie charts, bar charts, and other graphic displays showing how many “good guys” and how many “bad guys” there are. And it

must be rather comforting to know that your salary costs per dollar of computer rental are a fraction of a percentage point lower than the average for your industry.

Yardsticks such as these, where they exist, warm the cockles of the controller's heart. But they aren't always available; and where they are lacking, we are confronted by a dilemma. We have already banked the benefits of most of the applications intended to reduce clerical costs; we would now like to move into potentially more attractive applications; but more often than not their benefits are very difficult to quantify. How much is “better customer service” worth? What is the value of “improved decision making”? We *know* that these goals are desirable, and real people know it too. “But,” managers insist, “what are they worth?”

The elusive nature of future benefits becomes even more frustrating when we consider that business has armed itself with elaborate and highly effective systems for identifying costs. The cost of equipment rental, the cost of salaries, the cost of light, heat, and floor space—all these are recorded and reported to the custodian of the enterprise. He can measure whether these costs are ahead of, or behind, last year's costs. And the custodian has many years of experience that serve well as his yardstick. He has no such yardstick for costs related to the computer.

But why all the commotion? Admittedly, the costs of using the computer are high and continue to increase. Yet, if we examine these costs relative to other costs incurred in a large corporation, we find that they are not in an absolute sense large enough to justify the attention they get. Yet it is easy to see why they do get attention. These are *new* costs, costs the enterprise did not incur 15 years ago. They differ in nature from other costs. For many companies, particularly those outside the technology-based industries, the salaries of young computer professionals seem exorbitant. In banking, for example, senior systems analysts not uncommonly earn more than branch managers.

The dilemma of inadequate yardsticks is summed up well in the old maxim, “It is better for a woman to be beautiful than to be bright, since men can see so much better than they can think.” I'm not sure that there is any direct connection between beautiful women and low costs and high benefits; but to many real people both are desirable. And the current situation—with its highly visible costs and its far from visible benefits—is undesirable, particularly for men trained to think in economic terms.

“Laws” in the Real World. One of the comforting things about technical work is the existence of reliable natural laws which govern the worlds of physics, chemistry, and mechanics. Mathematicians have given us tools for dealing with these laws in the abstract so that we can apply them with considerable precision in complex situations. Writers of reference manuals for computers likewise give us laws of a kind. Although you may smile at this and question whether reference manuals are really descriptive of the delivered product, I believe that, in the long term, we can have considerable confidence that instruction X will produce result Y.

Many computer professionals live only in this very comfortable world. It is a rational world; it is a world where the effects of man's actions can be predicted quite accurately. It is a world in which the computer, following natural laws, will dutifully execute large, complex programs without error, doing exactly what it is instructed to do.

But the real world is not nearly so rational, and the trail between the problem and the solution is often difficult to traverse. For this reason, when we offer a “rational” solution to a problem, real people may be quite skeptical that the proposed solution is indeed a rational one. They are aware of real things that could upset our apple cart. Cicero once said, “If truth were self-evident, eloquence would not be necessary.” To convince real people, the computer profes-

⁵ Dr. Sullivan Campbell, “Beyond Symbolism: Imagery and the Imagination,” *Computer Graphics*, 1966.

⁶ Russell L. Ackoff, “Management Misinformation Systems,” *Management Science*, December 1967, B-147 through B-156.

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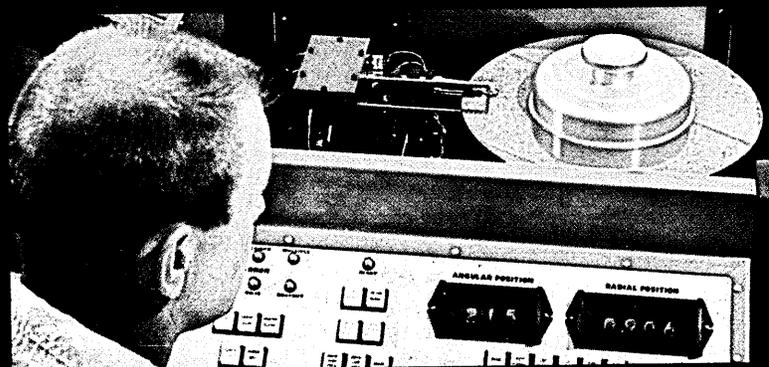
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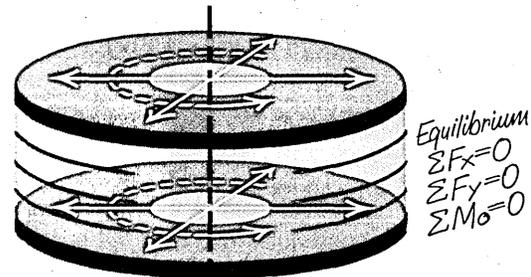
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IN THE WORLD OF REAL PEOPLE . . .

sional will need all the eloquence he can command.

Enough of the difficulties. What might we do? What *must* we do? How can we align ourselves with the world of real people so that they may become comfortable with our technology and our ambitions?

There is an understandable tendency to shrug one's shoulders in frustration and to chalk the whole matter up to human frailty. There also is a tendency to say that dealing with real people is outside our area of technical competence. Because we don't know the rules of the real-people game, and are convinced that no one else does, we turn back to the reference manual where the rules are known.

These reactions, although understandable, are also unforgivable. Here is why. First, we *must* learn to deal with real people if we expect to produce tangible results, whether these be improved profits for an employer, or a social good such as more comprehensive medical diagnoses. Second, it is naive to think that real-people problems will go away. We cannot take refuge between our core arrays and Chebyshev polynomials in the hope that the world will soon come to its senses and learn to think as we do. Third, most of us aspire, and expect, to be treated as professionals. This aspiration will be realized only if we can successfully apply our knowledge. Fourth, it is our job to overcome whatever difficulties we face. We cannot blame other real people.

Since there is no magic wand with the power to turn real people into easy-to-work-with unreal people, we must simply reconcile ourselves to working in a real-people environment. We must learn to exploit all that is good in it and to gird our loins against the bad.

Though they are neither magical nor entirely original, let me offer six suggestions that I hope will be useful to practicing computer professionals.

Recommendation 1: Concentrate on the "right" applications. This implies a knowledge of the economic environment of your industry, and of your company's unique position and ambitions in that environment. We talked earlier about using the computer to extend intellectual capability. Put yourself in the executive's shoes, and ask: "What extensions to my intellect are important?" Or ask him that question. Not every application will contribute directly to profits, nor should it; but every application *should* further the goals of the enterprise.

Scarce talents are involved—allocate them well! Beware of overambitious and underambitious efforts; both are likely to fizzle.

In the category of overambitious efforts, I would put most of the vaunted, totally integrated management information systems. The explicit objectives of many such systems currently being proposed, if one is to believe the trade journals, border on the preposterous, notwithstanding our advanced computer technology. Such efforts will fizzle because the likelihood of real achievement is nil.

Underambitious efforts are likely to fizzle too, but for different reasons. For if we set out to accomplish little, and are completely successful, we have still accomplished little. I don't mean to disparage straightforward applications that can be successfully implemented with a minimum of effort. Yet if we are to be effective, we must do things that are meaningful. And in most cases, meaningful efforts are those which—despite all the difficulties—will bring about change. Let's not waste time painting and cleaning the oxen's stall when there is plowing to be done.

Be willing to shift gears and direction if necessary. All of us would prefer an orderly development program that leads to a well-defined long-range goal. And it is good to plan long range, to anticipate equipment and personnel needs, and to be alert to opportunities for applying our talents in a

coherent and complementary way. But we are not in a static environment. Needs and opportunities will change, perhaps dramatically. Incentives, costs, and technology are constantly in flux. Accordingly, our priorities must continually be reassessed.

Recommendation 2: Clarify the role of the user. Users of computer systems have unique—perhaps exclusive—knowledge of how proposed applications are likely to affect their operations. For this reason, we must press them hard to accept prime responsibility for three functions:

1. *Defining performance specifications:* The user knows (or should know) what end result he needs. With the help of those who understand the technology, he should define the performance specifications of a system proposed to deliver that result.
2. *Estimating benefits:* The user knows (or should know) the value of this performance and should be willing to set target benefits, quantifying them whenever possible.
3. *Motivating people:* If the full potential of an application is to be realized, the user must provide the leadership and motivation to those who will use it.

We must not delude ourselves: unless the user recognizes the value of a proposed application, the designer is fighting a losing battle.

Recommendation 3: Be sensitive to the other guy's value system. Each of us has his own unique value system. I do not advocate that computer professionals change theirs, or attempt to change those of other people—particularly real people. But I do suggest that it is possible to take advantage of other people's value systems in a most wholesome and professional way.

Admittedly, the particular values that govern the behavior of any individual are difficult to identify. Some people intuitively take behavior and attitudes into account; others are less alert and, as a result, less successful.

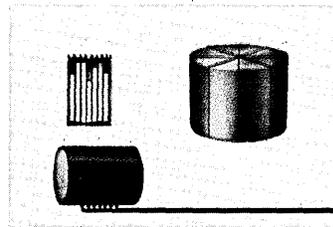
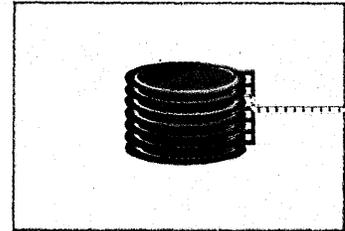
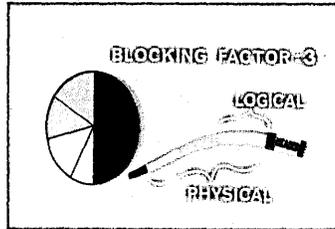
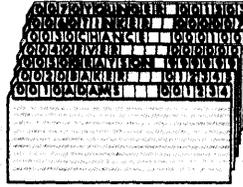
This is not manipulation; it is simply common sense in dealing with people. And common sense is a valuable attribute to have when you are trying to introduce change.

Recommendation 4: Place your technical expertise in perspective. I am not suggesting that computer professionals abandon their dedication to advancing the technology, but I do suggest that pragmatism in applying that technology is a virtue. Call it the art of the possible if you wish. Charles Kettering once said, "The only difference between theory and practice is that in practice you can't leave anything out." Regardless of their technical competence, those who fail to take into consideration the difficult real-people issues such as motivation and value systems are destined for failure.

Recommendation 5: Realistically assess benefits, costs, and risks. This charge is directed at both the computer professional and his client, for neither can do it alone. Computer professionals are well trained to answer the question of technical feasibility; but technical feasibility, despite its fundamental importance, is only the first step in a realistic assessment of benefits, costs, and risks.

Beyond technical feasibility lies the question of economic feasibility: "Is the application worthwhile?" The question is answered by comparing the user's estimates of benefits with estimates of costs. Two kinds of costs are involved: (1) development costs (typically estimated by computer professionals) and (2) operating costs (typically requiring estimates by both the computer professionals and the user).

In contrast to technical feasibility, which for a given application can be established once and for all, economic feasibility will often change as the environment changes. A project judged at one time to be attractive on the basis of potential economic benefits may well become unattractive if changes occur in the economic environment. For example, if the development costs of a particular application are



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TACT WILL IMPROVE YOUR INPUT DATA

social pressure

by CORMACK P. HEARN

The greatest challenge in the science of data processing is that of collecting consistently timely, accurate and complete input data. Unless this challenge is met, the finest automatic data processing system designed is destined for failure. There is that quality among individuals, usually associated with management, which makes it distasteful for them to be anywhere but "on top." A means of harnessing this motivation to obtain management support in collecting the most timely, accurate and complete input data has been successfully utilized. This system basically is one of communication, comprehension and cooperation and is titled "TACT."

Of course, everyone knows that tact is a vital necessity in handling any problem; however, are we aware that TACT is the answer to our computer input data problems? TACT, as described in the following article, means Timeliness, Accuracy and Completeness Techniques. It is the means by which we can control our data and improve the usefulness of our reports.

The reasons for inadequate (improperly recorded, untimely, incomplete) input data to any system are as numerous as the number of people preparing reports. Perhaps, some of the "old hands" feel that automation is not here to stay, others offer but token support. Regardless of the reason, the fact is that personnel preparing data are "human" and differ in degree of motivation.

It is illogical to assume that all personnel will give the desired attention to input data, or that once all individuals involved in generating data are thoroughly trained, they will all do the very best job. Those employees preparing data must be continually observed through analysis of the input they submit. Those people contributing most to erroneous, untimely, and incomplete data must be identified so that training can be administered.

Managers who are performing an outstanding job must be made aware of the fact that they have attracted the attention of top management. All levels of management must be aware of how well, or how poorly, their data "rates." The task then centers itself around keeping top management apprised of the quality of input for a given period of time, who is sub-standard, and then assigning a numerical rating to determine the relative proficiency of each manager.

To illustrate the techniques to be utilized, the method to obtain accurate data is covered in detail in the following paragraphs. A distinction will be made between accurate and complete data. To control timeliness, use the same techniques as for improving accuracy.

The form used to collect this information must contain a code to identify the individual, or organization, submitting the data. The program(s) should be so designed as to assign a code to each error discovered. A listing of each mistake made on every form, or document, submitted is made and forwarded to the data initiator (see Table 1). These listings of inaccurate input data are numbered sequentially each month to ensure that the data initiator receives every listing forwarded. Of course, a reporting agency does not receive a listing until the machine detects an error in the information submitted. Each month these sequence numbers start with "No. 1." In addition to the above, the listing reflects the processing date and a reference number to

identify the listing in case it is necessary to communicate with the data processing organization regarding these listings.

In order to employ this system, all input data must be edited for accuracy, timeliness and completeness. During the course of this editing, information must be extracted on the number and kind of errors being committed, age of the data when received, completeness of the data and, of course, the initiator. In addition to the above, the reporting agency must be informed as to types of errors being made, late data submitted, missing data, and what is expected to correct these deficiencies. Next, management must be informed as to their effectiveness (in comparison with others) in preparing input data. Periodically, top management must communicate with branch officials outlining the status of the program and stressing their objectives to obtain "pure" data. Each branch level manager must be convinced that top level management will consider his effectiveness in this task when preparing his overall performance evaluation.

As errors are detected by the machine, they are accumulated by processing cycle. For instance, if processing is weekly, a listing is prepared weekly notifying the reporting agency of errors and the action required to correct these mistakes. These reporting errors are suspended, and the only way the reporting agency can clear the suspended record is to submit corrected information. A method similar to the "dun technique" is used for this purpose. First you notify the agency of errors through codes on a listing. If a clearance report is not received within an established number of days (dependent upon location of input initiator), a second notice is forwarded. Again the machine suspends the incorrect data for a given period of time; however, the third notice is forwarded to the next higher echelon of management for action. It is rarely necessary to send more than one "third notice" to an initiator of incorrect data.

The computer programs should be so designed that every time an error is detected, the organization identification code, and all associated detail data, are collected. This is



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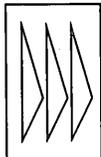
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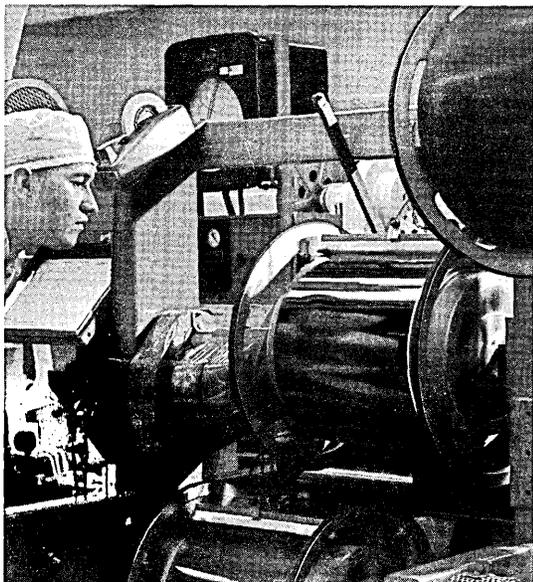


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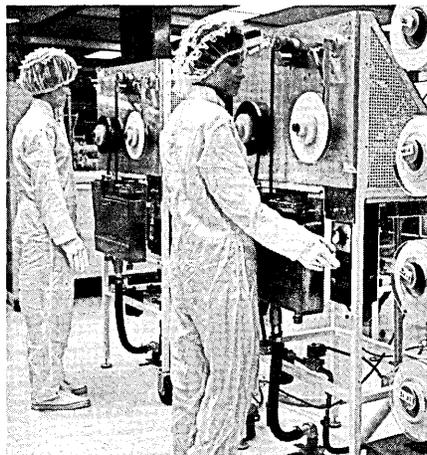
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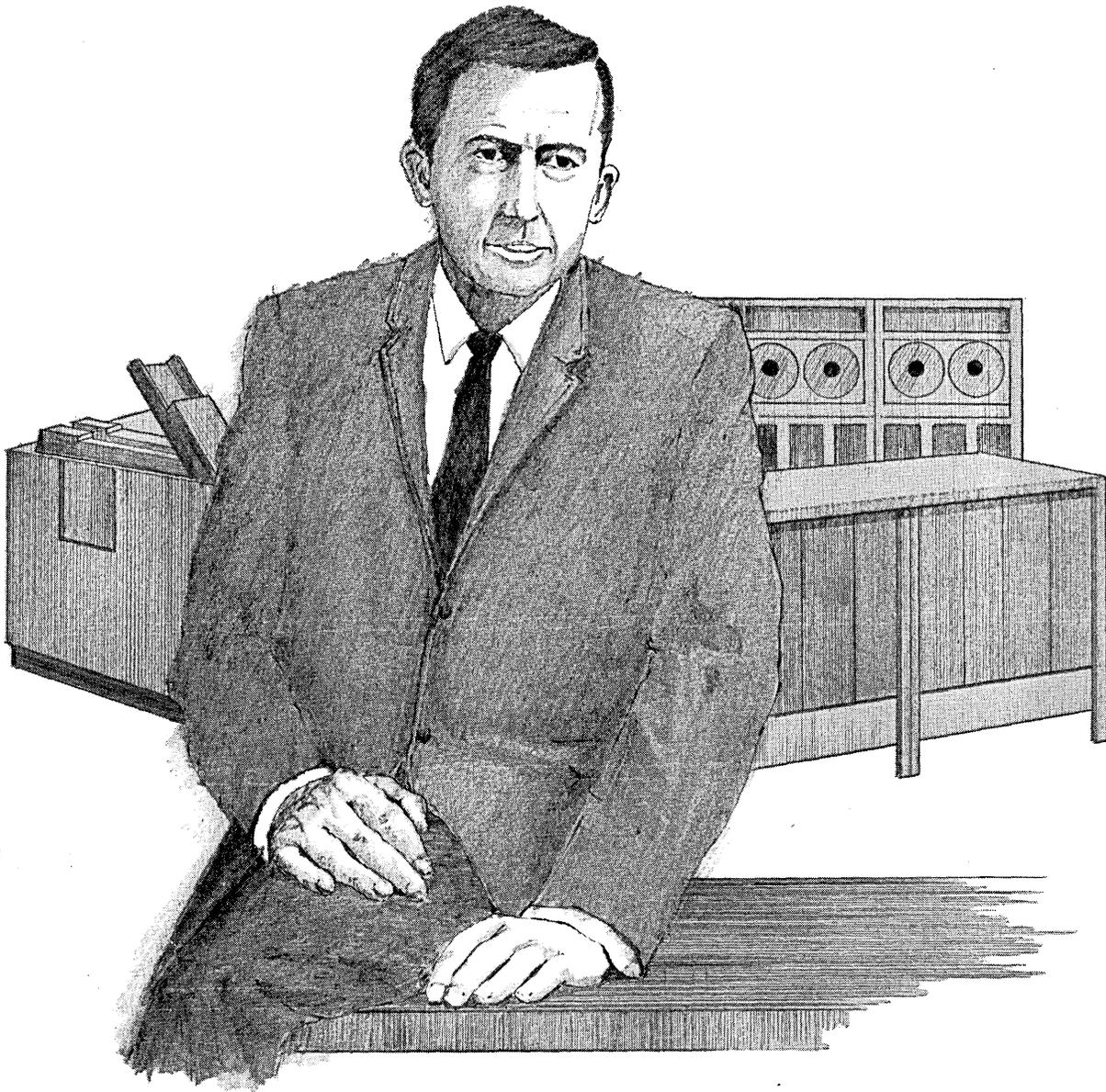
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TACT...

necessary since error charges will often be challenged and backup data must be provided to prove the machine was correct in assigning an error to the transaction in question.

When the notice of error is received, the data initiator must determine what is wrong. The data error analysis list (Table 1) tells this; however, it is in coded form. In order to identify these error codes, a code list is required which includes every conceivable error that can be made and its associated, or identifying, code. This code list should be in the hands of the data initiator, so when notification is received that the data are in error, the mistake can be identified through the code list and corrected data submitted. This error code list is the guide as to what is wrong and what must be done to correct the mistakes.

input rating

As a result of collecting all errors by the code of the organization that committed them, it is possible by simple programming to rate the effectiveness of each reporting agency in the preparation of input data (see Table 2). Generally, the input data error analysis is prepared to rate all echelons of management within the company. As you

will note from Table 2, this report shows the performance of each branch of the company. The aggregate of the total documents received, and also the total errors committed, are used to arrive at a "company average." This then becomes a means of measuring the effectivity of each branch of the company in preparing accurate input data. Of course, it is possible that the "company average" would be too high. Always keep in mind that the goal is zero errors.

It is not enough for a branch manager to know his organization is not meeting the company average, or that his error rate is "x" per cent. The branch manager needs a report similar to Table 2 to show how effective his lower echelon of management is in preparing quality input data. In order to recognize those individuals doing a good job and also to effect required corrective action, the report shown in Table 3 (see p. 64) is necessary. Note that the report for the branch manager reflects the total errors for each department that is preparing input data. In order to determine which areas of reporting are causing the most difficulty, this report also shows the per cent of the type errors committed. This can be utilized to pinpoint areas requiring additional training or procedural clarification. In any event, to get the problem corrected, it is necessary to know the specific reporting codes responsible for the majority of errors. As a matter of caution, it is pointed out that it is often possible to

DATA ERROR ANALYSIS LIST NOV 1968 - REPORT NO. 2							
PROCESSING DATE: NOV 8, 1968			PAGE NO. 1		REPORT REFERENCE NO: A28		
The following information submitted by your organization contains erroneous data and required correction and immediate resubmission. For explanation of mistakes, and procedure to follow to correct these errors, refer to AETNA COMPANY MANUAL (ACM-400) dated December 28, 1967.							
ORDER	PART NO. IDENT.	DATE DA MON Y	SOLD TO	SOLD BY	TERMS QUOTED	BRANCH IDENT.	NOTICE NUMBER
4-0092 CODE 06	A0412397	07 10 68	1721	118	40-10	A	2
5-0021 CODE 01	G1639874	06 11 68	1310	116	40-10	A	1
5-0033 CODE 02	F0296581	05 11 68	0180	132	40-0	A	1
5-0048 CODE 03	C1113728	07 11 68	1562	101	40-10	A	1
5-0051 CODES 01-04	D1004691	07 11 68	1228	025	40-0	A	1
5-0085 CODES 04-05	B0339144	06 11 68	0570	039	40-0	A	1
5-0012 CODE 06	E0928765	06 11 68	1401	145	40-10	A	1

Table 1 (above) and Table 2 (below)

AETNA COMPANY INPUT DATA ERROR ANALYSIS (Company Recap by Branch)															
Preparation Date: Nov. 1, 1968 For Period Ending: Oct. 31, 1968													Report Reference No. A29 Page No. 1		
TYPES OF DOCUMENTS															
Organizational Component	ALL DOCUMENTS			INVENTORY CONTROL			MANUFACTURING MGT			FINANCIAL MGT			OTHER TYPES		
	Documents	Errors	Error Rate	Documents Received	Total Errors	Error Rate	Documents Received	Total Errors	Error Rate	Documents Received	Total Errors	Error Rate	Documents Received	Total Errors	Error Rate
BRANCH E	5828	58	1.0	2754	29	1.05	2082	19	.91	956	7	.73	36	3	8.33
HOME OFFICE	3711	111	3.0	954	11	1.15	589	6	1.02	2159	94	4.35	9	0	0
BRANCH B	6180	247	4.0	2367	37	1.56	3398	197	5.80	366	11	3.01	49	2	4.08
BRANCH F	4956	247	5.0	1721	143	8.3	2614	86	3.29	563	18	3.20	58	0	0
BRANCH A	3218	225	7.0	1818	121	6.66	871	96	11.02	442	6	1.36	87	2	2.29
BRANCH D	5412	487	9.0	2555	153	5.93	1946	301	15.47	842	27	3.21	69	6	8.70
BRANCH C	3975	397	10.0	1477	226	15.3	2160	159	7.36	267	9	3.37	71	3	4.23
COMPANY OVERALL TOTALS AND AVERAGES															
	33280	1772	5.32	13646	720	5.28	13660	864	6.33	5595	172	3.07	379	16	4.22

have more than one error on a document, or punched card. To preclude distortion of statistics, only one error should be charged per document. As an extreme example of referenced possible distortion of statistics, assume only one document were received during the rating period and it had three errors; the reporting agency would have 300% error.

completeness

Completeness of data is a means to insure that all data generated is received. In order to do this, each branch office sequentially numbers each input document that is forwarded the data automation organization: this sequence number is comprised of a month code and a consecutive number for each month. A record, or log, will be established by each branch containing sufficient data to control the assignment of sequence numbers. As stated, each report submitted will be assigned a sequence control number consisting of a month code (A for Jan, B for Feb, etc.) and a number. These numbers will be in ascending order; e.g., if ten reports are submitted on 1 January, the sequence numbers would be A-0001, A-0002, A-0003, etc., through A-0010.

If, on the following day, eight reports were submitted, the sequence control numbers would begin with A-0011 and continue through A-0018. Sequence numbers assigned each following report for the remainder of January would be constructed as described above. Programs will be so designed as to insure receipt of all sequence numbers, or to advise the initiator that sequence number x-xxxx has not been received and should be resubmitted.

On the last day of each month, the data automation organization will be advised the last sequence number assigned for the month; e.g., if during the month of August, 232 sequence control numbers were assigned, this would be

instance, if the data are seven days old when received, the problem might be solved by reducing the age of data to two days and using the present equipment. We need to concentrate on cutting down the time required to initiate the data and for the data to flow from one point to another, rather than automatically thinking we need faster machines to process the data. Untimely data, even when processed on the finest, fastest computer, is of little benefit to management.

How then does one go about obtaining timely data? First, we must inform top management of the age of the data and then follow techniques similar to those outlined in the above paragraphs.

It is assumed that all input data has a date associated with it. This would either be the "as of date," date submitted, or some other kind of a date. When the data is received by the machine, the date received is recorded. If the method of input is a PCAM card, then this card would contain two dates—the as of date and the date received. The next step is obvious. You merely compute the time in days between the two dates. Periodically, you prepare a report similar to Table 1 to inform management the age of the date (by specific type) that is being received.

What evolves from the above is actually a "social pressure" system utilizing the totem pole approach. This motivation results in extended effort on their part to maintain an awareness of the input data problem and do something about it so that their next rating will show them at the top of the totem pole.

It is often advisable to have someone in the top echelon of management prepare a letter to accompany the machine prepared input analysis. The purpose of this letter is to inform the lower echelons of management that this problem has the attention of top management. At the time, cooperation of all concerned in achieving a specific goal, for example, a zero per cent error rate for each reporting agency, is solicited. In addition, the subject of "TACT" is included in

AETNA COMPANY ANALYSIS OF ERRORS BY TYPE ERROR															
(Branch Recap by Department)															
PREPARATION DATE: Nov. 1, 1968										REPORT REFERENCE NO. A30					
FOR PERIOD ENDING: Oct. 31, 1968										PAGE NO. 1					
Organizational Component	Total Documents	Total Errors	Error Rate	CODE 1		CODE 2		CODE 3		CODE 4		CODE 5		CODE 6	
				Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors
Department A	1477	226	15.30	80	35.4	17	7.5	25	11.1	10	4.4	7	-3.1	10	4.4
Department B	2160	159	7.36	35	22.0	16	10.1	24	15.1	12	7.6	0	0	8	5.0
Department C	267	9	3.37	0	0	0	0	2	22.2	0	0	0	0	3	33.4
Department D	71	3	4.23	0	0	0	0	0	0	0	0	1	33.3	0	0
				CODE 7		CODE 8		CODE 9		CODE 10		CODE 11		CODE 12	
				Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors	Total Errors	% Total Errors
				16	7.1	33	14.6	4	1.8	15	6.6	6	2.7	3	1.3
				14	8.8	19	12.0	5	3.1	5	3.1	15	9.4	6	3.8
				1	11.1	1	11.1	0	0	1	11.1	1	11.1	0	0
				BRANCH C OVERALL TOTALS AND AVERAGES											
	3975	397	10.0	115	29.0	33	8.3	51	12.8	22	5.5	8	2.0	21	5.3
				31	7.8	53	13.4	9	2.3	21	5.3	23	5.8	10	2.5

Table 3

indicated as H-0232. This report would have a special code that would then trigger the machine to account for 232 reports for the month of August and close the books for the initiator this month if all were received, or to continue "pressing" for the data if not received. The purpose then is to see that, in addition to getting accurate data, you also get "complete data."

Today everything moves at a fast pace. In the field of data processing we continually hear of "faster machines with greater capacity." However, before one considers faster equipment of any kind—whether it be punched card accounting machines or computers—one should have a good feel for the timeliness of the information received. For

the Management Control System (MCS) of the organization. Periodically, the lower echelon of management must explain any unsatisfactory reporting effectiveness rating and state specifically what will be done to correct any deficiencies in reporting input data over and above the organization standard.

In summary, it is well known in the data automation profession that input data is the "heart" of any data system and that reports generated by the computer are only as good as the data fed into it. *Today's managers need responsive management systems* which must be timely, accurate and complete. Utilization of the techniques described above should produce them. ■

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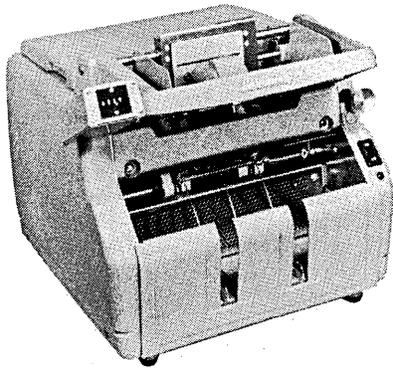
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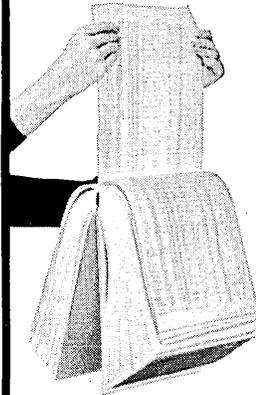
SOLVE SMALL PROBLEMS THAT make the big difference



TALLYPRINTER

A Cummins Tallyprinter can be used to assign consecutive link numbers to items entered at random into a computer for future association and subsequent reference to a particular run for rapid identification. It imprints the fastest, clearest, most legible impressions you can make — automatically — feeds, imprints, dates, counts, stacks in sequence — in one rapid operation. Rapidset or Consecutive Numbering in addition to, or instead of, marking a date is optional. Predetermined count also available.

CIRCLE 28 ON READER CARD



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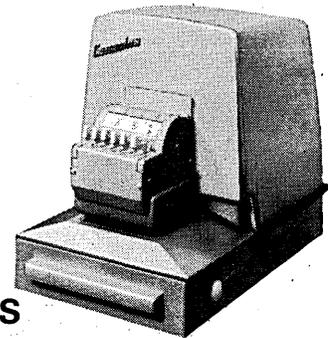
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CIRCLE 30 ON READER CARD



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OCR FOR HANDLING PUBLICATION SUBSCRIPTIONS

seeing is believing

by ANTHONY J. RIZZO

Our conversion to the use of optical character readers began when processing performance studies indicated that our unit record equipment was no longer capable of efficiently handling our growing subscription list.

This problem reached crisis proportions during our 1965 Christmas promotion. This annual promotion represents a mailing to subscribers who in the past have purchased gift subscriptions. From 500,000 to 600,000 renewal subscriptions must be processed within a six-to-eight-week period, in addition to the normally busy seasonal workload.

Although we employed a staff of 75 keypunchers and verifiers in our first and second shift operations at *TV Guide*, we hired additional trained and untrained keypunchers for this promotional period. We were aware that those lacking experience represented a questionable asset, but we desperately needed hands to process the workload, regardless of the cost of training these people. Despite our preparation, when the cashiering department cut off the Christmas issue, approximately 200,000 orders remained to be processed. This figure represented subscribers whose orders were received before Christmas. It was evident that another means of input had to be found.

We began "beating the bushes" for a configuration of hardware to supplement our card processing department by absorbing at least the renewal and accounts receivable portion of our input. This represented approximately 50% of all input through our system.

We first studied the product line of a manufacturer whose method of input utilized keydriven cathode ray tubes. We found this method as restricting as keypunching and verifying, in that our operators would not only require the skills of a keypuncher and verifier, but our system would require their having the complete knowledge of our validity and editing routines. It would, in our opinion, have been wasteful not to have this input validated at that level since the on-line features of the crt permitted the operator to communicate with the computer which housed all of our validity routines. This caliber of people was not available and was the reason for our initial study. Also, we would still be processing 100% of input manually.

After further study, we decided that optical character reading was the input method we required, especially since we controlled the output of all our renewal and accounts receivable invoices. After investigating the document reading equipment available from several companies, we chose

the Model 3010 of Farrington Manufacturing Co.

We selected this reader, first, because it could be operated completely off-line. This capability was necessary, for our Univac 1050 would not permit on-line reading of our input volume and still be expected to print our promotional and billing business. Secondly, it permitted the reading of a greater variety of form sizes. And thirdly, a feature which Farrington calls "rescan" prevents premature or unnecessary rejections. The Model 3010 does not attempt to read a document while it is moving, or on the fly. The document is read while stationary in the reading station. The reading mirror will sweep the document up to seven times.

The Model 3010 has a rated speed of 312 documents per minute for one-line reading of up to 40 characters and 156 documents per minute for a two-line scan of up to 80 characters. The reading speed will always vary, however, based on the combined factors of document size, read zone length and number of lines per document.

In our particular application, we deal with an average of 250 documents per minute, which includes operator handling time. Documents in varying sizes from 2½ to 8½ inches in width and from 2¼ to 6 inches in height are acceptable on paper or card stock with a minimum weight



Mr. Rizzo is EDP Manager, Subscription, for *TV Guide* magazine, where he began his business career 12 years ago as an IBM operator trainee.

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late operation without disturbing MAC's work.

Of course this is only an introduction to MAC. For full details write MAC, Lockheed Electronics Company, Data Products Division, 6201 East Randolph Street, Los Angeles, California 90022.

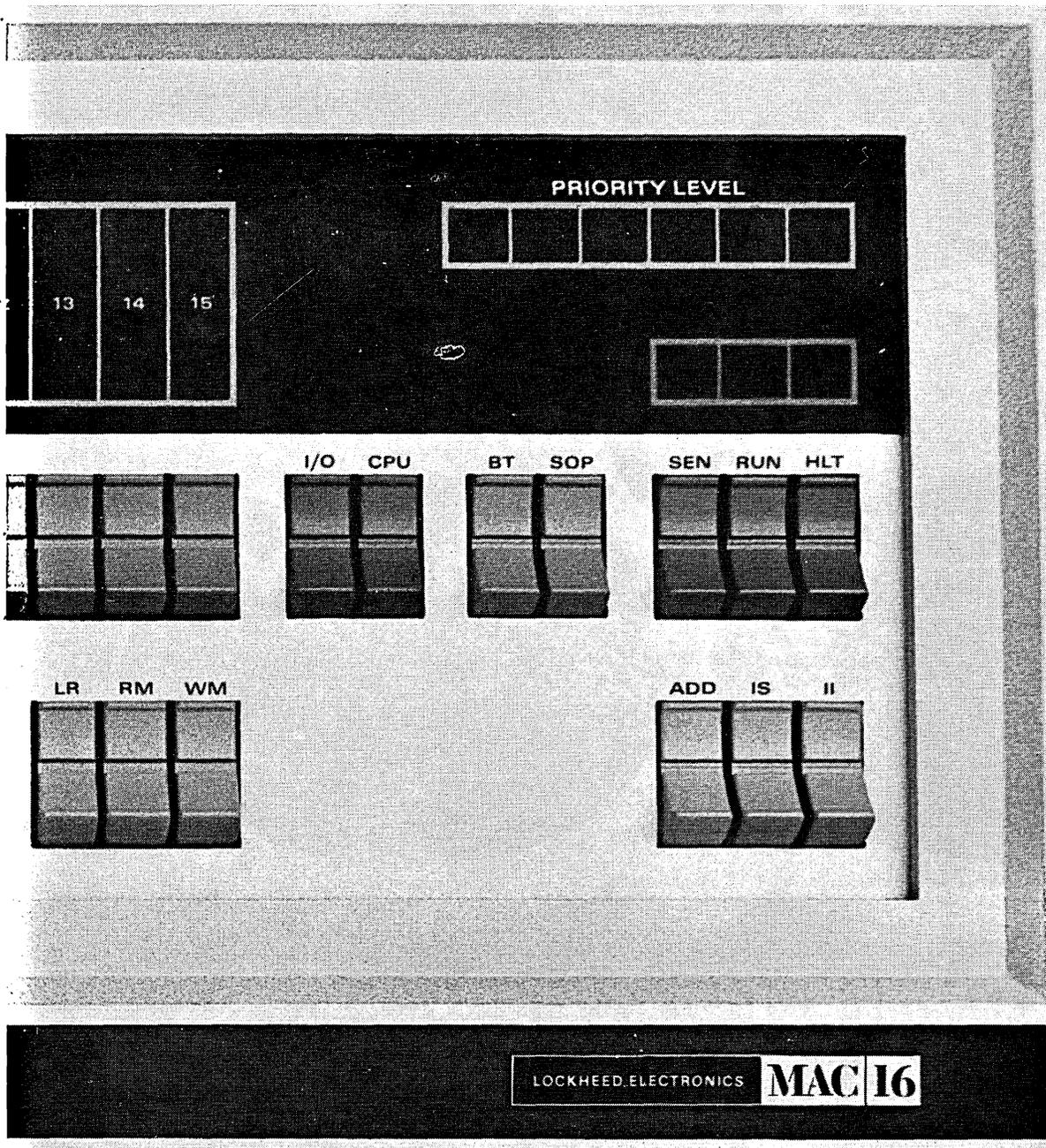
See MAC at the FJCC.

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CIRCLE 32 ON READER CARD

MAC



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MAC
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of 20 pounds. During a seven-hour shift, the Model 3010 transferred 105,000 documents onto magnetic tape, with a reject rate of 1½%. This reject rate is maintained in our operation today.

We were aware that the printing of our renewal and accounts receivable business (turnaround) would become a critical area in our scanning operation. Quality control routines were set up by our production personnel. For example, we test scan approximately 500 documents every two hours. Our reject rate at this level of processing is less than one-half of one per cent. Once this rate is exceeded, a new ribbon is placed into operation. We also clean the print drum or type bars every hour. This may appear cumbersome, but the few minutes spent at this level does improve document quality.

The speed of Farrington's document reader left questions in our minds regarding its accuracy. The check digit feature, available also in the competitor's readers, answered one of our questions. This feature insures against substitution of characters. Our computer, when preparing this tape for printing of renewal and accounts receivable business, assigns the check digit, which is accumulating numerics at their respective values and alphas at their numeric values (Hollerith System). We use the "9's" check system: the total of our scan line is divided by nine; the remainder is subtracted from nine; this result becomes the check digit. While the scanner is reading, it is performing this same calculation. The result must equal the pre-assigned check digit printed at the end of the match code. If equal, the document is accepted; if unequal, the document will be rejected.

Though satisfied that our decision to use the Farrington reader was correct, we also wanted to justify its cost. From October through December of 1965, we employed 75 people in our card processing area. This staff keypunched and verified 2,568,000 orders, accounts receivable, and customer relations transactions. During that time, they worked a total of 4,108 overtime hours.

Our renewal and accounts receivable business represented 50% of our input—1,284,000 orders—keypunched and verified. Using a department average for renewal and accounts receivable business of 250 per hour, we calculated that this represented 5,135 working hours, or 13 people working three months.

Using an average pay scale of \$75 per week, we calculated that the document reader offered an initial saving of approximately \$11,700. By eliminating the rental of seven key punches and six verifying machines, we saved \$2,300. The reader rental was \$3,200 per month or \$9,600 for three months. Compared with the salaries of 13 people for three months and the rental of keypunchers and verifiers, there was a \$4,400 saving.

The combination of speed and accuracy of throughput with a cost saving prompted our eventual purchase of this hardware.

At the conclusion of our 1966 Christmas season, we compared our results with the same three months of 1965. We had employed 55 operators in our card processing department versus 75. In 1966, we worked 2,488 overtime hours versus 4,108 in 1965. Meanwhile, our order volume had increased to 1,531,000 versus 1,284,000 in 1965, and our costs had decreased.

The most gratifying factor was that *all* orders delivered into our cashiering department by our cutoff date *were processed* into the Christmas issue, a far cry from 1965 when



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CIRCLE 33 ON READER CARD

that 200,000 remained behind. During the 1967 promotion, our orders increased by 300,000 to 1,820,000, but our staff remained the same.

Although we enjoyed a successful Christmas in 1966, we were still not content with our overtime costs. Our production people noted that despite our program to train keypunching and verifying personnel we encountered difficulty in attracting workers for these jobs. We found that keypunchers and verifiers were not available, but that typists were responding to our solicitations. This observation, plus our success with document reading, led us to explore the realm of page reading. We examined results by other users of page readers. We were interested basically in the averages per hour their people were attaining. We found that in most cases they were equaling their keypunching averages and that in some installations they were surpassing their punching averages. We then proceeded to examine their formats and their use of special symbols.

An evaluation of the page readers and typewriters of several manufacturers was undertaken, resulting in our selection of the Farrington Model 2030 page reader and the IBM Selectric typewriter equipped with a pin feed platen and Farrington self-checking font elements.

The Farrington reader offered the features of character insertion and demand sweep reading, which at the time were not available on other equipment. Character insertion gives the operator the ability to make corrections directly, thus avoiding line rejection and the re-entry of data. It can also serve to pinpoint a malfunctioning input typewriter.

The 2030 can read up to 75 characters per line. When demand sweep is incorporated, through plugboard wiring, we can terminate the sweep of the scanner mirror after a predetermined number of characters. For example, all of our input is restricted to 35 characters per line. Since this is

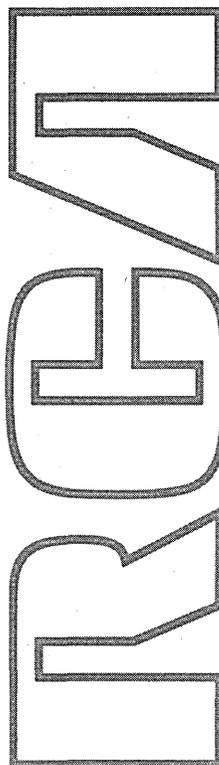
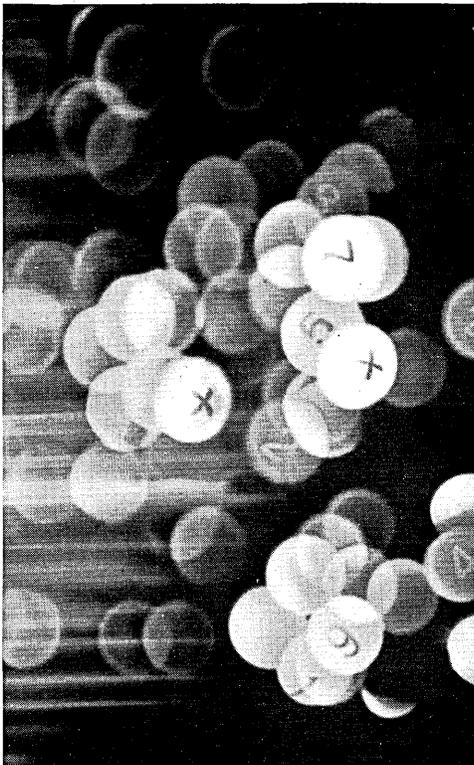
the format that the typists and proofreaders associate with when reading an address, we achieve faster throughput in our typing department and simpler, more accurate proofreading. We also avoid the use of special symbols, which is possible only with a block format type of input. Once a one-line scan type of input is incorporated, symbols are necessary to determine the start and stop of a line of address, within a scan line. We accomplish this simply by identifying the first line of a record, then the editing run on our 1050 seeks out the second, third, fourth, etc., lines until the next special symbol is read. Thus the typist now only types the symbol once at the start of the record, and necessarily the proofreader is left with a logical looking address, free from cumbersome symbols.

We are getting 10,000 lines per hour through our page reader, using a base of three lines per item, spaced five lines to the inch. This amounts to approximately 3,300 items per hour, or 23,000 items per seven-hour shift, written onto tape for validity or zero balancing routines. To handle this volume, our study indicated that we would need a staff of 35 typists. We were fortunate that our keypunchers and verifiers assumed the duties of typists and proofreaders. So far, we have surpassed our punching average by 15 items per hour.

During the 1967 Christmas promotion, we decreased overtime to 960 hours. We also hired high school students on a part-time basis in our typing department, which would never have been possible with the keypunching system.

Recently we began typing and optically reading outside direct mail lists, providing the customer with a compatible tape. Thus our optical readers enable us to get additional revenues during the slower periods of the year.

To sum up, we at *TV Guide* are extremely pleased with our decision to go with optical character reading. ■



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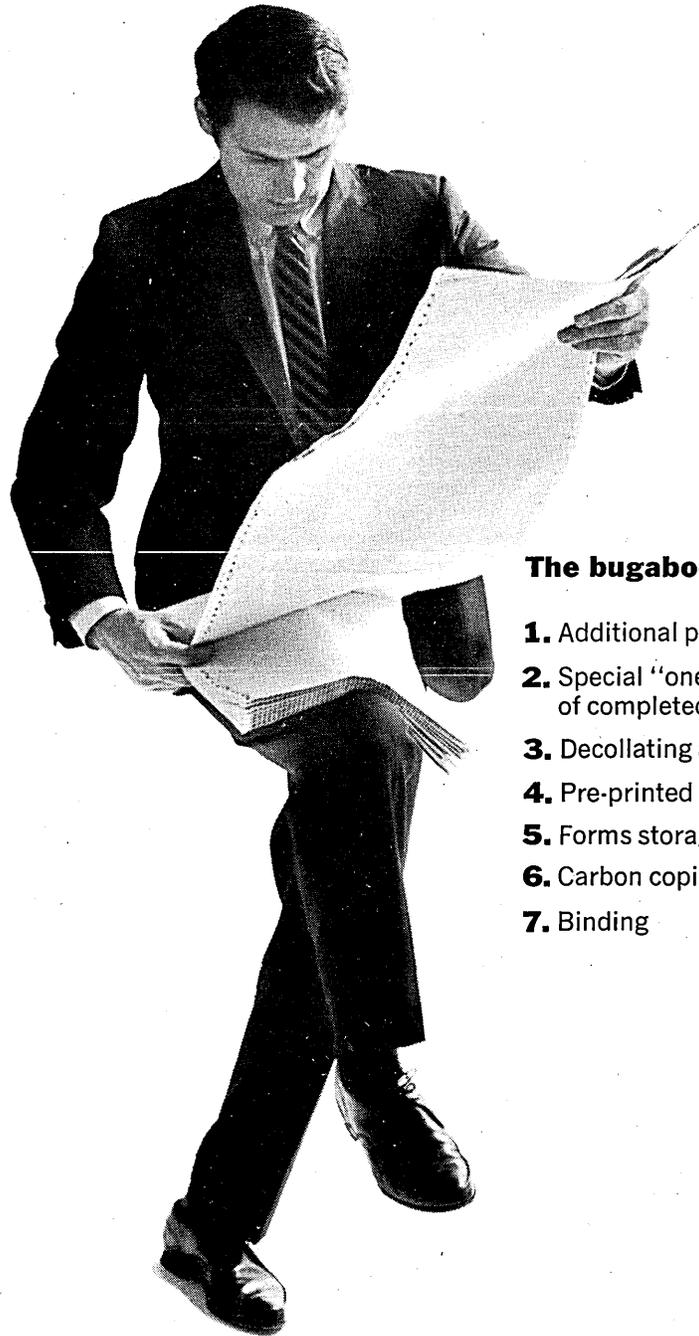
Among other RCA Controllers are models for local computer-to-computer communications, and for long-distance data handling at 28,800 bytes per second . . . one for Data Gathering, which provides off-line operation . . . and still another, a high-speed binary synchronous compatible controller.

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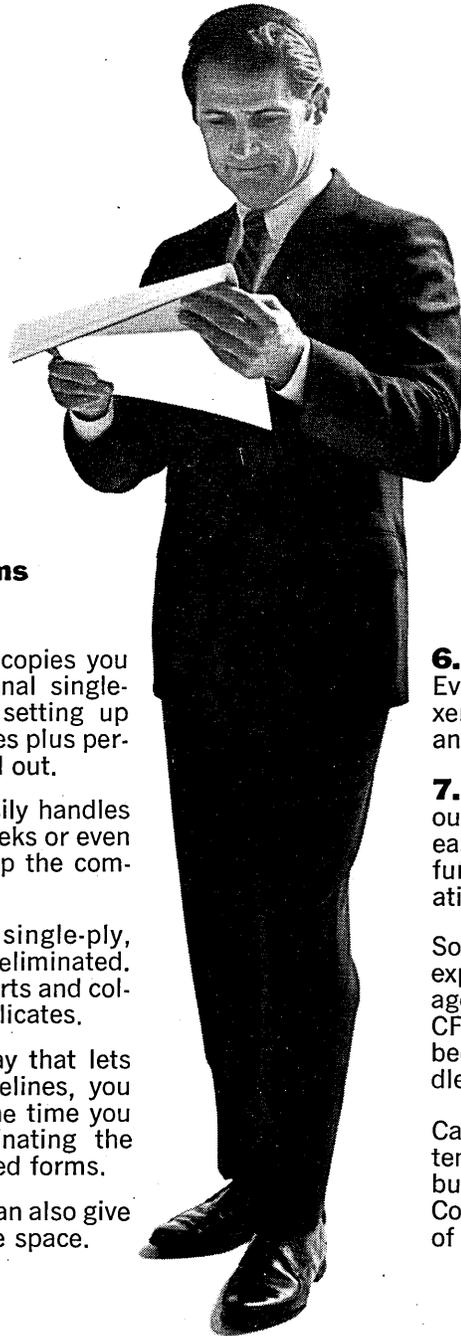
How the Xerox Computer Forms Printer takes 7 printout bugaboos...



The bugaboos:

- 1.** Additional passes
- 2.** Special "one-shot" copies of completed reports
- 3.** Decollating and bursting
- 4.** Pre-printed forms
- 5.** Forms storage
- 6.** Carbon copies
- 7.** Binding

and wipes them out.



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- 1.** The CFP runs off all the copies you need, off-line from the original single-ply fanfold. Time spent in setting up computer for additional passes plus personnel time involved is wiped out.
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- 5.** Printing your own forms can also give you a large saving in storage space.

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Call your nearest Xerox Information Systems Representative and tell him what bugs you. He'll show you how the Xerox Computer Forms Printer can take care of it.

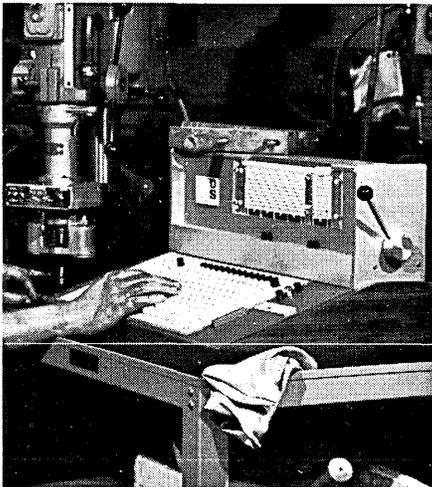
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CIRCLE 36 ON READER CARD

ACM SYMPOSIUM TACKLES URBAN ILLS

... doctor in the
house?

The 1969 Urban Symposium, "Applications of Computers to the Problems of Urban Society," sponsored by New York City area ACM chapters, was held at the New York Hilton on October 18th. The symposium provided a glimpse of many diverse viewpoints on how computers may be utilized to help solve urban ills. Experts in edp and urban affairs were scattered liberally about, with many individuals who had valid credentials in both realms. The program itself, however, was handicapped in that it attempted to embrace a field so broad that coordination between the various papers and topics of discussion was often weak... an indication of the basic problem in the current effort, a tendency to go off in many different directions.

General Chairman Justin Spring expressed pleasure with the large number of attendees, and the broad, international representation, which included people from many fields other than just data processing. About 450 people attended, perhaps two dozen more than last year, making this the largest attendance at an Urban Symposium to date.

Britton Harris, professor of city and regional planning at the Univ. of Pennsylvania, delivered the keynote address. He stressed that the computer bridges many varied disciplines in urban problem-solving, thus serving as a communications device. The computer, he said, is ideally suited for use in analysis and prediction of urban problems. A danger, however, is oversimplifying problems in order to make them fit neat mathematical formulas. Notably, any established mathematical model can be thoroughly confused when political bodies change the "rules" by altering taxes, zoning, etc. Prof. Harris provided a broad overview of edp and its applications to the urban milieu. He concluded his talk with the inspiring words, "Let us march together to the dawn of a new

era, with hope in our hearts and bugs in our programs."

Following Prof. Harris' address, the audience was put in a proper mood by the showing of two technically imperfect, but emotionally powerful documentary films on the South Bronx area, which has a population 90% Puerto Rican and Negro. The films emphasized the poverty, despair, and general ugliness of the South Bronx community, without touching on any possible cures for this situation or its relationship to computers. The films were followed by a half-hour coffee break which enabled the sombre attendees to re-adjust to the luxurious confines of the crowded Hilton ghetto.

The official program billed the documentaries as "the urban problem," so naturally the subsequent panel discussion was entitled, "the urban response." The program was running behind schedule, however, and the panel "discussion" consisted mainly of the presentation of papers. Their concern was that while all were interested in solving existing urban problems, that most cities and states are not using dp in the right way, or the most effective way; that the ultimate goal of the use of dp in government should be what assistance it can provide in the achievement of organizational goals, not just the more sophisticated processing of data.

Moderator Prof. Hershendorfer of MIT, chairman of ACM's SIGCAPUS, (Special Interest Group on Civil engineering, Architecture, city, regional, and transportation Planning and Urban data Systems), attempted to establish the composition of the audience by asking for a show of hands by categories, with the following subjective results: public administration, 20%; education, 20%; hardware manufacturers, 5%; software services, 40%.

The panel began with a talk by Dr. Emmanuel S. Savas, deputy city administrator of the City of New York, who described the myriad of

computer activities being undertaken by the city in such areas as education, job matching, utilization of ambulances, and traffic control. He asserted that the greatest problem facing the application of edp to the problems of New York was in the management and decision-making processes, which are impeded by a continual "crisis atmosphere" in city government. For example, he stated that "when there's a sit-in in a commissioner's office, it's difficult for him to discuss dispassionately the problems of higher level systems design."

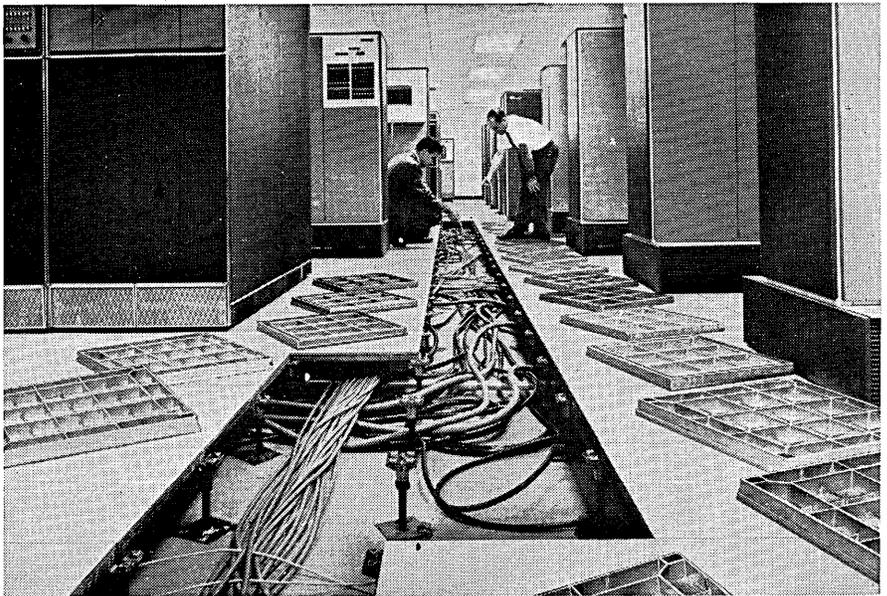
Col. George F. Gorgol (USAF, Ret.), director of data processing of the City of Chicago, described his own woes, pointing out that New York City with a population of 8 million, is spending \$23 million annually on edp, while Chicago, with 3.7 million people, is spending a mere \$4 million. Later, however, Dr. Savas commented that this wasn't really a valid comparison, since New York spends about 35% of its edp dollars in administration of welfare, municipal hospitals, and property assessment and taxation, which are functions handled by Cook County in Illinois, rather than the City of Chicago (the City of New York includes five counties, usually known as boroughs).

The City of Chicago established a centralized edp facility way back in 1957, which now serves all city agencies, utilizing three third generation systems. Chicago's edp problems are primarily in the area of personnel: civil service employees tend to have long tenures and be of "advanced" age—they're reluctant to change, difficult to train, and opposed to reorganization. This inertia is especially harmful because edp is a new tool for city government, and demands innovation and flexibility.

"Tug" Tamaru, general manager of the data service bureau of the City of Los Angeles, described LA's Dept. of Data Processing, which he believes may be the first such department in a city administration. LA has tried to "look at the city as a total system, with three main vertical subsystems: fiscal, property, and personnel." A recent achievement of the department was the implementation of an "integrated sanitation management information system," which paved the way for another GIGO gag.

The panel concluded with remarks by Charles P. Smith of the State of California, who repeated the same general personnel problems normally encountered in the "internalized value" system of the civil service environment—reluctance to change, means becoming ends, and inflexibility. He confessed that while they were working

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CIRCLE 37 ON READER CARD

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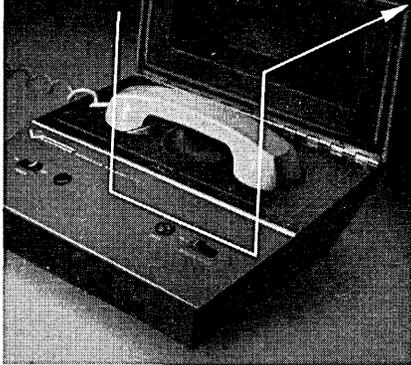
The Model 33 ASR set with paper-tape reader and punch keeps data on the flight path more economically, too. The set can receive data from its own keyboard or tape-reader, or from distant sets, as page copy with or without tape. And forms that fly by wire at an automatic 100 words per minute mean



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CIRCLE 39 ON READER CARD

ACM SYMPOSIUM . . .

within a dollar budget, California needs a better reporting system by which to analyze dp utilization. (Before Smith became director of management services, the state had some \$50 million in 100 installations and 5000 people—and no central coordination.)

During the afternoon session, 15 papers were scheduled for delivery, classified under the headings "social implications," "urban planning," "housing," "the computer at election time," "geographic data bases," and "air pollution."

The symposium gave the "best paper" award to George C. Hemmens of the Dept. of City and Regional Planning of the Univ. of North Carolina, for "Analysis and Simulation of Urban Activity Patterns," in the urban planning category. He described an ongoing effort to use computers for simulating the out-of-the-home activity patterns of the resident households of a metropolitan area over a 24-hour day, and discussed the concepts proposed for structuring the analysis and simulation of these activity patterns toward determining land use and transport plans.

In the category of social implications, I.D. Robbins, Chairman of the Board of the City Club of New York and President of Hunt's Point Management Corp. delivered a paper entitled, "Will It Lay One More Brick?" He stressed that computers often hamper the head-on attack of urban problems by being mis-applied, or by detracting from the necessity of human decisions and innovations. The computer cannot be the "planner," he said, "nor can it make political decisions." Mr. Robbins gave several examples of uses of computers which evaded the real problems at hand. A simulation study of a garbage land fill, for instance, did nothing to solve the real problem, which is not the desirability of using refuse for fill, but the necessity of getting permission to dump—often a thorny political problem, since local communities understandably object to the presence of garbage dumps.

Thus, the emphasis has been on finding ways to use computers, rather than on the solutions to the problems, which ultimately must be determined by humans. Mr. Robbins confessed, however, that his relationship to computers is "purely theoretical."

Judith Moss, of the Government Information Systems division of Lockheed Missiles and Space Company, presented a paper on "Confidentiality and Identity." She pointed out that accuracy of data collected about an individual is as important as his right

of privacy; there should be no margin for confusion of identities, errors, or omissions. None of the work done so far in this area has touched on the problem of uniquely identifying each person so that all relevant bits of information would, in fact, refer to one and the same person. Associating data with the wrong person could be a greater invasion of privacy than the general release of correct information. Miss Moss criticized the often-voiced opinion that Social Security numbers can solve the identity crisis, pointing out that not everyone has an SS number, there is deceit, and just plain old-fashioned errors in the numbers. (At another conference, DATAMATION learned of a man in Wisconsin who allegedly has 5,000 SS numbers.)

In the area of housing, Barry Jackson of Fisher/Jackson Associates described a "Basic Housing System" which comprises a set of computer programs that determine and evaluate alternative residential building possibilities in a specified area. Input data are descriptions of lots and existing buildings. The system considers zoning restrictions, computes what buildings are possible on the site, and establishes financing costs and operating expenses for each building. These output data thus aid planners, developers, or investors in determining an optimum choice among building alternatives.

In the "air pollution" category, Ellison S. Burton of Ernst & Ernst presented a paper called "A Simulation Approach to Air Pollution Abatement Program Planning." Mr. Burton described a technique which simulates significant components of air pollution in a geographic area and calculates the costs and measures of effectiveness for any quantifiable abatement strategy. This analysis permits the least-cost combination of emission controls for the set of pollution sources achieving a stipulated air quality level. The least cost solution allows the efficiency of all other possible strategies to be ranked. Detailed information is obtained for any given pollution control plan, including what each pollution emitter's contribution is, and who will pay the cost of abatement. In many cases, pollution control is unnecessarily expensive and ineffective; hopefully, simulation can significantly improve this situation.

Following the Urban Symposium, Prof. Hershdorfer declared that it had been very successful "in terms of turnout and participant interest," and had satisfied its main function of exposing on-going efforts and as yet unpolished, as well as some very polished but misdirected, work to the public.

—F. BARRY NELSON

FOLLOWING THE URBAN SYMPOSIUM, PROF. HERSHDORFER DECLARED THAT IT HAD BEEN VERY SUCCESSFUL "IN TERMS OF TURNOUT AND PARTICIPANT INTEREST," AND HAD SATISFIED ITS MAIN FUNCTION OF EXPOSING ON-GOING EFFORTS AND AS YET UNPOLISHED, AS WELL AS SOME VERY POLISHED BUT MISDIRECTED, WORK TO THE PUBLIC.

→ ON READER CARD CIRCLE 27 FOR CONTROL DATA
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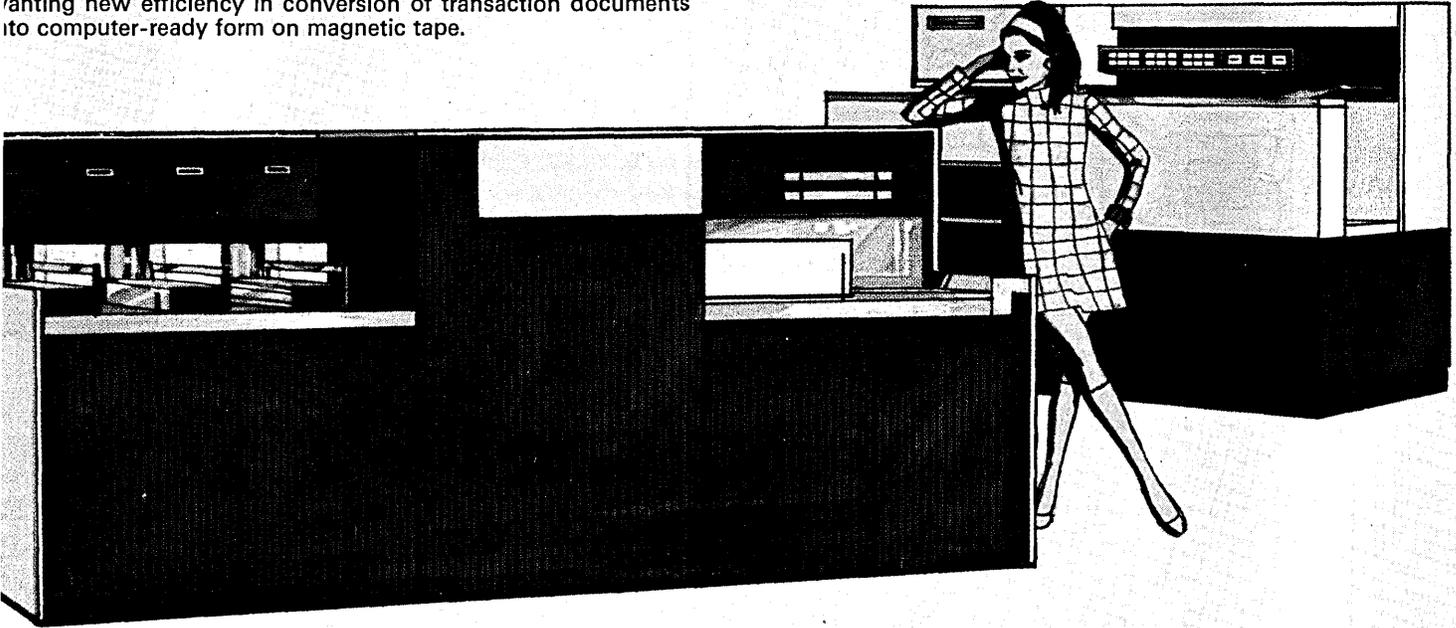
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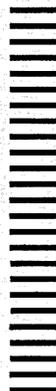
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RETAILERS AND EDP

The sheer numbers in products and consumers, the diversity of items, the change in consumer tastes, and the very nature and individuality of retail organizations themselves, have slowed the retail industry in fully applying edp technology economically across the board. Currently, management information systems and whatever they mean are not in the immediate purview of the retailer, but, said Sam Harvey, chairman of this year's Electronic Data Processing Conference of the National Retail Merchant's Association, the bits and pieces are beginning to fall into place.

The 10th annual meeting, sponsored by the Retail Research Institute of NRMA, took place in Montreal, Canada, Oct. 6-10. The session titles seemed to be a repeat of much of last year's conference, but there were more



point-of-sale devices announced (POS is still considered the major problem), more standards programs developed or planned, more case studies on OCR and microfilm applications, and more system definitions and/or applications involving purchase order management, on-line communications, merchandise (all kinds) information systems, inventory control, vendor pre-ticketing, distribution, and accounts receivable.

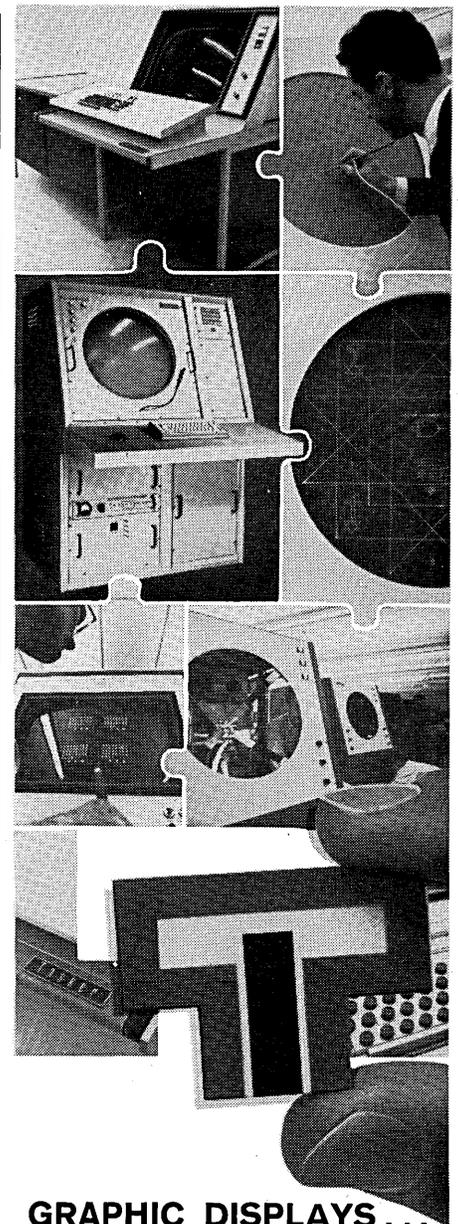
Dr. M. S. Moyer, professor of marketing at York Univ., tried to put edp into perspective for the general audience. "EDP has been a blessing be-

cause it has helped them answer truly important questions; a curse because it has encouraged them to ignore truly crucial questions." It has focussed their attention on informed merchandizing, while deflecting it from enlightened marketing, stimulated interest in efficiency while stunting their interest in effectiveness, he said.

Though to be credited, edp, Moyer said, is myopic—scanning the "store rather than the shopping area, the inventory rather than the intention to purchase, the transaction rather than the person, and the customer rather than the consumer." In other words, the computer does not make the management information system. And currently, the way stores are evolving with longer hours and more inexperienced salespeople, with central buyers who do not communicate with the consumer but the store, and with other developments leading the store further away from knowing itself, the retailer, he warned, must turn to strong market research, in combination with edp, to reach the total information system.

Point of sale systems continue to be the retailer's hot topic. This year, Friden finally announced its version, MDTS, described in New Products. It is aimed at providing the retailer with a cash register with several modules permitting off-line storage of data on a tape, after-hours polling, or on-line real-time transmission of data to a computer.

In his talk, Harry Gray of Litton Industries, announced that divisions Sweda and Kimball are working on POS-related equipment. A system now in pre-production testing, he said, consists of a reader that takes sales information from punch tags during or at close of a business day, a keyboard, magnetic tape recorder, and acoustic coupler. Also being added by Kimball is a tag-punching machine which uses 80-column cards for input (coupled with the keyboard for operator input). Both Friden and Litton seem to be emphasizing the evolutionary approach, permitting the retailer to experiment with different input methods



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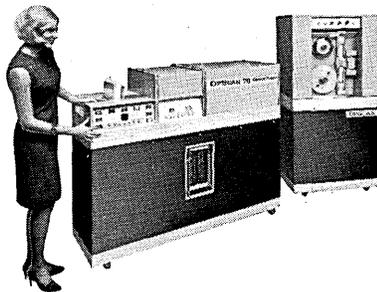
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RETAILERS . . .

before deciding whether to go on-line. Friden, by the way, has a built-in market for its system, since Parent Singer plans to use about 2000 MDTs in its retail stores. The unit goes into test in Singer and other retail stores next summer. Punch and other tag readers are being developed for it.

In the background, there was the growing force of the General Electric retail systems group. A pilot system, using a terminal developed by GE and Friden, on-line to a GE system, is being tested at J. C. Penney in Glendale, Calif. And it looks as if GE is hoping to capture the whole Penney network with this approach, as well as other retailers. We hear GE is considering setting up its own data centers to capture the data as well. (The GE-Friden combine is ended.)

Uni-Tote was also there, describing its on-line credit authorization system and point-of-sale equipment. NCR and IBM did not present systems like this, although some attendees claimed that both firms have systems competitive with the Friden unit under development. For NCR at least, the problem is impacting its own cash registers now on the market.

NCR did describe a purchase order management system it has in the planning stage, which would automate ordering, receiving, checking and marking functions in a department or specialty store. It also will help automate the decision-making in buying. NCR says that the system will be defined by fourth quarter 1969 and fully programmed a year later. Generally, in addition to MIS programming, the on-line approach espoused will entail several terminals including crt's at the buying, receiving, merchandise checking, and marking areas. NCR has 25 people devoted to this development. In the audience, an IBMer quietly whispered that E. J. Korvette is already implementing parts of this type of system.

Skipping from session to session, we landed on the perennial problem children of the retailing industry, credit-granting and credit bureaus. Credit-granting, now the life blood of the retailer, is being attacked by the banker. And credit bureaus, for a multiplicity of reasons, are losing ground to the nationwide computerized companies entering the field.

In "The Credit-Granting Function Today and Tomorrow" session, we walked in on William Blankemeyer, Credit Bureau of Cincinnati, Inc., who was relating the woes of the independent credit bureaus in automating. He noted the cooperative effort of the



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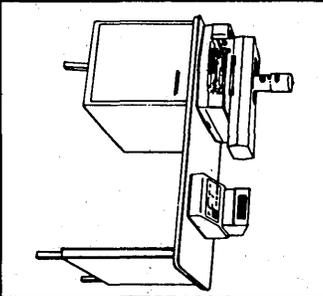
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RETAILERS . . .

Association of Credit Bureaus of America and IBM to develop a package for the bureaus, CB-360, which started in 1965. He felt "bamboozled" by the whole thing, citing that many bureaus adopting automation and this package are way behind schedule, while others have changed direction, starting with their own center, then switching to cooperative centers of several bureaus. But his comments, and the private opinion of a management consultant, indicated that the CB-360 effort was less to blame than simply the confusion of the bureaus in facing competition and in trying to determine how and whether to automate.

George Jones of the Credit Bureau of Cook County, Inc., Chicago, put the problem into better perspective. He noted the gradual consolidation of credit bureaus and the direction toward central information files. But he said, "operational weaknesses have been prevalent in the industry. Profit margins have been too low to provide sufficient funds for anything but very limited systems study and improvement." The storage and retrieval systems have most commonly been file drawers or soundex systems. And now the bureaus are faced by computer-oriented organizations entering the field, and the reaction must be immediate if they are to survive.

There are over 4,000 bureaus (reporting and collection) in the ACB of A, with information on 60 million family "groups." But the information is fragmented, he said. For example, Chicago has 24 credit reporting agencies; Los Angeles has 60. And the retailer is obliged to be a member of several agencies to obtain full information—and there are more agencies on the way.

"Fragmented information (either the same information in many places, or only limited information in one place) will not completely serve the needs of all credit grantors no matter how quickly it can be retrieved," Jones stated. He did not feel that nationwide networks, central files serving one industry (banks, oil companies, retailers), or a central facility handling several different files of individual reporting agencies is the answer to the problem of "fragmentation." Instead, he called for regional centers which would keep "one complete file for each credit-seeking individual." In this way, the credit industry would save money in equipment and personnel, while providing depth of information to all industries, credit grantors, rapidly. Such a file, Jones claims, could be updated on an exception basis at each

billing cycle. In turn, the system could automatically produce early warning reports to alert the retailer and other grantors to any derogatory information. (No mention was made of providing the individual with same.)

Even if this is a functional solution for the credit bureaus, the retailers themselves must come to terms with their major mentors in credit-granting, the banks. Ethel Langtry, director of the Retail Research Institute, pointed out that banks long ago recognized the potential of credit-granting, having developed the numerous programs available today and spent many public relations dollars to promote them. A "high-powered" committee of bankers have approached the retailers about working together, but with the proviso that the banks assume credit granting and billing functions. The idea of one identification card and one bill, she noted, has consumer appeal, but the retailer would lose his connection with the customer, as well as his own receivables. And, she added, the way the bank looks at a loan (dollar for a dollar) is not in line with the retailer's philosophy—which is to render service to its customer.

Thus, toward examining this and other problems, NRMA has invited 15 members of top management of retail firms to study immediate and long-range factors affecting credit-granting—including government regulation and legislation, economics growth in credit, technology and the "less-check society."

During the credit bureau session, the question of standard identification number was brought up. Some of the panel seemed to dislike the Social Security number as the ID, as adopted by banking, and pointed to the case of a man in Wisconsin found to have 5,000 different numbers. During this and other sessions on this topic, several problems were brought up concerning this number. The most difficult is the lack of any central agency to track down duplications and false numbers. Irving Solomon of Ernst and Ernst, said that a bill through Congress setting up such a center would be necessary, but it will be difficult in view of current controversy over the privacy and central data bank issue. The Social Security Agency (although privately in favor of this number as standard, opined one observer) cannot provide this function.

In a session on identification of individuals and organizations, it was indicated that USASI is leaning toward a name and number identification, the most likely being the Social Security number so far. The only other real candidate was the birth number adopted by state registrars, but its dis-

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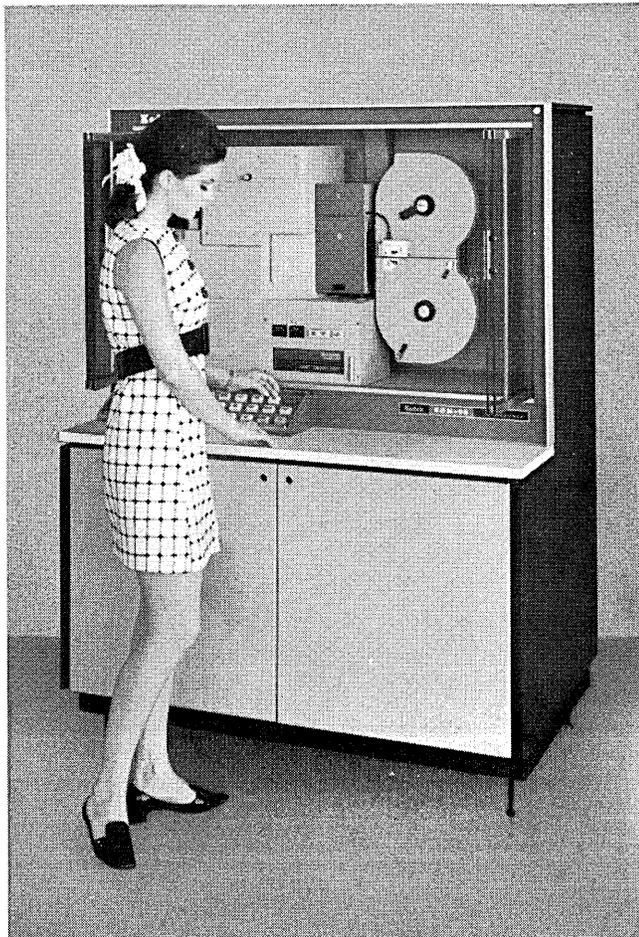
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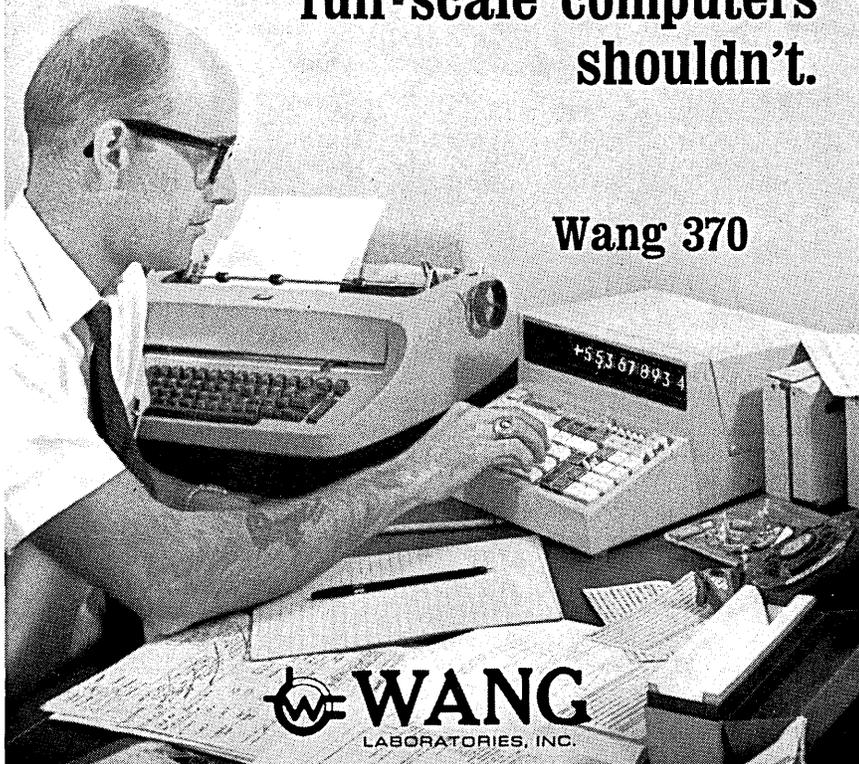
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CIRCLE 45 ON READER CARD

RETAILERS . . .

advantages, including the use of the individual's date and place of birth and excessive digit length, seem to disqualify it.

The organization identification is another problem. While the committee favors a numerical code, there is no one system in broad use which covers all the entities of an organization. The closest is the Census code, which uses the employer identification numbering system. DUNS and a Department of Defense vendor numbering system are other codes under study.

Also in the standards arena, more specifically applicable to the retailer, is the standard invoice, now adopted by NRMA. The 450 attendees heard from banker George White of Irving Trust Co. on its potential. The current method entails data translation by both seller and buyers because of the variance in forms. The standard invoice, White says, will "simplify payment of invoices, permit funds to be transferred to the vendor's banks on the exact days desired, and permit buyer receipt of machine-readable or transmitted input for updating accounts payable records." The vendor could also receive this input for accounts receivable. In other words, the retailer's adoption of this standard aids the automatic payment system the banks are moving toward.

There was also continuing discussion of the S.K.U. number for item identification. An NRMA technical committee on vendor pre-marking has developed a standard method for determining this number, which can be used either for input into a POS device or on a punch ticket.

In summary, the dedicated retail industry observer would best contact NRMA in New York for the proceedings. This is a group whose jargon defies in many ways the general computer buff and whose problems often defy the quantitative methods of edp. Mark the men's store chain in Washington, D.C., which has seven stores carrying the merchandise of high-priced clothing manufacturers but which has different clientele in each store.

The manufacturers and service companies actively attacking this field have in part been noted above. They are almost a small clique. Few software firms were represented. But it must be noted that although IBM, GE, NCR, and Honeywell were the only mainframers at the conference, retailers were betting on Control Data, a horse which came in third at the race track the night of the NRMA outing there.

—ANGELINE PANTAGES

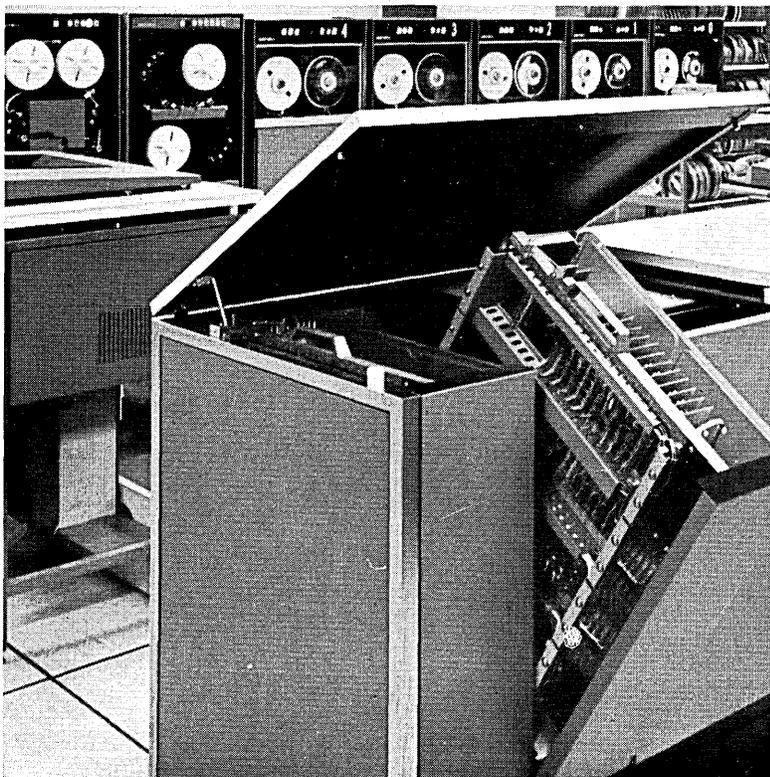
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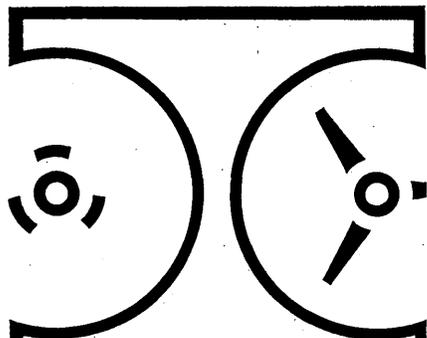
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a conference report

CAI CURRICULUM AND INSTRUCTION STRATEGIES

Have CAI operations providing only drill been harmful to the development of instructional use of computers? Will CAI programming languages such as COURSEWRITER and PLANIT be replaced by general-purpose languages for programming interactive use of computers? Have CAI projects in the universities failed to adopt significant missions such as compensatory education for ghetto youth?

These questions were raised—and some answers attempted—during a conference in Washington, D.C., last month presented by the Institute for Computer-Assisted Instruction, Inc. About 20 participants from corporations, universities, school systems and federal agencies attended a three-day briefing session at Sterling Institute, Watergate Center. Each day, three or four institute staff or invited speakers presented summaries and moderated discussion. The afternoon of the second day included a demonstration of the CAI facilities of the Naval Academy at Annapolis.

The purposes of the briefing session as stated in the program of the institute for CAI concerned where to use CAI in the spectrum of teaching modes, and how to acquire usable CAI instructional programs at reasonable cost. The portion of content most interesting to DATAMATION readers concerned function of CAI languages, comparison of languages, and the issue of standardization.

On the first day three different programming languages were described and discussed. Karl L. Zinn (Univ. of Michigan, Ann Arbor) began with an overview of programming languages and their relation to instruction strategies implemented on computer-based systems. He said in essence that special purpose languages for programming CAI have not provided for all that lesson designers want to do, and that more than one kind of language is re-

quired for the variety of modes of computer use. He elaborated ideas presented at the ACM National Conference in August and a conference on CAI in mathematics education in September.

Rex Lamb (State Univ. of New York at Plattsburgh) described his experiences with COURSEWRITER on an IBM 1440. He talked through a sample of COURSEWRITER coding for processing answers to the question "Who will be the next president of the United States?" The exercise showed how a few statements in the language can very simply represent a question-answer sequence to be delivered under computer control, and how other op-



erations and functions are available for the author who wants to provide for additional processing and adaptation to student performance. However, Lamb's example also demonstrated the tedious effort required to incorporate the individualization for which CAI is acclaimed into each question of a computer-based course.

Samuel L. Feingold (System Development Corp., Santa Monica) de-

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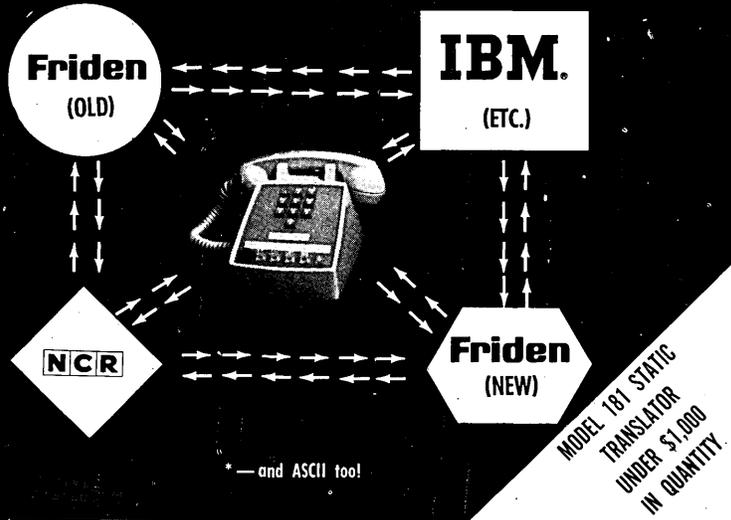
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scribed the PLANIT language which he co-authored for the SDC time-sharing system. Originally PLANIT was designed for computer-based instruction in statistical inference, but since has evolved into a more general language for programming instructional interactions. It retains facilities for problem generation and student computation which are useful in training for some mathematical skills. Another feature which distinguishes PLANIT from COURSEWRITER is a special form of conditional expressions which obtains needed values from a data vector describing student responses and progress through a set of frames (see DATAMATION, September 1968). The National Science Foundation recently awarded a contract to SDC for implementation of PLANIT on the 360/40 and similar machines.

David Monsen (Computer Curriculum Corp., Palo Alto) described the procedure statement approach taken by RCA, in particular for the drills in mathematics and language skills developed at Stanford Univ. The curriculum designer adopts a strategy which contains scoring and timing features, and standard replies such as "too long" or "wrong, try again." Any number of procedure statements might be prepared by the curriculum designer or his programmer associates, but ordinarily each one is used for relatively large blocks of curriculum.

The differences between the three programming languages were sharpened when Zinn showed sample exercises coded in two or more languages. He listed aspects of instruction strategies and modes of computer use, indicating those which were not well handled by special-purpose CAI languages today.

The participants raised interesting questions about where and how computers should be used in training and education today, and what kinds of languages are required. Lamb, Feingold, Monsen and the ICAI staff for the briefing session responded to these and other issues with more opinion than information. It seems that languages will include more general facility for programming interactions between learner and system. Computer use will tend toward greater student control. Money will be spent on CAI in the schools only to the extent which it contributes to the solution of major problems. Training programs in industry will incorporate computer-based instruction only where clear advantages over alternative media are indicated.



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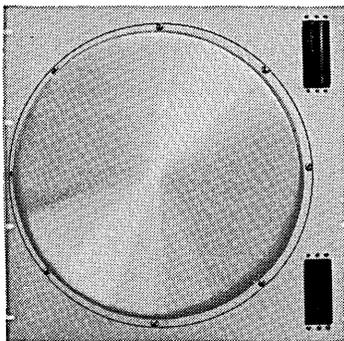
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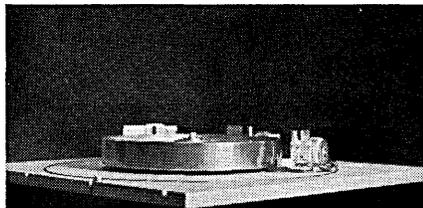


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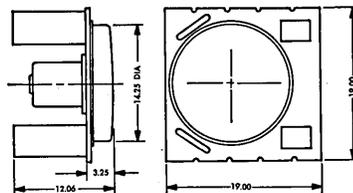
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CIRCLE 51 ON READER CARD



news scene

*an interpretive review
of recent important
developments in
information processing*

"BACK FROM THE BRINK" . . . OR "THE PERILS OF DASHEW BUSINESS MACHINES"

Can a modest-sized company that has been in bankruptcy for two and a half years and faces such formidable competitors as Addressograph-Multigraph in the cutthroat credit-card business survive?

"Yes," says president Samuel L. Greene of Dashew Business Machines, and he offers some figures to prove it. Dashew's stock, once "selling for about a quarter a share with no takers," is now around \$5; the company has a delicious \$9 to \$10 million tax loss carry forward; and fiscal '69 should bring an estimated \$325K net profit.

Dashew, founded in 1951, was in the business of making machines to handle plastic cards for credit identification and computer input, including imprinting from them at the point of sale. By 1962, however, the company was sickly and ached to be acquired. Greene arrived in '63 as vp marketing, bringing experience as a district manager for ElectroData plus marketing jobs at Stromberg and Digitronics. And then came the corporate suitor with trunkfuls of dollars—Hughes Dynamics.

This company's history is a stirring story in itself, but in essence it planned to use Hughes money to establish a complete credit system. The groups included a credit-checking operation, credit-card production and processing, computer centers, data transmission facilities, and software preparation. Their integrated activities would then be marketed as a service, with HD taking over a customer's accounts receivable and processing them at a standard rate per transaction. One of the companies acquired for this purpose was J. B. Carroll of Chicago, a producer of specialty plastics. Carroll and Dashew together had the facilities for complete handling of credit cards—from production to end use.

It didn't work.

try again

In March of '64, some \$17 million later, Hughes Dynamics expired, leaving Dashew crushed by debt and feeble than ever. During the next year or so, the company used up three presidents. Greene stayed on. And in August of '65 the company sank into Chapter X of the Bankruptcy Act. The court appointed a trustee who, in turn, appointed lucky Sam Greene administrative officer. What this meant, it turned out, was that Greene had seven weeks to come up with a comprehensive plan to restore the company's health, in the meantime keeping it ambulatory by meeting payrolls, holding off ravenous creditors, soothing customers, and persuading suppliers to have faith and keep smiling.

Back to Hughes, where Greene said, in effect, give us another half million and I'll never darken your door again. He got it and then began laying about with long knives.

From some 550 employees, the staff was cut to about 180. The engineering department declined from 54 to 1—and he was a new hire. Duramatic Corp., a subsidiary making hand-embossing machines, was sold to an investor group—bringing a quick \$650K. Most of the management-level people went. And the company moved from its 118,000-square-foot facility to a 12,000-foot one—selling off much of its machinery as well. The plan was one familiar to families: trying to operate within real income.

The line of products was cut down to those that could be readily sold at a profit and the emphasis was put on supplying the burgeoning market for credit cards. (Green maintains a morgue of products developed during the Hughes Dynamics days, many incorporating ingenious ideas that may

some day be resurrected.) The firm's credit card and embossing business increased 300% while the company was in bankruptcy and Dashew now has about 20% of the market in spite of around 20 competitors.

came the dawn

Dawn came Jan. 8 this year, when the court returned control of the company's assets to the new board of directors, who chose Greene as president. Dashew consisted of the headquarters in Santa Monica, Calif., which includes some engineering and manufacturing facilities; J. B. Carroll, in Chicago, where the plastic work is done; and Dashew Canada, a wholly owned subsidiary in Toronto, which handles marketing there and includes an embossing service center.

The products are the Databosser, plastic credit and identification cards, plastic specialties (such as circular slide rules), and industrial printed plastics; services include embossing and equipment maintenance.

Sales of the Databosser are fairly small. It's bought only by large organizations, such as banks with widespread credit-card schemes needing the 3000 card/hour capacity. It's largely hand made, uses a modified 407 read unit, and sells for about \$50K. Addressograph is the only competitor. The cards are the big winner. They continue to proliferate as new uses are found, such as automobile warranty programs, and retailers want their own for promotion purposes—rather than relying on the bank plans that allow customers to deal with competitive stores.

New methods of imprinting photographs have added new markets too. Dashew has a contract to provide drivers' licenses for the state of Virginia. And Greene sees the checkless society as requiring vast numbers of plastic cards as computer input. Punched plastic cards for automatic telephone dialing and data collection are in the works, as are cards with magnetically encoded information to be read directly.

With its fortunes rising at last, Dashew is going after acquisitions. It expects to get Kirk Plastics of Los Angeles this month, a company doing \$750K sales with about \$100K net.

The net for fiscal '69, which started Sept. 1 this year, is based on projected sales of \$3.9 million and the first quarter results fit the forecast.

If you open the door to the room where the credit cards are stored, an alarm rings at the Santa Monica police station.

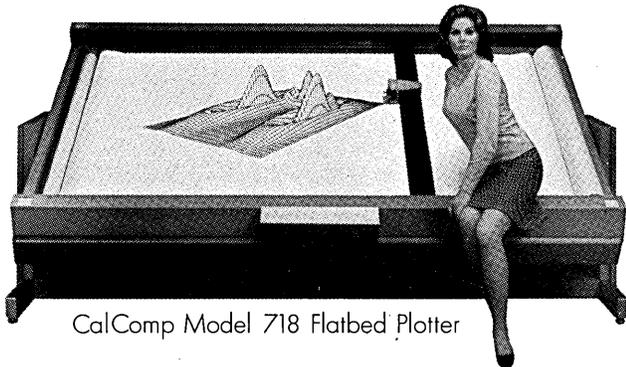
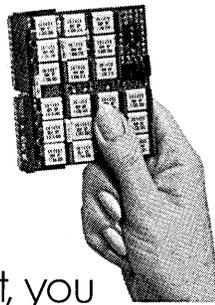
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(Continued on page 97)

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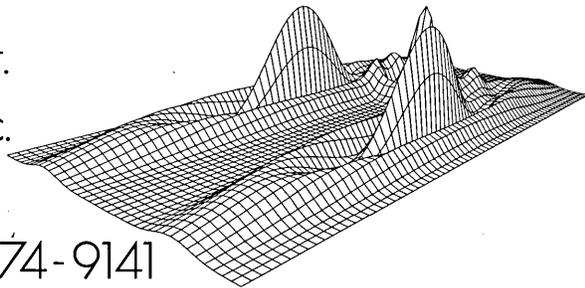
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IBM SERVICE BUREAUS COMBINED; SBC, IMD

Just what are the general implications of the transfer of IBM's time-sharing services arm, Information Marketing Department, from the bosom of the Data Processing Division to wholly owned offspring Service Bureau Corp.?

Some time-sharing service bureaus think SBC won't be as hard to fight as IBM. A few mainframe-makers hope fewer Call/360 customers will turn into hardware sales for IBM. SBC must be ecstatic that it can finally attack the IBM-blessed time-sharing market—and with IBM-blessed management, programmers, programs, and salesmen. And IBM can still report IMD sales in its annual revenues, is not constrained from offering these services abroad, and can still give users Call/360 Basic (for model 50) and DataText (for model 40), although both come without support or maintenance. The biggest loser is the user who had been hoping to latch on to future Call/360 packages under the same deal; it's not likely SBC will put them in the IBM tape library.

The transferral was prompted by the growing controversy over whether time-sharing services fall under "service bureaus." The 1956 Consent Decree prohibited IBM from engaging in service bureau activities (which were ambiguously defined in the text) and forced IBM to divest itself of SBC, which became a subsidiary. As reported in August, News Scene, p. 87, both the Justice Department and Congress have been investigating the matter, and it looked as though the whole Consent Decree, very much outmoded by technological developments, would come under review. The latter is still not out of the question, opines one source, but IBM has staved it off for now by making this transferral from "one pocket to another." (This source also notes that Justice Department activities in anti-trust actions will be naturally slowed down during the period of adjustment to a new administration, if not by President Nixon's political philosophy, so the department is probably happy that IBM moved without court action.)

IMD, whose products include Quiktran services, Datatext, and most important and recent (June), Call/360, cannot have amassed revenues that mean much in the IBM annual report. (They are not broken out.) The oldest service, Quiktran, has not been ambitious, as IBM was not a time-sharing service booster until this year. But the

IMD organization director L. E. Donegan has been building does not look like a small business: so far it includes 700 people, including 125 salesmen and a programming force in San Jose that developed the OS-independent Call/360 software; operational centers in at least seven cities; and well developed plans for information services aimed at specific industries, such as finance. If IBM ever had an inkling that it would some day spin off IMD, it could not have planned it better, according to one source. Donegan and IMD have reportedly been permitted to operate independently in many ways, so that the group could be lifted from DPD without great pain, administratively or in technical operations. The IMD financial operation was also separate from DPD; for example, any services IMD performed for other divisions or DPD were paid for.

will they fit?

How will IMD and SBC fit together? It seems certain that IMD will not be molded to fit the current SBC organization—long a remote stepchild, but rather that SBC will take on more and more IBM characteristics. Donegan has been made SBC vice president, and judging from the late October executive changes following the transferral announcement, he may be number two to new president John F. Williams (formerly executive vp). (Current reports are that no one will be named to Williams' former spot.) President Herbert R. Keith is now chairman of the board. Last April, William F. Glavin was named vp of staff and H. T. McCormick vp of the field operations.

SBC has 3,000 involved in the operations, programming and sales of its batch, remote batch, consulting, and contract programming services. There are 88 offices in 71 cities, according to SBC information. The SBC spokesman would not release a full breakdown of personnel or current equipment used. Last reports were that SBC still had a great deal of second generation in batch operations, although much of this was scheduled to be replaced by 360's. In 1966, SBC announced plans for a nationwide computer/communi-

cations network, and it has now in operation two centers, New York and Los Angeles, with RACT/ASP systems (models 50 and 65) for remote batch processing. One data services competitor scoffed at SBC's computer/communications network strength, but he thinks GE isn't making any money with its Information Processing (t-s) Centers either. (GE claims all but the newest are in the black.)

service centers

IMD's centers for Call/360 are now set up in New York, San Francisco, and Chicago, and originally plans called for serving 34 major cities from these centers by year end. Quiktran centers in Cleveland, Chicago, Los Angeles, New York, and Philadelphia serve 17 additional cities as well. Datatext (on the 360/40) is offered out of Philadelphia. How these offices and systems will be transferred to SBC is unclear, although one can assume SBC, as in the past, will pay standard prices for its equipment (wonder if they'll purchase, rent, or lease). The pricing of the services is another questionmark; although there were cries of "unfair pricing" over Datatext, Call/360 rates were considered to be in the middle of the market.

What does IBM lose by this "forced" action? Nothing, if compared with what it would have lost if the Justice Department had "held the same dialogue" with IBM when it announced the uninspiring Quiktran service—now a silently admitted violation of the Consent Decree. On the other hand, if IBM had been given free reign in time-sharing, it would have been interesting to see what the sales force would have done with the two-pronged attack: Call/360 services and Call/360 model 50's. But because of the decree, IBM can barely talk about, much less openly help SBC. This seems to equalize IBM with GE somewhat, since GE, by choice, has kept services and computer sales separate. Future software developments for the service, such as Call/360 PL/I now developed and ready, will probably be kept as proprietary not-for-sale products, such as GE's IPC's are.

To see an IBM at full blast in this arena, buffs will have to watch IBM World Trade, which has announced some time-sharing plans in Europe and Australia and won't be second or last to move when the market breaks open.

—ANGELINE PANTAGES

COMPUTERS, ELECTIONS AND TELEVISION — YOU CAN WIN SOME OF THEM

The close, crucial November election presented an ideal situation for the fe-

licitous function of man and computer,
(Continued on page 98)

news scene

and in the official tabulation and reporting of the vote, the operation could hardly be faulted. Although results seemed to come slowly at first, once the ballots had been gathered and checked (a somewhat tedious process) and the computers could at last get to them, the returns for the various registrars' offices flowed out quickly and steadily. In Fresno, Calif., for instance, where the programming debacle occurred in the primary, 6,860 absentee ballots were counted in the first 12 minutes after the polls closed, and by 1:30 a.m. the total 142,000 votes cast in the county had been counted. This time, Fresno used software developed both by the county and the Seiscor Corp. in Tulsa, which had solely supplied the programming in the primary.

breakdown

The unofficial tally, however, was something else. The National Election Service, set up by the networks and the wire services to provide as snappy a snap tally as possible, had its difficulties. Before midnight New York time, the 360/40's NES used to tally and report the results it received from its seven nationwide regional centers began to issue some strange and surprising news, reporting, for example, that comedian Dick Gregory had piled up 9 million votes in Pennsylvania. Other inaccuracies included returns from 600 precincts in a county where only 200 existed, and reports that nearly half the popular vote had been tallied when, in fact, only a quarter of them had come in.

Percentage figures for the three candidates were also presented that added up to more than 100%, and all of this indicated either fraudulence or misprogramming . . . the latter proved to be the case.

NES in New York shut down its computers around 1:00 a.m., a spokesman stating that the results then being reported were not considered "reliable beyond question." This, after 13 hours of testing on the Monday before the election and nine hours the same day that indicated the system was ready to go, although on the preceding Saturday CBS had been unable to complete its rehearsal because of a communication foulup. With both prime and backup computers down in N.Y., NES went to backup computers in its seven regional centers: Cincinnati, New York, Los Angeles, St. Louis (which had a small breakdown of its own), Atlanta, Philadelphia and Dallas.

Dallas County had an election night flap of its own, centering around a

controversy that had raged for weeks prior to the election over the use of punched card devices called Vote-a-Corders (made by Datamedia, Binghamton, N.Y.), to replace paper ballots and standard voting machines in roughly a third of the county. Under actual conditions, a few of the Vote-a-Corders didn't punch the right kind of holes, resulting in a pinhole rather than a true punch, and when run through the card reader of the 360/40 system operated by Dallas County, the pinhole cards were rejected. The rejects were less than 500 out of 136,000 tabulated by the procedure, but they were sufficient to create a delay in the count and put Texas in the doubtful column long enough to make it critical. These cards had to be reviewed visually by a panel of election judges to determine just what the voter meant to do, a time-consuming process that resulted in the cards being final-tabulated almost an hour later than the voting machine returns. Accusations were made that the judges were punching the cards the way they wanted, which caused them to give up on the process and go home—or try to. At least one judge was returned to the county records building by sheriff's deputies.

In the aftermath, both pro- and anti-computer forces claimed victory for their point of view. Ray Hyman, a computer consultant hired by Dallas County, said, "We inconvenienced a great many more people than we inconvenienced." Another official, county clerk Tom Ellis, described the repunching process done under the scrutiny of the panel of judges as "tampering" with the voter process and said it destroyed confidence in election officials. He did admit, however, that the heavy voter turnout had been handled more efficiently than ever before by the new system.

the backup

In Los Angeles, the backup computer was at Statistical Tabulating Co., which is located about a mile from the Biltmore, where the NES regional center for 13 western states was headquartered. When NES in N.Y. was functioning correctly, this 360/30 tabulated the local results being transmitted in untabulated form, which then, in hard copy form, were motor-cycled to the Biltmore, where they were phoned to N.Y. to check on the totals being developed there and these results were not further used. But the plot congealed when the N.Y. NES went down. When it was no longer calculating vote totals and sending local totals back to the regional centers via TTY paper tape, it still had to send regional totals back to the surrounding

states. So N.Y. had to key in one copy of the Stat Tab phoned-in calculations at TTY keyboards to transmit to neighboring states in lieu of the paper tape reading that was used when the system was go. New York actually received its totals from voice transmissions from all the regions—snap tallies from precincts that were computed locally, and also totals from regional registrars' offices where NES people impatiently awaited hard copy from the registrar's friendly 360/20, which was used for no other purpose than to produce from 1050-transmitted cards the paper output to be given to news people clustered at the registrar's office.

All of this contributed once again to the discomfiture of the television pundits, who made funny jokes about ballots being transported by mule train on freeways, ignoring the fact that the trouble lay with their own system (it cost each network about \$3 million for coverage). For instance, 164 key precincts in Los Angeles County were allotted to the networks for snap tallies on the presidential and senatorial races and the commentators became disgruntled when the reports from these precincts proved inconclusive and no projections of victory for any candidate could be made—a development that, in retrospect, may have justified the snap tally.

programming error

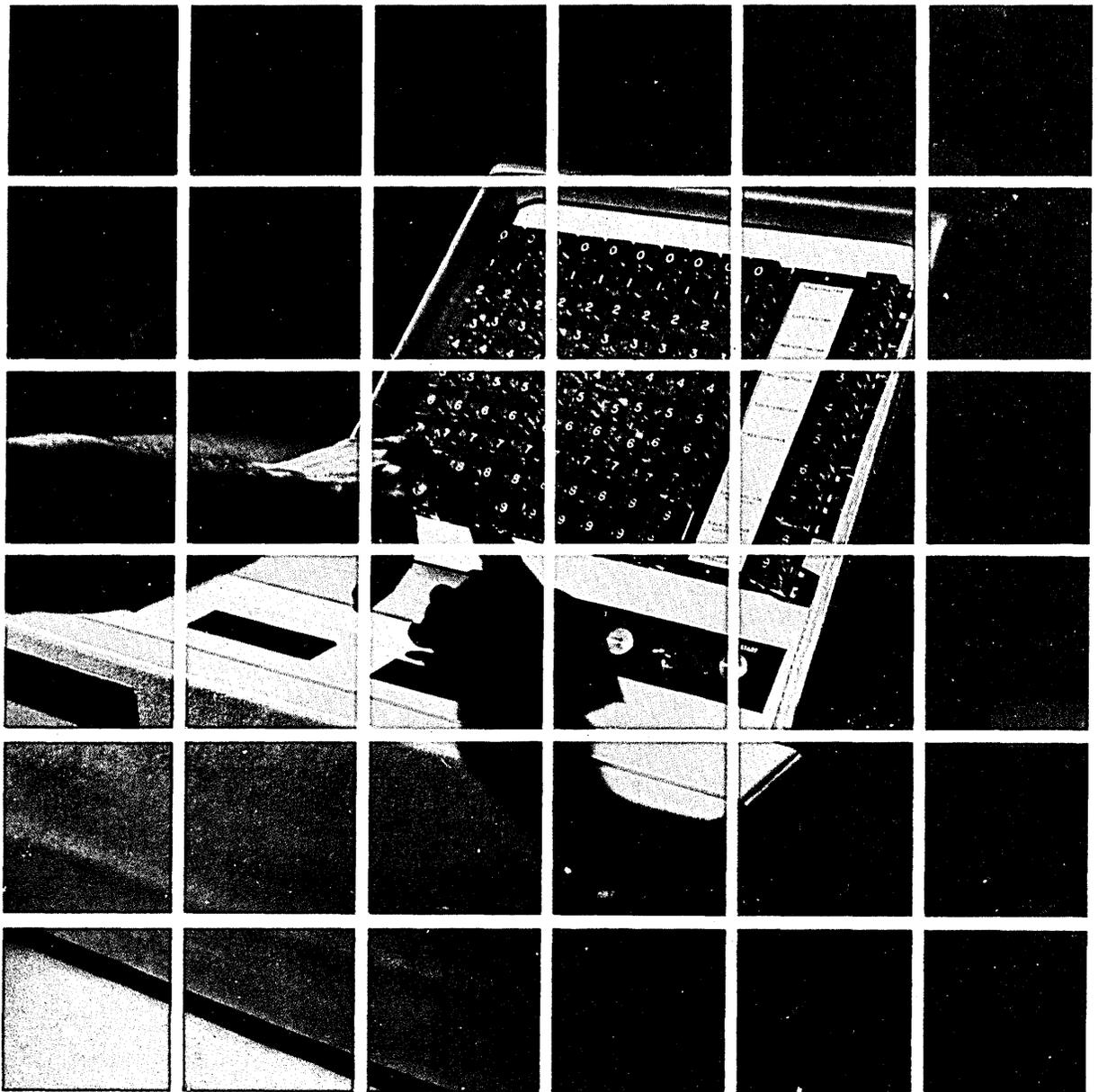
The NES breakdown was blamed on a programming error (the software was done by Programming Methods, Inc.) that may have been fed into the machines as early as last January, but no one in the organization was prepared to say just what the error was or how it got there. NES was relieved that the mistaken tallies for the most part were large and detectable and the most astounding did not get on the air—the conclusion was that the mistakes compounded themselves and that nothing of any subtlety occurred.

But that brings up the matter of subtle programming and security of operation in an election of such importance. There would seem to be a need for more visible safeguards against possible rigging, a need to know who checks and who checks on who checks, a need for enforceable security measures, even down to the precinct level to prevent mistakes, conscious or otherwise. NES stands by its final tallies. But that was a very close election. What if a mistaken victory had been announced? Would anyone have accepted an official computerized verdict the following day?

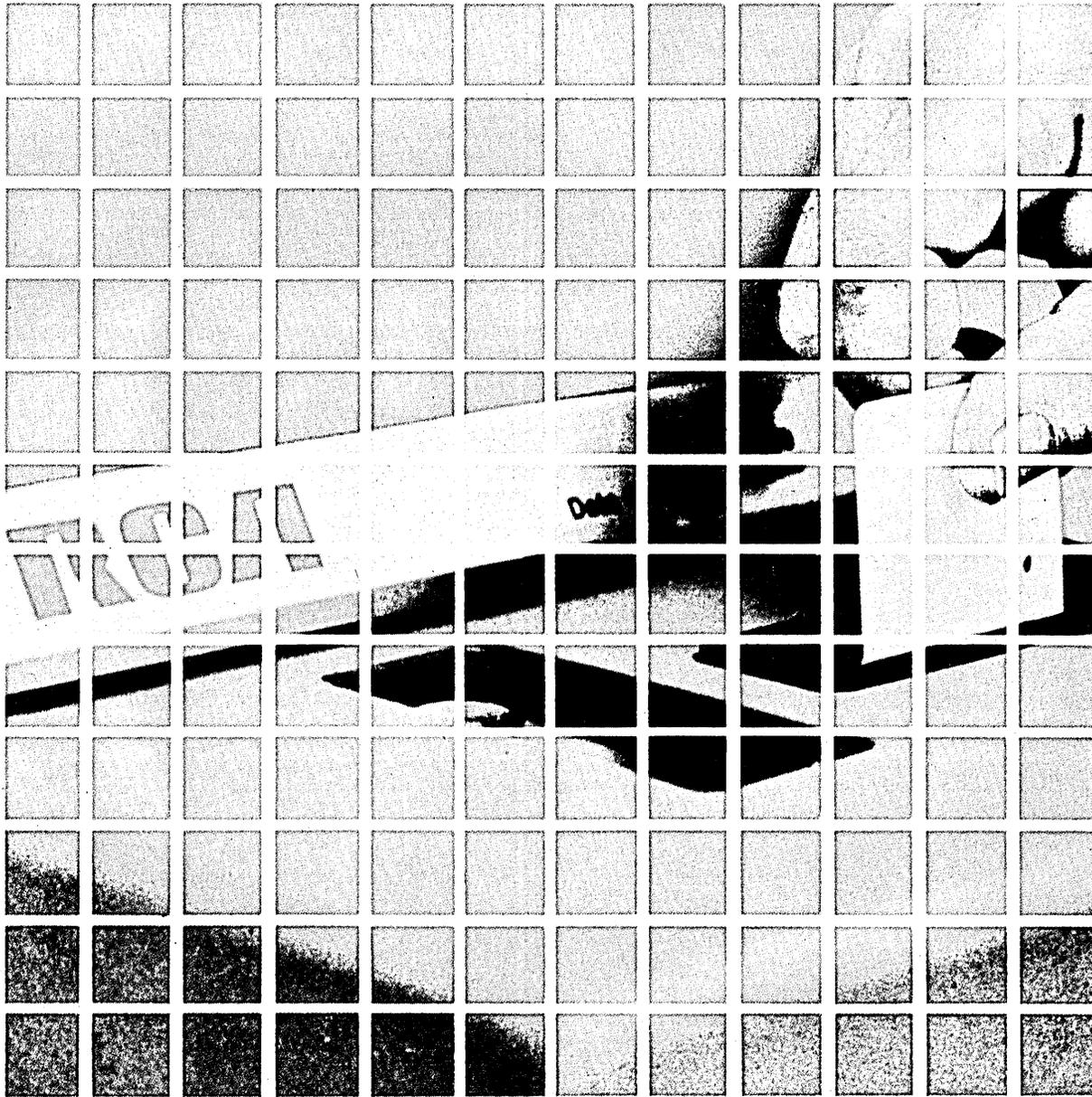
—AUBREY DAHL, DICK McLAUGHLIN

(Continued on page 103)

Get the inside story-as it happens



RCA Spectra 70 Data Gathering Systems



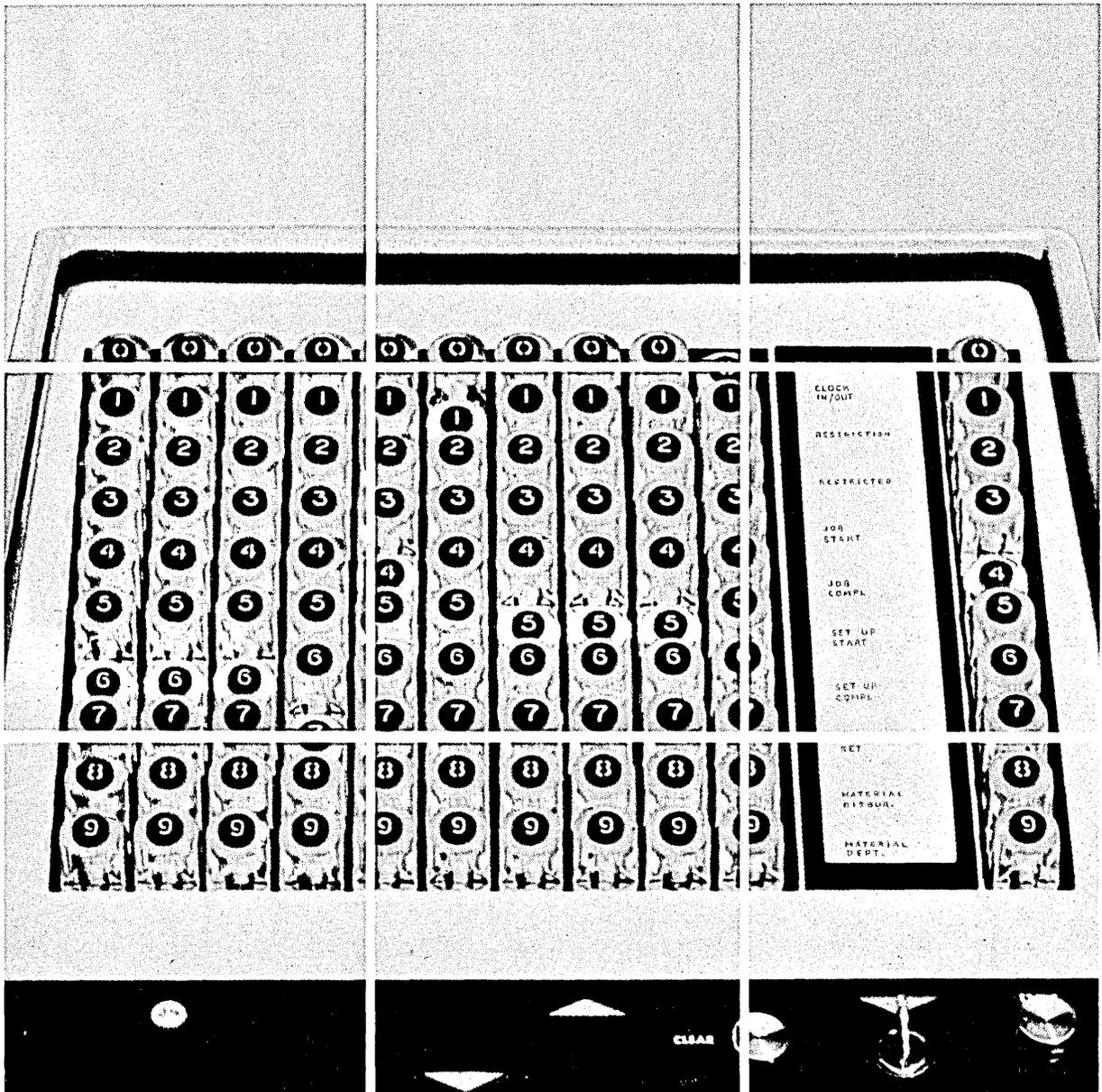
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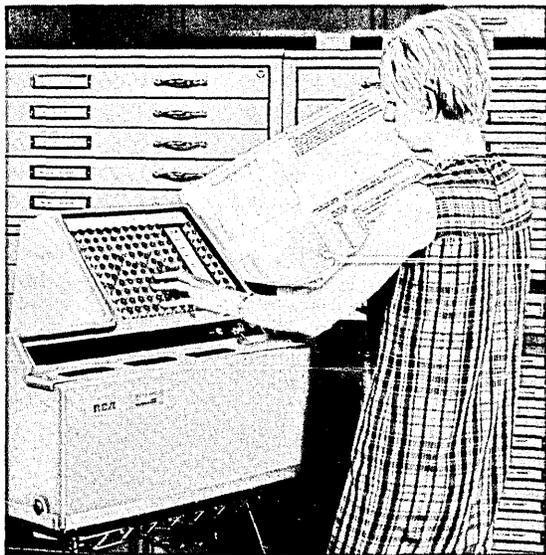
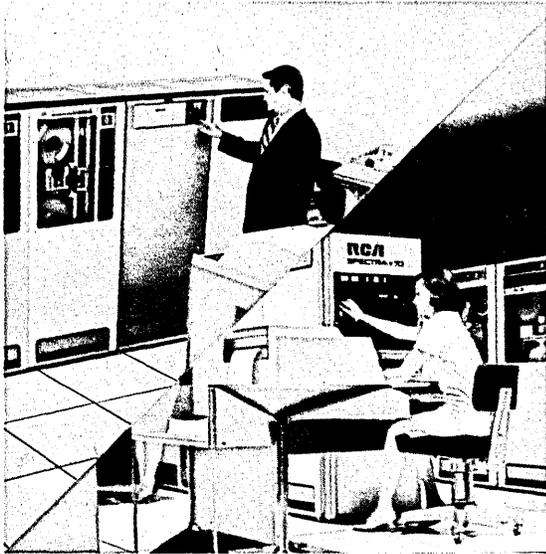
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LATEST ASCII CONVERSION LETTER CLARIFIES FEDERAL REQUIREMENTS

A "final" version of the long-awaited ASCII implementation letter was circulated to certain dp industry sources for evaluation last month; full publication was considered likely soon afterward.

The latest text, generally, is the same as the one we described in Oct. (p. 69). However, a number of points have been amplified. One of them involves nonconforming systems ordered shortly before July 1 '69, the date on which conversion to ASCII code and record formats is supposed to begin throughout the federal establishment.

Those systems ordered before March 11 '68, even if delivered after July 1 '69, will not have to comply with the ASCII standard. Those ordered before July 1 '69 but after official publication of the letter will have to comply, while those ordered between March 11 '68 and July 1 '69 will be evaluated individually. The March date is significant because this was when LBJ ordered implementation of ASCII. An agency acquiring a nonconforming system during the latter time frame will have to describe it, in writing, to the National Bureau of Standards. If the bureau and the using agency disagree regarding the need for nonconformity, the argument will "be kicked upstairs to the Bureau of the Budget," explains an NBS source.

The implementation schedule of the earlier letter is retained in the later one; basically, the conversion to ASCII interchange code and record format will occur in parallel to accommodate the requirements of new or upgraded systems: "Utilization of existing nonstandard systems and equipment should be continued as long as economically advantageous," the latest version of the letter says. Users are further assured that "these federal adp standards do not extend to the internal structure of the central processing unit or peripheral devices."

agency authority

Agency heads will have authority to place their dp systems outside the new regulations, but first they must "coordinate" with NBS. The coordination must allow enough time for the standards bureau to adequately evaluate the impact of the proposed nonconforming application before the agency head okays it.

Generally, a nonconforming system will be allowed only if there are "sig-

nificant, continuing cost or efficiency disadvantages encountered by use of ASCII," and "the interchange of information with other systems is minimal and is expected to remain minimal."

The final version of the letter also says ASCII standardization will apply generally to "all computer and related equipment . . . brought into the federal inventory (after July 1 '69) or acquired or leased with federal funds," to data systems developed by or for government agencies, and to data developed outside the federal government at taxpayers' expense if the information is to be added to a federal data base.

"Related equipment" includes all character-oriented hardware that produces magnetic or perforated paper tape for input to, or that receives such media as output from, a computerized data system. Terminal facilities procured primarily to support a computer-based system must also be ASCII-compatible, when this is technically feasible. If the full character set can't be adopted, "the largest possible subset should be used and the ASCII collating sequence observed." Systems transferred from one user to another within a federal agency, and between agencies, will also have to comply with ASCII wherever technically and economically feasible, says the letter. It adds that agencies that receive data in machine-readable form from other government sources (i.e., state and local) or from outside organizations

"should take the lead" in getting these suppliers to adopt ASCII code and record formats.

However, central processor, peripheral or other related equipment used substantially full time as part of the control element in a larger system, where that larger system is not itself primarily concerned with information activities, will not be within the scope of the ASCII standardization program.

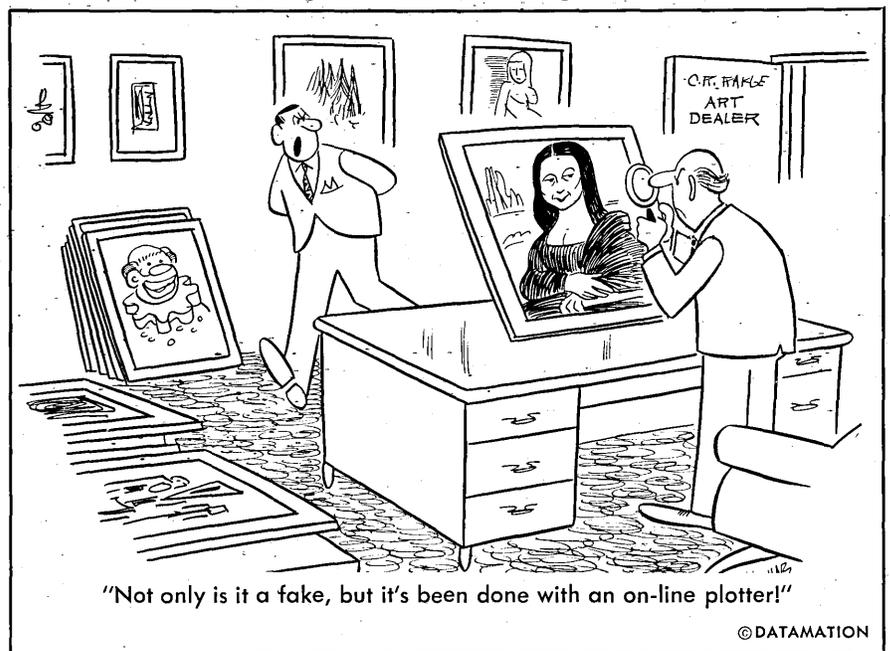
permission to implement

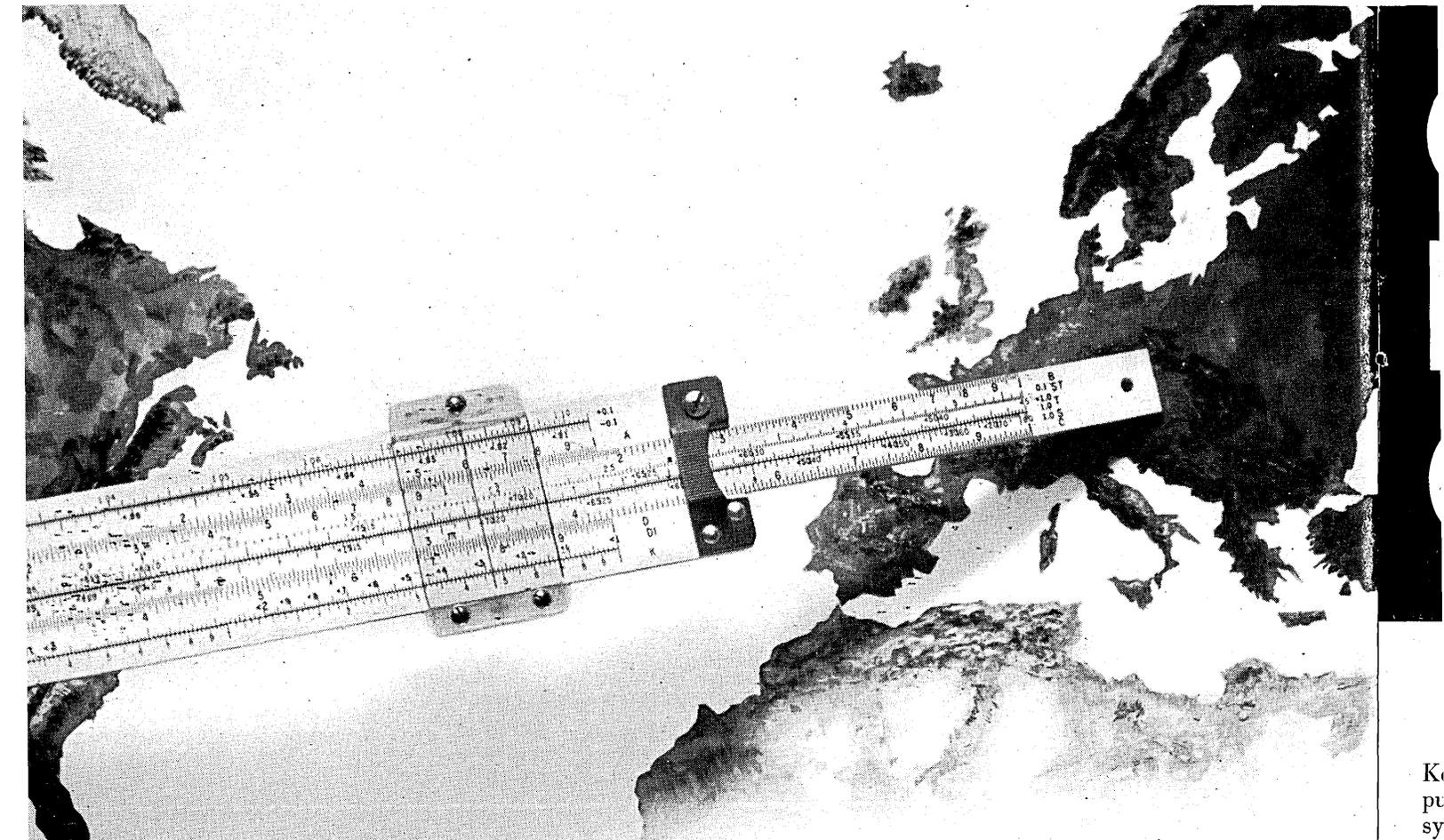
As we explained last month, users who can't efficiently use the full ASCII character set, and those who need other or additional characters, will be permitted to implement subsets or expanded and extended versions of the standard ASCII family.

A subset encompasses only some members of the ASCII family, but it retains the standardized code assignment for each. Expanded sets make use of the additional 128-character codes in the 8-bit format that are not reserved for standard symbols. An extended set encompasses more than 128 characters; basically, it uses the unreserved positions twice, with the assistance of a "shift" or "escape" code to discriminate the symbols represented by the same bit configuration.

All of these variations will have to be registered and approved by NBS before they can be implemented.

The letter implies that packed numerics will be regarded as a nonconforming code. An NBS official confirmed that the implication is correct. "But we'll tolerate packed numerics, at least for a while." EBCDIC is also a nonconforming code, he added. "It won't be tolerated, though, unless the user can make a convincing case for not switching to ASCII."





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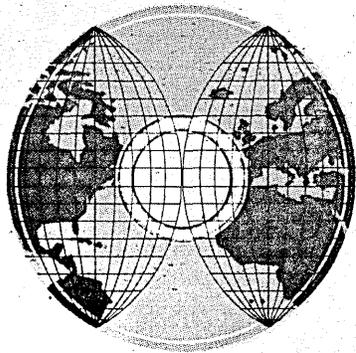
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UNIVAC REFUGEES ANNOUNCE HARDWARE

An auxiliary computer which can increase the efficiency of big systems "up to 25%" should be available some time next spring in St. Paul. It's the creation of Comcet, Inc., a company formed by Lee Johnson, Don Herman, and six others. Johnson is president, and Herman is board chairman, of Compress, Inc., the well-known dp system simulation specialists.

The new computer is called the Comcet 60. It is intended to interface with the 360 line, beginning at the Mod 40, and with all other makes of similar capability. Reportedly Comcet will add smaller and larger models later. A typical Mod 60 system will sell for \$250K. Leasing is contemplated, but no details are available.

Two prototype 60's are supposed to be completed by next spring. Hopefully, shipments to customers will begin by summer. The grapevine reports that a major oil company has already ordered at least one of the new computers, and a major t-s data center network will take "several more." Herman and Johnson refuse to discuss sales prospects except to observe that new companies always generate a lot of rumors which invariably turn out to be false.

Comcet may be a special kind of new company, though. The first public offering of its stock opened at \$10 a share and shot up to \$30 within a day. The price has remained at or close to this level since.

Comcet's principals include Paul Byrns, who was previously chief of product development planning at Univac's federal systems division; Ross Rash, computer graphics product design manager at Univac; Royal T. McArdell, a Univac FSD cpu designer and manager; and Charles Riley, who managed Univac's United Airlines project.

One notable feature of the Comcet 60, says Johnson, is the use of hardware to perform many functions that require software in dp-dedicated third generation systems. These include detection of communication control codes, stripping of start/stop bits, generation of start/stop bits and sync codes, and buffer linking. Adds Herman: "Existing communications-oriented systems are almost invariably

patch jobs—they consist of separate components, originally designed for differing applications, and linked by cable. In the Comcet system, there is no cabling; all components are in a single cabinet, and system integration is maximized."

Among the other features of the Comcet system is a visual display on which the dynamic load at critical points is shown in analog form. Thirty-two load points can be displayed simultaneously, and the system monitors a total of 177.

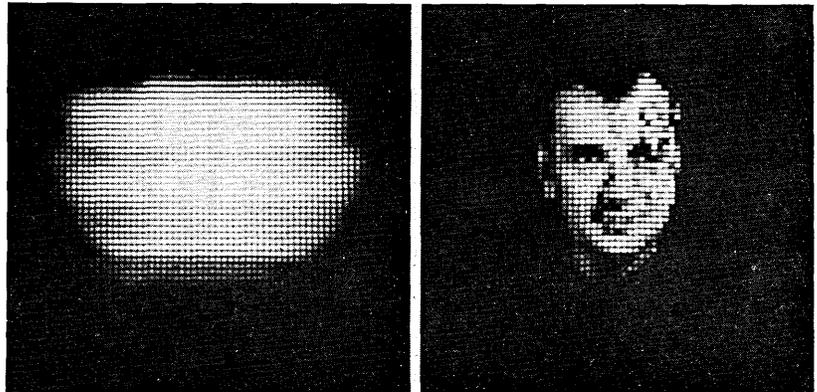
The processor of the Comcet 60 will accommodate up to 64 communication channels, plus four general purpose I/O links. Typical instruction execution time, register-register, will be 1.8 usecs, and maximum execution time—for a multiply instruction—will be 17.5 usecs. The system will have a mini-

mum 32K byte core, to which four more 32K byte modules can be added. The logic will cycle data, four bytes at a time, out of memory in 900 nsec. Data will be pumped out onto each full duplex channel, or sucked in, at a maximum rate of 250K bps. A "typical rate" for 64 full duplex channels will be 640K bps.

RADIO STATION FLASHES ON-LINE TRAFFIC SIGNALS

KNX Radio in Los Angeles is providing computerized traffic information to its listeners with the aid of an SDS 940 linked to the station's control units from Scientific Data Systems' time-sharing installation in El Segundo. Information is fed to the computer, whose memory contains over 10,000 traffic specifics from the L.A. Police Dept., the Calif. Highway Patrol, amateur radio operators, helicopters, and the station's remote units. The computer relates the conditions (location, weather, time of day, congestion, etc.) to provide on-line alerts and alternate route suggestions 20 times a day during peak traffic periods. The SDS time-sharing installation is considered a prototype by SDS to enable the firm to

COMPUTER-BASED IMAGE RESTORATION

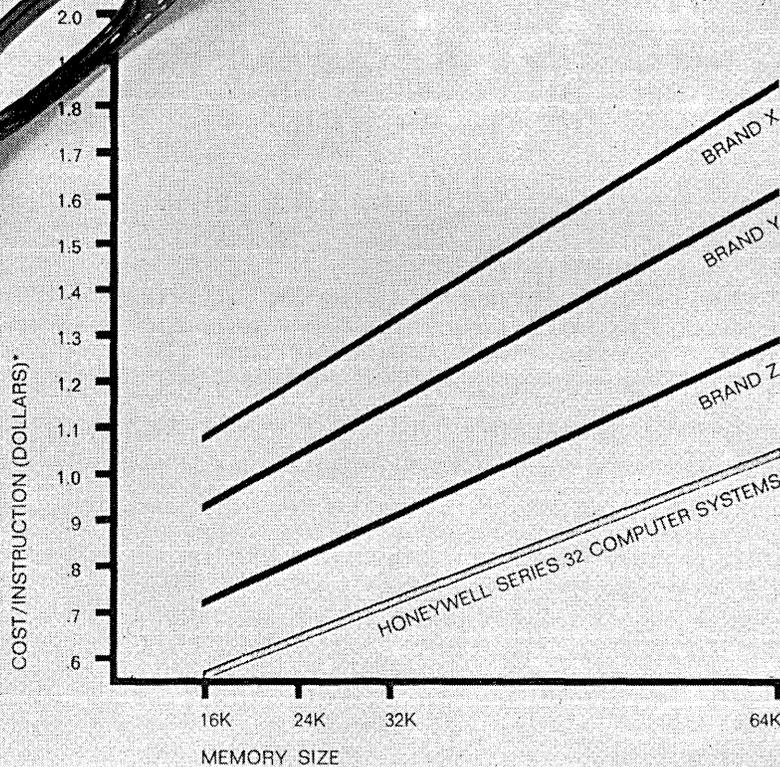


Computers have come to the rescue of photographs blighted by distortion, blur and exposure errors as researchers at Scripps Inst. of Oceanography's Visibility Lab (La Jolla, Calif.) are getting clearer pictures by using an IBM 1800 data acquisition and control system thusly:

A scanner converts the picture into dots (more than 4,000 per image); each dot is appraised by the scanner and assigned a number value—from one to 10,000—corresponding to its shade of gray. This information is sent directly to the computer, which is told by the experimenter what went wrong with the photography. If the picture is out of focus, for instance, the com-

puter is told that each point in the picture has become a tiny circle and is instructed to turn the circles back to points. The scientist can interact with the system, revising and adjusting the process as it runs its course.

The research at Scripps involves such areas as celestial photography (to overcome distortion by the earth's atmosphere) and microscope and X-ray photography (to eliminate light diffraction). One important application of the latter is in medicine, where researchers say great strides could be made in conquering diseases if they could see "just a little bit more." ■



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advise 940 customers on the best way to handle certain applications, and a variety of customers is being sought.

ON-LINE CONGRESS LOOMS

Legislation authorizing the Library of Congress to establish a "Legislative Data Processing Center" will be introduced in the House early next year by Rep. William Moorhead, Pennsylvania Democrat.

His measure contemplates an on-line system serving every senator, representative, and congressional committee, linked to all other computers within the federal establishment, and capable of providing data on pending bills, already-enacted statutes, budgetary statistics, past and current federal programs, plus many other kinds of information desired by legislators. The system would be capable of analyzing data as well as reporting it.

Moorhead's bill differs from proposals offered by Rep. Jack Brooks of Texas, which were incorporated into a congressional reorganization bill that died in the last session. Brooks, for example, wants the General Accounting Office to operate any information retrieval system established for Congress. Since the Texas Democrat heads the House subcommittee that probably will be given primary responsibility for evaluating the Moorhead bill, its fate is uncertain. But, within both Houses, there is widespread interest in automated information retrieval systems, and in the use of systems technology as a policy-making tool, so some legislation addressed to the problems concerning Rep. Moorhead is likely to be enacted.

Congress would control Moorhead's proposed legislative data processing center through a Joint Congressional Committee on Data Processing. The joint committee would also have a mandate to search for impediments in legislative dp activities, and recommend improvements to "responsible authorities." It would be assisted by an advisory board consisting of eight ex-officio members selected from within the federal establishment, plus four industry dp experts. Two of the latter would be chosen by either House.

THE OLD CUC IS DEAD, LONG LIVE CUC

Not long ago, it wasn't hard to find people who had been with Computer Usage in the late '50's, early '60's—a host of them were still at CUC. But the firm's staff is fast losing this unusual longevity label: in the last few

months a large and undetermined number of top level people have left.

Besides top execs Elmer Kubie and Carl Reynolds, gone are corporate technical directors Charles Sheffield (scientific applications), George Trimble (technology), and Martin Hopkins (programming languages); CUC's president and CUC vp Walter Nelson; regional or office managers Irving Kay (N.Y. metropolitan), Joe Vierra (N.E. region), Ernest Severin (Houston), Jack Elvig (asst. manager, Houston), G. Darrell Dewey (N.Y. State sales manager).

In September Reynolds, Kay, and CUC contract exec Guy Rucker formed a multi-service firm, I/MAP, Greenwich, Conn. In October Kettelle Associates Inc. bought the four-man firm and made Reynolds president of Kettelle, with John Kettelle as board chairman, Kay as gm of the I/MAP division for installation management, and Edward Woisard as gm of the systems division. Kettelle, an OR-oriented consulting firm formed in '58, will gross about \$2 million this year, has 80 people, offices in Paoli, Pa., Colorado Springs, and Washington, D.C. A New York office is planned.

Nelson, Dewey, and CUC manufacturing consultant Jerry Cantor have formed Analysis and Programming Corp., also in Greenwich, for business and scientific software and computer services. Trimble joined ex-CUCers Tony Penta and Dick Ketover at Penta Computer Associates, NYC software house formed in March. UCC claimed Joe Vierra for its subsidiary in Switzerland. Severin and Elvig are at Automated Systems Corp., Houston.

Marty Hopkins has joined earlier CUC defectors, Ed O'Connor (S. W. regional manager), Art Heald (SFO branch manager), and Jim Fish in the recent formation of a software firm called Columbia Computer Corp. headquartered in Fairfax, Va. Mitnick and West went off to become vice president and regional sales manager, respectively, for dataStation, New York service bureau. (This firm will have a 360/75 installed by the end of this month, along with two 30's, a 7094, two 1401's, and an IC-6000, and will ultimately offer remote on-line, as well as batch, services.)

The reasons for the departures have varied. CUC isn't the first of the old-line firms to spawn entrepreneurs, but a number of the CUC old-timers who've gone complained that CUC just moved too slowly, missing opportunities (like the acquisition of Automatic Data Processing), and choosing the wrong new ventures (CUBS, CUE). The departure of Kubie springboarded others.

Most made their decisions before

IBM exec Charles Benton came on, and it's with Benton that CUC puts its hopes for a reversal of what is a losing trend financially. Benton has brought on Jim MacDonald (IBM-Baltimore) to take over the northeast region, and we hear there could be more IBM transplants—people and style. The firm's philosophy is changing (see Oct., p. 96) and new policies in marketing, sales, and salaries have already been introduced.

"THE LOTTERY," BY COMPUTER

New York State's monthly lottery has suffered in sales because it takes several extra days to collect all the stubs around the state to make the drawing—and the betting folk have lost interest. Ticket Reservation Systems, we hear, has proposed a pilot \$5 weekly lottery (with immediate turnaround time) using 500 on-line vending machines in the New York, Buffalo, and Albany areas.

The buyer would insert his fiver, lift up a door on the machine, and write in his name and address on a ticket. With the closing of the door, the machine would issue a numbered ticket to him, keeping a numbered "stub" on the address form in the machine. At the same time, the computer at the center would shoot a stub with this number into a locked hopper. At the end of the week, the drawing would immediately be made from this hopper. If the state concurs, the pilot system could go into operation after the first of the year.

CI SAYS SEND YOUR KEYPUNCHING OUT —WAY OUT

Computer Input Corp., a Los Angeles based firm, is setting up what must be one of the world's most unusual computer-oriented services. So you say you can't get three-day in-house turnaround on keypunching and verifying 100,000 cards? Shell Leachman, one of CI's principals, says that he can send the work halfway around the world and still get it back in time. CI has set up two data centers, one in Bangkok and one in Taipeh, each with 100 girls to do keypunching and verifying. Leachman claims that the combined output of the two bureaus will be about two million cards per month, which they will produce at an average cost to the user of a nickel a card. Output will be provided on magnetic tape, if desired.

The two data centers have been established as separate corporations, receiving their financing from "local" investors. Leachman, who was SBC's Los Angeles sales manager for many

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years, got the idea for the international operation while serving as a principal computer systems advisor to the far east under a foreign aid technical assistance program.

The minimum turnaround time for the operation will be determined by air freight schedules, but a realistic estimate for large jobs will be in the neighborhood of five days. In addition to performing keypunching services, the centers will also provide optical scanning input typing services, and even programming. Most of the programming, however, is expected to come from "local" contracts, and will be done in assembly language . . . although the Thai and Chinese programming staffs speak FORTRAN, COBOL, PL/I, and RPG. The centers will operate small 360's (a model 30 and a model 40) to back the programming operations.

Although far away, the idea is not as far out as it appears, says Leachman. Most in-plant services will not be able to beat CI's schedules on large jobs, and most in-house keypunching services cost users about a dime a card after wages and rentals and everything else is figured in.

One more thing. Leachman says that if the job is big enough, Computer Input will fly the client over with the job. He did not say whether the customer would have to fly as freight, though.

CONVERSATION WITH COMPUTER CAN BE MADDENING

Daniel G. Bobrow of Bolt Beranek and Newman tells of an experience that he claims is one of the first examples of a computer actually passing Turing's imitation test, which consists essentially of communication between a person and a computer and two devices, one controlled by another person, the other by a computer. If the computer's answers are indistinguishable from human responses, it is deemed to have passed the test.

As Bobrow tells it, a BBN vp in charge of selling Telcomp commercial service went to the PDP-I computer room one Saturday morning to use the computer for a demonstration. He found a note on the Teletype that said, "Type all messages into this Teletype and end them with a period." This had been left by a programmer who had just succeeded in running a LISP version of the DOCTOR program (based on the ELIZA program developed by Prof. Joseph Weizenbaum of MIT), but the vp thought that the Teletype was

linked to Bobrow's home, since Bobrow often used the computer during the night. So, the vp started typing to whom he thought was Bobrow . . . but was in fact the version of the DOCTOR program. The following conversation ensued:

VP: Do you think that I can use the computer this morning?

TTY: Why do you ask?

VP: I might be able to make some additional Telcomp sales.

TTY: Why aren't you sure?

VP: My prospective customers have never seen a demonstration of the system.

TTY: Does this mean very much to you?

VP: Of course it does.

TTY: You seem very positive about that.

VP: This is ridiculous.

TTY: What do you mean this is ridiculous?

VP: Is there any reason why I can't use the computer now?

TTY: Tell me more about your prospective customers.

VP: Please dial me up on 491-1850

The vp did not end his last request with a period and the computer ignored it, which so irritated the vp, who thought Bobrow was putting him on, that he called Bobrow to find out why. It took some time to convince the vp that he had been arguing with a computer.

However, Joseph Markowitz, of BBN, maintains that the computer did not pass the Turing test, because the vp was limited by a strong *a priori* belief that he would be talking to a man, whereas Turing specified that the observer be forced to choose between two (hidden) devices . . . one known to be a man, the other known to be a machine.

UCC MAY TAKE FIRST STEP TOWARD BECOMING EDP "UTILITY"

University Computing Company is reportedly ready to move ahead with its plan for establishing a data common carrier network. Within a few months, we were told, Microwave Transmission Corp.—a UCC subsidiary—will ask the Federal Communications Commission for a license to move data between San Francisco and LA. Microwave Transmission recently acquired Transamerican Microwave, Inc., a west coast carrier that has been leasing microwave

channels to CATV firms.

According to the grapevine, once Microwave-UCC acquires this license, its data transmission system will be enlarged. A knowledgeable source, when asked what sort of service was being contemplated, said it would meet "all the needs expressed by the dp industry in their responses to the FCC computer utility inquiry."

More specifically, the service will offer data speeds ranging from 150 baud to 50 kilobits, including 1200, 4800, and 9600 bps., as well as 12 kilobits. PCM and conventional analog signal conversion will be available.

The system will provide a transmission error rate of "as little as 1 in 10⁷ bits." Charges will be based on a three-second or less connect time, produced by electronic switches, and on a minimum message interval of three seconds. AT&T, by comparison, requires each of its customers to buy at least three minutes of line time, and, on the average, takes 20 seconds to make or terminate a connection.

The result of these and other improvements, we were told, will be data message tariffs somewhere between $\frac{1}{4}$ and $\frac{1}{2}$ s of the present rates.

A UCC spokesman was asked about rumors that his company—which operates on-line dp service centers in Dallas and elsewhere—would try to squeeze other service bureaus out of business once the new data transmission network was set up. He answered that, "as common carriers, we will consider the service bureaus potential customers rather than competitors, and eagerly court them."

RETAILER MEET GIVEN POINTERS AGAINST THEFT

A bright young programmer who decided he and his friends need not pay their bills for purchases from the store that employed him "simply inserted a routine in the billing program to transfer all charges in his own and his friend's accounts to a suspense account . . . which did not appear in detail but was included in the trial balance total . . . This went on until the auditor, using the magnetic tape billing data under special routines for confirmation purposes, produced a run listing a substantial unexplained account."

In a paper given by William Aaron of S. D. Leidesdorf & Co., at the retailers' annual NRMA EDP Conference in October, this example was given to show the ease with which such nefarious activities can occur, along with some guidelines for protecting against them.

"In the presence of computers, we can no longer rely on the classic 'sepa-

rate-people-separate duties' to achieve adequate internal control. What we need now is functional separation . . . in terms of the three primary functions: authorization, recordkeeping, and custodial functions," he said. Here are some of the questions the edp manager and owner must answer in this regard.

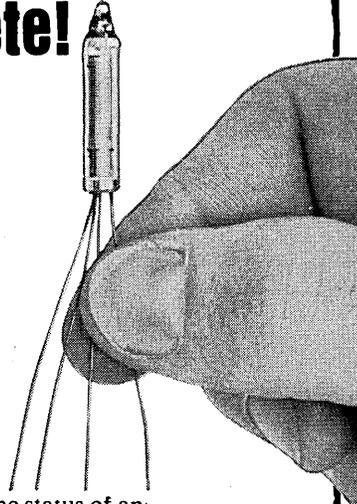
Authorization: What are these controls? Are they adequately documented and promptly updated? Whose responsibility is it to define and monitor operational controls? Are all changes in processing methods supported by written authorization, and are they reviewed for conformity with authorized changes? Who reviews? Are there controls to record operator intervention and controls over computer usage? Who reviews exception reports?

Recordkeeping controls: Are computer operating personnel independent of systems and programming personnel? (If the programmer is also the operator, the climate for embezzlement grows warmer.) Are there controls over maintenance for accuracy and reliability? Are there operating logs in the dp department? Are data control amounts originated within the dp department and can differences between processing results and controls be accounted for? Are debugging routines adequate for proper program functioning? What assurances are there that processing controls and audit trails, as authorized, are included in programs? Does program documentation facilitate reconstruction? Are program libraries maintained and safeguarded? Are program changes authorized in writing? Is there adequate insurance protection for the files against embezzlement?

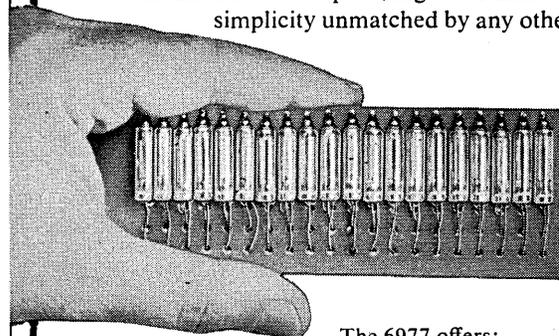
Custody over assets: Is the computer department authorized to issue disbursements and are these controlled by persons not in the computer department? Are bank reconciliations prepared by the dp department and who reviews them? Does the computer department authorize purchases or merchandise shipments, manufacturing schedules, etc.? What are outside controls?

If these three functions, says Aaron, are being performed properly, the computer will generate reliable data. He warns that the on-line systems now being installed are eliminating paper records and causing more reliance on the initial design of the system and on the computer people themselves. Aaron did not imply distrust of computer people, but merely that the user firm cannot afford to let the control of his information get so far away from him that he could be robbed blind. (Cont. on p. 112)

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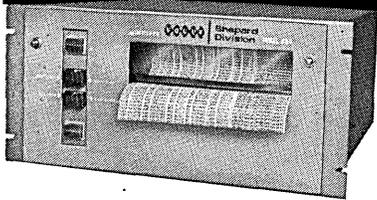
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AT&T GRANTED FOREIGN ATTACHMENT DELAY

The foreign attachment battle neared at least a temporary decision this month after Ma Bell was allowed more time to lift its ban on customer-provided terminals.

Originally, Bell asked permission to remove the prohibition last Nov. 1. Late in October, the company requested a delay until next Jan. 1. It wanted the ban on terminal interconnection to end at the same time as a related restriction, forbidding the interconnection of customer-provided communication systems with the public phone network. (See Nov. p. 19).

The commission still hasn't decided whether to accept either of these tariff changes, but it is virtually certain to do so, probably late this month.

Until Jan. 1, the ban on direct electrical connection of all customer-provided terminals and communication systems to the phone network remains in effect, and other questions raised by last summer's Carterfone decision—notably, whether AT&T is liable to independent equipment makers and to users for damages—remain suspended.

Although FCC probably will go along with AT&T's foreign attachment proposals, the commission may require further concessions. The Department of Justice clearly had such concessions in mind when it recently asked why, under the pending tariff proposals, Ma Bell had to be the exclusive supplier of network control signaling equipment. This equipment, together with a protective device, constitutes the data access arrangement that would link customer-provided terminals and communication systems to the public phone network.

"We think AT&T should be required publicly to make its case for (banning use of customer-supplied network control signaling equipment)," Justice told FCC. The justification should be subjected to "questions raised by independent suppliers of communication equipment and other interested parties."

The commission probably will ignore this recommendation unless Justice is supported by users and/or independent equipment makers. There seems to be little chance of that, since many users and equipment makers are reportedly willing to settle for what they've won so far.

Excessive charges for the data access arrangement hardware might galvanize them into further protest. But Bell apparently is going to wait for the tariff changes to be accepted by the commission before revealing the related rates.

NEW FIRM TO DEAL WITH DEC USERS

Noting the success of Digital Equipment Corp. in the small computer market—about 3500 of the PDP-8 line now installed—it is no wonder that a number of new firms are forming to either compete in manufacturing or to provide services to PDP-8 users that DEC is not providing. An example of the latter is DEC spinoff, Infocom, Inc., in Wellesley, Mass., which has a small COBOL-like compiler and applications packages for business data processing.

Infocom president Michael Ford (ex-PDP-8 product line manager) and marketing vice president William Landis (PDP-8 marketing manager) note that PDP-8 users in areas like typesetting have been pressuring DEC to provide business packages so that they could more fully utilize their systems. Dr. William Highleyman, Sombers Associates, Inc., had developed the 3K-word SAIBOL-8 compiler, tailored for the 8 systems, and six-man Infocom obtained the rights to market this package. Cost is about \$4K.

Applications programs written in this language thus far include payroll (about \$2K purchase price) and job cost analysis (about \$2500). Others to be offered are accounts receivable and payable, and inventory control. Currently the company is tailoring these packages for the communications and advertising media that are using DEC systems in typesetting, and for the brokerage community. Others will be aimed at retail stores, motels, restaurants, and a variety of "light industries" now using tab and ledger card systems or service bureaus.

Infocom will sell or lease (through a leasing company) either a total hardware and software system, or any of the software packages. An example of system cost: under a five-year lease at \$400 a month, the user can have a 4K-word PDP-8/I with "high-speed" reader and punch, ASR-35 teletype, SAIBOL-8 compiler, and payroll package.

IBM CAUGHT IN RAPID TURN-ABOUT

"The company will continue to study maintenance and rental charges, purchase prices, and the relationships among them." This was IBM's final comment after it quickly withdrew its October announcement of changes in the maintenance fees of most of its computer lines—the increases primarily affecting the 360 line.

This was IBM's first effort to generally adjust maintenance prices since the announcement of the 360's, and

while observers generally agree that the rising cost of manpower could have justified some changes—and may in the future—they also felt that IBM had to abort the plan because it was discriminatory. The increases would have impacted only purchasers, including leasing companies, of course, since rentals, which include maintenance, were not adjusted. The decreases, conversely, which primarily involved some 7000 and 1400 series cpu's, would have favored the buyer for the same reason.

IBM gave as its reason for withdrawal ignorance of the fact that some leasing companies have fixed price contracts, including maintenance, and the increases would have profoundly impacted them. (Levin-Townsend, for one, claimed that the change would have cost them \$600K a year.) It is moot to argue that a firm with such highly regarded marketing talent and a department devoted to leasing-firm liaison could have been unaware of such contracts, or that IBM is not responsible for such practices. Users interviewed, including lessors, had little sympathy for the fixed-price contract. Very few leasing firms have had these contracts as long-standing policy, but recently more and more companies are using them as inducements in the face of stiffening competition.

The protests of the user/owner and the lessor of 360's were against the obvious discrimination. The increases (which did not apply to the 25, 85, or high-speed versions of the 20) would have, in effect, increased the purchase-rental ratio of the remaining cpu's in the 360 line, as well as many of the peripherals. The additional costs to the user (15-20% of current fees) are obvious, particularly when the equipment costs over, say, \$5 million and he is trying to decide whether to rent or lease, as was one user we interviewed.

IBM, as said, will continue study of the maintenance fees and purchase prices. Currently, those of the 25 and 85, in particular, are way out of kilter with the rest of the line. For example, maintenance for the model 25D (16K bytes) cpu is \$195 a month, while the model 30D is \$100 a month; but the rental of the 25, which includes maintenance, is in many configurations less than the 30. The purchaser's maintenance on the model 75/I cpu is \$675, while that on the 85 will be \$3,800; but the rental on the 85 is not 5-6 times that of the 75. These prices on the 25 and 85 obviously make it less attractive to purchase them. While the aborted changes would not have brought the rest of the 360's into line with the fees on the newer models, they seemed in part to be aimed at stemming the purchase volume.

Given the implication that there will be changes in the future, here are some examples of some of the adjustments IBM made in the withdrawn schedule: The original 360's as mentioned went up about 15-20% per cpu, as did the cpu's of the 7074, 7044, 7040, and 1800 data acquisition and control system (used also in the 1500 educational system). Among peripherals going up a like amount were the tape drives for the 360 and 1800, 360 printers, 360 and 7000 series drum storage, 2321 data cell, 2314 direct access storage, and the mag tape unit for the 1400, to name a few. About 100 systems were involved in the increase.

Among the 40 systems that were decreased were the 7070, 7090, 7094, 1620, and 1401 cpu's. The 1440 came down by only a dollar or two. The 2702 transmission control unit, 7741 communications unit, and 2250 crt also decreased by 15-20%. Accounting machines generally stayed at the same price, as did some 360 equipment like the 2260 crt.

SOFTWARE COOPERATIVE RISES IN THE SOUTH

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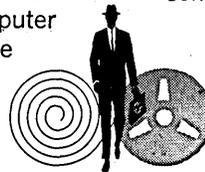
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wares has been launched under the auspices of Associometrics, Inc., of Dallas, and Appalachian Computer Services, Inc., of London, Ky. Together, these two outfits have fashioned Mutual Computer Services, Inc., a corporate shell designed to serve as an exchange point for the proprietary packages developed by them. Financial and physical arrangements for one company to use another's packages and for the people to make them go are to be handled through the joint venture. "It's open-ended," said George C. Burrell, president of Associometrics. "Other software firms with a good program to offer can utilize Mutual Computer Services to get at clients in cities where they normally couldn't hope to do business."

At present, Associometrics has available a special package for law firms (PLOMS, Professional Legal Office Management System), for municipalities, and for golf handicap schedules (sic). Appalachian has generated special systems for banking and grocery businesses. The plan is to build up a large bank of good programs, and sell more and better time on their in-house Honeywell's and 360's.

X3.4.2F WILL ASSESS NEED FOR OS CONTROL STANDARDS

An ad hoc committee to look into the advisability of a standard operating system control language is now being formed, with an organizational meeting scheduled for Feb. 4-5 at System Development Corp., Santa Monica, Calif.

Millard H. Perstein of SDC has been appointed chairman of the committee, USASI X3.4.2F, and is encouraging all those interested to attend the two-day meeting. The purpose of the meeting is to establish committee rules and assign tasks, as well as to review the work already done toward developing a standard.

Although Perstein notes that no attempt will be made to define just what aspects of a control language should be standardized until the committee is organized and reaches such decisions, the goal is to simplify the users' role when changing systems. Thus one of the first areas to be considered is that of initiating communication with the computer. It would be convenient to have agreement that a starting procedure, once learned, could be applied to any time-sharing system—at least to the stage where a user could get some printout explaining system operation.

Another likely area for investigation is the integration of on- and off-line

modes of operation. After a program is developed through interaction from a console, it would be useful to have an accepted means of directing the system to delay processing until batch time is available. Other areas to be considered are basic sequences, authorization, interrupts, and program hierarchies.

So far, about 100 representatives of manufacturers, users, software groups, trade associations, and professional societies have expressed interest in the committee's activities. Those who would like to take part in the meeting should write to Millard H. Perstein, chairman X3.4.2F, SDC, 2500 Colorado Ave., Santa Monica, Calif. 90406. They will receive copies of the committee charter, some applicable rules of procedure, and working papers on the subject produced so far.

FIRM DEVELOPS PROGRAMS FOR FIRE/RIOT CONTROL

General Research Corp., Santa Barbara, has established a new Public Safety Systems Division to develop computerized tactical management systems for police and fire control agencies. The systems, called COMCON (Public Safety Command/Control Communications Systems), are capable of operating in any city, with any computer, using any type of programming language, according to Ronald E. DiZinno, director of the division. The ideal setup, he stated, is a time-sharing environment with police, fire and public utility agencies all using the computer complex at the same time because of response time in milliseconds instead of the one-minute to half-hour manual response time now plaguing these agencies. The systems can operate on a day-to-day basis, but their optimum use is in a crisis situation, where they tend to become more stable as more events occur.

William C. Hanna, deputy director of the division, stated that the unique advantage of the system technology is its ability to keep track of hundreds of thousands of items of pertinent information in a fluid municipal management situation, and manipulate and display them for personnel to take quick and proper action. Such information could include the location and status of emergency personnel and equipment; proper response to a particular incident; hourly, weekly and seasonal changes in public safety requirements; current placement of permanent personnel; and the location of critical areas.

DiZinno and Hanna formerly were associated with ARINC Research Corp., San Diego, which is now conducting an experimental tactical management

system for the City of San Diego, using the time-sharing concept.

OLIVETTI OFFERS NEW TERMINALS

A new line of teleprinters and buffered, high-speed data terminals has been introduced by Olivetti Underwood. Prices for the teleprinters range from \$900-\$3200, and for the data terminals, from \$4200-\$8700. Those with crt's cost about \$4500.

The teleprinters, known as the TE 300 series, include "a complete range" of KSR, ASR, and RO units, which accommodate both 5- and 8-level codes. In 8-level mode, they transmit or receive 10-15 cps. The teleprinters possess the operating characteristics of an electric typewriter, rather than the "somewhat cumbersome characteristics" of the conventional teleprinter, says a company announcement. This design feature is meant to give the user greater speed and reduce his operator training problems. The teleprinters also provide 120-character line length, a "highly flexible program for horizontal tabulation," a split platen, and a front feed.

The new data terminal line, known as the TC series, includes three models with 40 cps serial printers and four with crt's. The latter display 256 characters simultaneously, in eight lines, and are linked to 256-character buffers. The company says 500- and 1,000-character displays will be added to the line later.

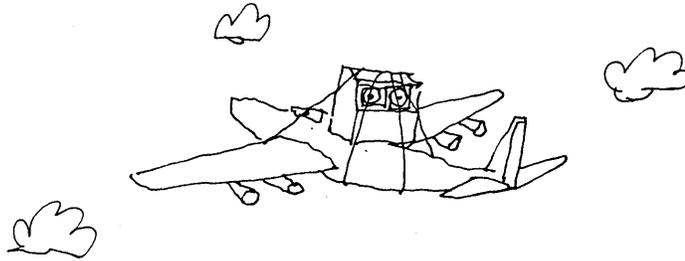
"Twenty or more terminals can be connected to one 1,200-bps communications line," says the company. All TC units are compatible with the "communications software procedures required by all of the major computer manufacturers."

The printing terminals are available with paper tape input and output. Among the other options is an electronically stored program that provides calculation, data editing and logic checks at the terminal, thus reducing the load on the cpu.

A company spokesman said Olivetti Underwood will manufacture all of the new line at a plant in Italy. If enough U.S. sales materialize, production will be shifted to the company's Harrisburg, Pa., plant, now devoted to manufacture of the Programma 101 desktop computer. Domestic marketing of the new telecommunications equipment line is in the hands of a newly formed peripheral equipment group headed by James Calvano.

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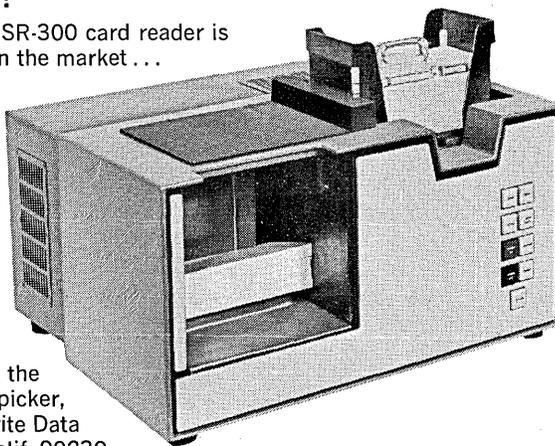
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ago," said the cab driver when he noticed the "Vote for Clean Air" button. But the Allegheny County Health Dept. is still waging a war on air pollution, still afraid of dangerous periods of inversion.

As part of its 10-year program for cleaner air, the County Health Dept. has installed the first on-line IBM 1800 systems for monitoring pollutants (other cities have installed off-line systems). Two sensing sites are currently on-line; by the end of 1969, all planned 17 sites (near the sources of emissions) will be operational. The system measures and evaluates several aspects of air pollution and meteorology: sulfur dioxide, hydrogen sulfide, carbon monoxide, hydrocarbons, aldehydes, fine particulates, wind speed and direction, oxides of nitrogen and total oxidants. The pollutants entering the sensing instruments at each location are analyzed and readings transmitted by telephone lines to the 1800 at Arsenal Health Center. The software for the system is IBM's TSX, plus pollution application programs written by two people in the Health Dept.

The 1800 system, which cost \$400K with another annual \$100K for personnel, has been funded by local, state and federal monies. The system replaces a 30-day analysis of dust gathered and an awkward electromechanical chart maker (which involved reading 11 six-foot strip charts daily), and gives maximum readings from each remote location. It then averages readings at a minimum of once per minute. A typical final printout—describing the level of pollution in terms of parts per million at any given air temperature—will also list the pollution level of all atmospheric conditions at each of the remote locations.

When the analyses indicate that conditions have exceeded maximum pollutant standards, the air pollution control bureau can quickly take emergency measures to avert serious situations. Possible action could include cutting back industrial operations, having power generated outside the area of concern or using alternate power sources, and having residents abstain from driving cars or burning refuse. By noting peak conditions of certain pollutants and point of origin, the system will be able to pinpoint industrial sources of the trouble and alleviate it.

For the past eight years, there has been cooperation between industry and the Health Dept. in trying to overcome pollution in Pittsburgh. Actually, the city has fought pollution since the passage of a smoke abate-

ment ordinance in 1895—ineffective because no control technology existed. In 1946, smoke control was enforced on industry, railroads and all solid fuel users except single and double family dwellings (at present, about 90% of the homes burn gas). In 1960, the drive began for industrial air cleaning facilities, a program that is on schedule. By 1971, at a cost of \$75 million, steel and power generating industries should complete installation of air cleaners that will virtually eliminate particulate pollution emissions.

ADAPSO PLANS ANTI-SUBSIDY MOVES, PURSUES BANK SUIT

At their recent meeting in Detroit, ADAPSO decided to oppose the subsidies, direct and indirect, that many equipment manufacturers give to certain users, including their own commercial information processing departments. Operators of t-s service bureaus feel particularly aggrieved by the latter practice. Batch-type service bureau entrepreneurs, meanwhile, insist that some schools and software consultants are selling excess time on discounted machines to outside users.

A stand favoring separate pricing of software and hardware may also be a part of ADAPSO's upcoming campaign. Basically, the association hopes to persuade manufacturers to change their policies relating to each of these problems. What ADAPSO will do if sweet reason fails has not been disclosed.

A government relations program was also launched; it is intended to influence federal policy on such matters as patent-copyright protection and the communications-computer interface. ADAPSO is considering a Washington office and/or Washington legal counsel.

The chief government-related issue involving ADAPSO at the moment is an effort to overturn a ruling by the Comptroller of the Currency that allows commercial banks to operate commercial service bureaus. A lower court has decided the association has no legal standing to question this ruling. The case is now before the Eighth Circuit Court of Appeals in St. Louis, and a verdict is considered imminent. At their Detroit meeting, ADAPSO's directors decided to take their complaint to the U.S. Supreme Court if they lose in St. Louis.

At the next meeting, scheduled for this month in Chicago, 20 representatives from time-sharing service bureaus will probably hear reasons why their fledgeling trade group should be a part of ADAPSO—but this merger doesn't seem likely now (see following story on the CTSSA meeting).

TIME-SHARE GROUP MAY GO OWN WAY WITHOUT ADAPSO

Computer Time Sharing Services Assn. opened its second meeting at Detroit's Metro Airport Hotel on Oct. 23 to the news that IBM was putting its time-sharing operations under the Service Bureau Corp. The group of independent time-sharing companies' representatives at the gathering were elated and felt that the initial organizational meeting (Chicago, Sept. 13) had more than a little to do with the IBM decision. After a long day's discussion, CTSSA decided that it would prefer to be an independent organization rather than a special interest group of ADAPSO, and that the annual meeting would be at the FJCC in December, at which time officers would be elected and bylaws adopted.

Two committees were chosen: a nominating committee consisting of Joan Van Horn, president, VIP Systems, Washington, D.C.; Lewis Clapp, president, Dial-Data, Inc., Newton, Mass.; and Donald Hogan, president, Data Central, Inc., St. Louis; and a membership committee whose members are Robert Guise, president, ComShare, Ann Arbor; Thomas O'Rourke, president, Tymshare, Inc., Los Altos, Calif.; Ryal Poppa, vp, Greyhound Computer Corp., Chicago; and Norman Schueckler, Graphic Systems Div., Graphic Controls, Buffalo.

STUDY SEEKS SAFETY ON SKI SLOPES

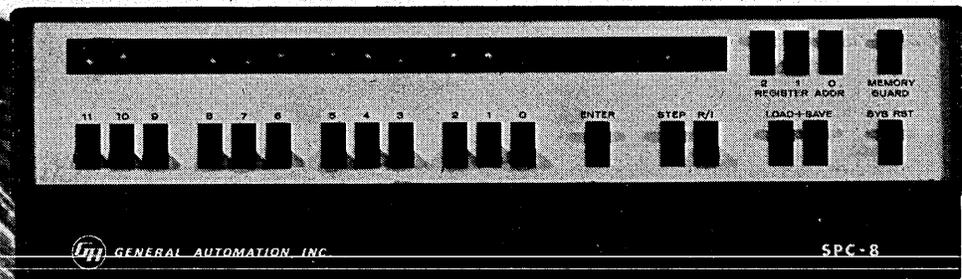
Research being conducted at the Moore School of Electrical Engineering, Univ. of Pennsylvania, may prevent 20,000 major skiing injuries yearly. The project, funded by U.S. Public Health Service for \$71,258, is being done by Dr. Lawrence D. Sher, assistant professor of biomedical engineering, with the aim of finding a releasable ski binding design which would keep skis on during normal skiing and release in time of emergencies.

This winter volunteer skiers, ranging from beginners to experts, will take to the slopes wearing false soled ski boots fitted with electronic transmitters and sensors. The physical activities will be relayed as analog signals to a nearby monitoring point and recorded on mag tape. The tapes go to the Moore School to be converted to digital data for computer analysis. By 1970, Dr. Sher expects to produce the first scientifically based design standards for safer ski gear.

The non-adjustable bindings are often tightened too much by skiers, sometimes from haste and sometimes because of anticipated rough going in competition. When skis get tangled in a collision or snag on an object they

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The SPC-8 is a full-scale general-purpose computer with an 8-bit 4K word memory, a cycle time of 2 μ sec, and IC'd construction for reliability. With its 6 programmable 12-bit registers, 2 accumulators, a hardware index register, the SPC-8 can execute programs at a rate of 230,000 instructions per second. The SPC-8 includes 46 basic commands, a priority interrupt system, and a teletypewriter interface.

It comes with special system interface units which interface the SPC-8 easily to instrumentation, computer peripherals, keyboards and displays, sensors and communication networks. And with programming aids and application software, of course.

With its power, performance, versatility, and low price, the SPC-8 makes sense in any application where computer power may be needed. It will pay you to get complete information on the new SPC-8. Write or call.



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act as a lever on the leg, at which time the binding is supposed to release but often does not, causing excessive force and twist on the leg. The problem is to discriminate, even for well adjusted bindings, between normal and excessive forces applied to the foot and leg during a fall. Dr. Sher says, "there is a maximum combination of forces that the binding must support for normal skiing and a minimum combination of torques and forces at which injuries occur. Somewhere in between is a safe middle ground." He hopes to find that middle area by measuring five key forces between boot and ski: vertical and lateral forces at the heel and toe, and longitudinal force along the ski. The frictional component between boot sole and ski top will also be measured.

A second part of the project will determine the threshold forces for injuries. These forces may be estimated from available information including existing medical records and films. An orthopedic surgeon versed in ski injuries will be used as consultant for this phase. By determining what these maximum, normal skiing forces and minimum injury-producing forces are on skiers of all sizes, sex, and ability in all sorts of weather, Dr. Sher expects that by 1970 he will find answers to design for a non-adjustable, release-type binding to protect novice and expert alike.

GE SOOTHES SHAREHOLDERS, OPENS BIG LA T-S CENTER

It is not true that GE is withholding from the market a long-lived light bulb, said executive vice president Herman L. Weiss in answering one of the simpler questions at the company's 1968 Information Meeting in Los Angeles, held at the end of October the day after announcement of a huge new time-sharing center opening for business. It is, true, though, that GE is in second place—worldwide—in the computer business, according to Jack S. Parker, another executive vice president. But, he added, "that doesn't imply that the gentlemen at IBM are having a great deal of trouble with us presently."

Besides these two spokesmen, the GE show featured Fred J. Borch, president and chief executive officer; William H. Dennler, executive vice president; J. Stanford Smith, vp Information Systems Group; Gerhard Neumann, vp Aircraft Engine Group; Hubert W. Gouldthorpe, vp Power Generation Group; a three-way-split-screen audio-visual display of the in-

tricate doings of the whole sprawling company; and a question and answer period, with oral answers but written questions, presumably to bypass the professional gaddies who appear at stockholder meetings attempting to reduce management to tears.

As for the computer business, Borch noted in his opening remarks that it—along with nuclear power stations and commercial jet engines—isn't making money. But he said that 1968 would show "reduced operating losses" and that information systems were "on plan."

Smith, head of information systems, continued this theme in his presentation, adding that there had been "increased integration of our worldwide operations, higher shipments and continued growth in long term revenue expectations." Apparently, the commercial time-sharing service is expected to help in bringing those expectations closer to the present. Smith said that GE has doubled the volume of that service in one year and now has 50 systems in operation with some 100,000 users. The new Los Angeles area center, opened in Inglewood the day before the meeting, has four 200 series machines and a 635. They offer local dialing for L.A. users, BASIC, and prices for terminal and computer time "as low as \$200 a month."

Smith also said that the information systems group is "embarked on a vigorous course of innovation . . ." and mysteriously cited an Internal Revenue Service installation as an example of "new kinds of terminals linked to process computers." The group now employs 25,000 people, with 150 sales offices in 50 countries.

During the early part of the question period, the management accumulated those dealing with the computer group. The first one: Is GE thinking of selling the computer operation? Borch said no—the company is not interested in selling any of its businesses. What success has there been in overcoming losses? The company is "coming along quite well." What is GE's share of the market and where will they be five years from now? It's a big market, they will be better off five years from now, and would like to be profitable.

The question that roused the most enthusiasm at the meeting: "Why does one who lives in Encino have to drive to East Los Angeles to get his electric blanket repaired?"

Well . . . the service operation is being expanded . . .

TERMINALS TO PLAY BIG ROLE IN "CASHLESS" SOCIETY

Dale Reistad, president of Payment Systems, Inc., elaborated on the role

communications terminals would play in a cashless or checkless society. Mr. Reistad, speaking at the BEMA Show in October, feels that communications, not financing, will be the biggest source of problems in implementing the envisioned society because of the number of tasks that the communications lines and equipment will be asked to perform, and the vulnerability of these systems to natural disasters, and to external constraints and regulations.

Mr. Reistad stated that the recent AT&T announcement regarding "foreign attachments" signaled a whole new era in data communication, and has special significance for the newly-developing funds transfer industry. He stated that the number of terminals required for a funds transfer system would be at least equal to the estimated number of cash registers in use, about six million, and perhaps would double that figure. These terminals, however, might take on entirely different forms than are now familiar. They would be found in the form of small keyboard units with credit card receptacles on gas station islands [See the "Product of the Month" in the "New Products" section], in a lightweight hand-carried unit operated by waitresses in restaurants, in toll booth credit card readers, and as cash register-like devices in supermarkets. The units posed for supermarkets will probably be the pioneers in the field, he felt, becoming most familiar sooner than the other devices could be implemented.

The terminals would be only part of the system; they would be augmented by multiplexors, message switchers, compactors (to further condense multiplexed transmissions), verifiers, purifiers (to filter noise on the lines), modems, and computers.

In this system the computers would take on varying roles. Some would serve as fund transfer processors in 200 to 1000 local, and up to 10 regional, processing centers. Other computers would provide the banking mechanics which would eventually result in bank account changes. Still others would serve in credit bureaus and in data processing centers—the actual paper processors which would interface with the public.

A system of this complexity would be a minimum requirement to process the 40 to 200 billion transactions expected annually for the 100 million projected account holders. Other estimates have quoted the figure of terminals to be closer to three million, the number of regional centers to be nearer one for every million consumers, and the number of customer interface data processing centers to be around 12,500. Whatever the figures used,

The deadly doughnut.



Want to give a computer indigestion? Share your coffeebreak with the tape.

Residual static charges attract crumbs to the tape surface,

crumbs cause "dents" and dents create permanent errors.

**Moral:
Don't eat in the
computer room.**

Food for thought: the top U.S. companies buy Audev computer tape. Could that be one reason why they're at the top?



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certainly AT&T's new attitude on customer-owned equipment goes a long way to opening a very wide market in all types of terminal and communications equipment, and might turn out to be the first really big step in the move to a checkless or cashless society.

INSURANCE COMPANY TO PROVIDE ON-LINE SERVICE

Security Life and Trust Co., Winston-Salem, N.C., will begin an on-line service early next year for savings and loan associations in a 20-state area. The service will aid tellers in routine passbook transactions and perform many of the S&L's accounting functions. SL&T will start with an in-house system now in use that includes an IBM 360/20 and a 40 with three 2260 crt's and a data cell drive. An additional 360/30 will be installed in mid-1969 as a dedicated on-line system, duplexed with the 360/40.

Initially, IBM 1060 typewriter terminals (numeric input, alphanumeric output) will be placed at user locations. During the fourth quarter of 1969, however, delivery is expected of approximately 100 IBM 2980 terminals custom-designed for use by tellers and that will employ keyboards with alphabetic as well as numeric characters . . . and will replace the 1060's.

Security's Information Services Dept. has developed an "alpha indexing facility" called SOLAR that permits retrieval of files from the input of a customer's name only. Should there be multiple identical names, secondary identifiers such as address and Social Security number are printed as output.

Security is also planning to form a management holding company to permit its entry into areas not permissible under its present charter. These may include leasing or other computer services.

GEMINI COMMAND SYSTEMS BEING CONVERTED FOR V/STOL

One spin-off of NASA's Gemini series has resulted in the prototype helicopter and vertical or very short takeoff and landing aircraft (v/STOL) avionics system being developed from hand-me-down Gemini Digital Command Systems (DCS). Radiation Inc., a subsidiary of Harris-Intertype Corp., which originally built nine of the DCS, will assist in design changes under a NASA/Electronic Research Center contract.

In the Gemini space flights the DCS were used in the NASA global tracking network to receive, store, and transmit

real-time and programmed command data to a spacecraft in flight. Their new assignment will be to provide redundant transmission paths, plus multiple parity and validity checks on data that they accept from radar stations and transmit to on-board computers. The complex DCS have more capability than can be used for such an assignment, but will save NASA at least two years in planning and designing the prototype avionics system that will replace them.

WHAT WE HAVE HERE IS NO FAILURE TO COMMUNICATE

The growing use of computers in the field of communications was stressed recently by C. W. Spangle, vp and general manager of Honeywell's EDP Division. Speaking before the 10th Annual BEMA Exposition in Chicago, Spangle said that while a projected growth of 10-15% a year in the entire data processing industry is encouraging in itself, the communications industry will grow even faster. He cited that currently 12% (6,200) of the computers installed in the world are operating in a communications environment; and he estimated that 21% of the computers shipped in '68 will be communications-oriented and that by 1975, 60% (66,000) of all computer systems (an estimate of 110,000) will be operating in a communications environment.

Reviewing other aspects of industry growth, Spangle suggested that the disc market will grow from its '67 level of \$60-70 million to a \$200 million business by 1970; and the 37% (\$5 billion worth) of installed computers now operating as disc-only or mixed systems will rise to 72% by 1973, representing \$22 billion worth of equipment in a market that will be valued at \$30 billion.

In addition to disc drive usage, Spangle noted other fields to be significantly affected by the development and sophistication of the dp industry, notably terminals, software, subscription services (e.g., time-sharing) and supplies manufacturing.

Concluding with a plea for more skilled people, Spangle gave some overwhelming employment statistics: 50,000 people a year are entering the computer industry. If this present growth continues, by 1980 there will be one million people directly involved in work with computers.

THREE CDC USER GROUPS MERGE INTO FOCUS

Sixty Wonderful Able Programmers (SWAP), along with two other Control

Data user groups—COOP and POOL/EXCHANGE—have disappeared.

They're all now combined to form focus (Federation of Control Data Users), formed in November at a joint user group meeting in Newport Beach, Calif.

The new organization, representing over 600 installations worldwide, includes all 3000, 160, 8000 series, plus 1604, 1700, G-15, LCP-21 and -30 and RPC 4000 computers . . . and some 6000 series and the first two installations of the yet-to-be-announced 7000 series.

focus will reportedly give a stronger voice to users of older machines, which have in the past been subordinated to their younger brothers.

A caretaker slate of officers was approved to complete initial organizational work for the new group until more permanent officers are elected in Minneapolis next spring. President is W. Schuyler "Sky" Stevenson, Environmental Science Services Administration, Boulder, Colo.; vice president and conference planning is Tod A. Olson, James Ford Bell Research Center, General Mills, Inc., Minneapolis, Minn.

Future focus spring meetings will be held annually in Minneapolis.

22 PDP-8/S'S CONTROL OIL PIPE LINE

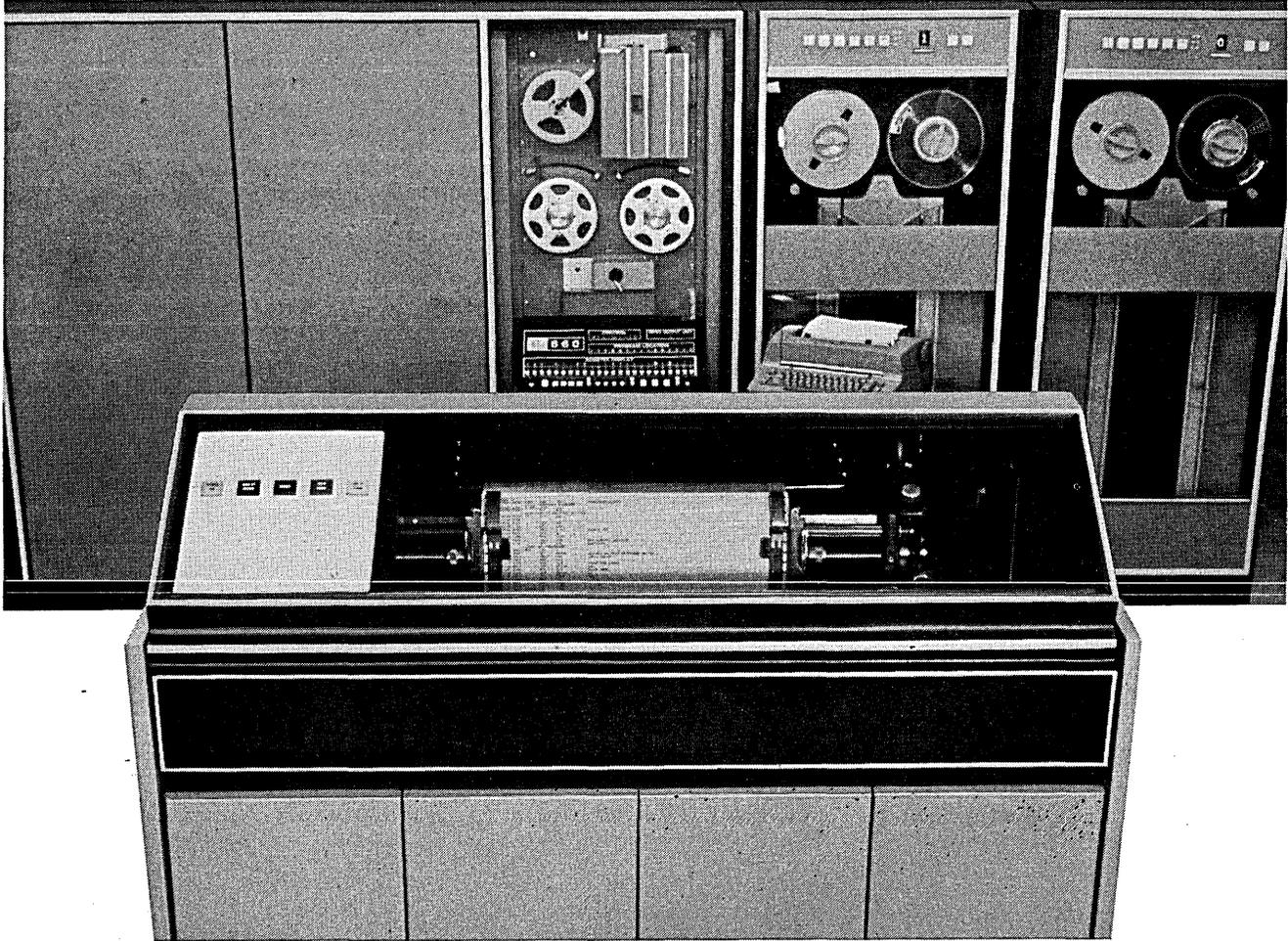
Interprovincial Pipe Line Co., Edmonton, Alberta, and its subsidiary, Lakehead Pipe Line Co., Superior, Wisc., have placed 32 pumping stations along an 1100-mile pipeline running from Edmonton to Superior under the control of 20 Digital Equipment Corp. PDP-8/S computers. Two additional PDP-8/S's are installed in Superior and Sarnia, Ont., for data acquisition from 30 more pumping stations along an additional 900 miles of pipeline extending to Port Credit, Ont.

Each of the 22 remote computers is connected on-line to two more PDP-8/S systems and an IBM 360/40 at the central computer complex in the Edmonton headquarters of Interprovincial. The remote computers perform all data acquisition, interpretation, and transmission functions. A number of safety checks are also computer-generated. In Edmonton, the PDP-8/S's control communications, while the 360/40 stores and processes the data; the PDP-8/S's are also used as backup for the 360/40.

RESERVATION SYSTEM SET FOR HOWARD JOHNSON'S

International Reservations Co., a computerized hotel/motel reservations business, has been formed as a division

Scientific Control Corporation needed a high-speed printer they could choose to ignore...



...they chose the LINE/PRINTER*

■ Scientific Control Corporation needed a high-speed printer to work with their SCC 660 Computer. One that would provide clean, smear-free printing over long periods of time...one they could **choose** to ignore. Why did they choose the LINE/PRINTER*...

■ Mr. W. D. Potter, Manager of Marketing Administration for SCC, said "...there were several reasons... We needed a high-speed printer that would stay in adjustment. We needed proven reliability. We wanted good print quality..."

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■ Want to find out what SCC said about our delivery time... Write Data Products, 8535 Warner Drive, Culver City, California 90230.

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of Planning Research Corp., Los Angeles. With a system initially developed for the Air Canada competition (a contract that went to a Univac/Raytheon combination), PRC has hooked a prime first customer: Howard Johnson's 355 nationwide motor lodges. It is expected that the Howard Johnson's lease of PRC-owned hardware and software will net PRC revenues of about \$10 million in the first five years.

The system (which, for Howard Johnson, replaces a set-up using WATTS lines) includes buffered keyboard-printer terminals located at the desk of each motor lodge and linked via telephone lines to duplexed 360/50's at the PRC computer center in McLean, Va. The terminals, based on TTY 33's, were specially designed and are being manufactured by Sanders Assoc.; PRC has ordered 1,000 of the units. The computer will take reservations, maintain room inventory and provide "a full range of management information" (such as data on traffic patterns, noting peak periods, that will aid in the selection of locations for new lodges).

In addition to the Howard Johnson contract, PRC is currently negotiating with other chains, anticipates its expansion into auto rental and "other reservable commodities." A tie-in with airlines will probably be established to pick up the hotel/car business generated by air travel, but a PRC spokesman says the company has no current plans to enter the airline seat reservations business.

Reservations sales offices will be established by PRC in six major cities; these offices will use crt terminals in handling telephone inquiries for all participating companies. (Howard Johnson's will have its own central reservations office in Atlanta.)

Providing the Maxson/ARIES Telemax system with formidable competition, PRC's International Reservations Co. has an operational target date of June '69; it hopes to have 50,000 rooms in its inventory by that time.

NEW FIRM AIMS AT SMALL BUSINESSMAN

Donald Oglesby and Charles Strack, both recently of Omnitec, Corp., in Phoenix, have entered their company, Data Computing, Inc., into the highly-competitive terminal-manufacturing market. Aiming their products and price schedules at the smallest of small businessmen, their first announced product is a low-speed card reader compatible with teletype and other

keyboard terminals. Basing their rental charges partly on the number of cards processed, Data Computing's basic rental rate for the CR-42 reader is claimed to be one-third that of any comparable reader-terminal marketed. Before going into business as Data Computing, Oglesby headed Omnitec's marketing division; Strack, its engineering operation. For more information:

CIRCLE 228 ON READER CARD

NEW BURROUGHS PLANT OPENS IN CALIFORNIA

Burroughs president Ray W. MacDonald used golden shears to cut his way through a ribbon of magnetic tape in officially opening the Burroughs Westlake Village manufacturing facility near Thousand Oaks, California. If the magnetic tape was symbolic of the products Burroughs will produce there, then the golden shears must certainly be symbolic of the \$100 million investment that the company now has in California real estate.

The Westlake site, which is dedicated to the production of mag tape handlers and disc units, now contains 300,000 square feet of floor space, but plans are already on the board to increase that figure to 400,000. Opening with 750-800 employees, 3,000 people may eventually be housed there, doubling the west coast manufacturing capacity of the company. General manager at the site will be John E. Brown; William Hunter is the manager of employment and industrial relations.

The California climate seems to agree with Burroughs; they have had offices there since 1903. Their employment roles in the Golden state have risen 70% in the last four years, and their investment from \$40 million to the \$100 million figure. In keeping with this expansion, Burroughs announced at the same time the construction of a Carlsbad, Calif., plant, and nine others across the nation. The 11 plants are being built at a cost of \$200 million. Such expenditures are matched only by the size of Burroughs' revenues, which, for their international organization, are expected to rise to \$550 million this year.

U.S. INVENTOR HONORED FOR NEW SEMICONDUCTOR

Sanford R. Ovshinsky, president and director of Energy Conversion Devices, Inc., of Troy, Mich., has been honored by the German Inventors Association for his discovery of unique semiconductor properties in disordered materials.

The development, called "Ovonics,"

has been termed as important as the discovery of the transistor. The new type of semiconductor can handle existing solid-state electronic applications in new and more efficient ways, and can solve entirely new problems that are beyond the reach of earlier technologies.

Ovshinsky received the gold Diesel medal. Only three Americans have been similarly honored: Nobel laureate John Enders received the award in 1962 for his research in polio virus, Werner von Braun in 1965 for his work in rocketry, and Edwin Land in 1966 for his developments in the fields of polarized light and fast action photography.

CRT NEWS SERVICE FOR STOCKBROKERS

Stockbrokers will be able to view capsule news reports from UPI on Bunker-Ramo crt's in their own offices through a service called Newswire, expected to be available in March, 1969. The service provides a continuously updated 10-minute report of general and business news developments affecting financial interests.

The text is displayed on Telequote 70 crt's, which have two screens, permitting simultaneous display of Newswire and retrieval of stock quotations, such as Dow Jones' Broadtape service. A 27-inch crt screen is also available for group viewing. B-R operates about 16,000 crt's, supplying stock quotations to 1800 brokerage offices. Only a few hundred of these units have screens large enough to adequately display Newswire, however.

BRITISH SCHOOL COLONIZES U.S.

Keyboard Training, Inc., claims to be the first "professional keyboard training service" in the U.S., with offices in New York, Philadelphia and Washington. The firm provides on-site keyboard training for employees, aimed at increasing productivity, speed, and accuracy. Operators may be trained on virtually any type of keyboard, from keypunch and data terminals to typewriters, but approximately 60% of KTI's business is training keypunch operators.

KTI claims to make experienced keyboard operators "50% or more faster" and reduce errors to "practically zero." An evaluation study by the Navy concluded that 13 weeks after completion of KTI training, seven keypunch operators were producing 43.8% more keystrokes per hour than prior to training. A Navy spokesman verified this, saying the training was "valuable." (Cont. on p. 126)

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PSI computer training schools across the country (over 32 now in operation) will graduate even more competent junior programmers this year than ever before. And when you consider that we give a minimum of 312 hours of instruction (including hands-on 360/30 operation) and rank as one of the top three computer schools in the nation, that can mean quite a lot.

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The company, headed by 33-year-old Richard Littlehailes, is repeating the success of Keyboard Training Ltd., London, which he established three years ago. KTI, founded in September 1967, raked in \$170K in revenue by the end of the fiscal year on July 31, 1968, and predicts over \$4 million for 1969.

KTI provides bilingual instructors for Puerto Rican trainees in New York, and instruction in sign language for the deaf and dumb. Notably, Mr. Littlehailes has suggested to the Pentagon that deaf and dumb keyboarders might be particularly useful for handling secret documents that cannot be entrusted to more vocal operators.

NEW FIRMS, MERGERS, ACQUISITIONS AND EXPANSIONS

Another new firm entering the difficult proprietary package marketing field is Boston Computer Software Corp., subsidiary of holding company and consulting firm Boston Computer Group, Inc. The six-man subsidiary says that it intends to establish itself with a "few selected packages" within a few industries, such as insurance and market research. One package now ready is a data analysis program, yet to be announced. The firm itself will provide only the marketing of a package, while, under joint agreement, the developer of the product will provide documentation, installation, maintenance, and user training. BCS is headed by the parent company's president, Dr. William Gordon, formerly assistant programming systems division manager for Honeywell. Other principals are executive vice president Leonard Spar (ex-Arcón marketing director), vp William S. Grinker (ex-IBM and Honeywell marketing), and treasurer Adolf Monosson. The Boston Computer Group has also set up subsidiaries Boston Computer Time and Boston Computer Leasing. All entities total 12 people.

Strategic Systems, Inc., NYC-based software-service company, has announced its intention to go into the time-sharing business with the formation of an 85%-owned subsidiary, Strategic Time-Sharing Inc. It has not yet selected equipment, but will go with small machines (DEC or Hewlett Packard), which will be modified for time-sharing. Right now, the new firm is redesigning software and hardware for clients, but in addition to time-sharing, it plans to design and manufacture remote terminals and other equipment with special features not

now generally available. One of 10 SSI subsidiaries, Strategic Time-Sharing is headed by Franklin S. D. Heiss, formerly with Computer Sciences. Most staff members will come from CSC, Western Union, and Sanders. Two-year-old SSI grossed about \$1¼ million in the fiscal year just ended—for a small loss.

Brandon Applied Systems, Inc., and Ennis Business Forms, Inc., have agreed in principle to form a jointly owned systems house to provide data processing services to small businesses. Plans call for the new company, which has not as yet been named, to develop software packages for the handling of financial, statistical and operating information (e.g., payroll, accounts payable and receivable, general ledger posting, inventory control and sales analysis). Personnel will initially be supplied by Brandon; it is later anticipated that Ennis's 20,000 outlets will be utilized to sell any packages that may be developed. Brandon had already announced the acquisition of Federated Printing Company, Inc., and Federated Manufacturing Corp.

California Computer Products, Inc., will invest more than \$1 million, with option to buy, in Century Data Systems, a new company based in Anaheim that will concentrate on the development of an IBM compatible disc file. The new firm is headed by George Canova and represents the first move by CalComp into computer peripherals outside the graphics area. Century will market to OEM and CalComp will sell, lease and maintain CDS products in the user market.

Mobil Oil Corp. has bought an equity interest in Bradford Computer & Systems, Inc., a consulting firm. The amount of stock purchased was not disclosed, but Donald K. Lourie, chairman of Bradford, stated that Mobil had not acquired a controlling interest. Bradford, established in February with a staff of four, has grown to 80 consultants. The New York-based company expects to perform much of Mobil's contracted computer services, with the stock purchase assuring a continuing relationship between the two firms.

Computer Research, Inc., software firm with offices in Pittsburgh and Philadelphia, has made an agreement in principle to acquire Nursing Centers, Inc., Milwaukee. The purchase, valued in excess of \$3 million, is part of a plan to diversify by acquiring "highly profitable and promising companies." Nursing Centers operates extended care residential and rehabilitational centers in Wisconsin. Computer Research is 49% owned by National Industries, Inc., a conglomerate. Reportedly, there will be no cooperative



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Working at a rate of 800 parcels per hour, Caprocon weighs and measures parcels instantly. It feeds the information on cubage and density to Kleinschmidt data printers. Bills, labels, and shipping instructions are printed out automatically. Result: more efficient palletizing, more economical aircraft loading, faster service than ever before.

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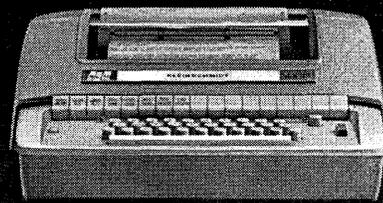
If you have a problem in telecommunications, shouldn't you communicate with Kleinschmidt?

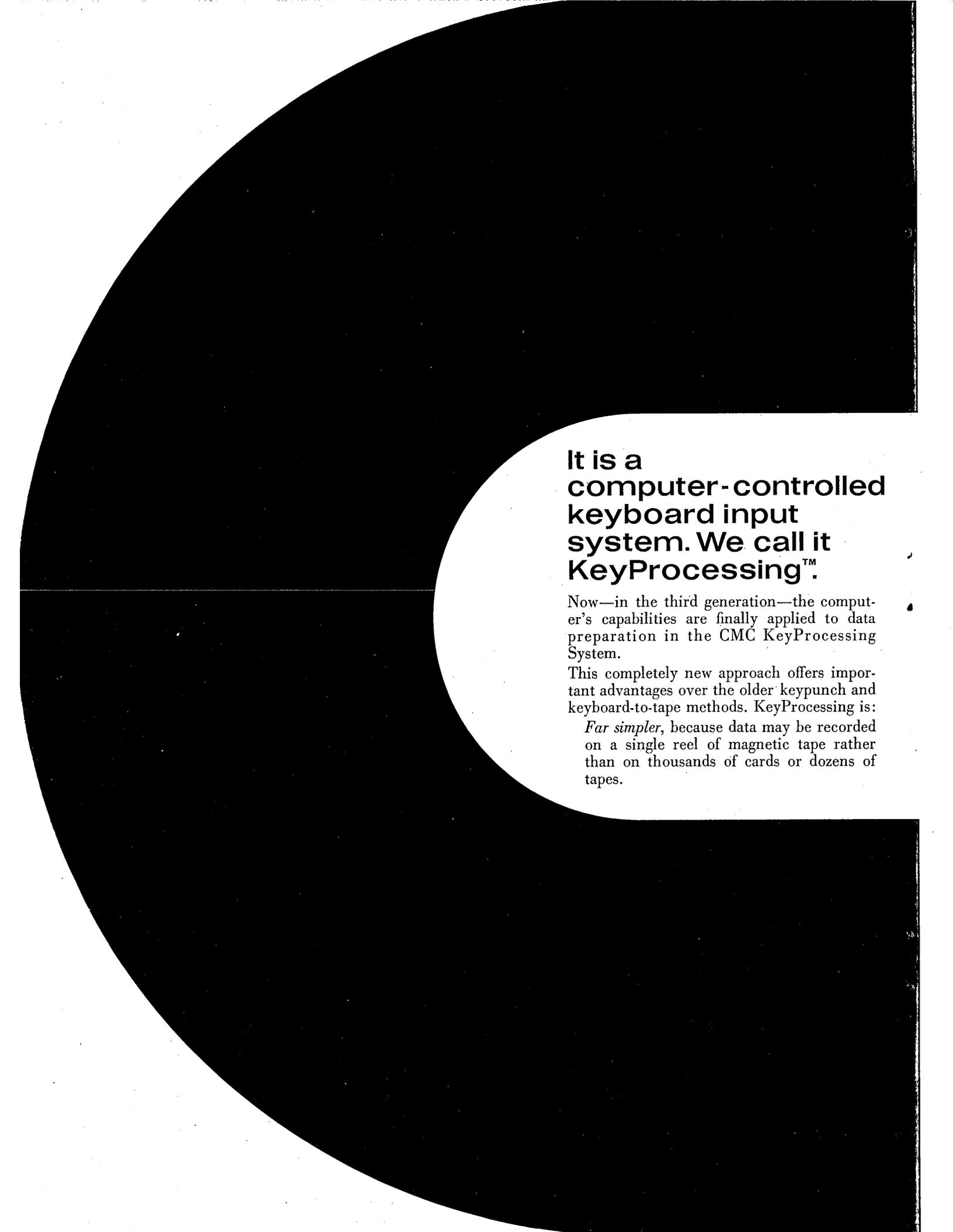
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After data has been recorded, it may be verified either by re-keying it and comparing

it within the computer or—*without the need for re-keying*—by balancing control totals to totals derived from the original keying.

Verified data is transferred, batch by batch, from the disk onto one reel of magnetic tape. From time to time this single reel is taken to your data processing system for high-speed input, while the keying operation goes on uninterrupted.

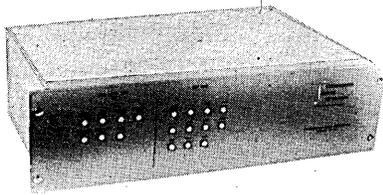
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—CI-12 COMMUNICATIONS INTERFACE—

The INTERNATIONAL SYSTEMS CORPORATION, MODEL CI-12 COMMUNICATIONS INTERFACE operates over voice grade telephone circuits. The software will support multiple half or full duplex communications lines for computation, data logging or alarm, message transmission and many other uses. Features include Auto-Dial, Auto-Answer, Queued and Buffered I/O and Automatic Error Recovery. Software for the system was developed by  SYSTEMS of Flint, Michigan. This system is also available on other computers along with a growing line of communications devices, including Touch Tone Input with Audio Response.

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October 15, 1968.

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efforts between the two firms, nor will there be any interchange of personnel or resources.

Aspen Systems Corp., Pittsburgh, developer of full text storage and retrieval techniques applicable to law, has acquired Computype, Inc., St. Paul, Minn., through an exchange of 13,960 shares of Aspen stock. Computype, a photocomposition firm, will be operated as a subsidiary company.

Fedder Data Centers, Inc., has entered into option agreements to acquire Data Systems, Inc., a service bureau similar to Fedder, and Institute of Data Systems, Inc.; an edp-training school; all three firms are located in Baltimore. Fedder expects to exercise its options this month by issuing 16,000 shares of common stock in exchange for all of the outstanding stock of the two firms being acquired. Pres. David E. Fedder stated that his company intends to actively pursue additional acquisitions in the computer service field.

Pittsburgh National Bank has established a time-sharing department that will offer services to engineers, researchers, and business and professional organizations. The system utilizes a GE 420 cpu. Users are equipped with tty units. And A. O. Smith Corp.'s Data Systems Div. is expanding its activities to include computer services to outside organizations. The division has two IBM 360/50's and more than 2,000 programs in its library, all of which have been tested and used internally and which A. O. Smith feels can be applied to other companies.

A proposal to be presented to shareholders of Computer Investors Group, Inc., Larchmont, N.Y., on December 11th, would transfer "substantially all of the company's assets" to a new leasing subsidiary, causing CIG to become a holding company.

Managematics, Inc., consultants in management science and computer technology, has opened offices at Two Penn Plaza, New York. The new firm is headed by Erving Katz, president, and Raymond P. Wenig, vp, both former senior consultants with the Professional Services Division of C-E-I-R. Initially, the staff will consist of independent consultants used on an as-needed basis.

Computer Aid Companies, Inc., a firm which specializes in problem solving for communities, industries and government agencies, has expanded from its Dallas headquarters with new offices in Washington, D.C. and Los Angeles. G. A. Zimmermann, president, has announced that vp of resource analysis, Dr. Joseph Coker, will

news briefs

manage the firm's east coast office; the Los Angeles facility will be headed by the director of personnel research, Dr. John Leiman.

Quinton Engineers, Ltd., an architectural and engineering firm, and Budlong Assoc., mechanical and electrical engineering consultants, both of Los Angeles, will be merged into a wholly owned subsidiary of Planning Research Corp., subject to agreement of shareholders and regulatory agencies. The two engineering companies have a combined annual revenue (FY'68) of over \$5 million, and a total of 220 employees. The purpose of the new subsidiary is to establish a professional service organization to provide PRC with "turnkey" operations, particularly in projects dealing with large public works and industrial plants (such as airports).

Bull-GE has launched what they claim to be Sweden's first full-scale, commercial time-sharing center in Stockholm, using a GE 265 t-s system; the center will serve Sweden, Norway, and Finland.

Dr. Riccardo Vanzetti and several others have left Raytheon to form Vanzetti Infrared & Computer Systems, Inc., in Wayland, Mass. The firm plans to develop advanced infrared systems and equipment for real-time measurement and inspection, and to interface infrared radiometers and systems with digital computers.

A new time-sharing company, Interactive Computing Corp., Orange, Calif., has been formed with Walter J. Kosinski, former manager of advanced time-sharing systems for GE, as president. The company is initially installing a PDP-10 and a PDP-8; both will be operational this month.

Leasco Data Processing Equipment Corp. has offered to buy Inbucon Ltd., a London-headquartered management consultancy, for \$9 million. The acquisition would bring Leasco's consulting and software personnel in Europe and the Commonwealth to about 850.

E.L.I. Industries, Inc., East Paterson, N.J., has formed a Los Angeles subsidiary, E.L.I. Computer Time-Finders, Inc., which will engage in the purchase and sale of used computers and the marketing of unused computer time. Joel Babas, recently Boston branch manager for Time Brokers, Inc., is president. The goal is to go nationwide; plans call for the opening of a Detroit office in the near future.

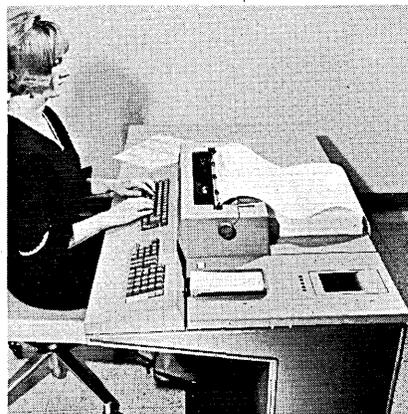
First company to take delivery of a Varian 520/i is Analog Technology Corp., Pasadena, Calif., formed three years ago to bridge the gap between analog instrumentation techniques and

the digital needs of data processors. Customers of the rapidly growing firm include NASA, the Navy, the Air Force, Aerojet-General, and Beckman Instruments. The 520/i will serve as the center of a pulse-height analyzer system being designed by ATC for measuring and analyzing a variety of electromagnetic and charged-particle radiations from space.

Boothe Computer Corp. has formed a subsidiary, Boothe Computer Ltd., to conduct computer leasing operations in the United Kingdom. Peter J. Hines will be managing director. With the appointment of Charles R. Thompson as vice president, Telecommunication Consultants International, Washington, D.C., has established a data processing advisory service for government and business. Which brings us to Data Science Ventures, Inc., a new Princeton, N.J., firm which will provide venture capital funds and management and technical assistance to new and growing companies in the dp industry, both here and abroad. Dr. Morton Collins, formerly a private consultant, will serve as president.

GERMAN COMPUTER SPRINGBOARD FOR VICTOR MARKET ENTRY

Victor Comptometer Corp., Chicago, announced the 800 series of small business computers at the BEMA show in late October. The cpu—the 820/20—for the series is made by Nixdorf Computers of Germany, and features two levels of memory—core and "rod cell"—from 256 to 82K digits. I/O includes



alphanumeric keyboard, paper tape, edge punched cards, 80-col. cards, magnetic and conventional ledger cards, mag tape and printers. The machine can handle two electronic ledger cards simultaneously; each card's magnetic stripe has a capacity of 1024 digits or 680 alphanumeric characters. An 820/03 cpu can serve as on-line or off-line terminal, with up to 32 units under central control. Other units include the 820/56 mag tape drive, 7- or

9-channel with 200 to 800 bpi . . . and the 820/51 data transmission and control unit. Purchase prices range from \$8500 to \$80K. For more information:

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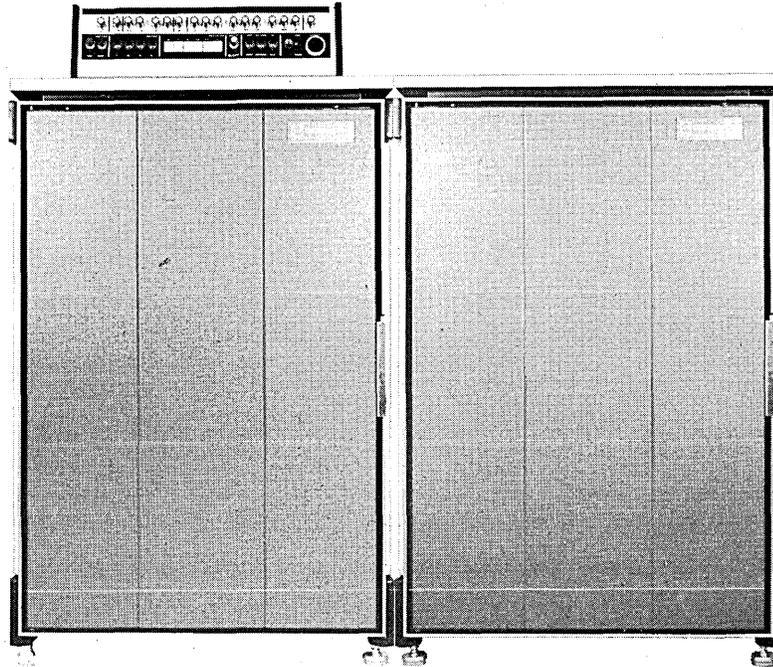
● The Board of Directors of Decade Computer Corp. has elected Emil Borgers chairman of the board and president of the company. He replaces Paul Linebarger, who formed Decade in July '67. Borgers was formerly exec vp with Systems Engineering Laboratories in Fort Lauderdale, Florida. Coming along with him as vp marketing is Dallas Talley, who was sales manager at SEL. Borgers will oversee the development and expansion of Decade's desktop computers and their new line of peripherals . . . which includes, so far, paper tape readers, and punches, a fixed head disc, and numeric keyboard.

● IMLAC Corp., Watertown, Mass., is a new firm in "alphanographics" and intends to produce "low-cost commercial single-station displays." The firm was formed in September and has merged with E. W. Pughe Development Inc., which designs and builds special graphic systems and circuit modules. Principals are board chairman Dr. James Cunningham, ex-vp of Electronic Image Systems, who was involved in system development for the first moon photos; president Earl Pughe, consulting engineer in displays, who helped develop what is now CDC's Digigraphics system and recently completed a color display system for the Air Force at Hanscom Field; vp Allan Morano; and marketing director John Colburn, Jr. (Bunker Ramo).

● New officers for IBM user group SHARE, elected in October, are: president, John Noerr, Sinclair Oil; vice president, Phillip Dorn, Union Carbide; and secretary, Thomas Theberge, McDonnell-Douglas. The new executive board consists of Dr. Theodore Dolotta, Princeton Time-Sharing Services Inc.; Carl Roessler, Yale Univ.; and Fran Balint, ESSA.

● Digitax hopes to succeed where many others have suffered heavy financial losses or gone into bankruptcy—in computerized income tax return service. The new group, a division of COAP Systems, Inc., Greenvale, N.Y., hopes that accountants will be attracted by the "simple" four-page form needed to compute an individual's federal, state, and city taxes. (Digitax

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claims that the difficulty of the longer forms, such as those input forms developed by Computax, are what have been costly to the service firm and cumbersome to the accountants. Digitax service is not as extensive as Computax, however.) The four forms are standardized, as well. For \$7.50 per return, Digitax says it will print out, in triplicate, returns including such schedules as wages, dividends, interest, itemized deductions, income averaging, etc. It will also provide a *pro forma* sheet for the accountant on the individual, which provides fixed information applicable toward the following year's returns. The accountant must provide a minimum number of returns to be processed. Digitax is now operating primarily in the New York area, although it expects to go nationwide, starting with California next year.

● A non-crt display panel, which reflects rather than emits light, has been developed by GE's Electronics Laboratory in Syracuse. Built for the Army Electronics Command, the panel will be used for displaying computer-generated information. The image is produced within the panel by diffracting an incident light source. The screen uses a thin film with magnetization normal to the plane of the display to produce stripe domains, which are then delineated by collecting a thin layer of solution at the domain boundaries. This liquid diffraction grating may be reoriented at 90 degrees to form a long-term non-volatile image. A magnetic pen may write on the display screen, or the image may be created electronically. The only way the written data may be erased is by a strong magnetic field. GE's labs are now working to control the inherent color of the display.

● A recent newspaper report that the Los Angeles County Assessor's office sent out "thousands" of garbled tax bills to L.A. property owners because of computer error seems to be an exercise in guilt by association. A total of three garbled test bills, which were used in the phasing adjustment of the high-speed Analox printer supplied by RCA for use with the 70/35 and 70/45 used by the Assessor's office, were sent out when they should have been thrown away. The real problem was with the printer, whose hammers were not firing properly at a stage of the printing and whose ribbon stretched, causing a no-print in the first few col-

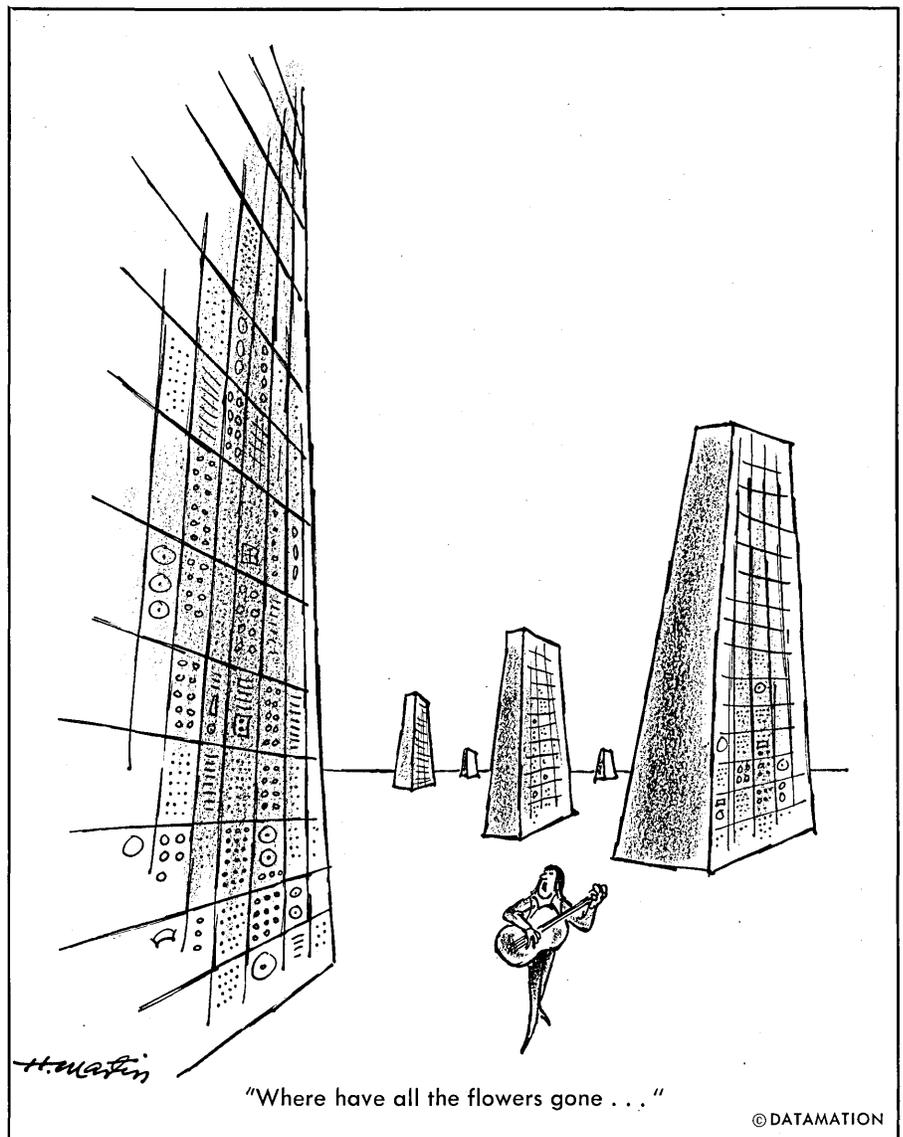
umns of some bills. About 60 thousand out of over two million bills had to be reprinted.

● An urban statistical package containing census tract information on population, housing, labor force, business activity and land use is available from R. L. Polk & Co., Detroit. Included in the package are 92 possible printout maps on combinations of selected data. The data, compiled as a byproduct in the preparation of city directories, is expected to be of use to city planners, government agencies and business interests.

● Answering the call of the government and other keypunch users wanting to upgrade to 029 keypunches, GMA Computer Corp. is offering to convert 024 and 026 systems to 029's. The Yonkers, N.Y. firm, whose major products are satellite card reader/punches says that it will provide ex-

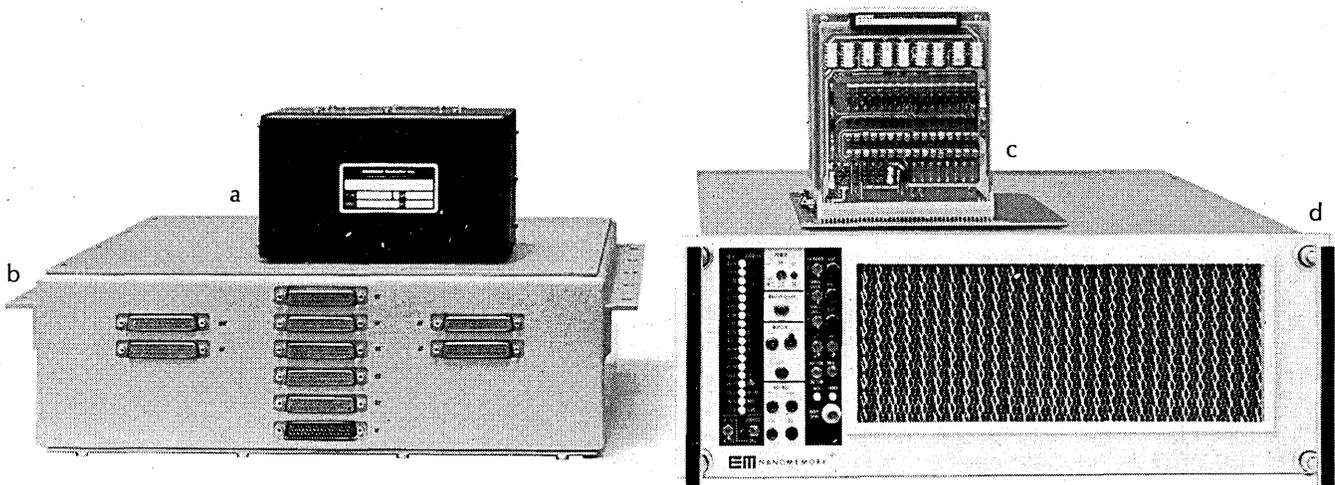
panded keyboard and printing, modern cabinet, and any necessary parts replacement. Cost for converting 100 systems is about \$1,800 each, regardless of age, versus about \$3,500 purchase price for IBM's 029. "Simple" wiring and circuitry changes are involved, says GMA. GMA indicates that it will deal only in large-quantity orders initially.

● The library of Florida Technological Univ., Orlando, Fla. is using Dial-A-Phone cards to keep record of book circulations. The plastic credit-card-sized cards are produced by Pilgrim Plastic Products Co., Boston, and fit into a Touch-Tone telephone, allowing the data stored thereon to be transmitted over telephone lines to a computer center. In the Florida Tech library, one card, located in the book, contains a catalogue number; another, carried by the student as a campus identification card, is coded with his



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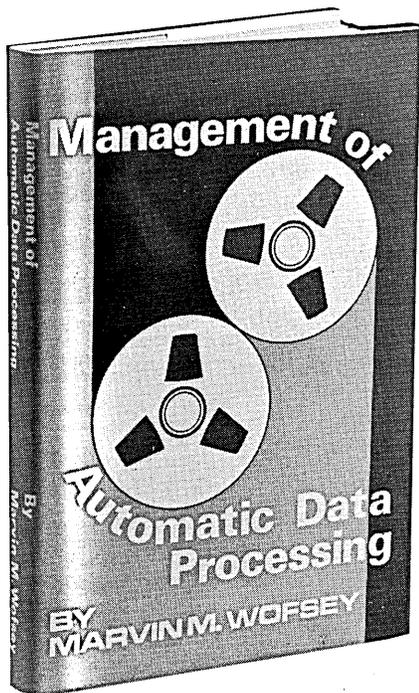
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Information Retrieval: A Critical View
edited by George Schechter
282 pages, 6x9, illus. \$11.00

Computers: Their Impact on Society Part II, 1965 Fall Joint Computer Conference
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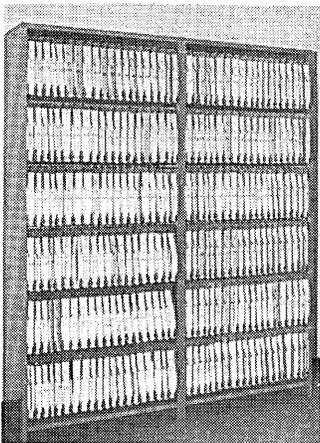
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Social Security number. At the circulation desk, the cards are inserted into the Touch-Tone phone and the information transmitted to the computer center. There, a paper tape is produced which is later computer-stored to provide a record for the library. The university also handles registration in a similar manner: each course and section has a Dial-A-Phone card. Registration consists of dialing in the course card for the course being selected, followed by the student's identification card. The computer maintains an updated registration file from which is produced class rolls, space allocations, etc.

- An informal gathering of individuals associated or formerly associated with Univac I and II Systems (employees of Univac, users or commercial contractors) is being planned for May 14-16 in Boston—to coincide with the Spring Joint Computer Conference. People interested in participating may contact Noel Zakin, 110 Barnwell Drive, White Plains, N.Y. 10607, or Larry Dorf, 408 Camino Verde, South Pasadena, Calif., 91030.

- DATAMATION's Bob Head and Herb Schwartz, AEC, are heading up a founding committee for The Society for Management Information systems, which had its first meeting Nov. 22. Included on the committee are Mel H. Grosz, Esso Mathematics and Systems, Inc.; Dr. James C. Emery, Wharton School of Finance and Commerce; Dr. Alan J. Rowe, USC School of Business Administration; James G. Rude, Pillsbury Co.; Robert Stevens of Touche, Ross, Bailey and Smart; Robert K. Wilmouth, First National Bank of Chicago; and Bob Forest, DATAMATION.

- The first 360/25 computer system in use outside an IBM location has been installed at the Missouri Power & Light Co., a Jefferson City, Mo., utility company that serves a 13,000-square-mile area. The /25, which will be used to process a monthly load of over 100K meter readings and produce bills, records and general accounting information, replaces a 1401.

- The long-awaited PL/I version of Scientific Subroutine Package for System/360 has finally been announced

by IBM. Although SSP/360 has become one of the most widely used IBM program packages, it is still available only in FORTRAN. The new SSP/360 PL/I is scheduled to be available in the first quarter of 1969. The package contains more than 100 mathematical and statistical subroutines that can be used separately or in combination with a user's own PL/I programs, including mathematical capabilities for matrix and polynomial operations, numerical quadrature and differentiation, and statistical operations, including multiple regression, canonical correlation, and analysis of variance.

- Tulane University School of Medicine, under contract with the Automation Section of the National Center for Health Service Research and Development, is gathering data to determine the minimum characteristics and requirements for computer terminals used in automated hospital information systems. The project will provide unusual programming information—the software, developed by Information and Communications Applications, Inc., Rockville, Md., allows a vendor mix of terminals to be used with a hospital's central computer. The results of this project are directly applicable to more than 7,000 community hospitals and institutions in the country. The project is geared for user—rather than equipment—orientation. Work is conducted at the New Orleans U.S. Public Health Services Hospital where a central 360 connects to crts, testing nine different display configurations.

- The Center for Urban Research and Experiment (CURE) has been opened as an interdisciplinary, non-teaching arm of the Univ. of Pennsylvania. The center, under the direction of Professor Robert B. Mitchell, will set up central computer-linked facilities for campus scholars and researchers, and offer seminars and public lectures; it will also create an urban simulation laboratory to collect all available computer models of land use and social processes for the University's use. An early project will be the establishment of an urban documentation center that will provide access to published, computer-stored data.

- NCR estimates that its purchases of Mohawk Data Science Corp. Data-Recorders for the fiscal year ending July 31, 1969 will be about 10% less than for the previous fiscal year, with

the major portion of the decrease occurring in the three months ending January 31, 1969. During the fiscal year ended July 31, 1968, NCR purchased approximately 2,700 MDS Data-Recorders as part of a five-year marketing agreement under which NCR sells the recorders.

● Electronic Memories, Hawthorne, Calif., core memory manufacturer, is now producing and marketing plated wire memories. Initial offering is a plane having 64 (32-bit) words, in either bi-polar or uni-polar mode, which may be operated over a temperature range of -50° to $+100^{\circ}$ C with a 200 nsec cycle time.

● Telex Corp., reservation system subsidiary of Maxson Electronics, has reduced monthly rental rates for terminal locations in travel agencies and commercial firms by 16% as a result of a line usage study indicating that these subscribers use proportionately less time on the network than do other subscribers. New rate is \$92 per month per terminal, \$18 less than the previous charge.

● The United States of America Standards Institute (USASI) is forming a group to investigate the desirability of standardizing JOVIAL. The first meeting of the group is scheduled for March 7, 1969, at BEMA headquarters, 235 E. 42nd St., New York, N.Y. 10017. Persons interested in participating should contact the chairman, A. R. Sorkowitz, NAVCOSSACT, Code 21, Bldg. 196, Washington Navy Yard, Washington, D.C. 20390.

● IBM has announced the formation of a specialized marketing organization, the Commercial Region, within the DP Div. Headquartered in Princeton, it will provide marketing services to the finance, insurance, communications, utilities and transportation industries, in most major metropolitan areas. These customers had previously been served by geographically based regions. The new arrangement will provide for a pooling of efforts for these customers, many of whom have requirements that are national in scope. The new region will be headed by W. Lee Noel as vice president. He was formerly manager of a NYC-based marketing district.

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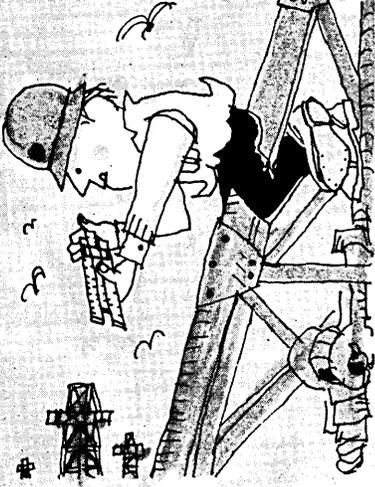
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Helicopter site in Fort Worth. The simulator, which consists of an IBM 360/44 hooked to two IBM-designed analog computers built by Hybrid Systems of Houston, is used to study hypothetical helicopter designs. A Link trainer type of mockup cockpit allows test pilots to "fly" the new chopper while it is being drawn up, rather than after it has already been built.

● A mask used to photo-etch integrated circuit chips may contain hundreds of minute patterns in an area about an inch square. The registration of each of those images is critical to the reliability of the resulting circuit. IBM's Boulder, Colorado, Product Test Lab has developed a computerized scanning densitometer to check registration of regularly spaced rows of images. A light passing through the mask is detected by an electronically controlled scanning microscope and converted to electrical pulses for recording on strip charts and mag tape.

shortlines . . .

Boothe Computer Corp. will continue to use its name under an out of court settlement with Greyhound Corp., which had sued it for trying to lure employees and customers away from Greyhound. The amount of the settlement was not announced . . . System Development Corp. has been awarded a \$430K contract by the Advanced Research Projects Agency of the Dept. of Defense to assist the Royal Thailand Government in its goal to improve data processing capabilities. One of the primary tasks of the laboratory will be to help solve computer programming problems due to the intricate Thai language, most of whose words have no one-to-one English equivalent . . . Technology-management gap bridging at American Univ.: Students at the Center for Technology and Administration can now take a curriculum stressing the functional aspects of computer methods and equipment as they relate to their own business situation without going through all the math and other courses for which they do not have the time, or in most cases, even the need . . . SHARE has voted nearly 10 to 1 in favor of having the ACM set up a secretariat for the big IBM user group at a reported \$50K a year and the executive board of the group has been authorized to enter into a contract. Permanent headquarters will be at ACM HQ in NYC . . . The Joint Institute for Nuclear Research, Moscow, USSR, has been accepted as a

member of FOCUS, the new Control Data user group. The institute has a CDC 1604 . . . Allstate Insurance's northern California research center may look outside the company for customers for its high-powered staff of computer systems experts . . . FYI, Viatron is not actually manufacturing its System 21, has not chosen a supplier. The firm has designed and will market the cheaper systems, which are for conversion of source data to tape cartridge to mag tape or punched cards. We hear that if current letters of intent all change into orders, the firm could have a backlog of well over a thousand units . . . Federal agencies planned originally to add 216 computer installations in FY '69, but because of budget cuts, "they'll be lucky to get half that number," says a knowledgeable source . . . Monarch Marking Co. is making special sales-tag-reading equipment for Friden's new point-of-sale recorder . . . Communitytype has delivered about 25 100 SR systems, has 10-15 more on order.

call for papers

International Symposium on Man-Machine Systems, St. John's College, Cambridge, England, Sept. 8-12, 1969. Unsolicited papers on research and development activities related to the design of man-machine systems are welcomed. Information on procedures for contributing papers is available from Robert C. McLane, c/o Honeywell, Inc., 2345 Walnut St., St. Paul, Minn. 55113. Sponsored by IEEE and Ergonomics Research Society.

Biennial Joint Materials Handling Conference, Portland, Oregon, Oct. 26-29, 1969. 25-word abstracts of papers on the general conference theme of "The Fast Changing World and Material Handling" are due as soon as possible to Max Frey, c/o Cascade Corp., P.O. Box 7587, Portland, Ore. 97220. Completed manuscripts are due May 1. Sponsored by American Society of Mechanical Engineers and IEEE.

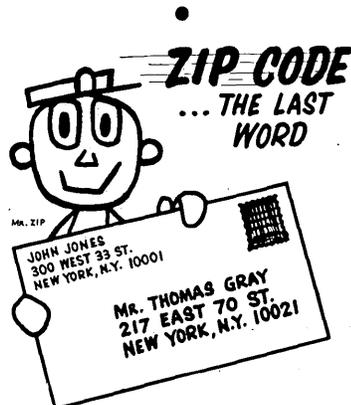
ACM Symposium on Theory of Computing, Marina del Rey, Calif., May 5-6, 1969. Papers describing original research results in the general areas of automata theory, formal languages, sequential machines, computability theory and theory of programming are being sought. Detailed abstracts are due by Dec. 15 to Prof. Michael A. Harrison, Dept. of Computer Science, Univ. of California, Berkeley 94720.

6th Annual Design Automation Workshop, Miami Beach, Fla., June 8-12, 1969. Authors are invited to submit papers of interest in the general area of

design automation, which includes the use of computers in design, analysis and synthesis. Three copies of a 1,000-word abstract should be submitted before Jan. 2 to Dr. H. Freitag, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, N.Y. 10598. Sponsored by SHARE, ACM and IEEE.

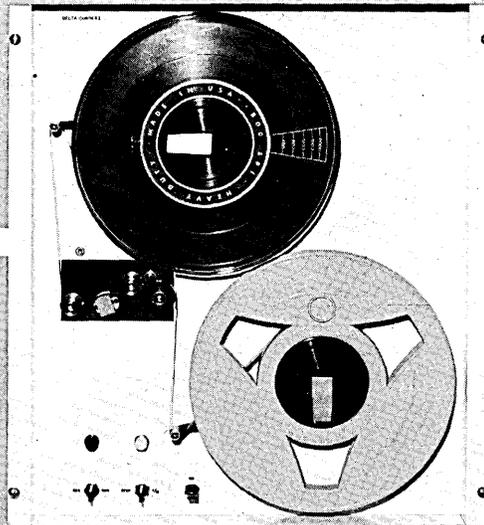
7th Annual Conference of the ACM Special Interest Group on Computer Personnel Research, Chicago, June 19-20, 1969. SIGCPR solicits papers describing relevant research in the general areas of: selection criteria and training programs for the disadvantaged; description of job content and selection procedures for systems analysts; approaches to the supervision of programming personnel and installation management; governmental guidelines for all jobs in the computer profession; mobility and turnover of computer personnel; any specialized proficiency tests for programmers and systems analysts. Three copies of a 300 word summary should be submitted by Feb. 1 to Dr. Charles D. Lothridge, General Electric Co., 570 Lexington Ave., New York, N.Y. 10022.

IFIP-IFAC Joint Conference on Programming Languages for Numerically Controlled Machine Tools, Rome, Italy, Sept. 15-17, 1969. Papers covering both computer programming and part programming are invited. Among the topics will be language capabilities, the influence of programming languages and machine tool design on each other, standardization and compatibility problems, methods of defining programming languages, and computer-aided design as it relates to machine tool programming. Letters of intent should be sent immediately to Prof. A. Caracciolo Di Forino, Istituto di Elaborazione Dell' Informazione, Via S. Maria, 46, 56100 Pisa, Italy, with a second copy to Dr. E. L. Harder, R&D Center, Westinghouse Electric Corp., Beulah Rd., Pittsburgh, Pa. 15235. A complete draft must be submitted by Jan. 15 to Prof. Forino and Dr. Harder.

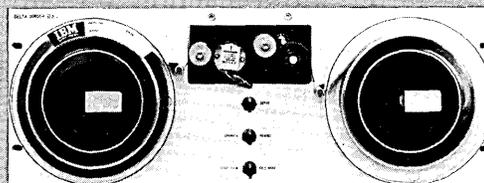


QUALITY

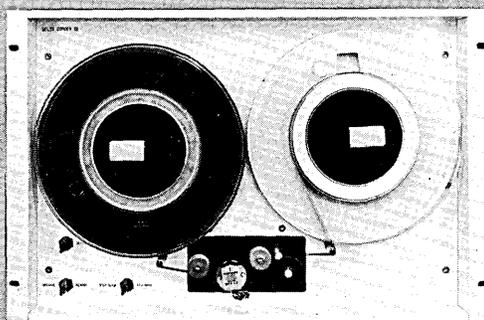
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21" Panel
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- ▲ COMPUTER COMPATIBLE 7 AND 9-TRACK FORMAT
- ▲ CHOICE OF STEPPING SPEEDS AND DENSITIES
- ▲ EASE OF STRAIGHT-LINE TAPE PATH THREADING
- ▲ PRECISION TAPE HANDLING FOR NEGLIGIBLE SKEW
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Compatible disk drive

LOW COST, HIGH RELIABILITY POTTER DISK DRIVE IS PLUG-TO-PLUG INTERCHANGEABLE WITH IBM 2311

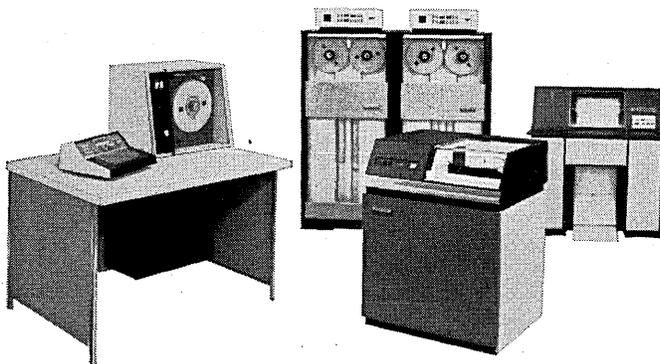
The Potter DD 4311 Disk Drive is a random access memory device with removable magnetic disk storage. It is totally compatible with IBM System/360, and can replace the IBM 2311 by plugging directly into the IBM 2841 storage control unit.

The Potter disk drive uses an access mechanism with a separate read/write magnetic head for each of the 10 disk recording surfaces of the IBM (or equivalent) disk pack. Because of its multiple-head access mechanism and cylinder or track mode of data organization, the DD 4311 is suitable for either random or sequential processing methods. The Potter Disk Drive features easy accessibility for maintenance with removable side panels, and maximum reliability with modular integrated circuit electronics.

Potter peripherals are operating in hundreds of data processing centers providing maximum reliability for minimum cost.

Potter service centers staffed by highly trained and fully equipped service personnel are located in principal cities throughout the world.

Potter Instrument Company, Inc.,
East Bethpage Road, Plainview, New
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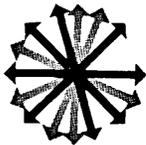


**STRETCH YOUR EDP DOLLAR.
PLUG IN A POTTER PERIPHERAL.**



flight
simulation

aircraft pilot training system



system spotlight

*This is
one of a series
of descriptions of new
computer-based systems
of general interest.
The equipment discussed
is already installed
and operational.*

*Information for the series
is compiled by
Compata, Inc., consultants
in digital systems,
logic design, and
applications programming.*

**Eastern Airlines
Miami, Florida**

Flight simulators for DC-9 and Boeing 727 jet aircraft are being installed at Eastern Airline's Miami training facility by Conductron-Missouri of St. Charles, Mo., designers and suppliers of commercial and military systems simulators. The systems are used by Eastern to provide initial and refresher training of jet pilots and flight crews in both normal and emergency flight procedures.

computer and peripherals

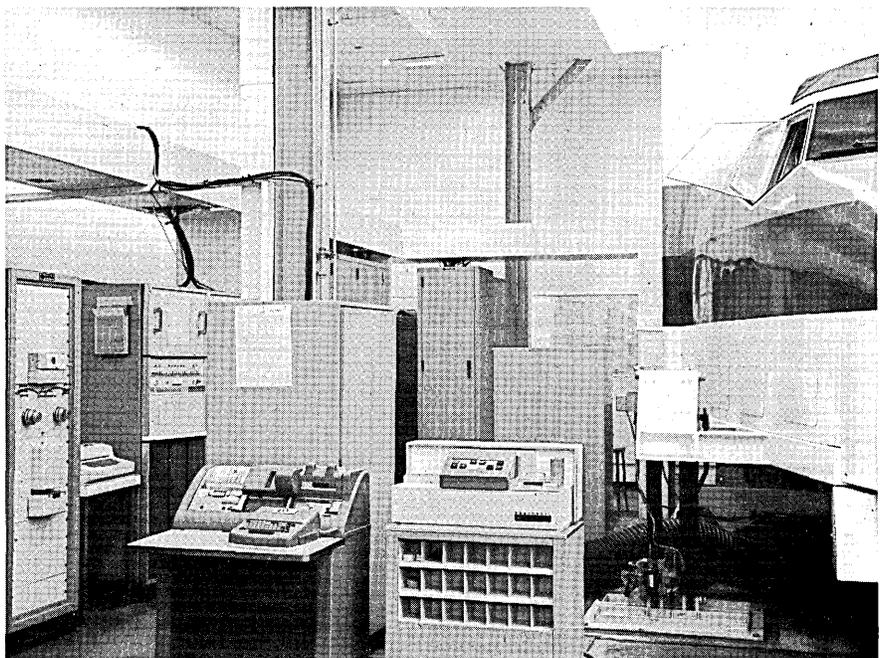
Honeywell DDP-124 processor
32K words of core memory, 1.75
microsecond cycle time
8 priority interrupts

Direct memory access channel
Card reader, magnetic and paper
tape

application

A high degree of accuracy and realism is acquired to simulate the operational conditions and dynamic response of the aircraft and its integrated systems and to provide effective training. Aircraft cockpit environments are recreated in careful detail to the extent that pilots are presented the sounds of flight, including radio noise, the whine and exhaust of jet engines, lowering and retracting the landing gear, and the rumble of tires on the

727 Simulator supplied by Conductron-Missouri



runway during takeoff and landing. A motion system which produces acceleration cues for roll, pitch and heave motions is also employed to give pilots a "true" sensation of flight.

The operation of the simulator is fully automatic for normal flight procedures. That is, the pilot may perform the various operations of engine start-up, taxiing, takeoff, climb, cruise, approach, and landing, receiving the appropriate sensations and being presented with consistent instrument and indicator readings during each flight phase. The operation of radio aids for navigation and landing are simulated to provide authentic displays as bea-

cons are encountered and landing sites approached. Voice communications are conducted with a training facility radio operator who completes the simulated environment by transmitting realistic instructions and replies.

Various training problems and emergency situations can be presented to the trainee by the flight crew instructor who controls and monitors system operation. Failures of engines, instruments, and controls can be introduced by the instructor, who can also influence gross weight, fuel load and other important flight parameters. Post-flight analysis of approach plotter maps aids in the training evaluation.

Typical criteria are glide slope error, localizer error, and situation response time.

software

Simulator software reflects the training environment emphasis on real-time operation. Application programs, which occupy about 80% of the 32K memory, are written in assembly language because a very high efficiency is required in both storage and time. Standard math subroutines with their emphasis on accuracy are not applicable to real-time simulation. Instead, algorithms are chosen which can be optimized in either run time or storage space, as required.

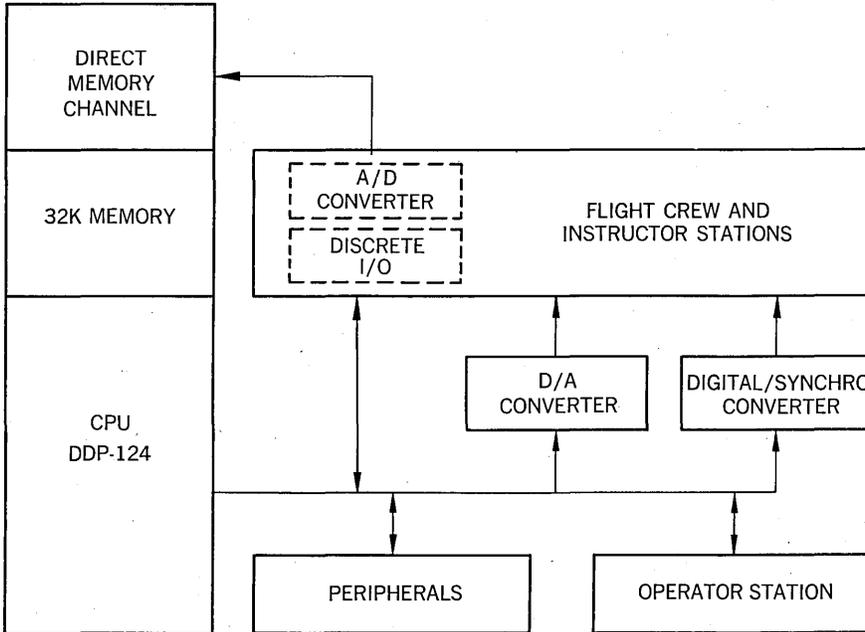
Computer programs in flight simulation are characterized by a high degree of logic operations due to the large number of discrete inputs and outputs that must be processed each program iteration. Approximately 20-30% of all program instructions are used in such decision-making operations. The computation iteration rate is 20 per second, and an average instruction rate is about 270,000 mixed instructions per second.

Except for a small number of utility routines, which are resident during real-time operation, simulator programs are broadly classed as pertaining to either aerodynamics or aircraft systems simulation. Aerodynamics programs continually solve the equations of motion and drive the motion base, air data instruments, "feel" system, and control surfaces. Aircraft systems programs simulate the radio navigation equipment (including pattern geometry of enroute radio beacons) and the hydraulic, electrical, propulsion, and air-conditioning systems.

hardware

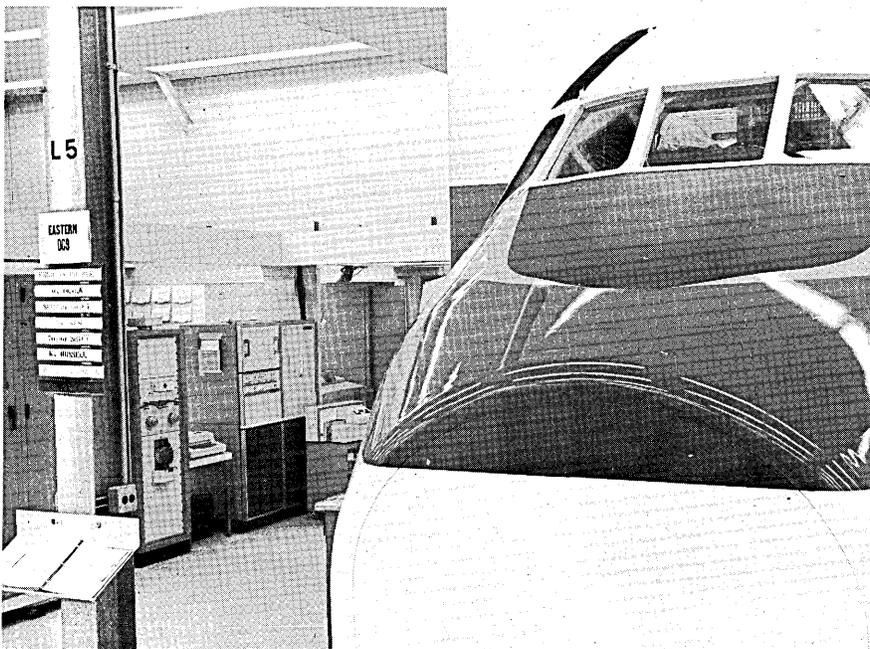
In the hardware implementation of the simulator systems, the computer interfaces with standard peripherals (used principally for software development and system maintenance), an operator/instructor station, and the flight crew station. The crew station receives discrete, analog, and synchro signals to drive cockpit instruments, displays, and indicators. The motion base movements are controlled by analog outputs. Cockpit switches and controls supply discrete signals and analog signals which are converted and returned to the computer via the Direct Memory Channel feature. Input and output signal types and quantities, summarized below, result in a computer input rate of approximately 4000 words per second and an output rate of approximately 6000 words per second:

<i>Inputs:</i>	<i>Outputs:</i>
1750 discrettes	1250 discrettes
125 analog	125 analog
	100 synchro ■



Training System block diagram for three degrees of freedom simulator.

DC-9 Simulator supplied by Conductor-Missouri (below)





The executive committee has just decided in favor of buying the IBM 1800.

They didn't really take a hard look at any other computer. That might have left them with a gutsy decision to make.

And the fact is, it takes guts *not* to buy from IBM.

It takes guts, for example, to buy an SEL 810B from us, Systems Engineering Laboratories. Instead of an IBM 1800 from IBM.

Even though the SEL 810B is a much better machine.

We prove that every day to people who know computers. But then, all too often, the decision moves upstairs for approval and here's what happens:

"Well, maybe the IBM 1800 does have its faults," says the little voice inside, "But IBM is IBM and if anything goes wrong, who can point a finger at us?"

Nobody, maybe. But we'd like to point out a few things they're missing by buying "security," instead of the best real time computer available.

The SEL 810B is faster than the IBM 1800 — 750 nanoseconds versus 2 or 4 microseconds.

At Systems Engineering Laboratories, we design and deliver custom front-end equipment with the SEL 810B. IBM doesn't with the 1800.

We'll deliver an SEL 810B in 90 days. It takes a year to get the IBM 1800.

The price difference is startling. You can actually buy two SEL 810B's for the price of a typical 1800.

Ask IBM about all this and you may get a sermon on service. We know our service, too. But we say a computer exists to work, not to be worked on.

Please understand we're not cocky, just confident. And there's nothing we'd like better than to show you the differences between the SEL 810B and the IBM 1800.

After that, you may decide to request a repeat performance for your executive decision-makers. And they may surprise themselves with a lion-hearted decision.

For a demonstration, call Joe Popolo at Systems Engineering Laboratories in Ft. Lauderdale. The number is Area Code 305/587-2900. Or write P.O. Box 9148, Ft. Lauderdale, Florida 33310.

Systems Engineering Laboratories

CIRCLE 77 ON READER CARD



hoskyns systems research formatter

modular software for IBM system / 360



Surprise package

FORMATTER — a new *kind* of software package. 5 packs like this, 200 cards in each. Supporting manuals.

That's all there is. But look what it does! **It effectively converts your line printer into a document printer.**

FORMATTER prints blocks of data, handling page numbering, heading and page overflow. It will print your data in any format you want. The programmer doesn't have to worry about the layout. FORMATTER looks after all this for him. If he wants to change the format, he doesn't

have to modify his program. He's free to concentrate on the logic. He can consider the document *as a whole* — not as a succession of lines. **It's easy to learn.**

FORMATTER allows you to change your order of printing at run-time. Means faster printing, more time for new work, fewer programs to write. FORMATTER is a stand-alone program for use in COBOL and Assembler Language installations, and is also suitable for multi-programming. There are only 9 operating instructions. **It's easy to use.**

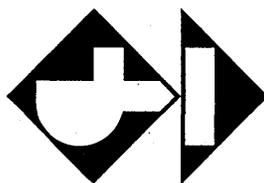
FORMATTER, in short, is incredibly time and effort saving.

Hoskyns Systems Research is the software subsidiary of one of the largest consulting groups in Britain.

FORMATTER costs \$850 — a small price for a very big programming advantage. If you are a DOS installation, you can use FORMATTER now.

**hoskyns
systems research**

Hoskyns Systems Research Inc., 61 Broadway,
New York, N.Y. 10015. Telephone: 212 9434771



CIRCLE 78 ON READER CARD

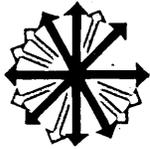
To: Hoskyns Systems Research Inc.,
61 Broadway, New York, N.Y. 10015.
I am interested in Formatter

Name _____

Company _____

Position in Company _____

Address _____



new products

point of sale unit

The clerk you take your Christmas purchases to will probably total them on a "normal" cash register. Next year that may not be the case . . . she may use a small computer, or an on-line remote terminal. A Modular Data Transaction System is being marketed by Friden which is actually a computer designed to look like a cash register. Like a normal register it has: a keyboard for digit entry, an indicator which shows results, a receipt printer, and a cash drawer. The facts that it has only a ten-key keyboard (plus unusual "action" keys), that it can multiply, and that the indicator is not mechanical make it unusual. Some of its other features make it more unusual.

The unit has its own 512 6-bit word core, and a cpu which can be interfaced with a number of I/O devices. Add one circuit board and the system can be interfaced with a 50K character mag tape and a communications controller data set interface. Up to several days transaction can then be stored on the tape and transmitted through the data set to the communications controller. The controller has an automatic answering feature which makes it possible for a computer to poll it for transactions. Up to five stations can be linked to one data set; each can be polled periodically or constantly.

A second circuit board conditions the station to communicate with an in-store concentrator, which accepts only full transactions. The concentrator functions as a scanner-receiver. It has one to 16 primary scanners, each of which can handle up to eight terminals, and each of which will buffer full transactions. A secondary buffer is interfaced to the storage device used, which can be a mag tape unit, a disc, or an on-line adaptor to a computer. The disc and on-line versions are capable of checking customer credit, updating records, grouping transactions by terminal number, etc.

A third board transforms the cash register/computer to an on-line, real-time terminal.

Because the computer terminal might seem fearsome to a salesgirl, the terminal is programmed to act as a teaching machine, too. The keys on the keyboard light in the sequence in which they should be used. Errors are minimized by locking those which

should not be punched until they become lit. Still, the clerk may have some things to get used to: credit card readers, transaction printers, and unusual "action" keys. Friden is hoping that its "around \$3,000" price will soon make the Modular Data Transaction System a familiar sight nonetheless. FRIDEN DIV., SINGER CO., San Leandro, Calif. For information:

CIRCLE 160 ON READER CARD

terminals for the 1108

Last year, Univac 1108 users were given COPE .45 for headaches caused by remote installation problems. Three new terminals are now also being prescribed. COPE .32, equipped with a 200 cpm reader and 300-360 lpm

printer, allows a small-to-medium user to get a piece of the remote transmission action at a monthly rental price of \$1,545. COPE .36, with a 200 cpm reader and 400-480 lpm printer, gives added output capability for \$1,750. COPE .38, with the faster printer but with the addition of a 600 cpm reader, is priced at \$1,885 per month. (COPE's rental prices include unlimited usage, prime shift maintenance, and 4800 bit vg line modems.) Software developed for the big brother .45 (1200 cpm, 700 lpm, \$3,380) is compatible with the smaller terminals, facilitating upward expansion with minimal conversion problems. DATA COMMUNICATIONS DIV., COMPUTER INDUSTRIES INC., Dallas, Texas. For information:

CIRCLE 161 ON READER CARD

1,000,000 bps modem

Computer-to-computer discussions will be expedited by the introduction of the Modem 1100, which is capable of transmitting data at rates from 9,600 bps to 1,000,000 bps. The synchronous full duplex unit uses a coaxial cable,

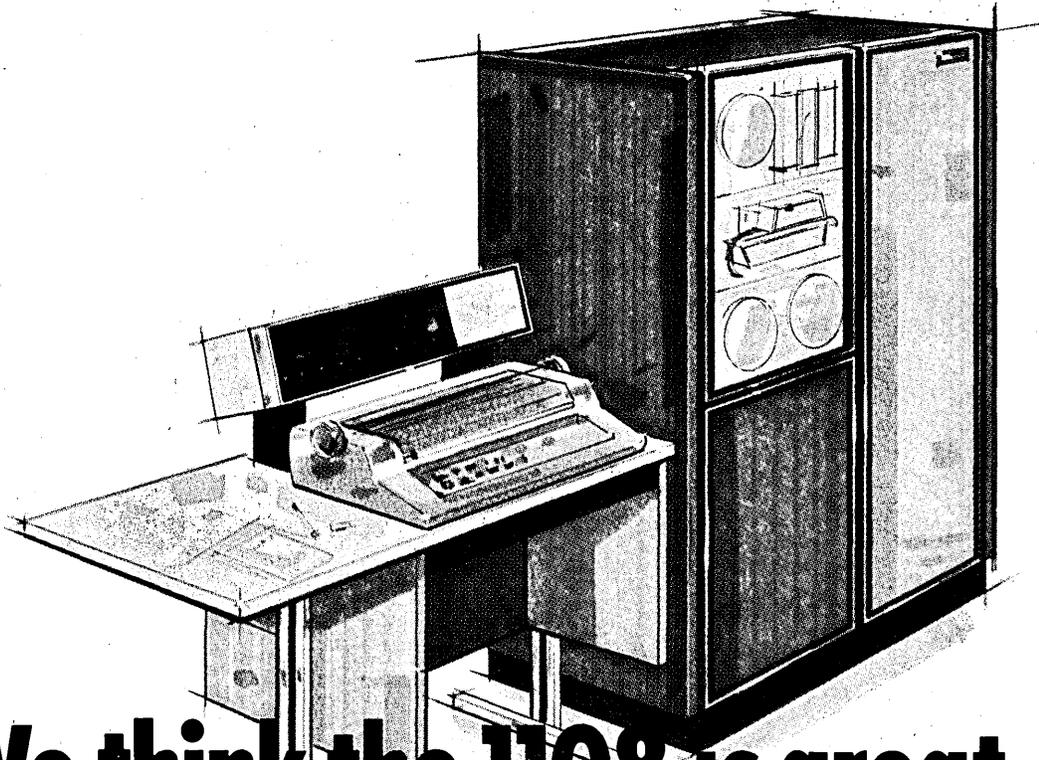
PRODUCT OF THE MONTH



Alexander Graham Bell started the problem when he designed his instrument to carry voice messages rather than data transmissions. Now, to force even modern telephone equipment to carry computer-oriented transmissions, Dataphone sets, magnetic, or acoustic couplers must be attached. These serve to convert a bit stream of one form or another to audio signals which the handset and lines can handle (at a rate of about 22 cps). A Code Tone Data Acquisition and Transmission System, on the other hand, begins with audio signals, in the form of extremely pure sine

waves, and transmits them over normal voice lines at a speed of 250-275 cps. Since the sine waves are so much purer than the wave forms produced by frequency modulators like Dataphone sets, Code Tone's developers claim, transmissions are less apt to wander from their assigned frequencies. (This feature should gladden telephone companies, which fear that nonstandard devices could conceivably generate signals that would encroach on frequencies reserved for dial tones, busy signals, and coin return commands.)

The designers have adapted a
(Continued on page 49)



We think the 1108 is great... but with an SCC 4700 front end it's even greater.

Put an SCC 4700, 16-bit IC computer up front and you not only save valuable 1108 time — you gain fully buffered communications, an expanded I/O structure and a pre-processing capability. All of this costs less than your present I/O equipment.

The flexible I/O structure of the 4700 provides up to four channels—each capable of handling 64 devices. This means a capability of handling up to 128 full duplex communications lines ranging from 2000 Baud up to 230.4 Kilobaud. And while we're handling the voice grade and above speeds, we can also service an additional 64 low speed lines.

Two type of I/O channels are offered: multiplexor or selector. The multiplexor accepts data from up to 64 devices operating simultaneously from a block transfer mode. The selector operates on a direct memory access principle providing very high speed data transfer for up to 64 devices.

SCC also offers a comprehensive line of high speed peripherals that tie onto the 4700.

Make a great multi-processor even greater. Contact SCC to arrange a demonstration of the 4700.

Booth 201-202-203 At The FJCC — Whatever Your Computer Application — Be Sure You Talk With SCC Before You Buy



Scientific Control Corporation

P.O. Box 34529 • Dallas, Texas 75234 • 214 — 241-2111 • TWX 910-860-5509

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Des Plaines, Ill.
Hazelwood, Mo.
Houston, Tex.

WESTERN REGION: Palo Alto, Calif.
El Monte, Calif.

CIRCLE 79 ON READER CARD

new products

video cable, or a twisted pair of high speed lines, and is compatible with EIA standard RS 232B. INTERNATIONAL COMMUNICATIONS CORP., Miami, Florida. For information:

CIRCLE 163 ON READER CARD

remote peripheral controller

"Computer stretchers" is the name given the 7500 line of off-line peripheral systems. Based on a mag tape handler/controller unit, the system allows for one device for data input and two for output. Cable transmission of data is the standard option, but, probably more important, a communications module is also available for remoting the 7500.

A minimum system would consist of the 7- or 9-track mtu/controller, and two other devices chosen from the following: a 200 cpm card punch; a 230, 400, or 600 cpm card reader; a line printer; a 150 frame per sec (5, 6, or 8 channel) paper tape punch; and a paper tape reader. A dual-stacker 300 cpm card punch and an extra-cost 300 frame per sec paper tape punch are not yet ready to be marketed. MOHAWK DATA SCIENCES CORP., Herkimer, New York. For information:

CIRCLE 164 ON READER CARD

tape drive for plotters

The MTR-1 mag tape unit carries only a numerical similarity to an earlier

model; any actual resemblance to other models, living or dead, has been designed out. The desk-mounted unit connects to the DP-1 flat bed plotter to complete an off-line plotting system, and is plug-compatible with the Cal-



comp 565 drum plotter and with the DP-3 22 inch HI plotter introduced at FJCC (HI is also working on the MTR-9 full-size plotter, and on a DP-5 10 inch plotter which they claim will be 400% faster than earlier models, partly due to new tape logic.) Various MTR-1 models handle 200, 556, and 800 bpi 7 or 9 track tape. Reel speed is 1.5 ips, rewind speed is 75 ips. Price is set at \$12,500. Five years' worth of software updating comes free. HOUSTON INSTRUMENTS, Bellaire, Texas. For information:

CIRCLE 165 ON READER CARD

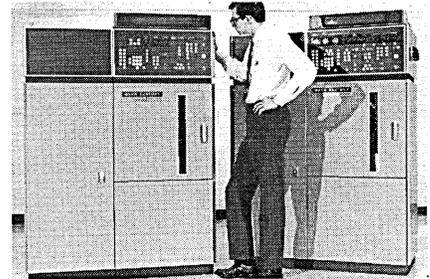
numerical control series

GE has introduced a new line of NC equipment called the Mark Century 7500. Based on fully integrated cir-

cuitry, the 7500 series will eventually replace GE's earlier transistorized Mark Century line, without an increase in price. Because GE is geared to the OEM market, which will take some time to adopt the 7500 series, the phasing out of the last generation line will take about two years, they feel.

Many previously optional features have been made standard, including: buffer storage, 8-digit command capacity, universal readout, mirror imaging, a 300 cps photoelectric tape reader, and self-checking test circuits. The capacity of the base machine can yet be increased by the addition of slope milling, a 500 cps tape reader, canned cycles, thread cutting, absolute data input, stored pattern offsets, preset tape searching, and multiple hole pattern cycle features.

The universal readout provides an eye level, 10 digit display which can be used to check axes locations, commands in process, tool offsets, and manually-entered commands, etc. EAI or ASCII codes can be accommodated at the flick of a switch. A dry-run cycle permits checking a program quickly, without actually machining a part. Commands are executed on a block-by-block basis. Three- or four-axes ma-



chines can be controlled by the same device.

Several other features have been included to make the equipment look good to programmers. The canned-cycle option is designed to save programming time, as are the multiple hole pattern cycle and the stored offsets patterns. Unnecessary trailing zeroes and leading zeroes need not be coded. Block delete codes permit sections of a program to be eliminated when not needed.

Finally, some of the basic designing has been made purposely flexible, such as the power requirements and inch/Metric formatting, to make the equipment internationally acceptable. NUMERICAL EQUIPMENT CONTROL DEPT., GENERAL ELECTRIC CO., Waynesboro, Va. For information:

CIRCLE 166 ON READER CARD

crt/microfilm plotter

One Calcomp 835 crt/microfilm plotter plus one Honeywell DDP-516

PRODUCT OF THE MONTH

(Concluded . . .)

small cassette tape recorder attached to an adding machine for recording inventory figures or sales transactions or any kind of alphanumeric or coded data. From the Code Tone coupler and transmitter, that recording is sent over phone lines to a computer room receiver, translated, and directed to a storage medium or to an input stream. The cassettes, which can store up to 840,000 characters on their two tracks, can also be used for permanent storage.

Pictured above are the adding machine/recorder, the coupler/transmitter, and the power converter plug . . . which can be used to run the recorder on 110v current or to recharge the batteries. The small unit in front of the adding machine

is the tape cartridge used.

The most unusual feature of the system may be its price. The cassettes can be purchased anywhere for about 69 cents. Power for the units is supplied by four flashlight batteries, at 25 cents apiece. Monthly rental on the adding machine/recorders and transmitters will be about \$35 in quantities. A custom-tailored interface on the computer end of the line will run about \$200.

The American Petroleum Institute has already approached the manufacturer to study using similar devices, incorporating credit card readers, on service stations, islands, Department stores and warehouses can use the unmodified units. J. C. NAILEN & ASSOC., Newport Beach, Calif. For information:

CIRCLE 162 ON READER CARD



If you have Sigma 7 tastes

and a Sigma 2 budget...

...get an EMR 6130

You would like a computer that performs like a Sigma 7. Yet, you want the Sigma 7 features in a Sigma 2 size system. Well, cheer up. The EMR 6130 can give you most of the key Sigma 7 features . . . at a Sigma 2 price tag!

The secret is ASSET, an unusual Real-Time Executive that allows extensive multiprogramming applications. Standard modules handle job and I/O queuing, dynamic core allocation, shadow-time batch processing, and interrupt processing to let you tailor the executive to your applications. Other software includes Real-Time FORTRAN IV and ASIST (a macro-level assembler). This package is available *now*.

The hardware features of the 6130 are unusual, too: Multiple, asynchronous memory busses permit true simultaneous I/O operations. Context switching is performed with just one instruction. Up to 126 external pri-

ority interrupts. Hardware multiply, divide, and double precision integer arithmetic are standard.

This brings us to a small surprise. The EMR 6130 is a 16-bit computer. But it happens to be the fastest (775 nanosecond cycle), most versatile 16-bit system on the market.

Let us prove it to you. Call or write our marketing manager in Minneapolis. If we can't convince you the EMR 6130 can do a better job for you, we might even forward your inquiry to the Sigma boys.

After all, it's your money.

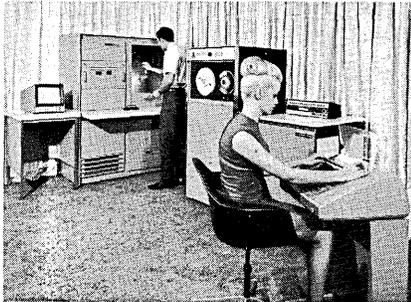
CIRCLE 80 ON READER CARD

EMR COMPUTER

EMR DIVISION OF WESTON INSTRUMENTS, INC. • A SCHLUMBERGER COMPANY
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new products

computer equals one Model 840 stored program crt/microfilm plotting system. Other parts of the arithmetic involved in this product announcement are easier to follow. Calcomp has joined its plotter to the 516 to produce an efficient stand-alone plotting system, capable of producing microfilm records



at a rate of 5 frames per sec in 35 mm or 16 mm format. Used as an off-line printer, the 840 produces $8\frac{1}{2} \times 11$ hard copy output at a rate of 1200 lpm, with 132 char/line. Software for using the plotting system as a line printer is included in the base price. Purchase price for the 840 (with the DYP 516, a 7-track mtu, and 35 mm equipment) is \$142,855. Leases are also available. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif. For information:

CIRCLE 167 ON READER CARD

16-bit computer

Hardware bootstrapping, memory protection, and parity error checking are features of the 16-bit 706 computer, which is expandable from 4 to 32K. IC hardware yields 900 nsec memory times. Software-compatible with the earlier 703, the system is supported by a real-time monitor with real-time FORTRAN IV, assemblers, and loaders. The hardware memory protect feature facilitates foreground and background processing; the real time software facilitates its use in process control and lab environments. RAYTHEON COMPUTER, Santa Ana, Calif. For information:

CIRCLE 168 ON READER CARD

computer editing

Up to eight typewriters can share the automatic editing facilities of one Astrotype control unit. The system is designed to enable several typists to backspace and retype over errors in rough copy and replay the resulting corrected letter at 150 or more words per minute. Copies of the corrected material can be reproduced as many times as desired. If additional corrections must be made in corrected copy,

they can be entered as footnotes to a page (actually character strings) and automatically incorporated into the next version of the text.

The Astrotype system operates with an imbedded PDP 8/L computer. Like the MTST IBM system, Astrotype uses small mag tapes for storing text. Its developers claim, however, that the DEC tapes employed actually store up to six times as much data as the IBM reels do (up to 500K words) at about \$7 per reel.

Astrotype's producers also claim that the small (4 to 8K) controller is capable of providing its users most of the editing features normally found in only large computer editing programs such as IBM's Datatext, at the greatly reduced price of \$280/month based on an 8-terminal system. Purchase price is \$56,000 for the smaller 4-terminal version. AUTOMATIC OFFICE DIV., INFORMATION CONTROL SYSTEMS, INC., Ann Arbor, Mich. For information:

CIRCLE 169 ON READER CARD

automatic flowcharting

The Autoflow automatic flowcharting program is now available in PL/I. Previously, Autoflow was offered only in COBOL, FORTRAN, and Assembly Language. The proprietary software produces two-dimensional flowcharts automatically and directly from the four computer languages. APPLIED DATA RESEARCH, INC., Princeton, New Jersey. For information:

CIRCLE 170 ON READER CARD

portable terminal

Honeywell has unveiled "Com-Pact," a portable, six-lb., battery-operated, 16-key data terminal which can input through any telephone. The device will sell for \$250-400/unit, depending on quantity ordered, and will rent for \$15/month/unit if the user orders 100 or more units.

Two other portable data terminals are already on the market. One, available for some time, is Ma Bell's touch-tone pad; the other, announced recently by Electronic Data Systems, Dallas (see October DATAMATION, p. 17), rents for \$20/month and sells for \$1110. The EDS terminal includes an incremental tape recorder as an optional extra, a feature which won't be available to Com-Pact users.

The EDS and Bell terminals each have 12 keys; Honeywell plans to sell Com-Pact to users with larger data input requirements. Six of the new terminal's 16 keys can be used for control symbols or as shift registers, giving the user the capability of inputting alpha as well as numeric data, explains Hon-

eywell. The company expects traveling salesmen to be a prime market for Com-Pact. Other likely users include traveling executives, police, construction foremen, and independent telephone companies.

The Com-Pact terminal consists basically of the keyboard and a cradle for holding a standard telephone headset. The user inputs through the keyboard and the corresponding tone signals are picked up acoustically by the headset receiver. Voice messages from the other end of the line are inductively coupled to a built-in speaker. The terminal also has an ear plug through which the user can listen in private. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 171 ON READER CARD

miniprocessors

One circuit board of the Interdata processors could contain the entire firmware logic necessary to simulate 500 to 700 instructions of the 360/30 or 360/40 instruction set. In addition to emulating other computers, the miniprocessors' microcoding can be used to advantage to create a specifically oriented machine. This has been done to make remote message concentrators or even front end processors for larger machines by designing a special communications computer around a C9 or C16 computer, respectively. The Remote Communications Processor (based on the C9), can handle up to 32 TTY lines, providing coupling and code conversion for about \$20K. A Central Communications Processor (based on the C16), which would link to a larger cpu to perform the nuisance work and interface mongrel remote devices, can handle 64 low speed lines or fewer 4800 Baud lines. Such a front end system, which would probably use two processors for maximum efficiency, would sell for about \$50K. INTERDATA, Oceanport, N.J. For information:

CIRCLE 172 ON READER CARD

code-converting mtu

A communications interface and a mag tape reader combine to form the CTU Communications Tape Unit. The standard unit has a 1024 8-bit character buffer which will handle a maximum block size of 512 characters. Half of the buffer is reserved for code conversion. This micro-coded feature enables automatic conversion from the character set of any input device to that of the desired output device. Double buffers can be ordered so that conversion to either of two separate character sets can be effected. The CTU transmits asynchronously at a rate of from 10 to 105 cps in a mode

new products

compatible with standard data sets. Reel sizes to 7 inches can be accommodated, with 7- or 9-track formats, 200, 556, or 800 bpi packing, and transfer rates to 4000 cps. Prices start at \$8300 or \$241/mo. INFOTECH, INC., Rye, N.Y. For information:
CIRCLE 173 ON READER CARD

automatic call for help

Autocom is an automatic warning device which telephones pre-recorded requests for help when a dangerous condition develops. The unit can be programmed to monitor environmental conditions in computer rooms, burglar alarm systems, power supplies, etc. When an unacceptable condition is detected, Autocom calls three telephone numbers with a voice message for each type of emergency. The device is also programmed to make priority calls should multiple emergencies occur simultaneously.

The Autocom 200 handles two types of emergencies, and sells for \$595; the 400 handles four types, and sells for \$795. The unit measures 9x12x4 inches and is powered by an alkaline cell power pack. It may be connected

directly to phone lines or through telephone company KS 2000 8 LI coupling devices. First approval for direct line connection has come from the Hawaiian phone company. AUTOCOM DIV., GENERAL RESEARCH CORP., Newton, Mass. For information:

CIRCLE 174 ON READER CARD

remote plotter

The Data Interface Plotter Terminal, Model PT-1, listens in on a tty line and plots the data which is being typed. The data must be typed in two columns, and scaled, but no other programming is required to incorporate the plotter. PT-1 plots one point every two seconds regardless of the location of the point on its 10" x 15" drawing surface, because the plotter is controlled by absolute value data rather than by incremental data. The plotter, with its tty channel interface, is priced at \$4,350. A \$100 pen-up, pen-down feature can be added. DATA INTERFACE CORP., Tarzana, Calif. For information:

CIRCLE 175 ON READER CARD

taped computer course

An audio tape accompanies the course materials for GE's Process Computer

Concepts Course, a home-study package designed to introduce a manager, plant engineer, or operator to the world of data processing. Based on the GEPAC 4000 computer, but generally applicable to the whole field, the beginner learns about the history of computers, computer internal operation, coding, flowcharting, assemblers, compilers, and operating systems in four to five hours. Price is \$125 for one copy, with quantity discounts and a 50% discount to educational institutions. GENERAL ELECTRIC CO., PROCESS COMPUTER DEPT., Phoenix, Ariz. For information:

CIRCLE 176 ON READER CARD

360 accounting software

For 360 installations having difficulty in measuring the efficiency of their programs, system software, or hardware, a package called SMS/360 has been developed. Capable of monitoring and reporting on cpu, channel, and device time and usage, part of the package also measures the time spent in various segments of a specific program. With SMS/360, its producer claims, a computer installation is given the information most needed to guarantee efficiency in its production programs, to insure the effective scheduling of its shop, and to determine the effects of operating system or hardware configuration . . . plus solid justification for making needed changes.

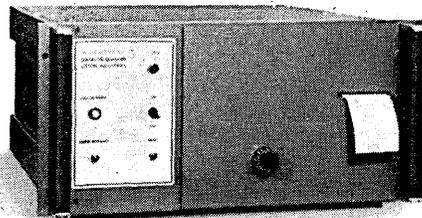
Two modules of SMS/360 are marketed, one called Problem Program Efficiency analyzer (PPE) and one called Configuration Utilization Efficiency analyzer (CUE). Versions are available for non-MVT OS and DOS/TOS systems. Versions for MVT are scheduled for almost immediate release. About 1% more run time is necessary with PPE in use, which link edits with the program and takes snapshots. No programming changes must be made to accommodate either module.

Price for an OS version of either is \$7,500 (\$12,500 for both). DOS/TOS versions of both, sold as a package, go for \$4,500. Lease options are available. In addition, the company markets services based on the use of either PPE or CUE. A specific program can be analyzed for \$75 plus machine time. An entire installation can be analyzed for \$1,200, first time, and for less on succeeding times.

B&B, which is about one year old and has a staff of 20, also plans to market a 360 computer usage billing system using the IBM-supplied handles. This package is not quite finished. BOOLE & BABBAGE INC., Palo Alto, Calif. For information:

CIRCLE 177 ON READER CARD

The only impact printer that gives our optical printers a run for the money.



Litton Datalog's MC 2400 — the 40 line a second, state-of-the-art printer.

Here's the first impact printer that approaches our fiber optics printers in speed, reliability and state-of-the-art design. Engineered to be uncomplicated, the solid state MC 2400 offers up to 40 lines per second, 16 column capacity, truly asynchronous operation, single shaft simplicity, and electronically

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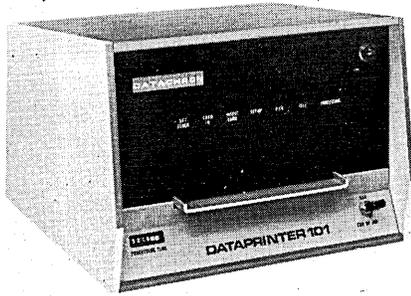
It's the only third-generation impact printer. Find out about it today; call Datalog Division of Litton Industries, 343 Sansome Street, San Francisco, 94104. (415) 397-2813.

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LITTON INDUSTRIES

CIRCLE 88 ON READER CARD

on-line printing clock

The computer operator is relieved of the responsibility of being a timekeeper with the Dataprinter 101. Manual logs, always suspect, are replaced by printed records produced on tab card stock. A regular 24-hour clock and a direct-wired processing time accumulator are combined to retrieve records



of total job time, actual processing time, set-up time, down time, and idle time. A reminder system signals the operator if a job is started without a card in the unit. A visual display is provided in addition to the printout... both are in hours, tenths, and hundredths. Selling price for the Dataprinter is \$925; a no-lease rental, including service, runs \$48/month. This is the first product announced by the firm. DATACHRON CORP., New York, N.Y. For information:

CIRCLE 178 ON READER CARD

crt polaroid

Accessories have been designed for the Polaroid CU-5 Close-up Land Camera to enable it to photograph crt displays. The attachments fit onto the front of the camera to frame the exact area to be photographed and to position the camera the correct distance from the screen for precise focusing. A b&w print develops in 15 sec. for a permanent record of the display. \$266 buys the CU-5 and attachments. POLAROID CORP., Cambridge, Mass. For information:

CIRCLE 179 ON READER CARD

two accounting machines

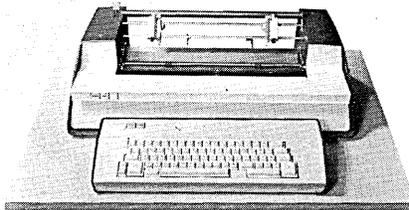
An electronic printing calculator and a computerized accounting machine have been put on the market. The Logos 328, the printing calculator, has built-in programs for solving percentages, square roots, and raising to powers. It is equipped with six registers, three of which can be addressed from the keyboard. All six can be used interchangeably, as the operator desires, to store constants or intermediate results. The 328 is equipped to handle 22 digits, including decimals to 15 places. Price for the Logos is \$1,595.

The accounting machine, called the P203, is a teletype size unit consisting of a keyboard console, printer, and built-in computer. It accepts programs which are formulated on mag cards. Up to 160 sequential instructions can be entered per card; any number of cards may be used. Decimal numbers to 31 digits can be stored in its registers. Several logic functions are available, including sign testing, instruction modification for subroutines, absolute value and integral value determination. Instruction registers store up to 32 instructions. Price for the unit is \$6,200; rental costs are \$136.40/mo. OLIVETTI UNDERWOOD CORP., New York, N.Y. For information:

CIRCLE 180 ON READER CARD

printer/keyboard

A band-driven print wheel is used in the Model 630 Serial Impact Printer, which is capable of spinning out lines at a rate of 20-35 cps. Electronically controlled stepping motors perform line spacing and print wheel moving functions, as well as 12 ips programmable forward and reverse tabulation. The incorporation of motors rather than mechanical controls is intended



to cut down on the number of moving parts, providing a more reliable system. The printer is OEM unit priced at about \$1,600. An auxiliary keyboard is available for about \$450. Electronics packages are provided for computer interfacing which are ball park priced at \$1,200. LITTON AUTOMATED BUSINESS SYSTEMS, Carlstadt, N.J. For information:

CIRCLE 181 ON READER CARD

compact memories

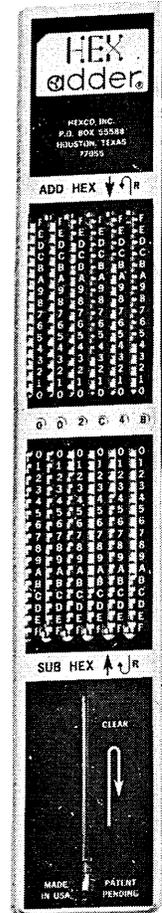
The 370 core memory system is modularly expandable from 4K by 40 bits up to 655K bits. Memory speeds range from 1.5 usec to .75 usec. Billed as incorporating "a new concept in self-test packaging," the 19-inch unit is built to provide easy internal access. The 370's smaller brother, the 420, has a 4-usec full-cycle time and an access time of 600 nsec. It packages 1K of 8 bit words in a 3 X 4 X 7 inch space. FABRI-TEK INC., Minneapolis, Minn. For information:

CIRCLE 182 ON READER CARD
(Continued on page 155)

IBM / 360 PROGRAMMERS

without 16 fingers ?

A pocket Hexadecimal calculator is now available for programmers of IBM/360 and many other 3rd generation computers.



HEXADECIMAL CALCULATIONS ARE:

- becoming necessary for most 3rd generation programmers.
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- delaying the debugging of new programs.

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CIRCLE 83 ON READER CARD

Is your computer ready for memory expansion?

You would be surprised how RCA's "plug-in" compatibility makes it easy and inexpensive to add more memory capacity.

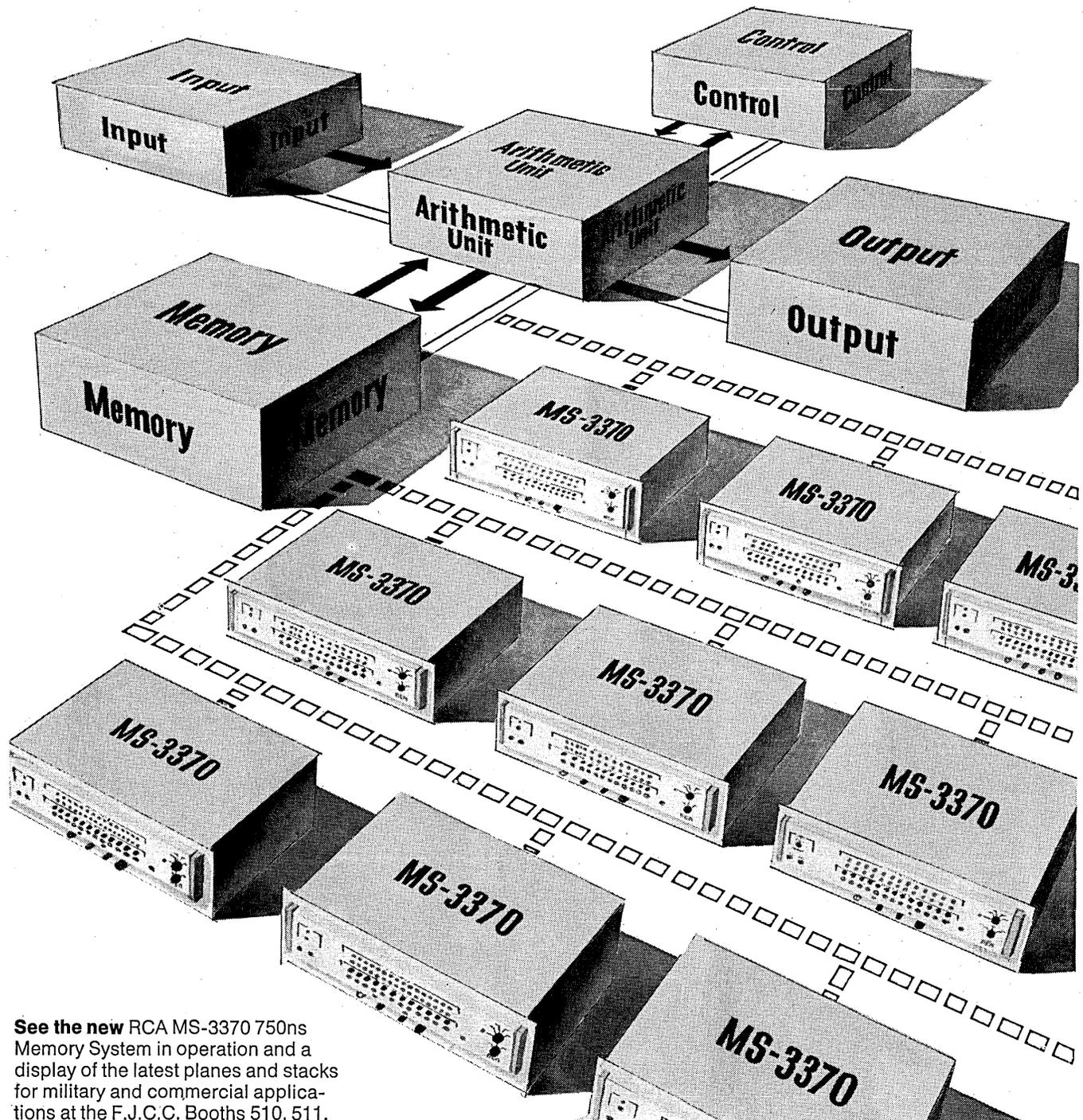
Experience shows that every computer soon runs out of memory. If your computer has reached this point, RCA Memory Products Division can provide compatible high speed memory systems for significantly less than you would expect to pay.

RCA offers standard off-the-shelf memories with cycle time as fast as 750 nanoseconds and access time of 290 nanoseconds, capacities of 4K x 4 to 32K x 72. We'll quickly work out the "plug-in" compatibility for you, including voltage levels, timing and hardware. Simply let us know what your interfacing requirements are, and we'll take it from there. Or, we'll assist you, if you wish to do

the job yourself.

An RCA Field Representative will be glad to discuss your needs. Or, call or write Marketing Department (617-444-7200, Ext. 233) RCA Memory Products Div., 150 "A" St., Needham Hts., Mass. 02194.

RCA



See the new RCA MS-3370 750ns Memory System in operation and a display of the latest planes and stacks for military and commercial applications at the F.J.C.C. Booths 510, 511.

new products

plot to digital

A drafting table-sized unit, Datacoder Digitizing System Model 303 has a 12½" X 10½" operating surface which can be overlaid with a working graph or used to display a film image. Its operator moves a cursor to a specific X/Y location and presses a button. Digitized to 8 bits for each coordinate, coordinate information is punched into paper tape. A lamp display indicates coordinates for the operator in Gray code. A toggle keyboard can be used to select 16 identification codes. Price is \$9,500. BOLT BERANEK AND NEWMAN INC., DATA EQUIPMENT DIV., Santa Ana, Calif. For information:

CIRCLE 183 ON READER CARD

management info system

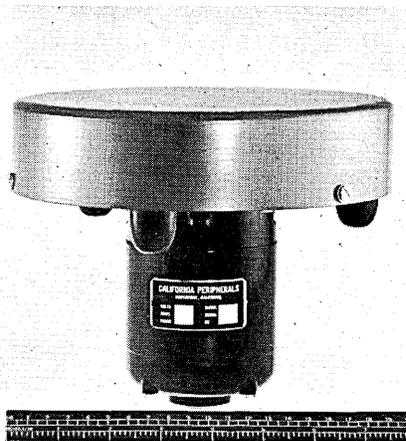
There is no upper limit of the record or file sizes which INQUIRE can handle, its producers claim. A question-oriented software package, INQUIRE includes programs for locating, storing, retrieving, editing, and altering both fixed and variable length records. The system is programmed in PL/I and operates on a 360/40. Available only in a

batch-mode version at present, all handles are present for conversion to terminal inputs. This is the first offering of the four-month-old firm. INFODATA SYSTEMS, INC., Washington, D.C. For information:

CIRCLE 184 ON READER CARD

mini-drum

A 100,000 bit random access drum has been developed which measures less than 8" across and sells for about \$800. Aimed at the small computer or con-



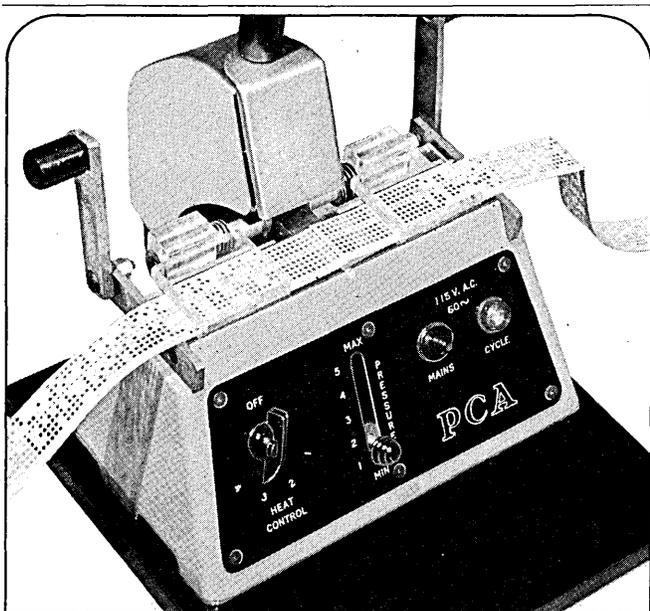
trol systems manufacturer, the system will sell for even less in quantities. Designated Model 588, the drum has 10 tracks, uses flying heads and a synchronous drive. Read/write electronics are also available. CALIFORNIA PERIPHERALS, Northridge, Calif. For information:

CIRCLE 185 ON READER CARD

one card a/d or d/a

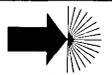
Digital-to-analog or analog-to-digital conversions can each be accomplished with one card. The DAC T series cards, d-to-a converters, accept codes of up to 12 bits, store them, and convert and hold the resulting voltage until given another conversion command. Binary models are available for either unipolar or bipolar operation, for either 12, 10, or 8 bits including the sign. BCD models are available for unipolar operation only (8421 code, 2 or 3 digits). Speeds up to 30v/usec slewing with 2 usec to settle to .01% are offered.

The companion units—the a-to-d series—are claimed to be the fastest converters available. Called the ADC U set, units with conversion speeds to 250 nsecs/bit are marketed. 8-, 10-, and 12-bit cards are included; each can be obtained with external clocking.



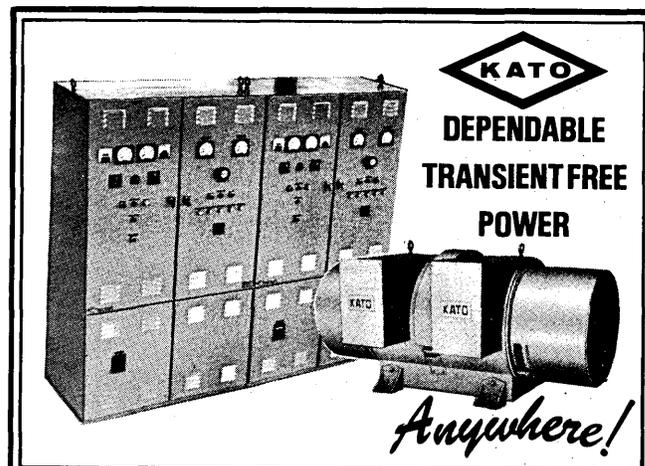
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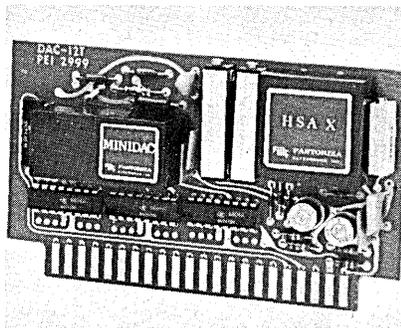
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CIRCLE 86 ON READER CARD

new products



The DAC series is priced from \$270; ADC units start at \$495. PASTORIZA ELECTRONICS, INC., Newton Upper Falls, Mass. For information:

CIRCLE 186 ON READER CARD

chart to tape

Engineering drawings are reduced to digital data for input to computers, plotters, and n/c tools with the Model 3800 X-Y coordinate digitizer. A glass scale measuring technique reduces drawings up to 60 x 80 inches with a resolution of .001 inch. Operating features include automatic grid round-off, plug board formatting, and manual entry keyboards. Output may be to cards, paper tape, mag tape or on-line. AUTO-TROL CORP., Arvada, Colorado. For information:

CIRCLE 187 ON READER CARD

portable card punch

The desk top model 2910 card punch provides portable card punching at speeds to 20 columns per second and these standard options: two level card program control, auto dupe, auto skip, auto or manual feed. Optional features include: printing (48 or 64 characters per card), numeric, alphanumeric or expandable pluggable keyboard, high speed skip, and auxiliary dupe. Basic machine price is \$2,200 (\$50/mo. lease); total purchase price of all optional features would be \$2,500 (\$65/mo.). GMA COMPUTER CORP., Yonkers, N.Y. For information:

CIRCLE 188 ON READER CARD

inventory system

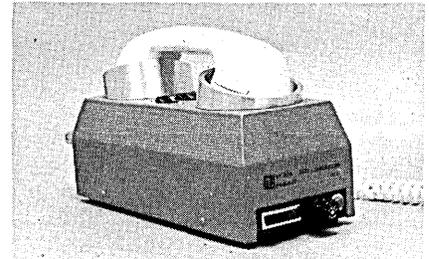
Toys for Christmas which come out of Transogram-affiliated toy companies may owe part of their existence to RMIS, a raw material inventory system. RMIS controls raw material movements, manufacturing costs, material usage, and labor costs. It also prepares reports contrasting production costs and bud-

getary estimates. Developed for use on a 360/30, the basic price of the unmodified system is \$6K. The software firm which markets it must believe in diversification . . . their last package (announced last month), called Treatment Evaluation System, was designed to aid psychiatrists in the treatment of patients. DELTA DATA SYSTEMS, College Park, Maryland. For information:

CIRCLE 189 ON READER CARD

magnetic/acoustic coupler

The magic word with the DC-22 Data Communicator is "switchable." The unit can receive either acoustically or magnetically at the option of the operator. In addition, it can transmit at two



frequency levels, again at the option of the operator. The DC-22 is rated at up to 300 Baud in either full- or half-duplex mode, and communicates with other DC-22's in half-duplex mode. Price is less than \$400 in quantities. NYTRON, Palo Alto, Calif. For information:

CIRCLE 190 ON READER CARD

1 to 4k memories

Three 12" X 15" circuit boards make up the entire ECOM memory system; one of them contains the whole core array and diode switches that make up the magnetics assembly. This modularity, the manufacturers claim, will enable delivery times of the 1 to 4K, 8- to 16-bit memory systems to be kept under 30 days. Full cycle time is 2.5 usec.; access time is .75 usec. Features include servo controls on critical voltages and built-in expansion capabilities. Price for a 4K 16-bit system would be \$3,579. STANDARD MEMORIES, INC., Sherman Oaks, Calif. For information:

CIRCLE 191 ON READER CARD

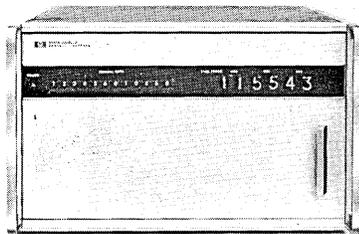
cartridge tape

Another cartridge tape unit aimed at the small computer manufacturer has been announced. Defining its slice of the market to be the PDP-8 series, the mtu is priced at \$1,941 complete with control and standard I/O connectors for the PDP machine. Accessories can

be supplied to make the unit operate as a program loader. A cartridge size of up to 300 feet can be used; four tracks are recorded on the ¼ inch ribbon. Read/write speed is in the neighborhood of 300 12-bit words per sec. The unit, Model TP-1351, mounts in a 19-inch rack. TENNECOMP, INC., Oak Ridge, Tenn. For information:
CIRCLE 192 ON READER CARD

coupler

Outputs from up to six digital instruments (digital voltmeters, counters, nuclear scalars, quartz thermometers, etc.) can be recorded on a variety of output devices through the use of the 2547A Coupler. Basically a translator, the coupler changes the input from parallel to serial form and transfers it



to a recording device (mag tape, paper tape, typewriter, etc.), inserting spaces or end-of-line and carriage control characters as required. At the same time, it can supply data to a digital recorder for visual inspection. The coupler can operate asynchronously or as a scanner. Plug-in options for manual inputs and time can be added. Price of the unit depends on the type of output device supplied with it. For instance, the coupler, set up for one input channel, and a teleprinter with output interface card costs \$4,150. Manual data entry costs \$1,000; the digital clock option sells for \$1,500. HEWLETT-PACKARD CO., Palo Alto, Calif. For information:
CIRCLE 193 ON READER CARD

mobile printer

A 40 character per line, 75 word per minute printer has been developed for use in connection with mobile radio receivers. The Telescripser printer, which sits on the transmission hump in an automobile, uses 5-inch wide paper and forms its characters in a dot pattern. The unit receives transmissions which have been formatted by a central station sending unit, which, in turn, can take its input from paper tape, keyboard, or punched cards. Its producers claim that even static or radio interference will not render the dot matrix characters illegible. The mobile printer is unit-priced at \$875; the cen-

tral station translator-transmitter sells for about \$1,800, and can handle up to 50 remote stations. KLEINSCHMIDT DIV., SCM CORP., Deerfield, Ill. For information:
CIRCLE 194 ON READER CARD

multiprogramming for ASP

OS/360 MVT (Multiprogramming with a Variable number of Tasks) is now available for Version 2 of the System/360 Attached Support Processor (ASP) program. This capability will enable each of the main processors, as well as the support processor, to handle a number of different tasks concurrently. Up to three computers can be linked in an ASP configuration. IBM DP DIV., White Plains, N.Y. For information:
CIRCLE 195 ON READER CARD

high-resolution tv monitor

Transparent to video signals, the Model 6947A tv monitor was designed to provide the high-resolution, linearity, and stability required by computer-driven graphic displays. The Monitor reproduces video images faithfully, its producers state, with less than 1.5% geometric distortion of the rasters over the entire 14-inch display area, alleg-

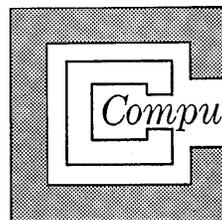
edly offering better definition of alphanumeric and lines. Its manufacturers have such confidence in the set's circuitry, that they have not included a "hold" control on the operator's panel, nor a "linearity" control. In fact, they say it was originally conceived as a measuring instrument to gauge tv picture quality. Price is \$1050 . . . in black and white only. HARRISON DIV., HEWLETT PACKARD, Berkeley Heights, N.J. For information:
CIRCLE 196 ON READER CARD

\$10 computer

You will be reprogramming your "\$10 computer" at the local gas station if marketing plans go through. Perhaps better named an analog data acquisition device, the \$10 whatchamacallit is based on an electro-chemical recorder which is "programmed" to turn on an idiot light on a car's dashboard when the vehicle is due for servicing. The device measures running time, number of starts, and parked time by un-plating a silver electrode. At the proper point, the light on the dash is triggered. It will go on each time the car is started until the owner gives up and drives his car in for servicing. Then it's replaced. BISSET-BERMAN

This announcement is not and is under no circumstances to be construed as an offering of any of the securities for sale or as a solicitation of an offer to buy any of such securities. The offering is made only by the Prospectus.

October 18, 1968



200,000 Shares

Computer Communications, Inc.

Capital Stock

(Par Value \$1 per Share)

Price \$12.50 per Share

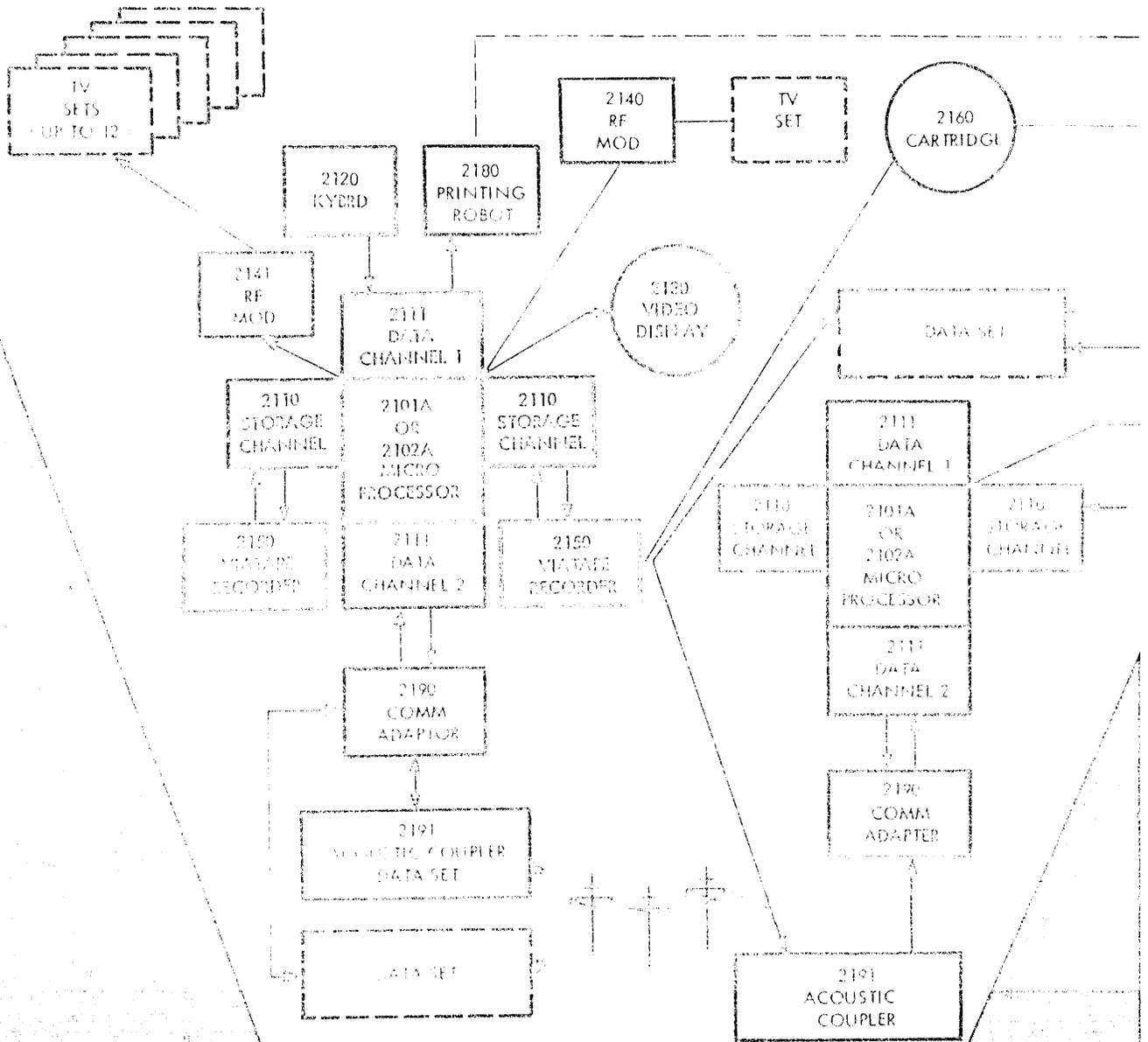
Copies of the Prospectus may be obtained from the undersigned only in such states as the undersigned may legally offer these securities and in which the Prospectus may legally be distributed.

B
BLAIR & CO., INC.

CIRCLE 87 ON READER CARD

BusinessWeek ran a two page news in its October 19th issue. We'd like to

The basic System 21 station shown in red provides desk-top data entry,



SYSTEM 21

CIRCLE 64 ON READER CARD

VIATRON System 21 puts the logic where the problem is



"It's good business to help colleges"

"Business has a direct and pressing need for colleges of high calibre. Carnation recognizes that its success tomorrow depends in large part upon the quality of the college graduates it hires today. We also benefit from the continuing stream of ideas and information which college researchers provide.

"Colleges are faced by the continuing pressure of higher costs due in large part to the demands of a more complex technology. To maintain their standards and to fulfill their crucial role, they need increased support by business.

"Carnation now provides voluntary financial aid to more than 125 colleges and feels that this is one of its best investments for the future."

**H. E. Olson, President
Carnation Company**

A major problem in the education of students is rising costs. If companies wish to insure the availability of college talent, they must help support colleges with financial aid.



SPECIAL TO CORPORATE OFFICERS—A new booklet of particular interest if your company has not yet established an aid-to-education program. Write for: "How to Aid Education—and Yourself", Box 36, Times Square Station, New York. N. Y. 10036

COLLEGE IS BUSINESS' BEST FRIEND

Published as a public service in cooperation with The Advertising Council and the Council for Financial Aid to Education



new products

CORP., Santa Monica, Calif. For information:

CIRCLE 197 ON READER CARD

tape holder

Tape-Porter holds up to 44 reels of Digital Equipment Corp. or LINC tape in less than one cubic foot of space. It consists of four walnut Carry-Posts, a Formica base, and four plastic dust covers. Each Carry-Post is removable for carrying reels from storage to console. Label areas on the posts record user names or tape contents. An optional Lok-Post feature permits key locking of individual posts. Tape-Porter sells for \$39.95 plus \$4.95 extra for each Lok-Post. DALYN DATA SYSTEMS, Rochester, N.Y.

CIRCLE 198 ON READER CARD

mini-disc

The 8000 series Disc Memories can be used as a memory stretchers or as a terminal buffer memories; their 7 x 7 x 10½ inch size makes it possible to mount two of them in the standard 19

inch rack space. Fixed, flying heads in a head per 6250-bit track configuration are used. Each memory system includes head address, decode and selection systems, bit and sector clocking, and functionally packaged ic boards (one for read and one for write). Average access time is 8 msec. INFORMATION STORAGE, INC., Detroit, Mich. For information:

CIRCLE 199 ON READER CARD

digital clock

Hours, minutes, and seconds are displayed in 1" numbers on this rack-sized digital clock. The 3½" x 19" x 6"



unit displays up to 24 hours in Nixie type numerals, which can be manually reset to any value. Price is \$750. ARTISAN ELECTRONICS CORP., Parsippany, N.J. For information:

CIRCLE 200 ON READER CARD

This announcement is neither an offer to sell nor a solicitation of an offer to buy any of these Securities. This offering is made only by the Prospectus.

October 31, 1968



475,000 Shares

COMPUTER CORPORATION

Common Stock

(\$1 Par Value)

Price \$17.00 Per Share

Copies of the Prospectus may be obtained in any State from only such of the undersigned as may legally offer these Securities in compliance with the securities laws of such State.

GLORE FORGAN, WM. R. STAATS INC.

BLYTH & Co., INC.

EASTMAN DILLON, UNION SECURITIES & Co.

HORNBLOWER & WEEKS-HEMPHILL, NOYES

STONE & WEBSTER SECURITIES CORPORATION

WHITE, WELD & Co.

BANQUE DE BRUXELLES S.A.

BANQUE NATIONALE DE PARIS

CREDIT COMMERCIAL DE FRANCE S.A.

J. HENRY SCHRODER WAGG & Co. Limited

CIRCLE 90 ON READER CARD

cartridge recorder

3M has entered the cartridge recorder market with an 8 x 4 1/4 x 3/8 metal cartridge of 1/4 inch tape. The cartridge contains the tape path mechanism, including reels, tape guides, pinch rollers, and reel brakes. Beginning-of-



tape and end-of-tape sensors are included on the 600 foot instrumentation grade tape. The cartridges slide into a slot in the recorder. When removed, the reels are automatically locked by the internal brakes. Tape speeds up to 60 ips are produced. Future plans call for the same type of unit to be produced in a 1/2 inch configuration. MINCOM DIV., 3M. CO., St. Paul, Minn. For information: CIRCLE 201 ON READER CARD

display readout

The Bina-View readout accepts any binary or Teletype code up to six bits, does its own decoding, and displays up to 38 different characters with a standard height of 1 3/8". The unit can be driven directly from a computer or other electronic equipment; it will operate on 128 milliwatts a bit and four watts a set pulse. The readout has a built-in memory; in case of power failure, it will retain and redisplay the last character selected when power is restored. INDUSTRIAL ELECTRONIC ENGINEERS, INC., Van Nuys, Calif. For information: CIRCLE 202 ON READER CARD

If you could see
the people
CARE feeds...

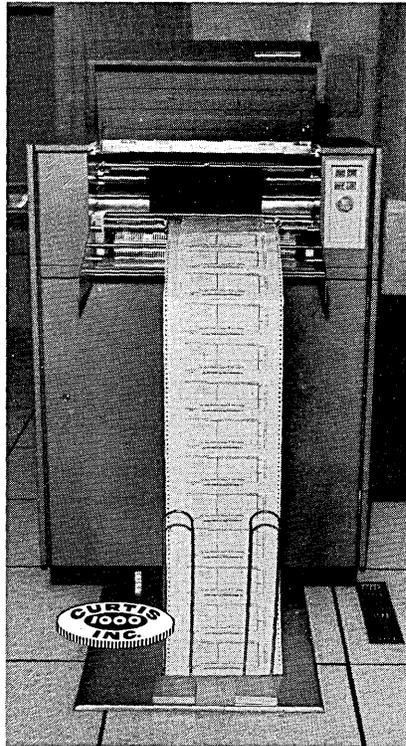


...you wouldn't need
coaxing. Mail a check.

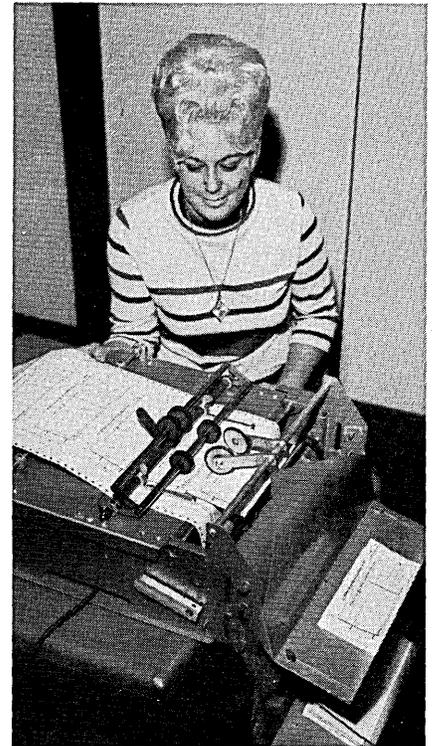
CARE Food Crusade, New York, N.Y. 10016

December 1968

Close the efficiency gap between your computer and the mailbox



CHAIN-O-MATIC CONTINUOUS FORMS-IN-ENVELOPES



NO INSERTING OR SEALING JUST STRIP AND MAIL

When you make mailings of computerized information such as billing, follow-up notices, verification of accounts, and 1099's, you'll save time and errors by printing out on Curtis 1000's CHAIN-O-MATIC continuous forms-in-envelopes. Information, name, and address are printed out on these units, which have a carbonless form preinserted and presealed inside each envelope. Only the name and address show through the envelope window. Strip the forms-in-envelopes and mail. That's all there is to it!

Sound like a better way to handle your periodic mailings? It is. In fact that's the way it is with all Curtis 1000 products. We continually look for better ways to make each of our envelopes and business forms more useful to you. Help you do a job better, faster, more economically.

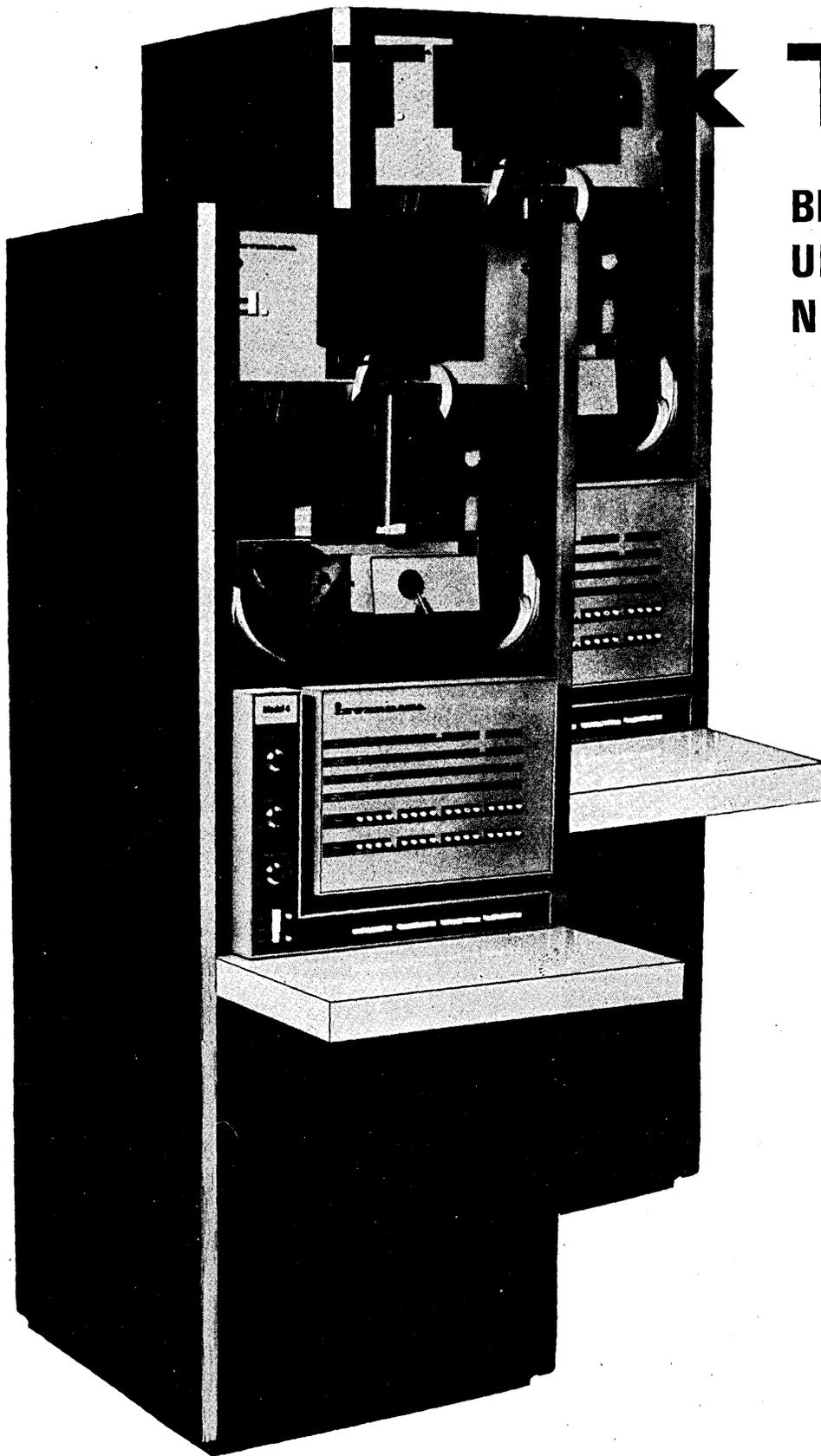
Interested? Use the reply card or write to Curtis 1000 Inc., Box 28154, Atlanta, Georgia 30328.

CURTIS 1000

making envelopes and forms
more useful to you

CIRCLE 89 ON READER CARD

161



Think Twice!

**BEFORE YOU SPEND \$50K
UPWARDS FOR YOUR
NEXT COMPUTER**

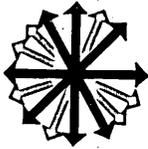
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COMPUTERS... PLUS
money left over for
your stockholders!*

**WE DARE CHALLENGE
COMPUTERS COSTING
OVER TWICE AS MUCH
HERE'S WHY..**

1. Instructions and speed similar to "Mod 40" class.
2. 16 running accumulations—nothing like it until you reach \$100K
3. Floating point arithmetic at these prices!
4. 400 us Microcode — for ultra high speed algorithms.
5. Up to 65,000 bytes—all directly addressable.
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8. A supplier who will really hustle to make you happy.


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new literature

UNIV.-INDUSTRY RESEARCH: Two-part portfolio describes research partnership between electronics-electrical goods makers and the Univ. of Wisconsin's University-Industry Research Program. The five areas covered in the program include an information service, research capability, faculty consulting assistance, experimental equipment use, and continuing education programs, meetings and conferences. Included is a directory of 500 potential faculty consultants to industry and the 1,000 technical subject areas in which they work. **DEVELOPMENT COUNSELLORS INTERNATIONAL, LTD.**, New York, N.Y. For copy: **CIRCLE 203 ON READER CARD**

CANADIAN USER FACTS: 72-page booklet gives results of survey of 394 computer installations in Canada, including total direct edp costs by 8 industry divisions, edp costs broken down into components and given as per cent of sales and per customer or account, number and breakdown of edp staff, extent of computer applications for industry, relative cost of various types of computer applications, utilization of equipment and services. Cost: \$5. **W. Ruskin, Industrial Engineering Group, Dept. of Mechanical Engineering, Univ. of British Columbia, Vancouver 8, B.C., Canada.**

DATA MANAGEMENT SYSTEMS: 297-page report describes a technique for quantitative evaluation of the relative effectiveness of large on-line generalized data management systems. **AD-811 682.** Cost: \$3; microfiche, \$.65. **CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.**

DESIGN PACKAGES: Four-page brochure describes Autologic series of proprietary programs for performing engineering, design, and drafting functions. The programs convert engineering data and requirements (in the form of equations, sketches, or data listings) into a logical design including component optimization and layout, printed circuit routing, component mounting-hole location, schematics, wire lists, etc. **INFORMATION MAN-**

AGEMENT INC., San Francisco, Calif. For copy: **CIRCLE 204 ON READER CARD**

OPTICAL CHARACTER TESTER: Four-page brochure describes Model 081 portable direct reading optical character tester which measures the quality of printed characters and documents which are to be machine read by optical scanners. **KIDDER PRESS CO., Dover, N.H.** For copy: **CIRCLE 205 ON READER CARD**

ELECTRONIC CALCULATORS: 40-page catalog contains specifications, prices, and typical configurations of the company's line of electronic calculators and accessories. Information is given on the selection of models for specific applications. **WANG LABORATORIES, Tewksbury, Mass.** For copy: **CIRCLE 206 ON READER CARD**

SEMINARS: Six-page brochure gives winter schedule of data processing seminars for management and technical personnel. **BRANDON SYSTEMS INST., New York, N.Y.** For copy: **CIRCLE 207 ON READER CARD**

TIME-SHARING LANGUAGES: Pocket-sized reference cards for programmers are a shorthand version of the commands found in the technical manuals and can be used to compare language capabilities as well as program on the company's system. Languages covered are **CAL, BASIC, FORTRAN II and EXECUTIVE.** **COM-SHARE, INC., Ann Arbor, Mich.** For copy: **CIRCLE 208 ON READER CARD**

CIRCUIT MODULES: Brochure describes the design and characteristics of the company's new line of circuit modules, which are available with **SUHL TTL** and/or other types of logic. **SYLVANIA ELECTRIC PRODUCTS, INC., Buffalo, N.Y.** For copy: **CIRCLE 209 ON READER CARD**

PAYROLL TAX PACKAGE: Users guide contains general information about payroll taxes and guidelines for the de-

These securities having been sold, this announcement appears as a matter of record only.

October 16, 1968

510,000 Shares

COMCET, INC.

(Not related to "COMSAT," Communications Satellite Corporation)

Common Stock
(\$0.05 par value)

Copies of the Prospectus may be obtained from the undersigned in any state where the securities may lawfully be offered.

A. G. Becker & Co.

INCORPORATED

CIRCLE 93 ON READER CARD

new literature

sign of payroll systems. Included are descriptions of the linkage, parameters and interface procedures required for the ALLTAX software package. **MANAGEMENT INFORMATION SERVICE**, Stony Point, N.Y. For copy:
CIRCLE 210 ON READER CARD

RPG DOCUMENTATION: Eight-page brochure describes **DOCUMATIC**, automatic documentation system for IBM S/360 Report Program Generator language. The system produces English documentation of programs written in RPG and produces output in six forms: system pictorial, input narrative, input record layout, description of processing, output narrative, output record layouts. **DATA USAGE CORP.**, Fort Lee, N.J. For copy:
CIRCLE 211 ON READER CARD

TAPE RECORDING & STORAGE: Eight-page brochure discusses the concepts, techniques, advantages and limitations of digital magnetic tape recording. **TALLY CORP.**, Seattle, Wash. For copy:
CIRCLE 212 ON READER CARD

OCR NOW? Twelve-page booklet discusses advantages, problems, and applications of optical scanning. **GRAPHIC CONTROLS CORP.**, Buffalo, N.Y. For copy:
CIRCLE 213 ON READER CARD

DISC MEMORY: Eight-page brochure describes **DSU-8100** disc memory of modular design (for customized capacity and expansion), featuring single-disc security and multi-computer capability. The unit consists of one or more disc drive modules, each driving from one to four disc storage modules selected from four standard models (which may be intermixed for best price/performance combination). Average access time is 16.7 msec; 25 msec for economy modules. **COMPUTER PERIPHERALS CORP.**, San Diego, Calif. For copy:
CIRCLE 214 ON READER CARD

ENGLISH FOR IS&R: 16-page report discusses requirements for an information retrieval language that enables users to employ natural language sentences in interaction with computer-stored files. Anticipated modes of operation of the system are outlined. AD-673 899. Cost: \$3; microfiche, \$.65. **CLEARINGHOUSE, U.S. DEPT. OF COMMERCE**, Springfield, Va. 22151.

PAGE READER SYSTEM: Eight-page brochure describes Model 300 page reader featuring multi-font reading capability (optional hand-print characters available); editing capacity (off-line optional); reading speed of up to 400 cps from paper 6-12" in width, 8-14" in length (continuous forms optional), 15-24 lbs. weight. **SCAN-DATA CORP.**, Norristown, Pa. For copy:
CIRCLE 215 ON READER CARD

ENGINEERING MANAGEMENT: 120-page book contains 13 papers from the 16th Annual Joint Engineering Management Conference which focus on present methods utilized by engineering managers to effectively use the computer and future aspects of computer utilization. Cost of "Computer Impact on Engineering Management" is \$5. **INSTRUMENT SOCIETY OF AMERICA**, Publications Dept., 530 William Penn Pl., Pittsburgh, Pa. 15219.

DATA GENERATOR: Data sheet describes Model 212 75 MHz, 16-bit data generator with simultaneous +5V and -5V NRZ outputs and $\pm 2V$ baseline offset. **DATAPULSE, INC.**, Culver City, Calif. For copy:
CIRCLE 216 ON READER CARD

TIME-SHARING SYSTEMS: Twelve-page brochure describes the company's line of four on-line time-sharing computer systems for both conversational and batch mode operation. Hardware and software elements and areas of application are included for each. **SCIENTIFIC DATA SYSTEMS**, El Segundo, Calif. For copy:
CIRCLE 217 ON READER CARD

COMPUTATIONAL LINGUISTICS: 68-page bibliography cites 664 U.S. and foreign articles, reports, and books particularly relevant to computational linguistics, with selective coverage in classification theory, computation and programming, computers and hardware, documentation, and social-science uses of computers as language processors. AD-673 474. Cost: \$3; microfiche, \$.65. **CLEARINGHOUSE, U.S. DEPT. OF COMMERCE**, Springfield, Va. 22151.

DATA SET: Four-page bulletin gives specifications and functions of the T202D data set that transmits/receives asynchronous serial digital data

over direct distance dialing networks at rates up to 1200 bps and over private communication channels at up to 1800 bps. The unit has end-to-end compatibility with Western Electric 202 series data sets, type 804A data auxiliary sets, and 801A & C automatic call units. **SANGAMO ELECTRIC CO.**, Springfield, Ill. For copy:
CIRCLE 218 ON READER CARD

INTERNATIONAL COMPUTER GUIDE: Four-page brochure describes two-volume loose-leaf international computer notebook which includes a guide to domestic computer systems, plus detailed evaluations and comparisons of more than 100 systems manufactured in Europe and Japan. Monthly updates are provided. **AUERBACH INFO, INC.**, Philadelphia, Pa. For copy:
CIRCLE 219 ON READER CARD

MEMORY COMPONENTS: 16-page brochure describes the company's line of ferrite cores, commercial and military stacks and systems. **ELECTRONIC MEMORIES**, Hawthorne, Calif. For copy:
CIRCLE 220 ON READER CARD

UNIVAC/IBM COUPLERS: Four-page brochure describes devices for coupling IBM 360 (30 through 70) and Univac 418, 490, 494 and 1108 computers. Diagrams illustrate the I/O relationship between the computers and the formal translations of character or alphanumeric data for inter-computer communication. Also included is software and application data. **DATAMETRICS CORP.**, Van Nuys, Calif. For copy:
CIRCLE 221 ON READER CARD

DISPLAYS AND COMPONENTS: Eight-page brochure describes the company's line of crt displays, display panels, annunciators, transistor controlled indicators, subminiature indicators, switch-indicators and digital and alpha readouts. **TRANSISTOR ELECTRONICS CORP.**, Minneapolis, Minn. For copy:
CIRCLE 222 ON READER CARD

INTEGRATED CIRCUITS GUIDE: 180-page book, written as background for electronic management, planning and financial personnel, gives the economic, technical and industrial factors involved in the marketing, purchasing and utilization of integrated circuits. Includes a review of the commercial integrated circuit suppliers, pricing, price projections and analysis of the market. Cost: \$50. **INTEGRATED**

An aircraft carrier may be a very big ship but it's also a very small airport.

Over the past few years the Navy's planes have grown more and more complex. A lot more maintenance checks had to be made—and a lot more men and equipment were needed to make them.

All of which took more time and more space. The trouble is on an aircraft carrier you never have enough of either.

The advantage of UNIVAC® computer systems is they save on both.

The Navy worked with Univac engineers to develop a computer system that would check and troubleshoot equipment by zipping impulses through a plane's electronic package.

The system is called VAST—for Versatile Avionic Shop Test.

VAST will do routine aircraft maintenance in a fraction of the time taken by the equipment it replaces.

It will also take less than half the space.

It will cut down on the men needed by twenty-five percent.

VAST is easier to use so it will

be easier to train men to use it.

And it can be shared by six different repair crews at the same time.

Univac systems are at work in many fields. In industry, science, education and government.

On five continents.

And the seven seas.

UNIVAC

Univac is saving a lot of people a lot of time.

 SPERRY RAND

CIRCLE 94 ON READER CARD

When it comes to expanding facilities, some airports are at a disadvantage.

So the Navy uses computer systems to keep its planes shipshape.



We need the best problem-solvers in the business to work on the best variety of programs in the business.

At McDonnell Douglas, you'll have an opportunity to solve problems in fields ranging from real estate to nuclear propulsion, from hospital management to space logistics, from retailing to construction, from advanced aircraft to marketing research.

Our data facilities comprise several of the country's largest, most modern computer systems. They serve our own exciting business and scientific programs in aircraft and astronautics, as well as commercial Datadrome customers throughout business, industry, science, government and education.

To keep pace with our expanding activities, we need more top people: **scientific programmers, math modelers, digital computer analysts, business programmers, systems analysts, consultants, marketing representatives and sales engineers.**

If multi-project problem-solving is the kind of challenge you're looking for, just send the coupon, with your resume if available.

We have openings in St. Louis, Southern California, Washington, D.C., and New York.



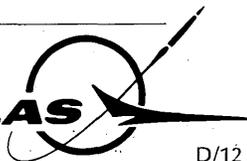
Mail to: Mr. W. R. Wardle, Professional Employment, Box 14308, St. Louis, Mo., 63178
or: Mr. P.H. Kilgore, Professional Employment, 3000 Ocean Park Blvd., Santa Monica, Calif. 90406

Name _____
 Home address _____
 City & State _____ Zip Code _____ Phone _____
 Education: BS _____ MS _____ PhD _____ Major Field _____
(date) (date) (date)
 Primary experience area _____
 Present position _____

Area choice: East Midwest West Best Opportunity

MCDONNELL DOUGLAS

An equal opportunity employer



D/12

CIRCLE 300 ON READER CARD

new literature

CIRCUIT ENGINEERING CORP.,
4900 E. Indian School Rd., Phoenix,
Ariz. 85018.

CRCT: Brochure describes 0707 low-speed, low-cost card reader communications terminal. Both half- and full-duplex devices are available, the latter being especially applicable as an input terminal for computer time-sharing centers. UNIVAC, Philadelphia, Pa. For copy:

CIRCLE 223 ON READER CARD

CORE MEMORIES: Four-page bulletin describes ECOM, first in a series of core memory systems designed for general system applications requiring random access to moderate amounts of digital data. The system features expandable capacities from 1,024 to 4,096 words of up to 16 bits each and a cycle time of 2.5 usec. STANDARD MEMORIES, Sherman Oaks, Calif. For copy:

CIRCLE 224 ON READER CARD

MEMORY SYSTEMS: Four-page bulletin describes the company's READ-Only memory systems, giving specifications, timing diagram, block diagram, principles of operation, and a discussion of the state-of-the-art using the braid transformer principle. These memories have a maximum capacity of 20,480 bits and 200 nsec access time. MEMORY TECHNOLOGY INC., Waltham, Mass. For copy:

CIRCLE 225 ON READER CARD

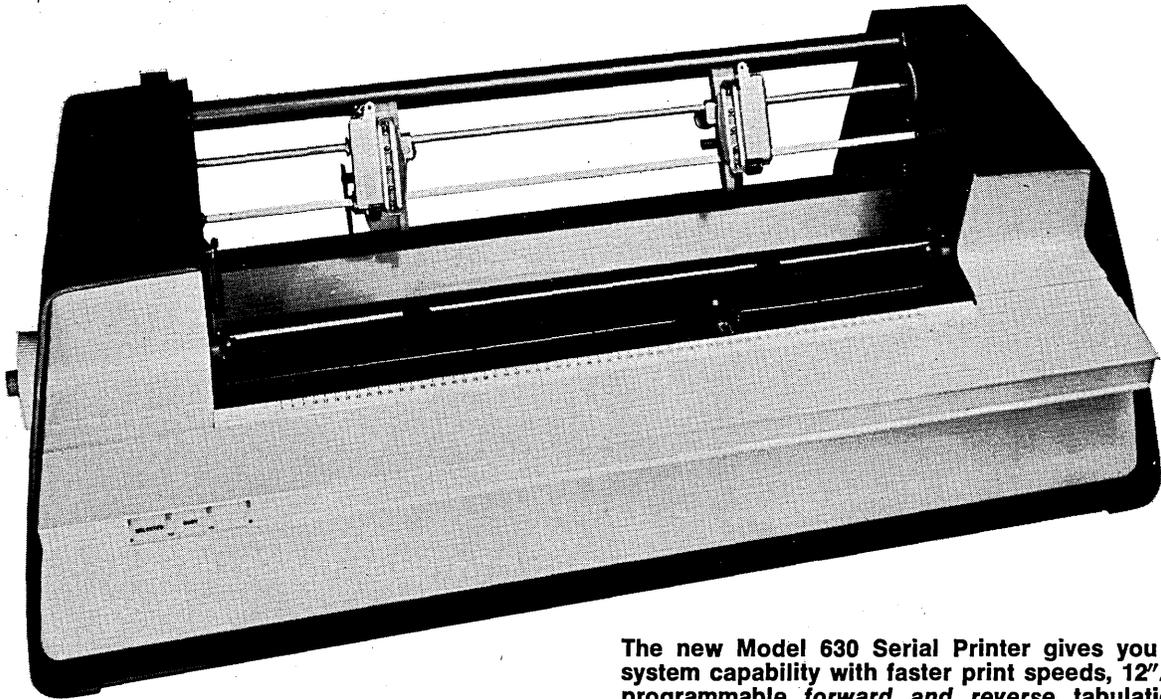
A/D CONVERTERS: Eight-page brochure describes the company's line of A/D converters operating on the principle of dual-slope integration, and discusses A/D conversion in general. THETA INSTRUMENT CORP., Fairfield, N.J. For copy:

CIRCLE 226 ON READER CARD

SERIAL CHARACTER PRINTER: Data sheet describes the SCP-12 printer which provides a fully digital printout capability for all makes of light beam galvanometer oscillographs. The 35-pound rack-mounted unit prints 12 numeric characters along the edge of the oscillogram in time coincidence with the analog trace. The analog record may then be directly correlated to the numerical information at any oscillograph speed, up to 1500 cps. ADTROL ELECTRONICS, INC., Philadelphia, Pa. For copy:

CIRCLE 227 ON READER CARD

New printer lets you cut data system design time



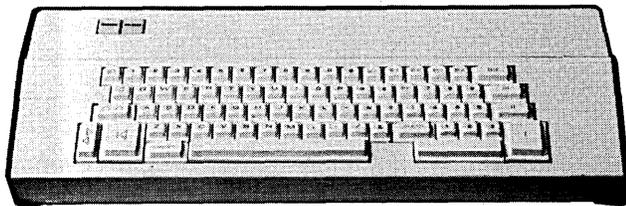
Now you can get a head start on building a data system for tomorrow's market. That's the idea behind Litton Automated Business Systems' new data system components for original equipment makers — and users who want to put together a system based on their particular needs.

The Model 630 is a completely new and different serial impact printer. It features a moving printwheel that allows faster, more efficient operation. Electronically controlled stepping motors cut down on moving parts — providing high reliability, low maintenance and longer

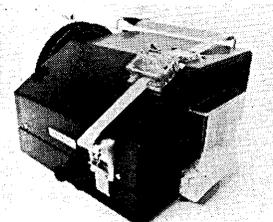
The new Model 630 Serial Printer gives you greater system capability with faster print speeds, 12"/second programmable forward and reverse tabulation, and automatic format control.

life. Positive detent assures smudge-free printing. The Model 630 can be ordered with tractor feed or split platen. A companion keyboard is also available.

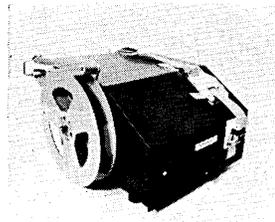
OEM products include reliable 50 cps. paper tape punches and readers in a variety of configurations. Series 500 Tape Punches and Readers give you such advanced design features as small, efficient electromagnets in combination with over-center springs for smooth, trouble-free punching over a long life — reluctance type pick up — bi-directional reader — semi-automatic tape feed.



Companion keyboard



Tape Punch



Tape Reader

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Litton Automated Business Systems
OEM Products Division
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Carlstadt, N.J. 07072

Please send me complete information on your new data system components.

Name _____ Title _____

Company _____

Street _____

City _____ State _____ Zip _____

AUTOMATED BUSINESS SYSTEMS
DIVISION OF LITTON INDUSTRIES



How to cut out your programming backlogs.

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Give me more information about your Programming Group.

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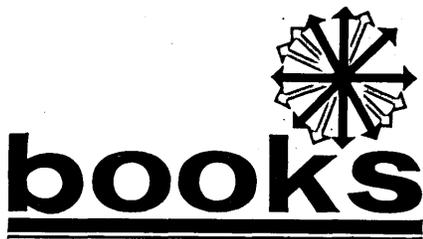
The Service Bureau Corporation

If you use computers, then we don't have to tell you that keeping up with them is a job for Superman. (There just aren't enough trained people to go around.)

That's why you'll be interested in SBC's Programming Group. These specialists can program any second or third generation computer in any user language, in any operating system. And develop software, too. They've got the technical experience to sophisticate your applications for real-time, on-line or off-line systems. Whether you own, lease or are just contemplating, let us assign a programming analyst to your project.

If you want to cut out programming backlogs (of course you do), cut out and mail us this coupon. Or contact our nearest SBC branch office listed in the Yellow Pages.

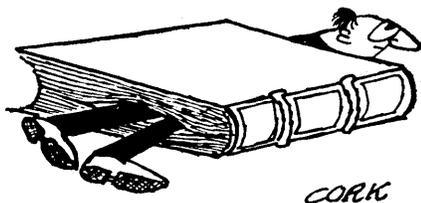




books

The Technology of Teaching, by B. F. Skinner, Appleton-Century-Crofts, New York, N.Y. 1968. 271 pp. \$2.95 (paper-bound).

It may come as a surprise to some people in the computer field—even to some who are directly involved in computer-assisted instructional work—to learn that the first man in the U.S. to suggest that machines could be used effectively in the instructional process was an experimental psychologist. It was Skinner's 1954 article entitled "The Science of Learning and the Art



of Teaching" which started activities in teaching machines and programmed instruction, and this article is included in the 11 chapters which comprise *The Technology of Teaching*.^{*} This book brings together material which covers 14 years of work by one of the country's most productive researchers and articulate writers.

The Technology of Teaching is essential reading for anyone concerned with the planning, design, development, implementation, or evaluation of computing systems used for instructional purposes. Although Skinner's primary interest in this book is to affect formal education, his comments apply with equal force to teaching practices which are found in other environments—such as business, industry, and government.

Skinner's comments throughout this book are based upon the experimental analysis of behavior, which shows that learning is a function of contingencies of reinforcement. This is to say that learning takes place when the following three variables are properly arranged: "... (1) an occasion upon which behavior occurs, (2) the behavior itself, and (3) the consequences of the behavior." In a short but brilliant

^{*} Four of the chapters were written especially for this book; three chapters are papers presented during 1966, but not previously published; and four have been published elsewhere.

introductory chapter, Skinner considers three traditional ways of characterizing learning and teaching.

The model which says "We learn from experience" suggests that the teacher should bring the student into contact with a wide range of experiences, appropriately selected and interpreted. The current emphasis on multi-media instructional material—in classroom as well as computer-based settings—is often defended on the grounds that the more varied the student's experiences, the better the learning.

"We learn by doing." This model, first suggested by Aristotle, stresses the essential role of the students' active participation. Simulation and gaming, when used for instructional purposes, seek to teach by having the student engage in the required behavior.

"We learn by trial and error." This formulation implies that correct behavior is "... simply what remains when erroneous behavior has been chipped away." Sometimes it is also taken to imply that a student must make errors in order to learn.

Skinner then points out that these classical theories each represent one part of any set of contingencies of reinforcement: learning from experience emphasizes the occasion upon which the behavior occurs; learning by doing

emphasizes the behavior itself; and learning by trial and error, the consequences. "But no one part can be studied entirely by itself, and all three parts must be recognized in formulating any given instance of learning. It would be difficult to bring the three theories together to compose a useful formulation. Fortunately we do not need to do so. Such theories are now of historical interest only, and unfortunately much of the work which was done to support them is also of little current value. We may turn instead to a more adequate analysis of the changes which take place as a student learns."

The remaining ten chapters describe the findings of this analysis, and show how they apply to the central issues in American education today. While it would be impractical to summarize the entire book in this brief review, I shall quote Skinner's comments on three points of particular concern to people in the computer field who find themselves involved in making decisions pertinent to these points.

Multiple-choice questions: "In a multiple-choice program ... the student selects his response from an array, and each item in the array acts as a prompt. We have seen that when wrong choices are prompted, the student makes mistakes which he would

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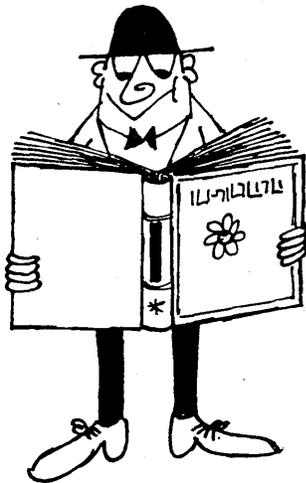
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never make without help. When a right choice is prompted, we never know whether the behavior could have been evoked solely by the variable to which control is to be transferred. . . . Multiple-choice tests are easily scored by hand or machine and programs are often written in the multiple-choice format because they can then be presented by machine, particularly by computers, but these practical advantages are offset by the inadvertent effects of prompts. A common answer to this objection is that all behavior is a matter of choice. When a student types an answer, is he not 'choosing' among twenty-six or more keys? But the point is that *the twenty-six keys do not prime right or wrong responses.*"

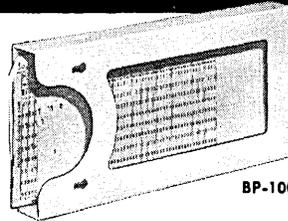
Audio-visual aids: ". . . audio-visual aids usually come at the wrong time to strengthen the forms of behavior which are the principal concern of the teacher. An interesting page printed in four colors reinforces the student simply for opening the book and looking at it. It does not reinforce reading the



page or even examining it closely; certainly it does not reinforce those activities which result in effective recall of what is seen. . . . In good instruction interesting things should happen *after* the student has read a page or listened or looked with care. The four-color picture should *become* interesting when the text which accompanies it has been read. One stage in a lecture or film should be interesting only if earlier stages have been carefully examined and remembered."

The discovery method of instruction: "If the student can be taught to learn from the world of things, nothing else will ever have to be taught. This is the method of discovery. It is designed to absolve the teacher from a sense of failure by making instruction unnecessary. The teacher arranges the envi-

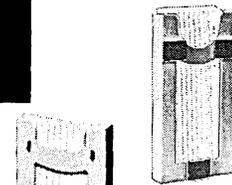
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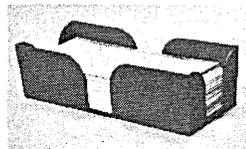


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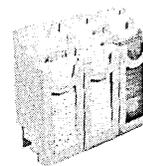


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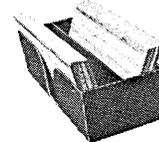
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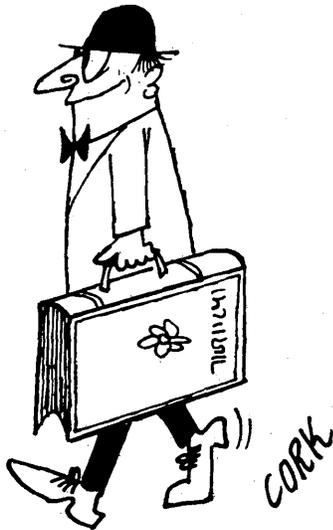
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ronment in which discovery is to take place, he suggests lines of inquiry, he keeps the student within bounds. . . . The human organism does, of course, learn without being taught . . . and it would no doubt be a good thing if more could be learned in that way . . . There are reinforcing elements of surprise and accomplishment in personal discovery which are welcome alternatives to traditional aversive consequences. But discovery is no solution to the problems of education. A culture is no stronger than its capacity to



transmit itself. It must impart an accumulation of skills, knowledge, and social and ethical practices to its new members . . . It is quite impossible for the student to discover for himself any substantial part of the wisdom of his culture . . . Great thinkers build upon the past, they do not waste time in re-discovering it. It is dangerous to suggest to the student that it is beneath his dignity to learn what others already know, that there is something ignoble (and even destructive of 'rational powers') in memorizing facts, codes, formulae, or passages from literary works, and that to be admired he must think in original ways."

The foregoing passages were selected to give the reader a sample of the range of issues addressed by Skinner in this book. Anyone who is drowning in the technical and administrative details of CAI system planning or implementation should pause occasionally to ask himself "Precisely what is it that should happen when the student sits at the terminal and is in contact with the instructional material?" *The Technology of Teaching* provides some persuasive suggestions in answer to that question.

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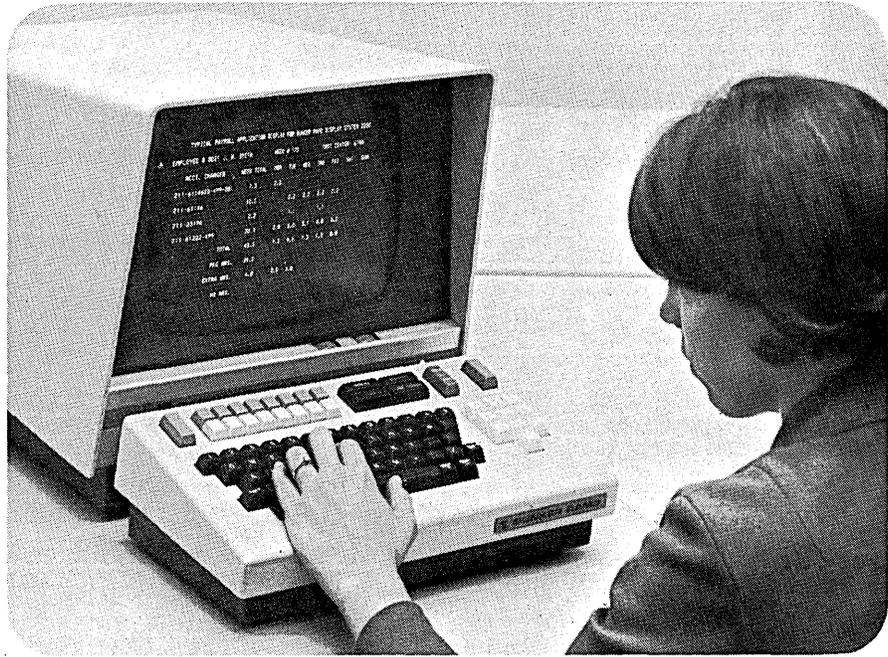
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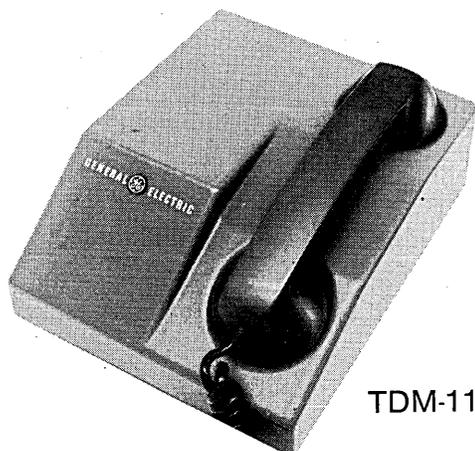
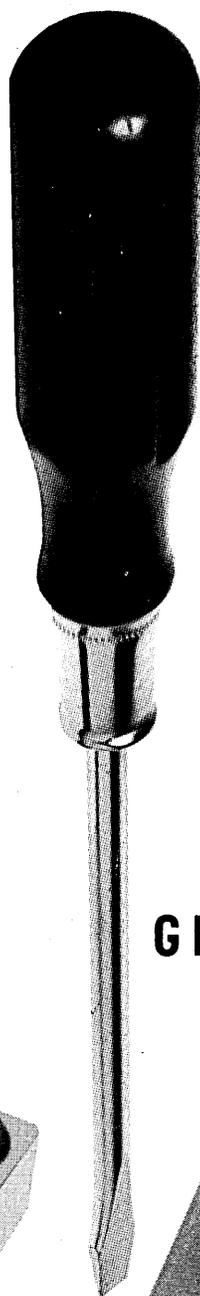
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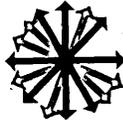


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vision. . . . **Dr. Jack Moshman**, Leasco Systems and Research vp, has been appointed chairman of the Computer Sciences and Technology Advisory Panel of the National Bureau of Standards. . . . **Henry E. Stelzer**, formerly with Mohawk Data Sciences, has joined Sangamo Electric Co. as product manager for the company's Data Station line. . . . **Edwin L. Podsiadlo** has been appointed vp-marketing for Data-Ram Corp., Princeton, N.J., manufacturers of ferrite-core memory planes, stacks and systems. Most recently he was product manager, memory systems, for Ferroxcube. . . . Univac has appointed **James V. Lowe** as western region manager for the Information Services Div. **Robert F. Donnelly** has been named director of contracts for the company's Federal Systems Div. . . . **Dr. Reinhold P. Sell**, most recently director of product planning and market research for Honeywell's computer operations in Europe, has been appointed director of the company's EDP Div. in Germany. . . . **Gerald M. Bestler** has been named president of Circuitron, Inc., newly acquired subsidiary of Fabri-Tek. He

had been with Univac in Minneapolis as manager of marketing in the computer graphics division. . . . **William Orchard-Hays** has joined Management Science Systems, Rockville, Md., consulting and software development firm, as chairman of the board and chief technical officer. He comes from Orchard-Hays & Co., subsidiary of Computer Applications Inc. . . . **Charles A. Merchant**, formerly manager of the corporate systems and programming staff at Raytheon, has been appointed director, information services, at Lincoln Institute Inc., Wellesley Hills, Mass. consulting firm. . . . **International Computers Limited**, London, has formed a Systems and Applications Programming Organization, the largest software organization in Europe, to be headed by **D. J. Blackwell**. He was formerly manager of the English Electric Computers systems programming division. The new firm is building headquarters at Bracknell, England. . . . URS Co. has announced three promotions: **Kenneth Kaplan**, former director of theoretical and applied mechanics of the Burlington Research Div., to vp, planning, San Mateo, Calif.; **William Plette**, now vp, to continue as director of plans and concepts of the Information Sciences Div., Falls Church, Va.; **Joseph**

Strnad, to continue as assistant gm of the Information Sciences Div., now a vp. . . . Under Secretary of Housing and Urban Development **Robert C. Wood** has received the Norbert Wiener Sterling Medal of the American Society of Cybernetics for his efforts in "bringing to bear the powers of science and technology to the problems of modern American cities." . . . **Walter C. Christensen**, former acting director of technical information for the Dept. of Defense, has been appointed gm of special systems of McGraw-Hill Information Systems Co., New York City. . . . Honeywell has appointed **Robert E. Clifford** as western area vp. He has been with the company since 1951 in various marketing positions. . . . **John P. McGivern** is now manager, rates and tariffs, for ITT World Communications Inc. . . . **Dr. Jacob E. Goldman** has joined Xerox as group vp, research and development. He had been director of Ford Motor Co.'s scientific laboratory at Dearborn, Mich. . . . **Clarence S. Margach**, vp Education and Training, Addressograph-Multigraph Corp., has been elected 1969 chairman of the Business Equipment Manufacturers Assn. **Clarence W. Spangle**, vp and gm of Honeywell's EDP Div., is vice chairman. . . . **Henry H. Greer**, exec vp, has been elected to the board of directors of Computer Response Corp., Washington, D.C. . . . **Alfred J. Henry**, Captain USN (Ret.), formerly commanding officer Naval Command Systems Support Activity, Washington, D.C., has joined Logicon/San Diego as a member of the technical staff for planning. . . . **Samuel I. Hendler**, general counsel to The Computer Exchange, Inc., New York, has been elected to the firm's board of directors. . . . **Lorne H. King**, vp/domestic relations, Mohawk Data Sciences Corp., has officially announced his retirement, but will retain his membership on the board of directors. . . . **William H. McKenzie**, former assistant director of the NYSE's Electronic Systems Center, has joined Auerbach Associates, Philadelphia, as program manager and project director, social information systems section. . . . **Richard M. Bird**, former director of edp and project manager at National Gypsum Co., is now manager of corporate systems at Allis-Chalmers, Milwaukee. . . . **Dr. Jerry Davey** is the new president of Credit Data Corp. . . . **Gary K. Hubbard**, most recently with Pillsbury Management Systems, is now vp and gm of Information Network Corp., recently formed time-sharing subsidiary of Wabash Magnetics. . . . **Glenn E. Rider** has joined Brandon/Gaynes Medical Systems, Inc., new medical services company initially operating in the midwest, as director of operations. ■

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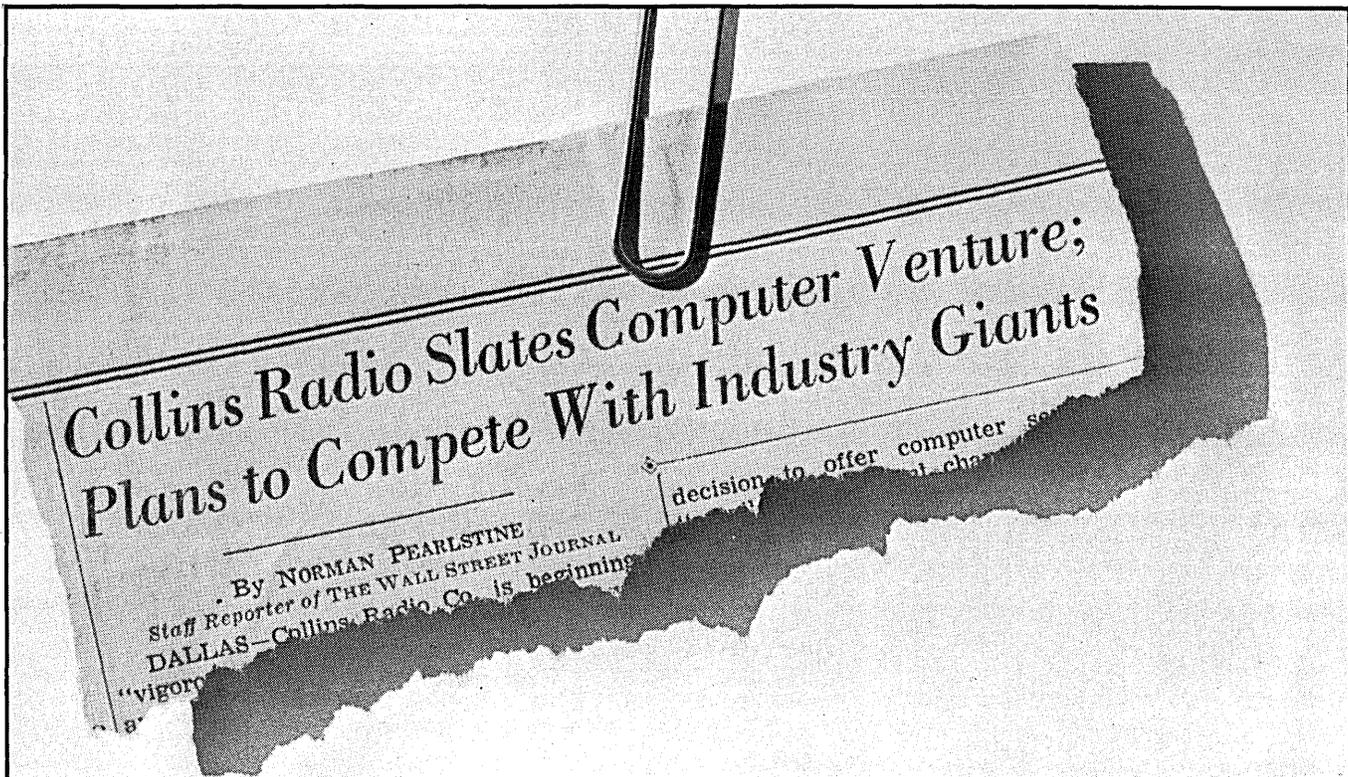
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POPULUS TO PAY TAXES IN ITALY

All the old blarney about computers and social revolution is about to come true with a vengeance in Italy; and unless there has been some covert change of heart round the sunny Mediterranean, reactive fireworks can be expected, for the Italian Government has a \$12 million project afoot that should end up with the populus actually paying taxes (Univac is tipped as the supplier of hardware). To other Europeans, the attitude of the Italians toward their tax laws is a constant source of amusement and also of sympathy for citizens who win most of the time over the incompetence of a swollen bureaucracy. But make no mistake about the seriousness with which the tax evasion game is played. Against this background there is little surprise at the secrecy that has surrounded the planning of a system that should cut ruthlessly through red tape to get at the Italian's paypacket.

NCR IS AFTER EUROPEAN MONEY

With Washington still keeping the screws down on money outflow for overseas capital expenditure, NCR has gone for a firsttime stock quotation in London to raise over \$28 million for manufacturing expansion in Europe. Already one of the biggest production units in Scotland, NCR has been rapidly increasing its buildup with Century series machines as well as the big demand that has come for more traditional equipment now that the UK is preparing for the changes from sterling to decimal currency by '71.

Burroughs has joined the money scramble, is trying to raise \$20 million to expand Scotland manufacturing facilities, to build 2500, 3500 and discs.

EUROPE PREPARES TO CONTROL RESOURCES

With the problems facing both industrially developed nations and the emerging countries on the need to practice better water resources management and prospecting, the council for the International Hydrological Decade is preparing specifications for a computer system that can be adopted by any of its 21 members. At a recent meeting in Paris at Unesco headquarters, it was agreed to produce a document on Saphydata, a system for acquisition, transmission and processing of hydrological data. This will be a composite system derived from countries with some experience in this field.

COMPUTER GROWTH NEARLY DOUBLES

Generally accepted figures for computer growth in Europe put the annual increase in units at 28% and in cash at about 45%. A recent analysis by Commerzbank suggests that Germany will continue as one of the big three markets. The cumulative total at the beginning of '68 was just under 4,000 machines.

In common with other European countries, the Postal Administration is one of the biggest single users with 28 machine installations. IBM has 57% installed and 65% on order, with a 20% sales increase last year. Siemens ranks second with its subsidiary ZUSE to take 11% of the business. But in the process field, Siemens supplies better than one out of two customers. Univac has 9% with Bull-GE hot on its heels with 8%. The remainder is split among 19 firms. Up to 1971 the Federal Government intends to allocate DM 470 million in the form of grants, including low

(Continued on page 185)

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world report

interest credits, for research and development. In the past the government share in research assignments has been about 4% of expenditure. Most government-backed work so far has been through the German Research Association and basic research at universities. Support for the dp section will come through the Minister for Economic Affairs. The most significant change in the market over the past two years has been an upswing in demand for medium machines, which has risen from 25% of the market to between 35 and 40% this year.

INVASION OF EUROPE BY LEASING CONCERNS

The invasion of leasing corporations is another change in Europe over the past months. The most dramatic has probably been the arrival of Leasco, which started by enticing Dr. Sandy Douglas from British Petroleum's subsidiary, Scientific Control Systems, to be followed by ICL's software king, Peter Hunt. Establishment of the software division came almost faster than Leasco's scale charges that fitted the UK scene. Then, almost as rapidly, Leasco put in a breathtaking \$10 million bid for Inbucon---the controlling company of Associated Industrial Consultants, which is one of the household names among British management consultants, but nevertheless not a name that has been conjured with to any extent in specialised computing fields. However, the object is to get a packaged deal out so that AIC's entree to a large number of companies in the UK and on the Continent would allow Leasco to put out offers combining machine leasing and software contracting, together with management and general industrial consultancy services. Certainly, a possible new way into a sector that has confounded a number of United States software houses that have come to grief with efforts at transatlantic trading. As well as Leasco, other third party entrants to the scene include both Boothe and Diebold leasing organizations.

PALEVSKY COURTS RELUCTANT CUSTOMERS

Against this plethora of activity, Max Palevsky's visit to the UK to revive flagging interest in SDS interests was almost an affair of conservative anglo-saxon understatement. That was until he implied an obituary for PL/I that had IBM falling over itself because big cheese has its largest UK customers securely in the trap. Palevsky was undertaking a piece of firefighting in an area where fortune has not smiled so sweetly on SDS. An earlier association with British General Electric Company came apart at the seams in the spate of industrial mergers that has filled so many columns in World Report recently. Although not reticent about the great love affair he could have with the British, Palevsky was less than eloquent about the success he has had already with the French---but there again the specs of the machines in the new French organization CII's range speak for themselves.

BITS AND PIECES

BOAC switched on its \$100 million system, Boadicea, which will do an IMIS job for the airlines as well as reservations, amidst rumors that Alitalia is doing the same job at about 1/3 the cost...Nigel Morgan and Janet Purnell of Scientific Control Systems have come up with a program that can spot gaps in the marketplace for specific products. Test run on the program was a survey of political attitudes that discovered a group that would accept a party platform determined mainly by self-interest, and similar in character to the Wallace third party effort---they want to keep the cliffs of Dover white.

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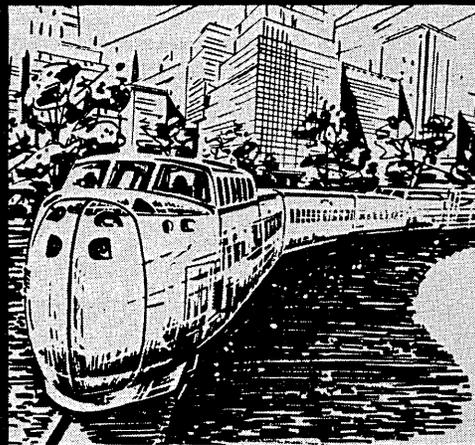
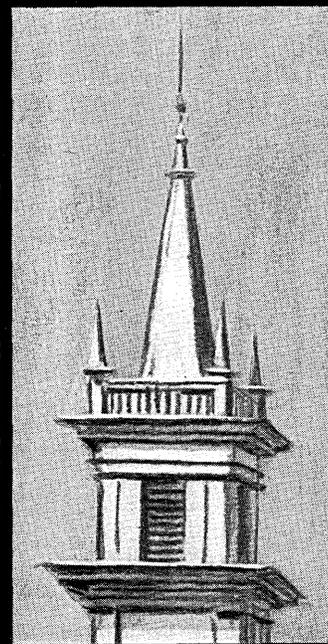
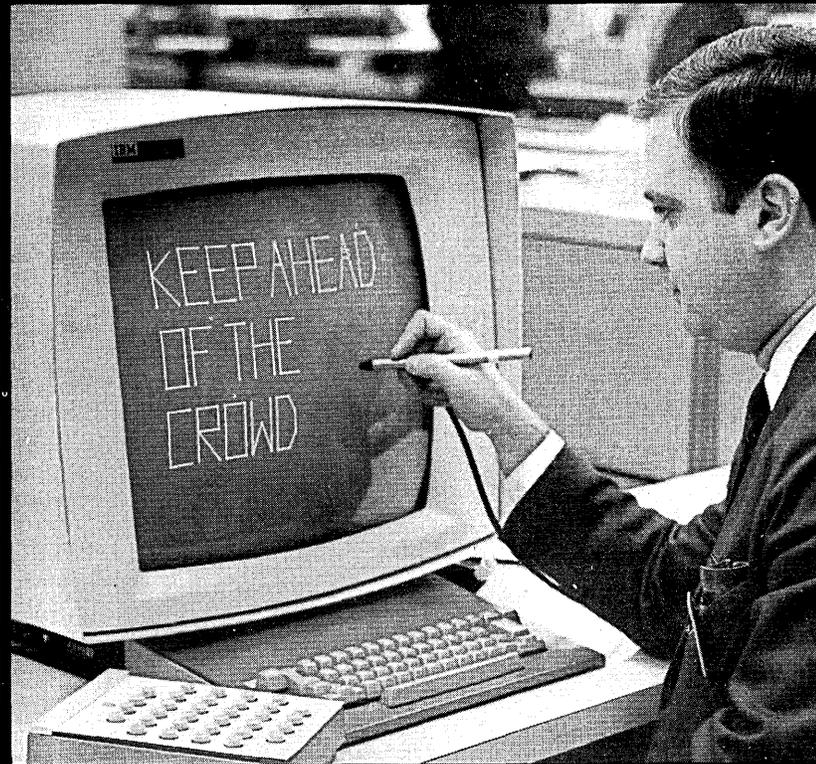
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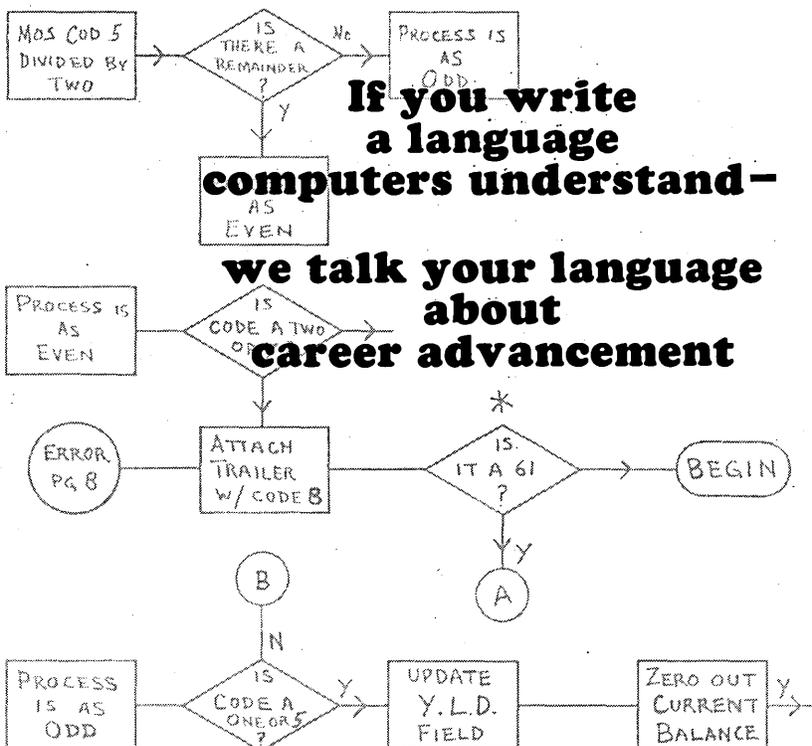
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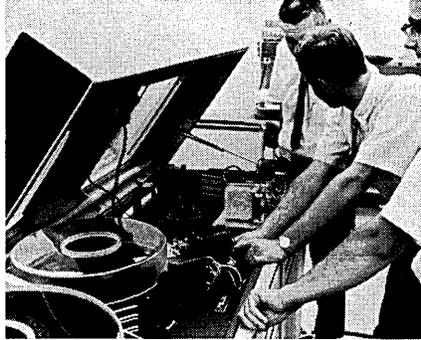
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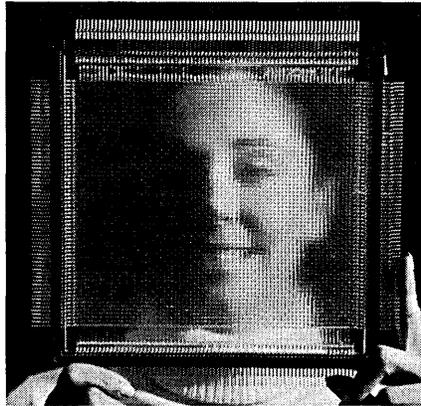
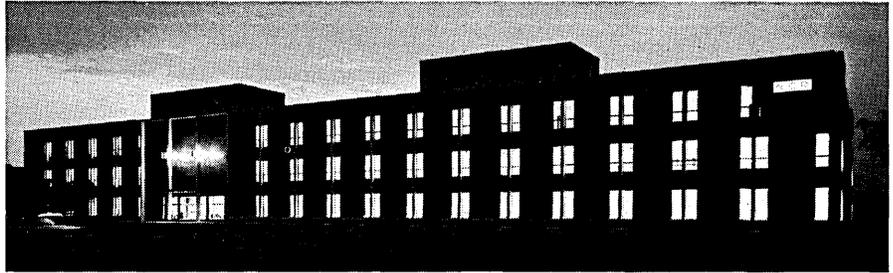
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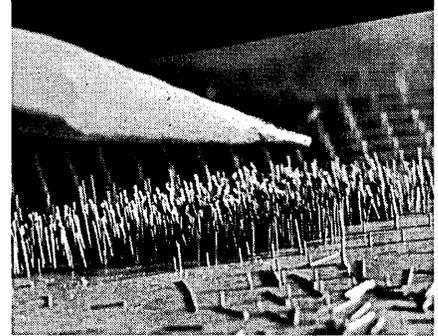
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Confidential interviews will be held at the St. Francis Hotel during the Fall Joint Computer Conference in San Francisco, Dec. 9-11. To schedule an appointment, submit detailed resume including salary history to Steve Williams at the Division. If you do not plan to attend FJCC, an interview will be arranged soon in your area.



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washington report

MAINFRAMERS AVOID TELLING THE TRUTH

None of the major mainframe makers are willing to comply with the Truth in Negotiation Act, GSA Administrator Lawson Knott told the Joint Economic Committee last month, and the government is unable, right now, to do much about it.

The act requires certain federal suppliers to disclose the cost on which their bids are based. Knott said the computer makers demur when they offer equipment that starts a new commercial line. The government is left with the choice of waiving the cost disclosure requirement or buying elsewhere. Procurement officers choose the former alternative to save money. Knott said GSA will continue, during '69, to try persuasion, but if that fails, "we will consider proposing appropriate legislation early in calendar 1970 that will require the submission of such data."

CAVENEY SIGHTS NEW TILTED WINDMILLS

Dick Caveney, whose likeness is rumored to hang in one of the pistol ranges at the Pentagon, has further endeared himself to military policymakers by asking the Comptroller General to halt procurement of the Worldwide Military Command and Control System.

To many government and dp industry executives, Caveney is a Don Quixote tilting at bureaucratic windmills; but informed observers respect Caveney's influence---on the Hill, and possibly more important, in the Nixon entourage. "I wouldn't be surprised," says one, "if Caveney goes to work for the federal government next Jan. 20th." In his "Wimmics" protest, Caveney said live tests impose "tremendous costs" on a mainframe maker who bids an independent manufacturer's peripherals, and result in a tremendous waste of tax dollars.

The Wimmics protest was filed shortly before GAO turned down Caveney's earlier complaint covering procurement of a computerized accounting system for the AF Accounting and Finance Center in Denver. He had charged that a mainframe maker who wanted to bid an independent's peripheral gear couldn't do so because the AF bid schedule didn't allow enough time. Caveney argued that the independents should be allowed to submit bids, on their own, for system components.

GAO rejected both contentions, largely on the basis of a GSA evaluation that concluded that the AF bid schedule was not "unduly restrictive," and generally approved AF benchmark procedures, although criticizing them for "excessive caution with respect to technical excellence."

Caveney says he is "going straight to Congress" with his AF complaint. "GSA has no business managing federal dpe procurement---they don't know enough about the equipment or the industry, and their evaluation of my complaint is a perfect example of their incompetence."

CAPITOL BRIEFS

Six of 8 mainframe makers who were given an advance peek at the ASCII implementation letter have commented on it. Honeywell was reported to be violently opposed; CDC was somewhat more restrained but equally against the proposed controls; IBM objected "mildly"; Univac was "neutral"; GE and NCR were said to be favorable...In FY '68, GSA's adpe sharing program provided machine time worth \$70.6 million.

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programmable intensities. The maximum random position time (for going from a spot in one corner to the opposite) is 40 usec; the FR-80 will draw a line from between those corners in 1 msec. If characters, rather than spots or lines, are desired, a set of 90, in up to 64 sizes and at five different rotations, may be used. The rate for drawing characters is 10K/sec. Output from the system may be 16mm or 35mm film, sprocketed or unsprocketed.

The FR-80 will set you back about \$225K, compared, for instance, to the half-as-fast Calcomp model 840, which goes for about \$143K. Neither the optional graphics package (with the light pen, an extra 4K of memory, and associated software) nor the optional 333K 18-bit word disc are included in the \$225 figure.

The market--which will probably run \$15 million in '69, \$40 million in '70--is getting crowded. Calcomp announced a unit at the FJCC, and Burroughs has been pitching a new one.

SANTA MONICA THINK TANK OFFERS COMMERCIAL SOFTWARE

No, no, not them. Technology Service Corp. is a systems and software house, headed by Peter Swerling, formerly of Rand, and at present employs 33 people, 24 of whom hold doctorates. The company was formed in Feb. '67 and billed \$275K its first fiscal year providing space surveillance systems to the military. The firm will now market some of the software programs it has developed, which include a conversational accounting program in Super Basic, a set of pattern recognition and system identification programs called Probe. The firm currently bills \$50K a month, has outgrown its original quarters and is now in two Santa Monica locations.

MYSTERY COMPANY ANNOUNCING FIRST OF LOW-COST DEVICES

A prewired keyboard that can be customized at no charge, that can transmit in binary, touchtone or any other code up to 9 levels, and that costs under \$100 is the first product of Peripheral Data Systems, Worcester, Mass. PDS, a division of Synergistics, Inc., has quietly been working on this and a host of other low-cost data collection and input devices for the last 2½ years. The 16-man group says it can now produce 1500 keyboards/month, and will next month announce details and schedules for keyboard input units, a new kind of credit card, and credit card reading devices--for openers. Example of cost on the keyboard is that a touchtone-transmitting board with 401E data set can be rented for about \$10/month.

IBM BUYS INSURANCE

IBM's hiring of Attorney General Nicholas Katzenbach as vp and general counsel is an attempt to bolster its defenses against the Justice Department's quiet, but persistent surveillance, says a source in a position to know. "IBM is determined to avoid a confrontation. They need someone like Katzenbach to tell them--accurately and continuously--which way the wind is blowing."

Burke Marshall, IBM's present general counsel, who worked under Katzenbach at Justice, will be promoted to the management committee, which our source refers to as "IBM Siberia." He suspects Marshall fell from grace when IBM recently transferred its commercial t-s operation to SBC; this was widely interpreted as a desperate, last-minute effort to stop a Justice Department investigation announced a short

(Continued on page 197)

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time before. IBM reportedly felt Marshall should have been able to find a better escape.

REALTRONICS NEW ENTRY IS KEY-TO-TAPE/DISC

Realtronics, Inc., New York (up to now a consulting and software firm) will announce in January its entry into the "integrated hardware/software systems" arena with a line elegantly called "The R1 Systems by Realtronics." A basic function of R1 is Key-to-tape or -disc conversion and it uses a computer to control the reactive keyboards, ala Logic Corp. or Computer Machinery Corp. But the emphasis is on a total system used in numerous tasks; seven models are in the basic line, but many hardware and software extensions will be offered in configuring special systems. (Software will include business application packages.)

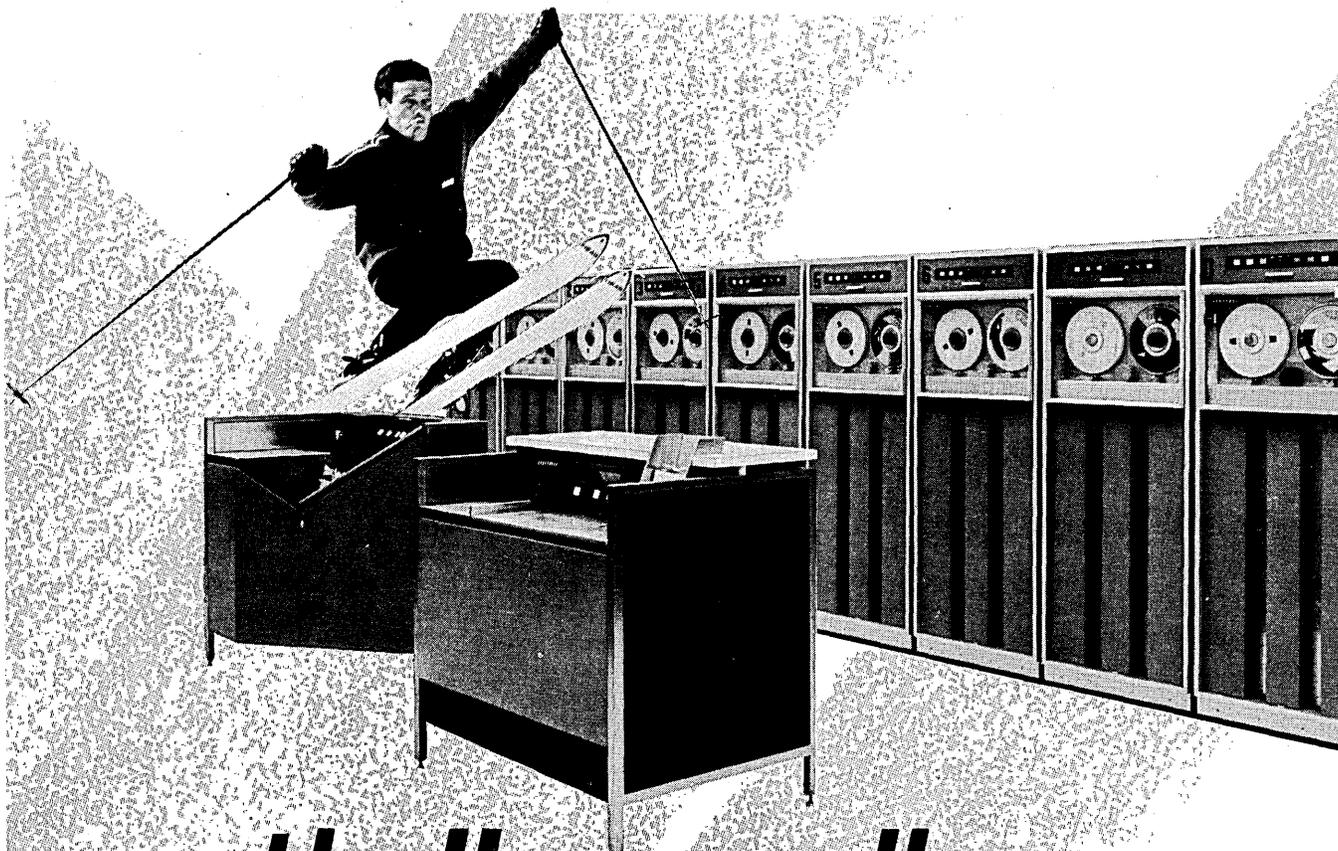
Other features are "high reliability" supporting the planned "replacement maintenance" policy (if it doesn't work, you get a new one.) The keyboard is similar to the O29 board, for operator-learning ease. Price: \$100-250K; rentals available. Deliveries will be 120 days ARO. Currently available hardware will be used with Realtronics interfaces and software.

NBS INSISTS IT SUPPORTS USASI

In October Look Ahead, Datamation reported the NBS plans to "issue clarifications" if the new federal Cobol language specs need interpretation-- and the manufacturer concern that this power may be taken from USASI. Datamation is told it misunderstood the NBS spokesman in quoting that manufacturers want this in USASI, "where each only agrees to his own interpretation." NBS, it was pointed out, "fully supports the work of USASI and knows of no instance in which any manufacturer agreed only to an interpretation that was to his individual benefit." Now, who will issue "clarifications?"

RUMORS AND RAW RANDOM DATA

Three members of CSC's Richland, Wash., operation have resigned to form Information Systems Management Corp., also to be based in Richland. Pres. is David C. McElroy and his co-founders are Milo B. Bauder and Edwin G. Atlee. Firm will specialize in data management systems and the development of industry-oriented languages...A key Congressional committee suspects the Army played favorites recently when it awarded a Sentinel System computer contract to CDC. One of the losers, who bid IBM gear, has reportedly charged that CDC's bid did not meet specs, and the committee is likely to ask the Army Chief of Staff for an explanation shortly...Ling interests have acquired 50+% of R. C. Allen, venerable cash register and typewriter-type firm. Chuck Ling, Jim's brother, to be chairman of the board...IBM is marketing a dual-cpu MP (multiprocessing) 65 that shares four 256-K-bytes of core memories... A 3½ x 4 x 10 inch card reader and badge reader with thumbwheels for manual input has been developed by Information Engineering of Phoenix. Price is to be under \$500...DEC has two more small computers in the mill...An office typewriter and ½" mag tape recorder combine to produce hard copy and computer input simultaneously. Price for both is less than \$4K from RJ Communication Products, Inc., Phoenix...IBM's still-a-comin'! 3.7 (?) reportedly uses 80-column punched cards half the size of the regular card, with small round holes.



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December 1968

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DATAMATION

letters

to computer programs was developed at ESD under direction of the Technical Requirements and Standards Office with contractual support from SDC. ESD documents were reviewed with industry before release and judging from the response the concepts are quite valid. Industry and DOD agencies have requested and received hundreds of copies of these documents and reactions have been enthusiastic.

The ESD approach applies project management to the system life cycle of a computer based system. Instead of just managing the economics of computer programming, ESD has made a significant first step in managing the cost, schedule and performance of computer systems.

Joseph L. Pokorney
Peat, Marwick, Livingston & Co.
Boston, Massachusetts

Edward A. Nelson, Ph.D, of SDC, replies: Mr. Pokorney is certainly correct in praising the role of the Air Force Electronic Systems Division (ESD) in the development of tools for managing the economics of computer programming. My own presentation at the ACM conference emphasized some of the products of ESD sponsored research, and this sponsorship was cited in the published conference proceedings, plus a reference to three of the 1967 SJCC papers mentioned by Mr. Pokorney. Other work sponsored by ESD was also cited by Mr. Pietrasanta, Dr. Sackman, and myself.

The favorable industry response to this ESD-sponsored work, which Mr. Pokorney mentions, is another example of how efforts by military organizations can make valuable contributions to other sectors of the economy.

who's in first

Sir:

Reference is made to page 120, DATAMATION, Oct. 68, "EDP at Sea Tracks Balloons."

Honeywell's claim that the first general purpose computer to hit the high seas is a DDP-116 is definitely in error as a Bendix G-15 was installed on the USN Compass Island in the late 1950's, and another G-15 was installed aboard a converted minesweeper for on-line reproduction of submarine detection signals in 1960. Sounds like a publicity department went astray again.

William C. Aumen
Corps. of Engineers
Washington, D.C.

on-line stock data

Sir:

Spear & Staff, Inc. (Oct. p. 116) is not the first firm to analyze all security data from major exchanges on-line in real time.

Decision Technology, Inc., designed and implemented an on-line, real time security monitor system for Jesup and Lamont, a New York investment firm, in May, 1966. The Security Investment Management System (SIMS) has operated from a Univac 1050 computer using Bunker-Ramo Series 200 Display Equipment. The system maintains five years of fundamental and trading data for each of 3,000 securities listed on the New York, American, Midwest and Pacific Stock Exchanges.

In the first quarter of 1969, a new version of this system will be implemented on a Control Data 3150 system operated by Decision Computing, Inc., a subsidiary of Decision Technology. In addition to performing current management support functions, this system, utilizing the same Bunker-Ramo equipment, will incorporate automated portfolio maintenance procedures.

J. O. Duhamel
President, Decision Computing, Inc.
Cambridge, Massachusetts

oh

Sir:

An addendum to "What They Really Mean" (Oct. p. 67) [from a CDC 915 sales brochure]:

"Due to its functional design and simplicity of operation, no operator time need be spent in routine maintenance. All adjustments and servicing can be quickly and efficiently done by the customer engineer."

means . . .

"The thing is so damn complicated you have to call the CE whenever anything goes wrong."

T. D. C. Kuch
Bethesda, Maryland

continued service

Sir:

We wish to correct one major inaccuracy in the November report (p. 149) on Philco-Ford Corporation computer activities.

Philco-Ford will continue to provide service to users of our computer equipment, regardless of whether such agencies or firms purchase the equipment from us or others. Your report last month incorrectly stated otherwise.

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Sir:

Readers of your article on Operation Bootstrap, a self-sponsored training program in Watts, may be interested in viewing a film on Bootstrap, available either from Friends of Bootstrap, 6784 Julie Lane, Canoga Park, California (attention: Lorraine Baron) or from System Development Corporation, 2500 Colorado Avenue, Santa Monica, California. Ideas on how the information-processing industry can contribute to Bootstrap's training program in EDP can be submitted to:

Samuel Feingold

Bootstrap EDP Industry Liaison
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Santa Monica, California 90406

conferences

Sir:

Your editorial in the Nov. issue entitled "Show Biz" on questions regarding computer conferences is very thought provoking. Your listing of the purposes of conferences highlights the most important goals and you raise questions which must be kept in mind to achieve these goals.

The problem of presentation was recognized by the 1967 Technical Program Committee under the direction of Harry Larson, who undertook with the assistance of Bob Perry to develop and implement a preconference program directed toward helping chairmen, speakers and panel members design effective presentations. Two-way communication in panel sessions was emphasized. This program was highly successful and is being continued for the 1968 FJCC. I know of no other technical conferences which have embarked on such a worthwhile program.

AFIPS has recently developed a JCC Guidelines Manual and the Technical Program Section is concerned directly with questions you raise regarding session quality. The Paper Selection Process calls for independent refereeing of papers, review and recommendation by session chairman and final determination by the JCC Technical Program Committee. These guidelines are extremely valuable and

should assist in avoiding some of the pitfalls mentioned in your editorial.

Both of the above developments show that computer "show biz" is coming of age!

E. M. Grabbe
TRW Systems
Redondo Beach, California

Sir:

I appreciate the opportunity for equal time to reply to your editorial on the Fall Joint Computer Conference. My responsibility is the Technical Program of the 1969 Spring Joint Computer Conference in Boston. Papers are just coming in for our Conference and my committee members, reviewers and session chairmen are among the "hundreds of people who put in hundreds of thousands of man hours," and they are particularly harried at the moment.

The computer industry is still mushrooming. Hardware, software, and applications technology are advancing at an unprecedented rate when compared with any other technology. The booming growth and many of the proposed applications of computers bring along perplexing problems of a non-technical nature. As you suggest, the main purpose of the Conference is to bring to public view the significant advances in technology and to provide an open forum for discussion of the important issues.

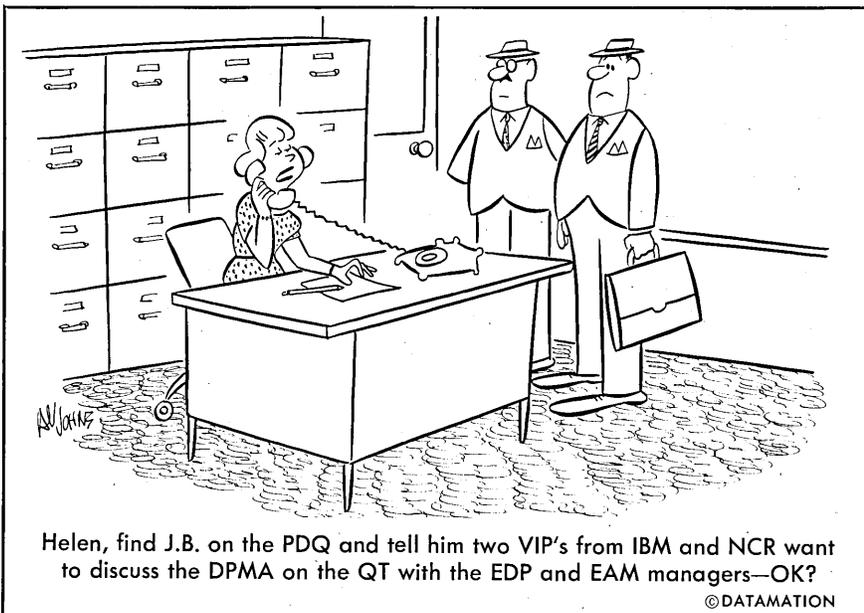
With so much progress, and so many problems, there is a vast amount of material from which a program committee chairman can select for a Conference. His choice is pretty much his own, tempered by the ideas of his committee, the Conference Steering Committee and the AFIPS Conference Committee.

We in Boston have elected to have a more concentrated program than the FJCC. This does not necessarily mean that our program will be better than theirs; it will be smaller. Our approach is dictated partly by the fact that so many of the fields are being expertly explored in depth at San Francisco, and also by a desire to emphasize some of the special computer talents and achievements of greater Boston.

One final word. It is necessary to solicit papers in advance. This does not mean that sessions are prefabricated. All solicited papers must go through the same review procedure as unsolicited papers and our instructions are quite explicit in that regard. Solicited papers are never guaranteed acceptance. If we did not solicit papers, much of the really significant work would go unreported. The best people, who do the best work, are frequently too busy to write about it, especially while the work is timely. Even with a hard push from many committees, some outstanding contributions are never presented at Joint Computer Conferences. The design of the Dartmouth Time Sharing System, the early tape handlers which used phase modulation recording and the new hybrid graphic displays are just a few examples. Also, soliciting papers means that we do not have to rely solely on random response to the Call For Papers to assure broad coverage.

I hope that with the great power of the press you don't put a permanent blight on the fun. Encourage your readers to come to the Spring Joint in Boston and let us know how they feel about a different type of Conference.

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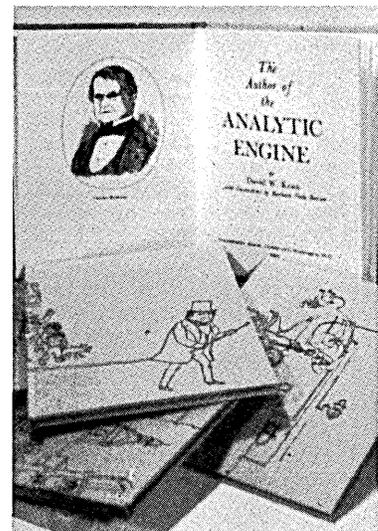
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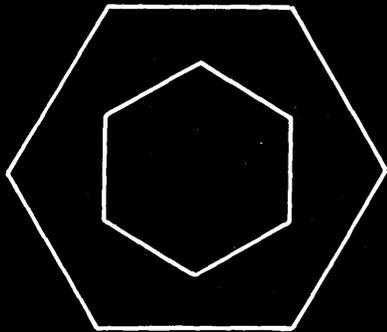
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the forum

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

INFORMATION AS A PRODUCT

"The fate of information in the typically American world is to become something which can be bought or sold." This was written almost 20 years ago by Norbert Wiener in *The Human Use of Human Beings—Cybernetics and Society*.

If we pause to observe the status of information in the American world today, we can see that it is rapidly approaching this fate. To those who handle information, the fate seems reasonable. To those who search for information, the consequences of profit and control over a marketable product have not been felt and they continue to revel in the abundance of available knowledge. If these are clouds on the horizon, they are being interpreted as potential relief from a drought. But it seems to me that those clouds on the horizon could affect our freedom. For when we make a profitable product out of information, we set the stage for the commercial control of our education. Education is a non-profit concept and freedom of access to all information is basic to a democratic existence.

In today's marketplace, from the con-

vention speaker's platform, and in all kinds of publications we hear and read



the words and terms "graphic communication," "visual communication," "information explosion," or just "communication" and "information." For the purpose of describing a possible direc-

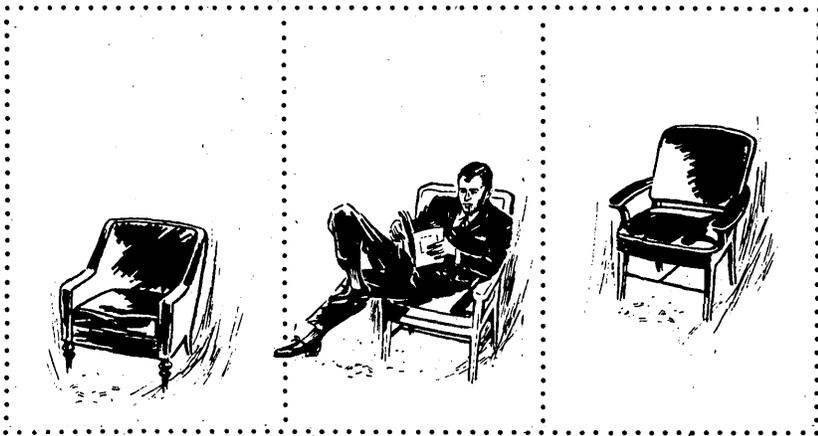
tion for future communication efforts, the terms are used here as representing a single concept. Already the concept is contaminated with ideas of control, power, and monetary profit. And already the concept has become a source of immense profit. The commercial mind is finding ways to manufacture trivial information and use superfluous communication for the sole purpose of profit. Consequently the world is becoming a large sphere of trivialities, redundancies, and . . . junk.

It began with the vast accumulation of information . . . an accumulation of information so prolific that efforts to evaluate and record it were quickly and obviously inadequate. In the wings of the stage of this drama stood the young star with a new and excitingly efficient program . . . the computer. Its performance paled all past efforts of the other performers. The computer made it possible to handle all the information we could generate . . . regardless of its value. In fact, the most significant efforts being made were not the evaluation of information and making it useful, but rather the electronic marvels of storage, retrieval and communication. The ambitions of industry have already caused us to lose sight of our goal. We will soon have great bins of useless or unretrievable information by the virtue of electronics.

Actually, the proportion of new information to the amount of communication used to disseminate it is small. We have generated, in some respects, a sophisticated rumoring process. One bit of "original" information is multiplied by many hundreds of other second-, third-, and fourth-generation bits of information to produce thousands of items so contaminated and diluted as to be more a communication function than an information one.

One has only to read a few magazines to realize this situation. Repetitions, modifications, adaptations, abstracts, and rewrites fill the majority of all publications . . . even professional journals. There are so many ways to chop up bits of information and so many ways to combine them that the situation is one of fantastic nonsense and useless activity.

So here we have . . . through foolish and misguided use of our talents and reproduction processes . . . produced millions of pseudo-informational items. Nobody has time to read them. The items are frequently misleading and inaccurate. But because we have now discovered that information can be



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stored in private vaults, we believe we have generated a salable product.

Of course, storing and retrieving information requires sophisticated equipment. The fact that a large percent of the stored information gets lost in the computer forever and cannot be retrieved seems unimportant to us. And the fact that we deal with nonsense and trivia is solved by storing everything whether it is useful or not. Frequently it is admitted that half of what is stored is worthless . . . but who can tell *which half* is worthless.

All this activity will keep us busy and content until those clouds on the horizon become destructive storms in the backyard. For within some span of time we will discover that we have created a family of information monsters which must be maintained and fed daily . . . but which will produce a low-yield product of limited usefulness.

We could, I believe, adapt our routines and eventually live with monsters like these . . . except for one thing. Because of their size, they will have become the possessions of industry and government. They will have become the sole containers of all of man's past and present information. They will have been programmed to respond only to profit. They will have become the sole repository of our educational resources. They will have become the control of man's potential development and growth. They will have become the control held by the giants of the profit-makers. And there will be no way to recover the rights of the individual.

I have no quarrel with the profit system except when it threatens our freedom of education. But if information and the dissemination of information are permitted to become a profitable product of industry and under its control . . . then profit-minded industry will encourage the generation of an abundance of nonsense and trivia to be transmitted over controlled systems and the individual will lose most of his freedom in one sweep of the industrial hand.

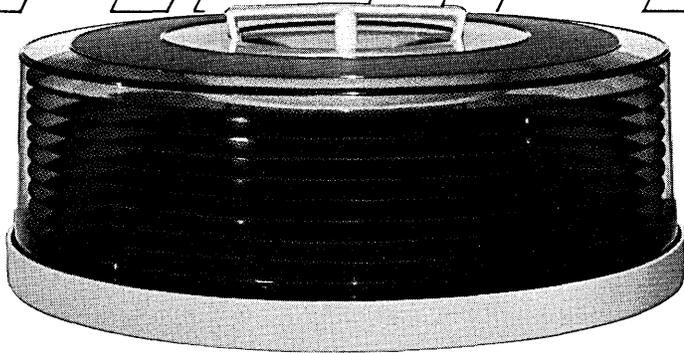
In some countries the government takes these privileges away arbitrarily in order to maintain its power structure. In this country we may one morning discover that our freedom of education . . . through industry's control of communication and information . . . has disappeared into computer storage.

—SELAH BOND, JR.

(Reprinted from *Graphic Arts Progress*)

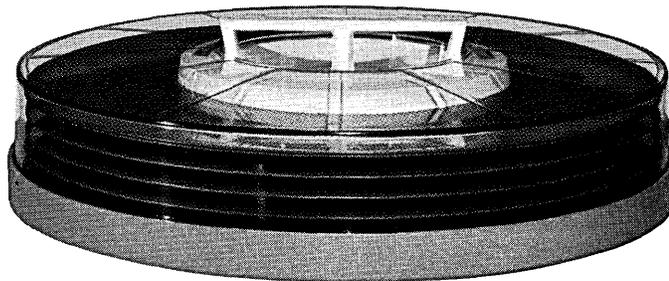
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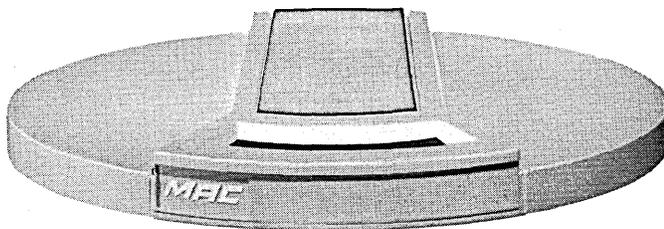
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