

DATA MATIATION®

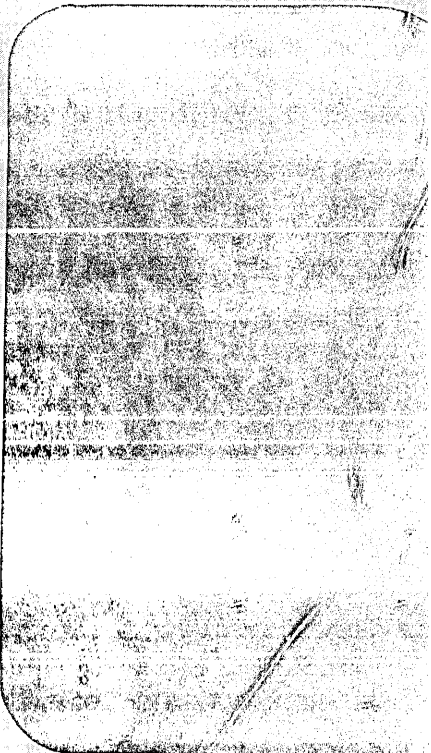
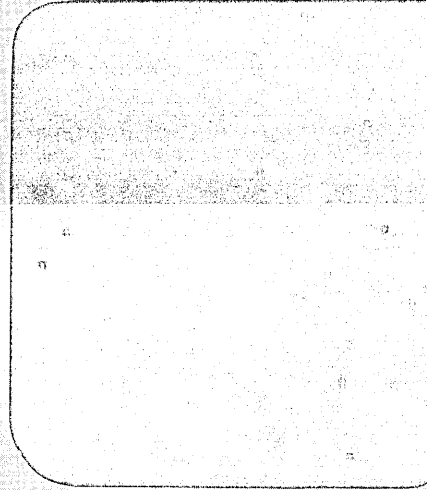
July

EDINBURGH
August 5-10

THE

DATA

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COMPANY	DATA MATIATION	40
PHONE	5980 614 814 ST	35 060
CITY	SEATTLE WA	98109



Bob Thomason is your answer-man on the Varian Data 620/i.

And on his nickel.

Bob Thomason knows more about the Varian Data 620/i systems computer and its use in systems than any other man in the company. He should—he's our engineering vice president. And now he is your personal answer-man, with our most authoritative answers on the 620/i and your application.

And he'll get you *immediate delivery on 620/i standard configurations*, a new availability resulting from the expanded production at our brand new plant.

Just to give you a base for talking to Bob Thomason, here are a few facts to start with:

The Varian Data 620/i is designed strictly for systems work, fully IC'd for reliability and small size. It is fast (1.8 μ sec cycle time, with hardware registers and our unique M-trace trace addressing), capable (116 and 118-bit words, 4K to 32K word memory, 11000 plus basic commands), versatile (Pascal, Basic, COBOL, program software, compilers, peripherals and options), and low price (\$33,900, in standard configuration, with teletype/writer).

We've delivered more than 1500 620/i's already, so we've had lots of experience in integrating the 620/i with all types of systems, and we're currently filling orders for 4000 more.

That's why Bob Thomason is ready for you. Phone him at (714) 216-2400. *Call now.*

 **Varian Data Machines**
a Varian subsidiary

2100 Thomason Drive • Irvine, California 92714
New Director • (714) 216-2400

11, rue de l'Éclaircie, S. St. Maurice and San Francisco, California, Vancouver, Westport, Connecticut, Chicago, Illinois, Houston, Texas, Salt Lake City, Pennsylvania, Washington, D.C., Melbourne, Australia, Auckland, New Zealand, Stockholm, Sweden, Zurich, Switzerland, United Kingdom, Singapore.

Transmits 6 times the data as TWX for the same line charge. Leases for less than \$25 per month. Why not put one in every branch office?

This low cost Tally transmitter sends business data over ordinary dial-up phone lines at 600 words per minute. That's six times as fast as a TWX or Telex. □ Tally designs simple, economical transmitters like this for branch offices that must make daily reports to a central accounting or computing facility. □ The Tally transmitter shown leases for \$23.76 per month on a 36-month contract. For a few dollars more you can get an option that answers calls automatically. Thus, a tape may be loaded at the end of each business day to await a call during the night whenever the central terminal is ready to receive. □ Another optional version not only answers calls automatically but corrects transmitting errors by re-trans-

mitting automatically whenever the receiving terminal detects a parity error. It leases for \$33.33 per month on a 36-month contract. □ These transmitting terminals are only two out of twenty different data communication systems offered by Tally. □ **More information.** For full information, please write or call Tally Corporation, 1310 Mercer Street, Seattle, Washington 98109. Phone: 206-624-0760. Or contact the Tally factory branch office nearest you.

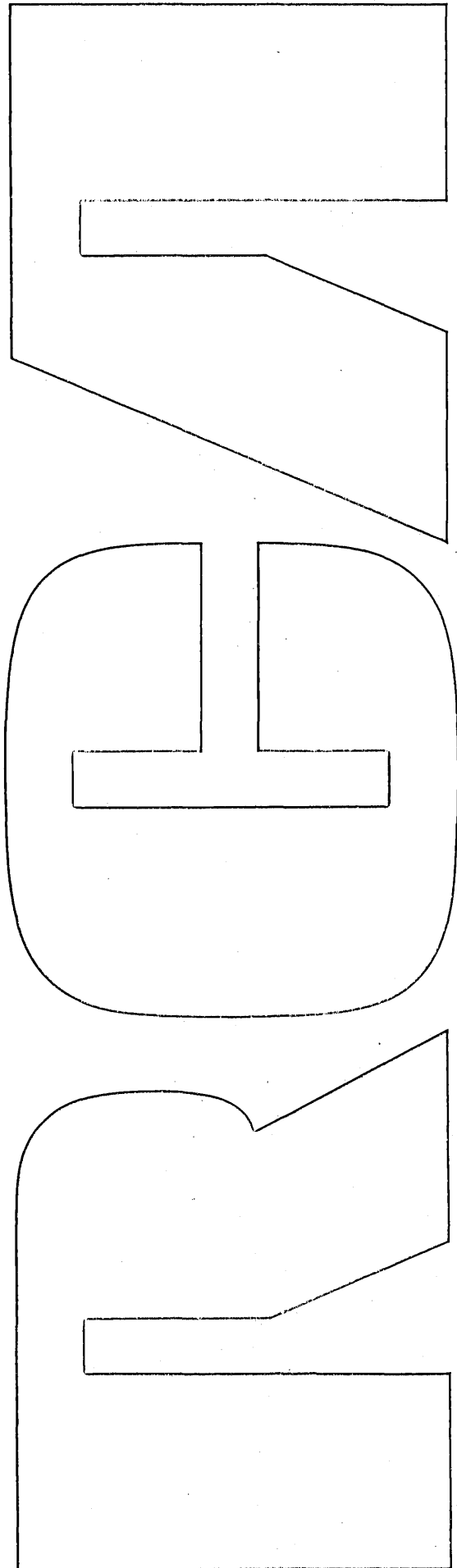
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CIRCLE 4 ON READER CARD



Computer
cost
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**RCA Spectra 70/35
gives you twice the
processor power
of a 360/25...
for the same price.**



**This simple comparison
spells the facts out
for you.**

**SPECTRA
70/35 360/25**

Monthly rental

Memory size (bytes) 32,768	\$2560	\$2560
49,152	\$3410	\$3410
65,536	\$3990	*
1401 Emulator	\$ 100	\$ 100

Operations per second

Add full word	52,631	20,202
Add two 10-digit fields	17,883	8,230
Memory move/ 6 bytes	39,308	15,873
Branch	94,697	35,842
Compare two 10-byte fields	21,478	8,888

Also . . .

Registers	43	16
Multiplexor data rate (KB)	61.5	30
I/O channels	3	1
Selector channel data rate (KB)	694	30

*Model not offered

**Twice the power
gives you advantages
like these:**

Reduced operating costs.

You get more speed from the 70/35, so you get more throughput per dollar. And your dollars get an extra boost when you rent from RCA, because *there's no charge for extra shifts*. The computer is yours to use all day, every day.

Broader system capability.

Which means greater all-around efficiency. The 70/35's superior data rate gives you greater I/O efficiency. You can have two high-speed selector channels that handle as many as 256 peripherals apiece. Plus a multiplexor that handles up to 192 peripherals. All three operate concurrently. And computing overlaps with I/O, of course.

Multiprogramming.

Task-handling efficiency increases with 6-level multiprogramming. You get multi-job streaming with monitor control, an advanced feature that reduces software overhead.

Flexible memory assignment.

Spectra 70/35 doesn't have a lot of permanent programs crowding memory and impeding processing. It moves programs in and out as they are needed. As a result, most users can do a thorough job of processing with the basic 32K memory.

System expansibility.

Memory expands to 65K. And you can add peripherals as you need them. Tapes, mass random access memories, up to 16 disc drives. And 1401, 1440 and RCA 301 emulation.

Compatibility with 360.

If you're a 360 user, you can convert to Spectra 70/35 quickly and easily. With no retraining of personnel. No extensive reprogramming. No disruption of your work flow.

Multiple applications.

If you need batch processing, scientific computing, or a communications-oriented system, Spectra 70/35 is your answer. You have a choice of languages, too. COBOL, FORTRAN, Assembler, RPG with a Disc Operating System.

And more.

When you use the 70/35, you get simple operation based on a typewriter keyboard. Sophisticated error recovery. Increased efficiency in the use of your computer resources. And you get the total support you'd expect from RCA. Our systems specialists help design your system, train your personnel and bring the system into full operation.

For more details about Spectra 70/35, call or write your nearby RCA sales office. We'll be glad to fill you in.

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CIRCLE 5 ON READER CARD

RCA
**Information
Systems**

Teleprinter 100 for Data Networks



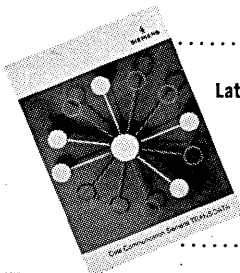
**The Lowest priced
heavy-duty machine available**

100 w.p.m.

Delivery out of stock

The newly styled Teleprinter 100 is used by railroads, utility and pipeline companies, plants, department stores, many other communications, information and transportation organizations, to transmit and receive data on communications networks. It is compatible with all systems—over 150,000 Teleprinter 100's are now in use in over 100 countries.

Up to 13 characters per second, 5 level international CCITT code. Transmits to one unit, several or all units in system. Low noise level. Makes up to 12 carbons. Sends in red, receives in black, or vice versa. Receive-only units available. Tape reader and tape punch attachments. Many special features.



Latest Literature on TRANSDATA:

For detailed information on high speed tape equipment, modems, etc., send now for the 32-page, color brochure, "Data Communication Siemens TRANSDATA".

SIEMENS AMERICA INCORPORATED
350 Fifth Avenue, New York, N. Y. 10001

CIRCLE 6 ON READER CARD



july
1968

volume 14 number 7

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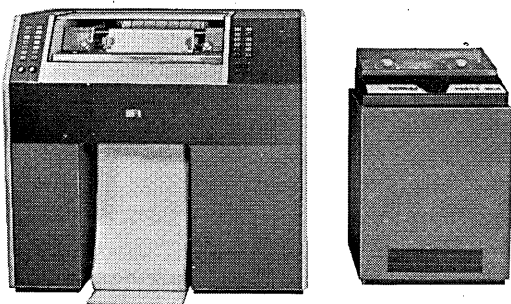


Central National Bank, Chicago, likes wider print line, higher speed of MDS Line Printer

MDS OFF-LINE PRINT STATIONS

MDS 7160—Prints from 7-channel, 200 BPI magnetic tape. Prints 1250 lines per minute, 16-inch line, 160 characters per line. Connects directly to IBM magnetic tape units . . . or MDS Type 2207 Magnetic Tape Unit.

MDS 9160—Prints from 9-channel, 800 BPI magnetic tape. Prints 1250 lines per minute, 16-inch line, 160 characters per line. Connects directly to IBM magnetic tape units . . . or MDS Type 3207 Magnetic Tape Unit.



If you're print-bound to a System 360, and need increased print-out capacity, do as Central National Bank of Chicago did...install an MDS 3160 High-Speed Line Printer.

Used as a second printer, the 3160 provides greater print-out speed and more characters per line than their other printer...and at lower cost.

The 3160 operates on-line with any System 360/30 or larger, contains its own controller, cable-connects directly to the 360's multiplex channel. It operates with IBM standard codes for printer control.

The 3160 provides a 16-inch print line, 160 characters...prints 1250 lines per minute (compared to 13.2 inch print line of 132 characters, 1100 lines per minute, for the other printer).

Call your nearest MDS Representative for complete facts and figures on the 3160 and other MDS Line Printers. Or phone us at:

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DATA SCIENCES CORPORATION

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26 Lesmill Road, Don Mills, Ontario

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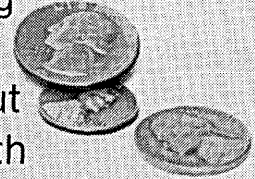
Prudential House, Wellesley Road, Croydon, Surrey CR9-3LD

Telephone 01-686-7626



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

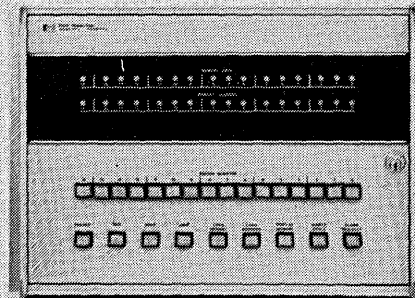
That's what the new Hewlett-Packard 2114A will be pegged at. But it'll heave to just like its big brothers. Throwing around big 16-bit words. Storing 4000 (or 8000) of them at a time in memory. Fetching them out of memory in two microseconds. It'll tie in I/O devices with standard plug-ins and use the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



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

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

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



HEWLETT  PACKARD
DIGITAL COMPUTERS

DATA MATION ⁶⁸®

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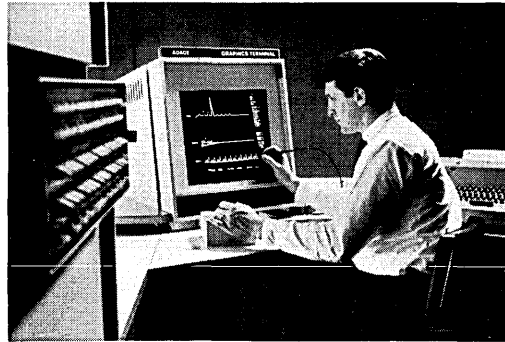
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automatic
information
processing
for business
industry & science

datamation departments

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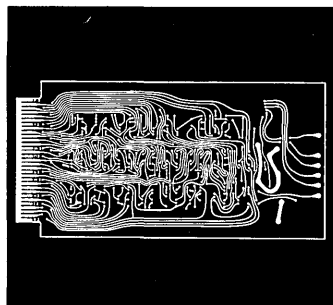
the \$188,000 graphics terminal



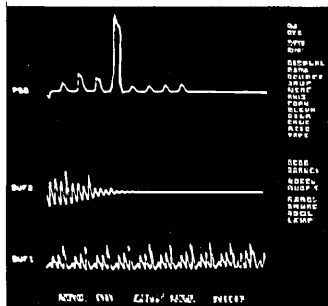
that costs \$60k

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

You can display more than 4500 vectors at 40 frames per second with resolution better than 100 lines per inch. "Straight" lines are really straight. They meet where they're supposed to, and they are uniformly



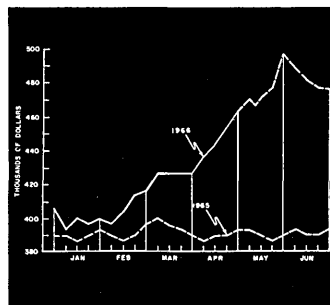
printed circuit layout



on-line signal analysis

bright regardless of length. And only with the Adage AGT/10 do you get built-in scaling and translation.

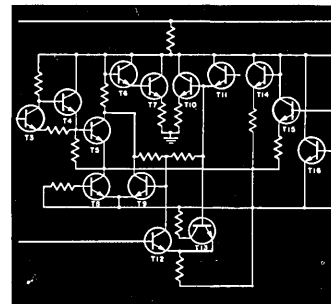
Every AGT/10 comes with its own powerful 30-bit word length processor with basic 4K of core memory and teletype I/O. A complete line of I/O peripherals is available as well as core memory expansion to 32K. Software furnished includes a resident monitor, a FORTRAN compiler (for systems with at least 8K memory), an assembler, and a set of graphics operators. The standard package also includes a library of utility and service routines with full provision for communicating with the central computer



business management systems

facility via dataphone interface or direct data channel access.

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



machine-aided drafting

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

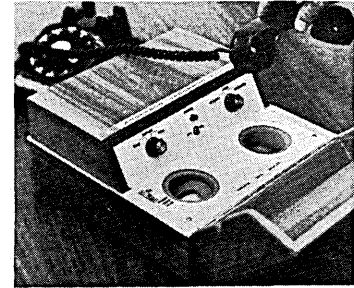
Adage
INC



calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
Aug. 5-10	IFIP Congress 68	Edinburgh, Scotland	IFIP, 23, Dorset Sq., London, NW1, U.K.
Aug. 20-23	Western Electronic Show & Convention	Los Angeles	WESCON, 3600 Wilshire Blvd., Los Angeles 90005
Aug. 27-29	National Conference & Exposition	Las Vegas	ACM/R. B. Blue, TRW, Bldg. R3, Room 1144, One Space Park, Redondo Beach, Calif.
Sept. 23-25	Journées Internationales de l'Informatique et de l'Automatisme	Versailles, France	Nat'l. Assn. of Tech. Research, Dr. Jacques Noel, 37 Ave. Paul Doumer, Paris 16eme
Oct. 6-10	10th Annual EDP Conf.	Montreal, Canada	Nat'l. Retail Merchants Assn., 100 W. 31 St., N.Y., N.Y. 10001
Oct. 9-15	4th International Congress with Exhibition for Instrumentation & Automation	Dusseldorf, Germany	Nowea, 4 Dusseldorf 10, Postfach 10203, Germany
Oct. 18	Symposium on the Application of Computers to the Problems of Urban Society	New York	ACM/J. M. Spring, Computer Methods Corp., 866 Third Ave., N.Y., N.Y.
Oct. 20-23	International Systems Meeting	St. Louis	Sytems & Procedures Assn., 24587 Bagley Rd., Cleveland, Ohio
Oct. 24-25	Mgt. Conference: Marketing, Manpower, Management	Detroit	ADAPSO, 420 Lexington Ave., N.Y., N.Y. 10017
Oct. 28-31	23rd Annual Conf. & Exhibit	New York	ISA, 530 Wm. Penn. Pl., Pittsburgh, Pa. 15219
Oct. 28-Nov. 1	10th Annual Exposition & Conf.	Chicago	BEMA, 235 E. 42 St., N.Y., N.Y. 10017
Nov. 20-26	Industrial Process Controls & Computer Exhibition	Milan, Italy	R. B. Wallace, (Ref. 944), U.S. Dept. of Commerce, Wash., D.C. 20230
Dec. 2-3	2nd Conf. on Applications of Simulation	New York	SHARE-ACM-IEEE-SCI/ACM, 211 E. 43 St., N.Y., N.Y. 10017
Dec. 9-11	Fall Joint Computer Conference	San Francisco	AFIPS, 345 E. 47 St. N.Y., N.Y. 10017

Every little
"bit" counts
in a
portable
dataset



Errors in data communication are expensive to correct. You can't afford portable datasets that don't provide reliability comparable to fixed line equipment.

Reliability is what you get with an ADC 260 Acoustic Data Coupler.

The ADC 260 offers portability, too. No longer need your remote terminal be "chained" to one location. Complete portable Teletype terminals provided.

It can be used interchangeably with Teletypes or any teleprinter which can interface with a Bell 103-A dataset.

Write for details.

ANDERSON JACOBSON, INC.

2235 Mora Dr.,
Mountain View, Calif. 94040
Telephone (415) 968-2400

ITT's Reactive Terminal Service* was first introduced in New York in April. And in Boston in May. Now it's here in greater Los Angeles to bring the efficiency and power of "third generation" computers directly to you right in your office.

Within a few months it will also be locally available from San Diego to Sacramento and by 1970 in more than 15 other major cities throughout the nation.

A unique combination of the latest computer and communication technologies, RTS is a proprietary system that permits you to "converse" with a remotely located System/360 computer via standard telephone lines and a wide variety of terminal devices. What's more, you can do so by making a simple, local telephone call.

In addition, RTS is the only computer time-sharing service that gives you on-line ability to write OS-compatible programs using FORTRAN-G.

You also have unlimited on and off-line data storage, 2-3 second terminal response time, line-by-line debugging capability, and the largest core storage per user offered by any commercial time-sharing service. You can also arrange for high speed, printout at an ITT Data Services' Computer Center near you.

There are plenty of other reasons why you should try our new Reactive Terminal Service. Like the backup provided by ITT's East and West Coast Data Processing Service Center networks. And other features we are adding to RTS—including large-scale 360/65 computers, COBOL and BASIC, and the integration of remote and batch processing.

For more facts about our no-commute computer service and what it can do for you, clip these coupons and get in touch with us.

Call Ken McGouran.
He's our West Coast Sales Manager.
(213) 322-7800

RTS Department, ITT Data Services
999 N. Sepulveda Boulevard
El Segundo, California 90245

Dear Mr. McGouran:

I must know all.

- Please send me your brochure.
 Please have your representative call me.

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Title _____

Firm _____

Address _____

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*Service marks of ITT Data Services, a division of International Telephone and Telegraph Corporation.

ITT's new No-Commute Computer Service makes its debut in Los Angeles



RTS, an advanced time-sharing
service, does for computing
what freeways have done
for commuting*

ITT
DATA SERVICES



letters

survey articles: a critique

Sir:

During this past year a variety of design requirements has caused me to review edp trade publications concerning systems cost with more than a casual interest. Of particular note were the analyses and cost trade-offs of various configurations including such objectives as on-line, time-shared or mixed mode systems. My finding—presumably shared by others—is that a considerable volume is being generated *without* conveying much significant information (as opposed to unsupported opinions); prevalently, contributors' performance requirements or distributions of cost among equipment or software are sufficiently unclear that readers who unquestionably apply such data are inviting their own demise.

Usually, the edp professional can relativize, qualify or supply the more subtle or totally absent premises or conditions (out of his own experience) often needed to place such articles in even a reasonable perspective. Unfortunately, however, many readers—both in and out of management—are not so equipped, either by experience or opportunity. For such people, these articles are misleading, at best; or worse, represent simple misinformation. To be consistent with my own criticism, I would like to cite Dr. Brown's "Cost & Advantages of On-Line DP", (March, p. 40) as a case in point. While the main title is innocuous enough, the subtitle "the way to go" would, not unreasonably, lead a reader to anticipate a synthesis of broad hardware and software experience to support the author's point of view. (With due respect, of course, to this—or any—article's scope and length.)

Consistent with the stereotype, however, this is not the case. Dr. Brown appropriately summarizes the stock advantages of on-line processing and some of the cost effective accommodations available in third generation equipment as an introduction. From this point he first defines batch processing for the purpose of his paper with the perhaps questionable exclusion of multiprogramming, justified only by the top-heaviness of OS/360. Secondly, he presents a ten-point qualification of "on-line" data processing which excludes time-sharing, but not

batch processing.

From this restrictive view, he presents a composite of costing data relevant to the candidate gear for his system. To the extent that the performance design of the discussed system is only outlined, the costing reflects little more than any CE could provide for his own equipment—almost ad lib.

Yet the numerous stated and implied restrictions and qualifications contained in the article seemingly does not inhibit Dr. Brown's extrapolation of this approach's possible merit for the future: "Establishing a design team which understands a new technology is not easy, but the flexibility possible with on-line systems can soon overcome their lack of experience." Surprisingly, this is not straining the author's credibility gap.

In conclusion, system analyses, designs and evaluations, *per se*, are only academic exercises if they are separated from their intended purposes. Consequently, to appropriately and effectively evaluate a system, the objectives involved, the related design criteria and constraints (including cost) should be present.

ART ALLIONE
Santa Monica, California

correction

Sir:

The article by Lawrence Berul (March, p. 27) "Survey of IS&R Equipment" was extremely interesting and informative. However, a device called the SC-4460 was mentioned. This must be an oversight since we do not have a product by that designation. The product described is the SD-4440.

L. M. BELL
Manager, Marketing Support
Stromberg Datagraphics, Inc.
San Diego, California

edp schools

Sir:

Your articles in the April (p. 22) and May (p. 33) issues regarding edp schools seem to leave a very negative impression.

As a manager of a staff of programmer/analysts and also a part-time instructor at one of these private edp schools, I can see some truth in what is said; but neither article answers the question: Where will the needs of the computer industry be met?

Public schools, colleges and universities are not meeting the need. They also do not test to see if this work would appeal to the individual or whether the person has the aptitude. The academics of this work can be

memorized so that an "acceptable" grade can be achieved even though the person would be unable to work in the profession.

To condemn private schools for lacking accreditation or any other "official sounding" title is really meaningless. Once a school is accredited in one subject, adding data processing does not stop them from being accredited. Their data processing curriculum could be an outstanding failure.

To condemn private schools for making money smacks of "communism" where the only good education is government supplied. Without private enterprise now filling this gap this industry would be in pretty poor shape. The real question is for each school (not just the main office of the parent school) to be licensed and evaluated by a meaningful, interested group. This would require legislation and money plus some standards, all of which are lacking.



So, we get down to the basics of what a programmer course should contain. I, for one, believe that emphasis should be placed on equipment available for hands-on use. A course should be designed to teach as much as possible about that hardware, and its available software and programming languages.

Also, a brief history of dp is in order. Along with history comes nomenclature, methods of operation of equipment, and eam equipment.

When these points are covered, the task of teaching "programming" usually resolves to "coding" and not much else. Systems analysis or design can be introduced but not really taught in a course of less than 200 hours. The cost and cost/benefits from any course longer than this are prohibitive and cannot assure any more success in employment or employability.

R. L. BROWN

operations & the new software

Sir:

"Management and the New Software" by Tom Scharf (April, p. 52) was timely and interesting. Unfortunately, the U.S. Civil Service Commission has



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CIRCLE 12 ON READER CARD

letters

recently taken the position that computer operations positions are overpaid and has published tentative new standards which would downgrade these functions. Having held responsible positions in programming, systems and operations, I feel that generally these three fields are equally important in the success of an installation and should generally receive equal rewards. I wonder if your readers could comment on whether industry in general is thinking of placing computer operations on a more professional basis?

The only complaint I have with the article is Mr. Scharf's statement that too often ordering hardware occurs based on the requirements of the most demanding application. He opposes this point of view by saying that the goal should be to get hardware utilized as fully as possible. While no one can argue with this, I think that the problem is broader. One, many more users should purchase hardware in order to achieve long term savings; and two, more consideration should be given to ordering the model of machine with the optimum throughput possibilities rather than trying to tailor the machine to present applications. Everyone knows that machine use climbs to occupy the hours available.
TERRY MILLER
Washington, D.C.

the whimper of os

Sir:

In your otherwise scholarly April article, "The End of OS," (p. 72) I must call attention to one obvious error.

In SHARE MCCXXVIII's discovery of the SHARE XXVIII item, it was erroneously noted that the Management Action Optimization program of the Management Information Department of DPD to be written using the Linear Interpretation Nucleus of DOS extended, in spite of Marketing Verification Department attempts favoring OS, involved purification of Type II programming standards, since OS has always been classified under Type I standards.

This should have been footnoted.

RALPH D. VICTOR
New York, New York

the machine game

Sir:

The stumper of the machine (Perstein letter, May, p. 14) is himself easily stumped: When it is discovered that all moves from a board have been elim-

inated (as in his example), the computer need only be programmed to concede defeat in *that one game* and then, following the same learning algorithm, eliminate the last losing move. Indeed, H. D. Block makes this point specific in his paper, "Learning in Some Simple Non-Biological Systems," *American Scientist*, March 1965, p. 61. At the expense of complicating matters, one may, when deleting the sole remaining move at a position, also delete the move leading to that position. This would avoid at least one machine loss.



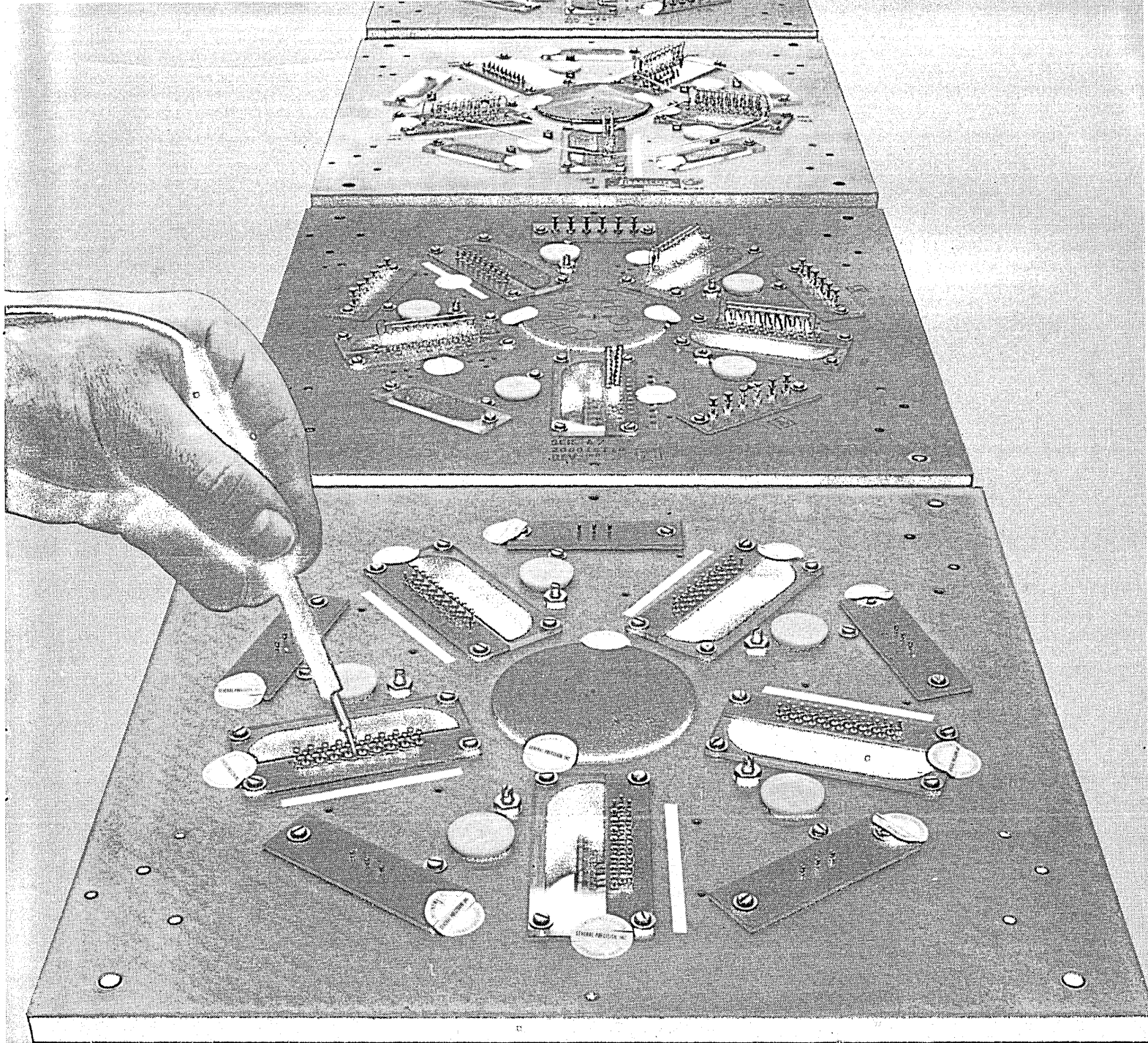
The need for a new fuse or a (second) function button may easily be inferred from the Hexapawn player article from the phrase, "it [the random number generator] generates another number until a move is found" (March, p. 71), or from the flowchart box, "SELECT MOVE AT RANDOM FROM TABLE" (p. 73). But the need, if actually present, is easily made unnecessary. For the simple game of Hexapawn a stumper can delay the learning, but he cannot do so indefinitely except, of course, by always deliberately losing to the machine.

DAVID J. LAPIN
RALPH L. LONDON
Madison, Wisconsin

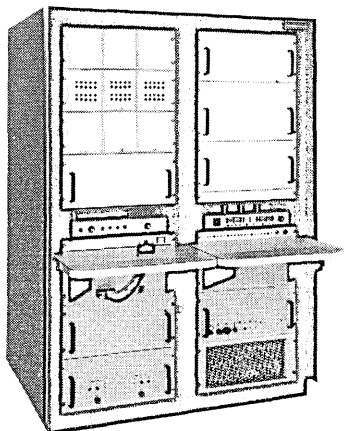
Mr. Hughes replies: The HEXAPAWN game is programmed as Messrs. Lapin and London suggest in the first paragraph of their letter.

Mr. Perstein replies: Messrs. Lapin and London have pointed out that a hexapawn playing machine, even a hexapawn learning machine, can easily be programmed to avoid the trap I exploited in my letter. I never thought otherwise. The point is that with machines that play simple games, people quickly abandon the game that the machine is playing and begin to look for flaws in the program, a much more interesting game.

For example, many years ago my son wired up a Brainiac kit (in accordance with the printed instructions) to play tic tac toe. We quickly discovered that the machine never lost, but we were critical of the way it played the game. Although it never lost, it almost never won because it played in such a way as almost to force a draw. It never laid traps. We figured out the circuitry for the machine to play a good



Fairchild has these fond memories of Librascope



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Thanks for the memory order, Fairchild—reputations are made of this. For the brochure detailing the longest line of discs in memory, write: General Precision Systems Inc., Librascope Group, Components Division, 808 Western Avenue, Glendale, California 91201.

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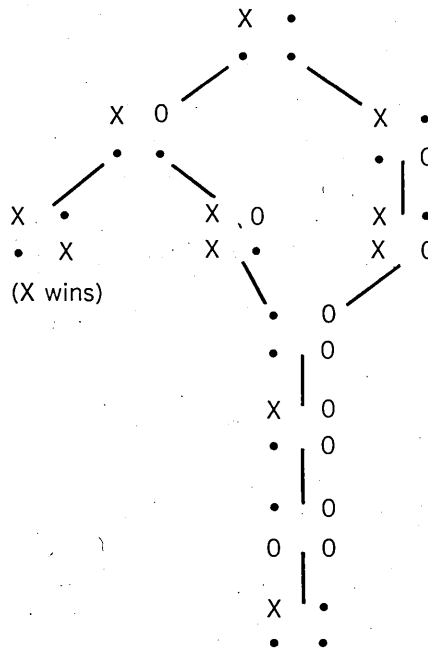
letters

game of tic tac toe, but the multi-deck, multi-position switches of the Brainiac kit had insufficient capacity.

More recently I programmed a nim-playing, time-sharing demonstration program. The program gives the initial advantage to the player in allowing him to set up the initial position—3 to 6 piles, a total of 14 to 30 tokens. (Random distribution of tokens does the best job of equalizing initial advantage, if the total number of tokens is $2^n - 2$.) It is almost trivial to program a technically perfect game of nim. Most of my program, however, is devoted to avoiding teaching the machine's opponents how to play well. The program begins with two-way idle conversation designed to randomize the initial input into the random number generator. When the machine is winning, it randomly selects among the safe moves available. When the machine is losing it generally makes a minimum move (to allow the opponent greater opportunity to blunder), but not always (to avoid signalling, "I'm winning," or "I'm losing"). After a short sequence of losing positions (the length of the sequence chosen randomly), the machine concedes the game . . .

After further reflection, it seems to me that an effective way really to illustrate how sophisticated programs are composed of simple modules (and thereby to short circuit the fear of sophisticated programs) is to develop a series of programs capable of learning a progressively more complex sequence of games. The 5000-year-old Oriental game of "go" seems admirably suited to be the basis of the project. The game

is played by placing stones (black for one player, white for his opponent) one by one on the intersections of a square array of horizontal and vertical lines. The objective is, by encirclement, to secure territory and, secondarily, to capture opposing stones.



(repeats starting position)

In the simplest possible version of go, on the 2 by 2 array, the first player cannot lose, but the second player can hold him to a draw. Ex-

cept for symmetry, all possible positions are illustrated at left (x for first player):

All that each player has to learn in this game is to avoid making one move. In the 3 by 3 game, the first player can always win. I don't feel up to analysing the 4 by 4 game at the moment (perhaps Martin Gardner of "Scientific American" already has).

According to go lore, the game has developed in just this way. When the go masters exhausted the possibilities of the game, they added another line in each direction. The present game of 19 by 19 has been played in this form for at least 200 years.

There is no record of the level at which the game was first introduced. No doubt some Chinese philosopher considered and discarded several levels before presenting the game to his emperor.

Well there it is. Perhaps some graduate students can pull the fangs of the computer by writing a demonstration series of go learners. The series should start at a level that can be understood by anyone smart enough to be worried about computers. The program should be able to play either first or second. Long before we reach the 19th level, the machine should be able to learn to beat the bejabbers out of all but a few hundred people in the world.

time sharing tales

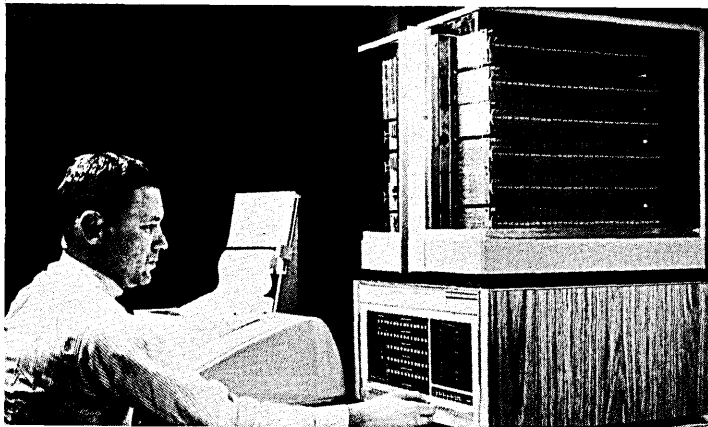
Sir:

The problems related to your readers by Mr. Wilkinson are far from commonplace. While some of the errors he describes have occurred in our heavy use of a time-share utility, they have been cleared up in a matter of hours. I think that your readers should be made aware of the means that can be used to straighten out these problems.

Mr. Wilkinson experienced problems from two sources: (1) his computer vendor, and (2) his telephone company. In both cases, the best strategy to remedy problems is the wise use of the threat. If a computer vendor has deaf ears while dealing with your firm, your best recourse is a change in vendors (or a threat to change). The costs involved are minimal. Most vendors require a monthly minimum fee with thirty days notice. After exercising the notice on your present vendor, you can re-negotiate with another vendor who will probably charge some initiation charge—again, minimal.

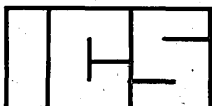
With respect to telephone companies, you are more constrained. Your choices are: (1) buy your teletypes instead of leasing them and work out a maintenance contract with a local firm who owns teletypes and does their own repair work, or (2) switch to another type terminal such as an IBM 1050 or a Friden 7100. In most cases, the computer vendors can provide portable terminals for use by the customer while he waits for his permanent terminal. Some vendors even maintain a stock of portables available for long-term lease to a customer who experi-

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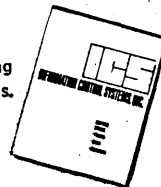


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ences problems like Mr. Wilkinson.
HARVEY A. SHAPIRO
Pittsburgh, Pennsylvania

Mr. Wilkinson replies: Our experience started out as 90-day feasibility study which made it impractical to purchase a terminal. During the heavy problem phase, two of the other three vendors had no equipment and the third had an incompatible language which makes it hard to switch. The line problem could have been corrected by using special lines, but for experimental reasons we needed to see if the regular exchange lines could meet our requirements.

input devices

Sir:

We read with interest an article in the May issue (p. 65) which described a system for the input of magnetic tape selectric typewriter (MT/ST) tapes. We have been using MT/ST typewriter systems at this medical center since August 1966 for acquiring medical reports for entry into a data processing system. Transfer of the MT/ST tape data is achieved by use of a simple interface unit which connects the MT/ST system either to a stepping digital tape drive or directly on-line to the computer. In the latter mode of operation the computer may also communicate back to the MT/ST typewriter. This feature makes it possible to generate MT/ST tapes through the computer system.

Use of the MT/ST system's playback unit requires only that wiring be brought out from some normally unused contacts. This approach is simple and inexpensive. Its only disadvantage is that the data transfer rate is limited to 20 characters per second. In cases in which higher data transfer rates are required, a different technique must be used for playback of the MT/ST tapes.

ROBERT E. ROBERTSON III
Bowman Gray School of Medicine
Wake Forest University
Winston-Salem, North Carolina

a contention of ideas

Sir:

In reply to the letters of E. C. Witt, R. C. Ilsley, and William Vetter (April 1, p. 13) and on the larger question of the role of computer professionals in social and political issues. Mr. Witt says that the undermining of support for our men in the armed services is indefensible, while Mr. Ilsley and Mr. Vetter say that the actions of peace groups border on treason.

I submit that attitudes of such closed-mindedness are incompatible with the approach that befits computer professionals. If we are called on

to seek new ways of solving commercial and scientific problems, without excessive obeisance to the methods of the past, shouldn't we be as open-minded in the much more important areas of interpersonal and international affairs?

One may argue that peace and freedom may be more effectively attained or preserved through military action in Vietnam, although the record so far does not seem very persuasive of this view. But, as Eugene Schwartz says in another letter in the same issue, "the essence of democracy is the contention of ideas," and on issues affecting the life and death of hundreds of thousands of Americans and Vietnamese, as well as America's future relations with the rest of the world, it seems to me we need the maximum exposure of contending ideas. From this we should arrive at decisions based on facts, rather than unreasoning appeals to loyalty (Mr. Witt speaks "as a loyal American") or literary mud-slinging (Messrs. Ilsley and Vetter speak of "includ(ing) this *crud* (sic) in your magazine"). To see computer professionals, with their supposed fealty to facts and openmindedness, suggesting the suppression of such discussion, is particularly disturbing.

I encourage you to continue report-

ing and to bring the viewpoint of the computer professional to issues which transcend faster transfer rates and the adequacy of operating systems.

WILLIAM ROBERTSON
New York, New York

our goof

Sir:

We thank you for the publicity given our company and our system on p. 72 of the May issue. The cost of a system license however, is \$750,000 and not \$375K as cited.

HARLAN C. BENNETT
California-Western States Life Insurance Co.

Sacramento, California

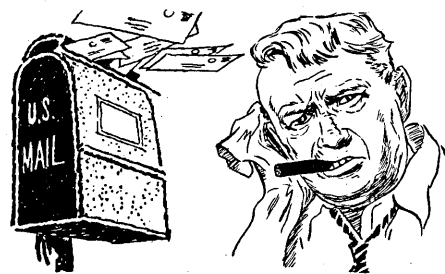
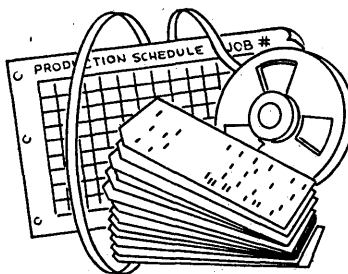
agricultural funding

Sir:

I bring your attention to an error in the News Briefs (May, p. 113); you state that work being conducted at the Laboratory for Agricultural Remote Sensing is funded by the National Science Foundation. This is totally incorrect. The Laboratory for Agricultural Remote Sensing at Purdue University has

(Continued on p. 162)

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CIRCLE 15 ON READER CARD

A few words about the Challenge facing the Computer Industry



The modern computer is a marvel of electronic power with its high speed circuits and other "hardware" features. The challenge facing the industry today is to match this hardware power with equally effective "software" in the form of programs which permit the machines to regulate and supervise their own operation.

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much more efficient than its one-job-at-a-time predecessor.

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ble of running more than one independent job at a time.

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People who work with Burroughs '500 Systems' can tell you how well we've met the industry challenge. Ask them. Or ask us. You deserve to know.

Burroughs 

look ahead

THE 360 BID FOR IMMORTALITY

This month's rumor about the next 360 is that mod 40 and 50-size machines will be announced next spring or summer -- both four times faster than the originals, costing only 10% more, and offering 12-month delivery. Word is they'll have internal ASCII, in obeisance to government wishes.

What if ASCII? First, an expert says IBM would have to change "less than 15%" of OS 360 -- and these changes involve almost all modules of the system. A costly proposition. The user? Over-all, upgrading to ASCII models shouldn't mean traumatic conversion, particularly for those programming in higher level languages. But there will be troubles for the programmer who has been "bit diddling" in assembly language. Any ASCII systems should have EBCDIC 360 emulation, however.

COMRESS COUNTERS S³ WITH SCERT V

Army dpe evaluators will complete development of the S³ simulator (see June, p. 17); developer Leo Cohen is now writing the program in 1108 assembly language. Collection, integration, and validation of the data base will be awarded separately, or done in-house.

Meanwhile, Comress has announced Scert V; this new version is designed at least partly to counter possible competition from S³.

Scert V reportedly simulates the operation of time-shared, remote-terminal systems in far greater detail than Scert IV. Message processing time is measured discretely for each message and each processing step. Each change in the message queue, and each change in processor and peripherals utilization, is listed. The new package also includes critical path analysis of multiprogramming schedules, more precise specification of scheduling priorities, and greater ability to simulate partitioned-memory systems.

Scert V, integrated into Comet -- the Air Force version of the Comress simulator -- will evaluate the systems proposed by vendors participating in DOD's big worldwide military command and control system procurement. WWMCCS is scheduled to hit the street next month. But some slippage is possible. If there is enough, S³ may be used also.

Meanwhile, Comress has set up a hardware manufacturing subsidiary, Comset, Inc., which reportedly plans to go public around the end of the year and be in production soon afterward. An official of the parent company confirmed formation of the corporation, but refused to comment on whether Comset plans to issue stock. He also refused to reveal the kind of hardware Comset will manufacture. According to the grapevine, it will be computers.

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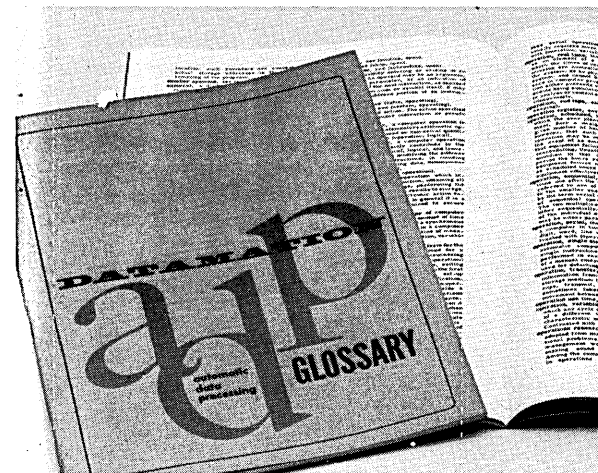
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THE PLUS & MINUS OF SOFTWARE PACKAGES

While three firms specializing in marketing software packages are having trouble getting off the ground, a couple of software houses' packages are doing well.

Informatics, we hear, has orders for over 120 of its Mark IV file management program, which sells for \$30K. This success has encouraged the company to broaden its base: it's put vp Dick Hill in charge of building up a service bureau biz.

Computer Sciences, meanwhile, fights Mark IV with Cogent II, which costs \$25K. CSC offers 10 packages, has some 90 installed, at an average price of \$15K ea.

ACM SEEKS HELP IN TRAINING PROJECT

The New York chapter of the ACM is helping out in an OEO-funded program of computer education for the underprivileged in New York City -- and they need volunteers, machine time, and companies willing to hire the graduates. About 120 students will be trained in keypunching, computer operation, or COBOL programming during an 8-week course, July - September. The Middle West Side Data Processing School is running the program for this area in New York.

The ACM is providing teachers for evening tutorials intended to help the student with course and career problems. Those interested should call John Mac Lean, 212-643-7376. Companies willing to provide machine time for on-site training and to consider hiring the graduates, contact: Mel Klanski at Computer Usage, 212-PL 2-5900. And any group in the country that has a similar project, the ACM curriculum committee would like to hear about it: Don Wells, General Telephone & Electronics, 444 Madison Ave., N.Y.

ANOTHER NEW ITTY BITTY MACHINE

Newest face on the small systems computer front is Data Technology, Mountain View, Calif., logic module and instrument maker. This month they're announcing the DT-1600, an 8-bit byte-oriented machine with a cute price tag: \$6600 in oneses, less for over 10.

Software includes an assembler, utility and maintenance routines and standard math (trig, log, etc.) packages. For \$8500, you get all this and an ASR 33. Core cycle 8 usec, but parallel arithmetic permits a 24-usec 8-bit add.

Addressing is indirect, except for current and base page, but direct addressing is optionally available. Standard features include a party line I/O bus, block memory transfer, priority interrupts. There are 73 commands, eight 8-bit registers. Initial delivery being quoted: 90 days.

The company, which grossed almost \$4 million in FY '68, is aiming at the industrial control and systems computer markets.

EXEC 8 NOW AMBULATORY

The bells and whistles operating system for the 1108, EXEC 8, is having problems -- slowing the progress of some mammoth projects, like United Airlines' 3-cpu 1108 II. (This will get started in January, six months late, and proceed more slowly than planned.)

About 10-15 users are on EXEC 8 full time now, but these aren't the larger configurations. The new exec can't efficiently handle the large variety of remotes and line speeds involved in many big 1108's. (United will have 72 high-speed lines, more than originally planned.) Stability has been a snafu, but

(Continued on page 155)



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Be skeptical. We'll show you a working Sigma 2 at any of our regional sales offices. Just give us a call and come see for yourself. It's quite a package.

In fact, it's hard to single out any one advantage of Sigma 2. And it isn't necessary.

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SDS

Scientific Data Systems,
Santa Monica, California

editor's readout

guest editorial:

LET'S REPRICE OBSOLESCENT EQUIPMENT

The United States computer field has just survived a massive equipment exchange. In doing so, many of our computer shops have virtually marked time for two years. Conversion has been an arduous, thankless, costly, backbreaking task. In many cases, this effort has been wasted—yes, wasted—since the effort need not have been undertaken at all.

To a user who needed third-generation equipment with on-line files, systems which provide a base for remote terminals, or for users with huge installations which were bursting at the seams, the third-generation equipment was indeed a panacea. However, for the majority of the small- to middle-sized consumers, the main motivation for exchanging the equipment was economic.

Manufacturers initially price their products based on their costs plus an expectation of profit while constrained by the pressures of the marketplace. They maintain their equipment in top-notch working order and charge the same rental for a piece of equipment the day before it goes to the junk heap as they did the first day it was installed. This is a strange economic phenomenon because computers don't depreciate. They perform a service for their entire life and then are scrapped. At least that's the way we treat them now.

However, the service center, whether competitive or captive, can't charge that way for its service. If the service center has equipment from two generations of computers, it is constrained by its own customers to charge for its services at competitive rates. Thus, the service center must in fact *be* competitive or swallow the loss itself. An engineering department simply won't tolerate higher costs for engineering computing merely because the computer center director failed to install economic equipment. The chief engineer can't tolerate excessive costs or his engineering rate will be uncompetitive. Thus, the cycle of the competitive marketplace works even when one is imbedded in the middle of a large corporation.

To keep competitive, the computer center director orders the latest equipment, stands the cost of conversion, and spreads it over his services as burden. In the last few years, some computer users have spent more in conversion and preparation for third-generation equipment than the reasonable market value of their second-generation equipment. On top of that, the second-generation equipment was satisfactorily performing the required work and delivering the computed results on an acceptable schedule.

What a silly economic system we now have. We are required to throw out something which is working well and replace it at great expense merely to have something else which is working well for a little less cost. The machine that was replaced goes to the scrap heap.

I hereby propose a superior economic system. When considering installing a newly announced piece of equipment, let us take a representative sample of our work, run it on the new piece of equipment, and determine the cost if that sample of our work were run on the new equipment. By definition, that is what

(Concluded on p. 22)

readout . . .

the same sample of work is worth if run on our *existing* equipment. Let us then make an offer to the supplier of our existing equipment to keep that equipment on rent at a new rental price based on its productive worth in the marketplace. If the deal is consummated, we can continue to operate our existing equipment and charge our customers competitively.

If the supplier refuses our offer, then give notice and install new equipment.

Such a system would work in the following way. The 1401's which were performing card-to-tape and tape-to-print peripheral operations would still be performing those operations. They were satisfactory, and in many cases extended character sets were not required. Many other small machines were successfully performing payroll, inventory control, and other simple bookkeeping tasks. They were reliable, and performed well. To be sure, I would rather have one family of equipment throughout a shop, standard programming languages, and only one operating system. But the costs in training and preparation have been enormous. Given a choice, I would rather install new equipment for new applications and leave the old stable applications alone.

For instance, a second-generation machine could sort as well as many third-generation machines except that it was not cost effective since we were charged a rent in excess of worth. All utility functions could satisfactorily remain on the equipment of the previous generation.

Consider the case of the federal government, a leasing company, or a large user of equipment who had purchased his installation. He must reprice his services as indicated above or his customers will so favor the new equipment with its lower unit cost that the utilization of the old equipment unwinds so rapidly that its actual cost per work-unit soars. When the actual cost increases astronomically, this, of course, merely accelerates the trend to the new equipment. Thus, stability demands sensible pricing policies which we do not now have.

As the programmers of the field continue to work, some fraction of them create lasting programs which perform needed services for their parent firm. Over the years, the manpower invested in these lasting programs becomes tremendous. To continue to reinvest our precious, technical talent in redoing programs which are really satisfactory (or require at most minor improvements) is not only wasteful, but it may be impossible. The time will come when the talent required to redo the old is so many times greater than the available manpower that the conversion from generation to generation cannot be accomplished within a generation! If that ever occurs, we're stalled.

In addition to our search for standardization and compatibility to make the transition between generations easier, let us research these economic factors and devise a system which makes the transition unnecessary for reasons of economics alone. This, of course, will stretch payout schedules as the revenue rates become less. However, that is exactly what we do with used cars and they're not even maintained in prime condition by the first user.

ROBERT L. PATRICK

TIME- SHARING IN EUROPE

by PEARCE WRIGHT

Perhaps more than any other event in the genesis of European computing, developments in time-sharing have softened some of the resentment which a sizable number of professionals hold against the marauders from across the Atlantic. And it must be one of fate's less mischievous quirks that has led her to bless Edinburgh as the first European venue for this summer's IFIP meeting. For this is the territory, one could claim, where the foundation for a better understanding had been laid.

It was at a Joint Computer Conference more than four years ago that one of the doyens, Professor Maurice Wilkes, demonstrated conversational working to a packed audience with a terminal on-line to Project MAC at MIT. A frequent commuter between his Mathematical Laboratory at Cambridge Univ. and MIT, Wilkes put on a characteristically unemotional display which thumped home the potential of man-machine interaction. So in a sense the big fillip on time-sharing which came from Project MAC was felt simultaneously on both sides of the Atlantic.

However, the transition from theory to practice has been an agonising wrangle for funding, particularly for the universities, which in most European countries are dependent on the benevolence of public finance. This has meant persistent lobbying for state support.

Unfortunately, this all started when the major manufac-

turing groups in Britain, France and Germany were at low ebb in their struggle for survival against the Stateside main-frame houses. With the best will in the world they could only accept time-sharing on face value as a long-term development.

some independent winners

But there was another side to the coin. In the commercial sector, time-sharing put some of the entrepreneurs of the industry on their mettle. And ever since they have been cropping up in projects that would once have been left to the big battalions. If a measure of success is to start a company with a capital of \$16,500 and then to sell out the majority holding at a company valuation of \$1,800,000, then Charles Ross and Michael Gassman are Europe's first time-sharing success story.

Ross, an ex-manager of the NCR financial bureau, and Gassman, economist and financial journalist, went into the specialist package business with a stock-market computer-

Pearce Wright, who lives in England, has long been an observer of computer activities throughout Europe. He is now European Editor for Datamation.

troubled progress

TIME SHARING . . .

answering network called Scan. It is based on twin Univac 418's and Fastrand drums. Prime job of the system is to give a portfolio analysis for clients. Details of more than 4,000 public companies quoted in the U.K. are filed with records going back five years. In the Mark I scheme, now operating on 60 consoles, the stockbroker selects relevant programs for computing trends and forecasts. Mark II is about to come on-line and will let the stockbroker create his own secure personal files, which will react with the general data bank.

At conception, Ross calculated that 200 terminals would bring a profitable operation. But now the scheme has been absorbed into the far wider plans of IPC (International Publishing Corp., Europe's largest publisher with two daily newspapers of circulations exceeding six million, two even bigger Sunday papers and a score of trade, technical and book publishing companies). Under the umbrella of International Data Highways it is working out packages for lawyers, doctors, insurance and market research in a \$12.5 million programme which may be built around twin 1108's.

A more recent adventurer is Dick Evans of Time Sharing Ltd. Having sold his house and cashed insurance policies, he started his company a year ago to market Bolt Beranek and Newman's Telcomp in the U.K. BBN has a controlling interest. Evans has gone for the burgeoning nonprofessional market in the U.S. "To put a tool in the hands of the engineer, researcher or accountant who has compiled experimental data on which he wants to do statistical analysis," he says. As a former middle-manager of marketing at ICT, Evans' success shows his adroitness at explaining the use of the program to users—"explaining the intellectual ergonomics," he calls it.

Time Sharing has about broken even with 60 consoles in operation with users in many of the big companies which have a \$1 million and upward annual commitment in data processing.

Evans has just upgraded his system from a PDP-1 to a PDP-9 plus PDP-8. He splits his users about 65% engineering and science, 20% education and 15% business. And his rates run at \$14 to \$15 an hour plus the cost of the console and the standard modem from the GPO for switched public lines.

small machines rise again

One thing that Evans' operation illustrates is a side effect of time-sharing developments. It is the re-emergence of the small-cpu specialist (comparable to firms like Digital Equipment) that had nearly disappeared as European industry contracted into large single manufacturing units when company followed company into the red. In the same way that Time Sharing is constantly monitoring cpu developments from which to tailor a system, there are other organisations buying in cpu's on the same basis.

In university and government research establishments, a cpu will be bought as a multiplexor to front-end a big number-cruncher or to hook a bubble chamber or automatic analyser into a bigger system. But the biggest growth for the free-standing processor is among telecommunications groups that are taking hardware to fit into the new electronic telephone exchanges going up in Europe.

It is against this background that the youngest company in the field, Computer Technology, stands to make a killing. Probably the only European firm with a computer designer as managing director—Ian Barron—its first machine in the Modular One series has just come off the drawing board and created quite a stir among the professionals. Although starting in the \$30,000 range, it is designed with hardware

subroutines that can make programming switching times on mightier brethren look outrageous.

There were no big defence schemes in Europe (comparable to SAGE) on which to gain experience in preparation for time-sharing. Nevertheless, the communications firms can lay some claim to pioneering work which provided relevant groundwork. The most successful, back in generation-one days, came out of Standard Telephone and Cables and Standard Elektrik Lorenz—both ITT subsidiaries.

At the time the airlines were toying with automatic seat reservation schemes, about the time new consultants such as Teleregister were operating, the ITT subsidiaries were attempting their own versions on the Stantec Zebra computer. One of the most successful was a job with Scandinavian Airlines for weight and balance calculations. This had a special keyboard with interchangeable metal plates with prefixed information notched into the sides. In the few minutes before take-off ground staff could compute passenger loads and fuel volumes and from these the available capacity on individual flights for carrying additional revenue earning cargo.

Soaring ambitions overtook the computer-communications men as they tried to do a full airline job on a souped-up version of Stantec. Not surprisingly, they fell prey to slow speeds, shortage of capacity, no mass stores and working in near binary without debugging packages. Foolhardy it may have been. But the multi-discipline experience they gained the tough way is reflected to advantage now in the hard core of Cables and Lorenz men implementing time-sharing systems elsewhere.

the majors are busy too

Back in the mainstream, GE has levered its European subsidiaries into action with replicas of its 265. A year ago the London company, De La Rue Bull Machines, opened the first bureau on public telephone lines. Pitching straight into the professional programmer market and the science and engineering department needing extra capacity, GE's rates are retailing at \$14 to \$15 an hour plus \$72 a month for the terminal with the Post Office's standard Datel 200 modem for dial telephones to go on top.

The GE service in London is run by Alex Jones. With blossoming competition he is playing cautious about the number of customers hooked on-line, but it is around the 100 mark, and a second service is obviously in the air. But Jones says, "You'll find the U.K. customer cost-conscious." This is probably a polite way of saying the U.K. organisations are reluctant to split their budgets between the main dp cost centre and additional facilities. The technical departments have to make a good case for taking a time-sharing service from outside, and carry it on their own budgets.

GE followed on the London experience with a Paris office earlier this year. IBM has been playing things remarkably cool. Quiktran has seen daylight only in France; but as 7040/44's never really proliferated in Europe, this may be a partial explanation. The 360 replacement with RAX has been pushed in France and Germany. And in Switzerland it has made particularly good inroads with the Swiss Federal Laboratory, World Health Organisation and the University of Zurich's Institute of EDP. In the U.K. the first customer has gone live with the new conversational CPS for System 360 as a computational subset of PL/I.

But the big battle in the commercial field is brewing in the remote job entry field. University Computing Co. is trying its hand with Cope 45's. These have been introduced through Computer Services (Birmingham), which UCC took over last year. Computer Services was already up to the neck with an 1107 hooked to 1004 remote batch processors.

University Computing appears to have made CEIR Ltd. (the British Petroleum subsidiary bought from CEIR Inc.) hesitate in its plans. Another 1108 customer, CEIR intends to run its big OR and management science jobs on the 1108 with remote batch processing. But a time-sharing service which was scheduled first for a GE 645, then a 360/67, has taken a back seat, though there are studies for front-ending the 1108 with a suitable message switcher for designing an economic time-sharer.

CEIR Ltd.'s big competitor is the Metra organisation in Paris. Its information processing division, SIA, has a CDC 6600 that takes remote batch processing and an IBM 1130 and Univac 2000's are possible extras under investigation.

SIA takes a sizable volume of work from the U.K. and so has set up another 6600 centre in London to take these jobs as a base load for starting operations. Plans to put a broadband data link between the two centres appear to have been deferred. At the same time, SIA, Paris, is facing competition from more conventional sources in the form of the French Army and SNCF (French railroads), which are both selling off surplus 1108 time.

the university scene

The 6600 almost inevitably brings the topic into the university sphere. And at Aachen a big 6600 has gone in with consoles spread across the campus. Using Respond, this is a combined educational and research machine. Ultimately the university intends to offer terminals to neighbouring technical high schools and colleges. London University is also ready for a 6600 and intends to link in four satellites of the CDC 1700 class; but this batch of remote terminal machinery will probably be a mixture of ICT, CDC and IBM equipment.

As the manufacturers recovered their confidence after the traumas of mergers and so forth, the industry developments began to trickle out about 18 months ago. University groups forced the pace. The result is the scheme for Edinburgh University's multi-access project on an English Electric System 4-75. One of the few major multi-access schemes in a British university entirely financed from public funds, it may also turn out to be the only university to end up with this particular system.

An early casualty in university developments was at Glasgow where Gold (Glasgow On-Line Desks) fell victim to high ambitions. Designed around an English Electric KDF 9, the second-generation workhorse for most British universities, it tried to provide for up to 1,000 users a system to tackle all their jobs from big computations to undergraduate programs taking less than one second of processor time.

But the real problem in the universities has been to get the holders of purse strings to recognise the demarcation between the needs of the computing science men, the researchers demanding a computation service, and the educators. The financiers of the hardware are certainly not eager to separate the three. There is very little effort throughout Europe to sponsor research for assessing the value of time-sharing (or for that matter any other system) in terms of an education investment.

As is their way, universities walk in their own particular paths of righteousness. And any two universities that collaborate can be a good bet for coming up with at least four ideas on what to do. Newcastle University chose to help IBM recuperate with the model 67 by being the first in Europe to install one earlier this year: a 512K store machine with a 2314 disc and four 2741 terminals plus two 1130's operating as remote terminals. Newcastle is splitting the 67 between education, a university service, and research on information retrieval systems. The university's specialisation is in computer typesetting and allied information retrieval

and dissemination fields.

Southampton and Belfast took ICT 1900's and went for a Joss-type scheme. But complementary ideas have since diverged on agreeing what the two bodies expect to get out of the system.

One of the new universities, Brunel, near London, has gone for specialisation in graphics. The guiding light, Professor Maurice Pittaway, believes that low-cost terminals and graphic software are an essential and attainable goal. And the Brunel contribution to the state of the art may appear in hardware with some work on cheap buffers for graphic stores.

With Wilkes at the helm, Cambridge is always looked to as a leader in these matters. But its work is something of an enigma to the outside world. For communications from those cloisters always seem more fitting as an original contribution to Nature or as a point made with academic discreetness in discussion at a soiree. Nevertheless, Cambridge is the place from which the initiates expect radical advance to come on, cracking the difficulties of evaluating the costs of time-sharing. Although an eye-wipe of the literature tends to confirm suspicions about Cambridge's affluence in numerical analysts, there is important work afoot by A. G. "Sandy" Fraser, et al., on the principles of file-keeping and logging.

A further development for the universities has come from the plasma physics laboratory of the Atomic Energy Authority at Culham. As part of Egdon 3, the fusion research men have devised Cotan for a conversational Algol and computer-aided design background.

Egdon is a disc-based operating system for the KDF 9, which the Atomic Energy Authority uses in its numerous establishments. Egdon has been handed over to the KDF 9 universities. So Cotan is available for the extension into time-sharing.

Returning to Edinburgh, the department of Machine Intelligence and Perception, under Donald Michie, has one of the projects which has excited most interest over past months with POP 2—from the efforts of one Popplestone. Evolved initially as an interdepartmental piece of software for getting over the programming load, it has been taken up as a problem-oriented package for users in other areas of on-line computing. But its real forte is for statistical analysis on experimental data. As such it might be taken up and tailored to fit groups such as the medical research laboratories and so on.

the future of time-sharing

Until the economics of time-sharing are established on a realistic basis, the growth in Europe will be restricted to the big spenders that have taken most of the risks in edp development in the past. But there is another factor which will play a vital role. This is the willingness, or otherwise, of the communications authorities to take their responsibility seriously for providing transmission services. Although they pay lip service to the development and frequently quote the American figures for the fantastic increase in data traffic over switched lines, there is a marked gap in what is provided for the industry in practice.

A lot of United States equipment is allowed on lines only under sufferance. The alternative modems for dialed-line time-sharing services are local products that are becoming compulsory installations. Much equipment is still going through teething troubles. And lines for wide bandwidth, 48 kcs and up, are like gold-dust. Admittedly most of the communications organisations have big programmes for reorganising their telephone services. But it would be disastrous if capital expenditure on electronic exchanges left no resources for proper development of data services. For the immediate future of time-sharing in Europe undoubtedly rests on the communications bodies doing their job. ■

SYSTEMS TRAINING IN THE U. K.

3000 a year

by HEDLEY VOYSEY

□ Last autumn a 12-week seminar on adp was held in London under the patronage of IFIP. The avowed objectives of this term of teaching included a full understanding of the importance of systems analysis and design. All outward appearances showed the session to be a success, but it must be noted that of the handful of attendees who followed up the high-level attack of IFIP with attendance at the six-week systems analysis course—copyrighted by the UK's National Computing Centre—only one achieved a clear pass. It cannot be determined which of the sessions was the most useful to those who went to both, but all the indications are that in Europe there is a real need for effective courses on systems analysis, which set high standards for those qualifying, to fill the well-paid posts that are going begging.

Whether the NCC itself has collected full marks in its task report on the training of systems analysts is another matter. Currently funding about five out of every eight dollars spent by the NCC, the Ministry of Technology set up the centre in mid-1966 to stimulate computing. At that time the deficiency in systems manpower was estimated to be a yawning gap which would amount to 15-20,000 analytical bodies by 1970.

just getting started

This is the first year of full operation of the main NCC systems analysis course, which is being handled by nearly 30 educational institutes and about the same number of corporate organisations. Their total annual output should come to nearly 3,000 systems staff who have been cleared to swim in the deep end of the data processing "action tank."

So the gap remains. Although the U.K. has many institutes that may take up the NCC-packaged course, there is in practice a very limited number who have the appropriate background. But the NCC has both preliminary and advanced courses under way.

In the business data processing area the Centre has identified eight divisions in system development which are worthy of separate examination. The idea is to produce manuals and an updating service to cover these areas. The divisions are: project management; communication; feasibility and justification; systems organisation; implementa-

tion, monitoring and maintenance; documentation; compound methods; and applications standardisation.

The mysterious division is the one labelled "compound methods." The NCC reckons that these are packages usually covered by claims to copyright and wholly concerned with the use of computers for business edp. Strict discipline for input and output format descriptions is a symptom of these methods, which usually carry a unique notational symbology in addition to the accepted methods derived from flow charting, mathematical or formal logic practice.

The Centre is not likely to spread any of these methods abroad unless they can be satisfied that they are machine and programming language independent. The area of techniques which has been found suitable for immediate investment involves the use of computers for the non-creative parts of systems work.

Around \$100,000 has been put by the centre into developing Dataflow, a method designed to use clerical effort to relieve the systems man of the work of collecting data. Checking this data for errors and redundancies is then the task of a computer program, which finally presents the creative systems analyst with the dimensions of the data base and its fundamental structural boundaries and links.

The original work on the Dataflow idea came from a joint venture between Samuel Fox & Co. Ltd.—one of the companies of the U.K.'s giant United Steel group—and ICT Ltd., now the central company in the U.K.'s main computer group, ICL.

dataflow taken over

Just at the time when ICT's interest in the idea was flagging, the NCC came along and picked up the key man on the project and made the development and evaluation of Dataflow its own. Now the project and its designer, M. Crowther-Watson, are possibly heading towards the simula-

Mr. Voysey joined the U.K. edp division of NCR in 1957 as a systems analyst and moved on to Univac's U.K. operation in 1960. Since leaving Univac in 1965 he has been reporting on computer activities and is now engaged in journalism.

tion of alternative computer solutions to shifting contours of data volume and file interaction.

A token investment has also been made by the NCC in the brainchild of Urwick Diebold Ltd.: Systematics. Urwick Diebold is the U.K. consultant house linked by a very thin thread to the John Diebold organisation and Systematics is a system notation having an affinity to the use of decision tables in systems design. The technical head of the project is Kit Grindley, who has long believed that the use of a data dictionary with a suitable compiler could result in the direct generation of many data processing programs.

The University of Manchester is responsible for developing a Systematics compiler that will produce machine code directly from the completed specification forms. Despite its somewhat sceptical approach to the method, the NCC is gradually moving into related areas of activity which may impel it to become a principal partner in the evolution of Systematics.

Decision table development in the U.K. has been the active interest of a few devoted specialists, among whom the most notable is P.J.H. King of the University College of Wales at Aberystwyth, where Welsh nationalism is an important, if extracurricular, issue. King's interest in this field has led him to contribute many papers on the subject of decision tables and their use in systems analysis to U.S. and U.K. professional journals. Currently he is urged onwards by the attractions of on-line computing facilities in making the most of scarce system talent. The production of good documentation is seen by Peter King as being greatly helped by putting the development of a data dictionary on-line to the analysis use and interrogation of it.

In one of King's recent papers on the topic, presented at Datafair '67, he developed his ideas using the notation of BCL. BCL is a data centered language which does not display its structure explicitly, although precisely specifying data, leaving the possible processing methods as an implicit function of the compiling process. The NCC's route to involvement with BCL has been somewhat circuitous. The language is being developed at the University of London's Institute of Computer Science by Dave Hendry (DATAMATION, Dec. '67, p. 39). Hendry's success at producing a compact working compiler for the language has led the Centre to evaluate BCL as a possible candidate for a general-purpose language. It is doubtful whether they have fully realised just how closely connected the BCL notation is to the systems design field. All of the data processing systems work of the NCC to date has been in the nature of a crash project.

a modest crash programme

A crash programme in the U.K. is not one with a surplus of funds and plans for a grand assault; it is rather a return to the desperate days of Dunkirk. The title publicly blesses the assembly of a motley armada of craft to carry out a task reckoned by the mandarins of the Civil Service to be impossible of leading to a happy ending.

When the short term view is gloomy, the long term task develops an irresistible appeal. Information processing specialists throughout Europe are drawn towards fundamental work partly as a reaction from the chaotic condition of many current computer projects. Perhaps inevitably, therefore, the NCC has collected long-term theoretical objectives in the control information area. To quote the Centre: "A control information system is concerned with the methods by which information that is necessary for the coordinated achievement of an organisation's objective is made available to all the relevant parts of the organisation." The system, they say, "must be able to react to changes in information as well as to changes in organisation and objectives."

The Centre officially regards its support of the Dataflow and Systematics projects as part of its progress in the understanding of the control information area. To report quite

honestly, it should be emphasised that the men behind these two schemes are not suffering from delusions of grandeur, although they are both convinced that their methodologies will contribute the first steps along the long vista-less road towards control information systems understanding and implementation. To the real theorists in this field, the le Corbusier of information systems is Borje Langefors, whose book on the theoretical analysis of information systems is thought by many to be of fundamental importance in this area, although its marketing impact has been of the proverbial lead balloon. The NCC is to try and encourage a few hundred professionals to dip into the English translation over the next few months and then perhaps we shall see.

Meanwhile, it is not easy to ascertain the effect of Langefors' thinking in his home territory, which is in the Northern European University which spans Scandinavia. Langefors became interested in information for control systems some 25 years ago and is therefore in a good position to wag his finger at the world and say "it has been a very expensive, world-wide mistake not to have used scientific methods for analyzing business adp problems from the start."

genius out of algol

On a much more down-to-earth note, Langefors can claim to have shown many managements that their system layout was not compatible with the memory size planned for the computer. One of the more esoteric side-tracks that have involved Langefors over the years has resulted in a computer language called Genius, an Algol-based language. This has a compiler running on a Saab computer and a general outline of the language saw the light of day some four years ago in the Scandinavian professional journal BIT.

Although neither IBM nor many weary dp managers warm to a man who has been entangled with the Algol net, they are not likely to ignore someone who has written at length about the cost-versus-value balance of an information system.

This particular theme is coming to be a happy hunting ground for consultant groups in Europe who are offering their services and special brands of methodology to achieve an analysis of "decision values." The boldest of these firms goes on to offer prospective clients a computer system in which the priorities of scheduling are partially determined by the value of the information to an organisation. The hand of Langefors' system algebra can be seen mistily behind their claims to manipulate a precedence matrix to determine the sequencing of runs. The natural interaction of systems analysts and programmers is tending in Europe to confirm one of Langefors' basic postulates. He sees the design of a feasible system as an iteration between dual processes. Specification works downwards and construction goes upwards. The iterations are needed to obtain a match of constructed properties with the ones specified. Langefors extends this simple piece of observation to deal with the hierarchical structures which bedevil the large computer project, in Europe as elsewhere.

The distinctive aspect of computer developments in Europe is the sad estrangement of education and industry. The Carnegie ideal of industry contributing to the community never got a really firm grip on the European imagination. A bitter example of the resulting indifference to communal dangers has come from the NCC, which reports that many of the institutes giving its course in systems analysis are barely able to fill the available places. Apparently, industry is unwilling to release the appropriate staff or to sponsor students from elsewhere. When the crash programme crashes there will be an inevitable post-mortem—but the disease is just one of the characteristics of European history. ■

SOFTWARE IN EUROPE

by H. D. BAECKER

Delegates converging on Edinburgh for IFIP 68 will thrill to the seductive rhythms of Native European software. As it is the closed season there for both haggis and hardware, the following sample of entries in the acronym stakes shows what we can do: ASP, BCL, CORAL, MLS, MOP, ML-1, PL/I, POP-2, GEORGE 3, IMP9, SIMULA 67, ALGOL 68, IMP75, MR93. (Yes, you did see PL/I there. More of that below.)

The host city itself is well on to becoming Europe's liveliest software center, thanks to the initiative of its university administration. The Edinburgh Regional Computing Centre is the only general multi-access project supported specifically from public funds in Britain. Starting from the English Electric System 4/75 hardware the university's computer science department have contracted to devise and implement a conversational multi-access facility for student and research use. A System 4/75 "simulator" has been implemented on a KDF9 and preliminary work is up to schedule for delivery of the real hardware within a year to achieve a working system by 1970.

Parenthetically we might remark that years ago the assembly code for the KDF9 achieved one of the most valuable and most neglected software breakthroughs yet, an absolutely format free assembly code. The assembler only notices symbols that represent marks on paper when typed; the user may introduce spaces, tabs, new lines, etc. at his whim, or not. The hours of pain and misery this simple convention has saved—would that it were adopted universally!

But none of this simplicity for now. At Edinburgh the group had to evolve a system for a 4/75 on a KDF9, and accordingly devised IMP, an IMPlimentation language, that could be compiled on both machines. Hence IMP9 and IMP75. IMP is the latest in line of succession of that family that began with Mercury Autocode, re-established itself as CHLF 3 (the re-union of the natural offspring that had been

from asp to simula

fostered at Cambridge, Harwell, London, and Farnborough), and gave birth to EMA (Extended Mercury Autocode), father of Atlas Autocode. A collateral branch is K-Code (EMA implemented on KDF9), father of the IMP's. As rooted in history as FORTRAN, enough to confirm one's faith in reincarnation, or family incompatibilities.

good things in small packages

The other major center of software activity at Edinburgh University is the Department of Machine Intelligence. As a tool for their own experiments in artificial intelligence this small group have developed POP-2, an interactive multi-access system for small computers. A crude description would be to say that it is an ALGOL-like language for handling strings and lists. Without regard to circumstance POP-2 may seem no great achievement, but in the light of the meagre resources and small staff employed in its successful development, and of the minuscule equipment on which it



Mr. Baecker is now senior lecturer in computer science at the Imperial College of Science and Technology, London, but will soon move to the Univ. of Calgary, Alberta, as associate professor. Involved with computers as a programmer first, he served 12 years with manufacturers and consultants. In 1962, he was co-founder of Europe's leading software house, Computer Analysts and Programmers Ltd.

provides extensive useful facilities, it is an achievement indeed. The package is now available commercially from the National Research Development Corporation.

Before leaving Edinburgh we might remark that it is probably the only European university where it is intended, within two years at most, that every undergraduate, including students of theology, fine arts, etc., shall complete a programming course. A fitting venue for IFIP 68.

Across the water at the Norwegian Computing Center in Oslo there is much activity towards the formulation of a new version of their ALGOL-based simulation language, SIMULA. The new version, SIMULA 67, is intended to be more than a refurbishing of the original version; it aims to contend for the succession to ALGOL 60. To this end it incorporates the Hoare-Wirth proposals for ALGOL X. It is rumored that three manufacturers, Burroughs, CDC, and Univac, have commissioned implementations, as well as the Siberian Academy of Sciences at Novosibirsk. In any case some European software consultants are investing in the language in anticipation of its spread.

Going south to Amsterdam we find the Mathematical Centre who have just issued MR 93, their draft proposal for ALGOL 68, the only endeavor to this end blessed by IFIP. By conference time we should have an inkling of its likely fate. A kindly cynic might describe the proposals as an excellent language magnificently obscured by its method of definition. The authors of the report have learned much from PL/I, without acknowledgement, and have built a language that goes far beyond it, not only as a means of expression but in potential ease and efficiency of compilation. With the large amount of Canadian help in its formulation it would be ungracious to claim it as a solely European accomplishment.

Off to the south-east IBM Vienna are taking the chopper to PL/I in an attempt to arrive at a rigorous definition. It is said that if they cannot define it, it must go from the language. Then IBM Hursley (the company's U.K. development laboratories) have the job of proposing an equivalent definable facility, to replace the one lost. Hence the inclusion above of PL/I in things European; Hursley began the implementation of PL/I and now Vienna and Hursley are locked in strife over the future of the language.

Heinz Zemanek, who leads the IBM project in Vienna, is also chairman of IFIP Technical Committee 2, which will adjudicate the fate of ALGOL 68. How marvellously strange for once to have a person who actually knows what is going on in a responsible position!

action down south

Tracking north to Copenhagen, the once active hive at Regnecentralen is quiescent, or hatching some new work in secrecy. But far to the south in Rome, at the National Computation Institute, a hardware venture of great importance to software is running. It is the design and construction of a cheap computer that by microprogram achieves many of the facilities of the new large Burroughs machines. The prototype will be used to develop software for an as yet not announced production series, perhaps from Olivetti/GE. The availability of such a machine in Europe at a locally economic price would be of major importance to software development in general.

To the east lies ALGOL territory.

The ancient universities of England at Oxford and Cambridge now both have an interest in software research. A new Programming Research Unit at Oxford is mainly concerned with the exploration of compound data structures. Their work is so far impeded by lack of a machine of suitably advanced architecture for the testing of their theoretical studies.

At Cambridge the emphasis has swung from the construction of one-off hardware to software implementation.

ASP (Associative Structures Package) is a ring structure processor developed towards work in computer-aided design. ASP itself runs on the large Titan computer, which has a PDP-7/340 linked to it on site by a 20KHz line. A reduced version, ASP-7, runs on the satellite. The system owes much to CORAL (Computer On-line Real-time Applications Language) rings, and has also been implemented on the National Engineering Laboratory's Univac 1108.

A nascent concern at Cambridge is the development of a "graphics ASCII", a machine-independent notation for the interchange of graphical data from machine to machine. Essential to the notion is that a display file in this sought standard form should be equally suitable for processing, storage, or for transformation for driving any display or plotter.

Other work on the university Mathematical Laboratory's Titan has been the development of ML-1, a very powerful macrogenerator. Within amazingly wide limits it serves as the individualist's do-it-yourself kit for the expression of idiosyncracies of programming notation. If you have a good macrogenerator, do you need a compiler at all? Probably you do, to stop individualism running riot!

MLS (Multi-Language System) is the new job control system and language for Titan which allows for jobs that use all the software facilities in the library, and for programs composed of umpteen segments in umpteen languages to be linked, loaded and executed.

crossbreeding

Titan is a non-standard Atlas 2 prototype, and unique. The Ministry of Technology are underwriting the installation of another machine, also unique, a cross between Atlas 1 and Atlas 2, at Cambridge. This machine will be dedicated to multi-access development for computer-aided design. It is a comforting index of Britain's abundant wealth that so much public money can be poured into the hardware and software development of incompatible one-off machinery.

Down in London the hotbeds of software activity are at the University of London Institute of Computer Science and at the Imperial College of Science and Technology's Centre for Computing and Automation. At ULICS the current major development is that of BCL, a successor to ACL (Atlas Commercial Language). BCL is being designed for general information processing, and shows great promise. A reference manual is eagerly awaited and the authors claim it to be easy to compile efficiently. The language capitalizes on the best aspects of COBOL: firstly, that the description of data should be entirely divorced from the statement of the manipulations to be performed upon that data; and secondly, that as much as possible of the red tape of data manipulation should be implicit in the data description and not explicit in the procedure statements.

At the CCA the big project is Jockstrap (that's right, it's higher than a bootstrap). Officially it is the Compiler Processor project of the Ministry of Technology, a successor to the Manchester Compiler Compiler. The object is to generate a compiler for any describable language for any machine. The system itself is written in Sictran, and a table-driven Sictran in Sictran compiler allows Sictran to be moved from machine to machine merely by altering the tabular generators. Already the system has moved successfully between Atlas 1, ICT 1905, and IBM 7090.

Now that mergers have reduced British manufacturers to two, the amalgamated International Computers Ltd., and brash new Computer Technology Ltd., that scene is not very live. Computer Technology's Modular One is a design orientated towards efficient and flexible software, but so far the company has announced nothing more adventurous than FORTRAN. ICL are groping towards a new machine

SOFTWARE . . .

design to replace the senescent 1900 series. Much noise issues about a machine for the 1970's compatible with both the 1900 and System 4 (i.e. System/360 compatible almost plus), but that will probably mean some hardware that will accept both companies' I/O codes and both sets of source FORTRAN, COBOL, and ALGOL.

Ever on the horizon after these many years is the Basic Language Machine, now approaching software validation tests. Since John Iliffe published the basic idea many years ago most of the worthwhile features have been pre-empted by Burroughs to incorporate with their stack philosophy, and little novelty remains with the BLM. Of course the Basic Language itself does, but its usefulness as a software tool cannot be judged unless experience of its use becomes widespread. There seems to be no plan to gain wide experience. British business as usual.

george is coming

Users of the larger machines in the 1900 series eagerly await the release of GEORGE 3 (GENERAL ORGANISATIONAL Environment), an operating system some streets ahead of OS/360, when it works. Incorporated in GEORGE 3 is MOP (Multiple On-line Programming) for multi-access use of the machine. One of the strengths of the system is that the on-line and batch command languages are identical, and that jobs can be swung from foreground to background, and vice versa, at will. Most features of the command language, including macros and conditional job steps, are accessible from within program execution. The language is comprehensive, consistent, and uses a notation suitable for human comprehension (which must rate as a novelty). Meanwhile the potential users of yet larger 1900 machines can look forward to GEORGE 3D and GEORGE 4, for multiple processors and paging hardware respectively.

Military affairs are more wrapped in secrecy in Europe

than in the U.S. so it is difficult to comment on software for military command and control, save to note the NATO existence of CORAL. It is a persistent European delusion that the American use of large computers for many applications is frivolous ostentation, and that of course we Europeans can achieve better results with a quarter of the hardware and a tenth of the manpower. Ten years ago software development lay with languages and compilers, so European academic establishments were proud of 8K machines without backing storage. Today the frontier is at file management systems, so we are ordering machines with a few tapes and small discs. Just so the military economists saw JOVIAL, and ran. As a result we have CORAL, "a subset of JOVIAL," for 8K machines with maybe a magnetic tape or so, but not necessarily. It is reputed that somewhere a CORAL compiler works (how?) but that rumor was probably started by Soviet military intelligence to score their own bosses. In the meantime, the defence projects predicated on CORAL . . .

good packages for small users

Nowhere have these notes mentioned applications packages. Partly this maps the author's interests, and partly this reflects the uniformity of those fields on both sides of the ocean at the moment. Of the manufacturers, ICL are consolidating and many claim that now they do better by their small users than IBM. Plan Calcul de France is not yet ready to dazzle the world with achievement though French applications groups such as METRA are making noteworthy advances in management mathematics. The playing fields of Eton are giving ground to competition from management games by computer. The recent success of Rolls-Royce in gaining vast aero-engine contracts probably owes not a little to their own vast in-house management information system, MAGPIE (Machine Automatic Generation of Paper Instead of Engines). We pray delivery will be as successful as landing the orders in the first place. In Scandinavia and Germany many ships are being launched with largely computer-generated hull designs, using a variety of local packages. Soon, but not too soon, tourists to Britain will be able to book hotel rooms anywhere by benefit of a computer, as they may already make railway reservations in Germany. A little later we may be using interactive multi-access facilities to teach students about the facilities themselves.

This paper tour may have given a drab picture of the European software scene. In many ways it is. Fundamental problems are only considered seriously when adventurous applications demand new approaches and when the designer can foresee that his findings will have some influence on hardware. These conditions do not at this moment exist in Europe to any appreciable extent. The universities in particular are alive with ideas, but as long as there is no hope of hardware to match them effort will be dissipated in politics.

As a finale to IFIP 68 we might celebrate the establishment of the first professional qualifications in computing by the British Computer Society by meeting in solemn procession on the Royal Mile. For this occasion Members will wear gowns of white telex tape punched "MBCS" repetitively in CCITT No. 2, whilst Fellows will wear green one-inch tape perforated with "FBCS" in CCITT No. 5. ■



COMPUTER SALES TO THE EAST

by ROGER PERKINSON

At this writing, an intellectual revolution is taking place in at least two Eastern European countries, Czechoslovakia and Poland. In the former, a startling change in the political arena has resulted; in the latter, a pressed government faces a serious challenge. It is interesting to note that computer people from the Western world, particularly the U. K., France and the U. S., played—however unintentionally—at least some minor part, along with other Western representatives of different industries.

The price these governments paid for progress cannot only be expressed in hard currency, but also in the exposure to and contact with these representatives who provided the brainware necessary to make the systems work, but whose combined influence on their normally well educated counterparts extended beyond the technical field. My colleagues and I are unanimous in admiring their open disposition during discussions involving economic and political thoughts, while at the same time remaining quite loyal to their fundamental socialistic concepts. The present government in Czechoslovakia reflects very well indeed the desire to incorporate some political and economic aspects found normally in the Western world and still remain true to the Socialist cause.

I suppose it could have been foreseen that computer people, if anyone, would some day pierce the so-called "Iron Curtain." There was simply no other way for the Socialist countries to catch up. Even today, there are only some 2400 systems installed, 2000 of which are in the Soviet Union with the remainder spread among the six other countries. Less than 50 of these systems are from the West and, what is more important, the vast majority are used for scientific and military purposes.

through the iron curtain

Recognition in recent years that the efficiency of an enterprise can be significantly improved with the use of edp, and that some of the problems associated with a labor shortage (other than the U.S.S.R. and Yugoslavia) can be resolved, has created strong central government pressure to automate in industrial areas. Funds were made available, and the welcome mat was out to supporting personnel. It wasn't always so. In the beginning at least one system was ordered (by the Soviet Union from a U.K. supplier) "hardware only," but this experience (it took two years to make it productive) proved the fallacy of this approach.

Well now, what is it like to be a Western computer representative in the Socialist countries? In discussing the two aspects, professional and personal, it is first of all well to keep in mind that, while one can generalize, there are differences among the countries concerned. This applies especially (and perhaps only) to the German Democratic Republic to which the Churchillian expression "Iron Curtain" still fits. It is difficult to obtain permission to enter the country, although once invited—even though you may be selling—you are a guest and treated as such. Nonetheless it is depressing and chilling to pass over the border controls, through the four or five physical barriers (walls, barbed wire, etc.) and inspections. While inside the country, you are restricted to the area for which your permit is issued.

the stowaway problem

If going in seems an incredible procedure, coming out is even more so, as the automobile (if you are driving) is thoroughly searched to make certain you haven't given passage to anyone from their country who wishes to leave. Baggage is removed, trunk and engine space inspected,

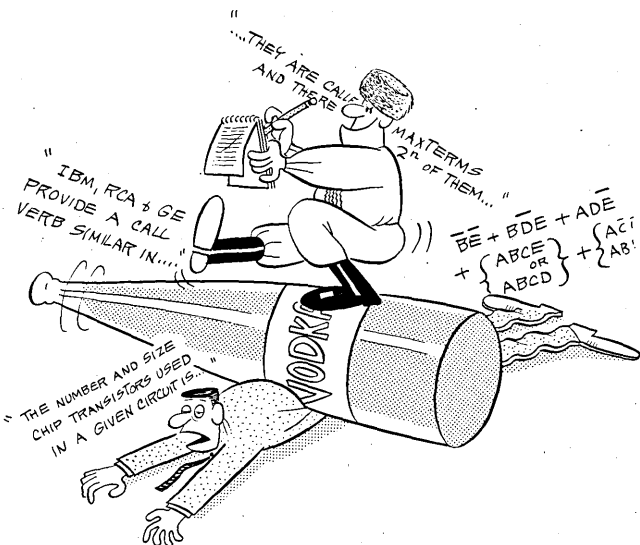
**SALES
TO THE EAST...**

seats removed, the underside of the auto inspected, and a rod is even pushed into the gasoline tank! The exit procedure begins five miles from the border at the first control point, and by the time you are "on the other side" again, you breathe a sigh of relief, even after much of this experience. Relative freedom of movement and more civilized border controls are the rules for the other countries.

From a professional point of view, we are frequently surprised how well informed our colleagues on the other side are. Technical publications from the Western world are apparently quite thoroughly read, and thus their theoretical knowledge is quite good. This is supplemented by intensive discussions with Western visitors, often referred to as the "bleeding process," in which the visitor is gently but firmly pumped for information by his eager but also grateful hosts. Generally, the information flow is one-way as the human desire to learn a bit more about their operation, experience and problems is offset by the equally understandable human desire to return home, and that means not risking the ever present threat of someone suspecting espionage. This, of course, makes the gathering of useful information for a suitable proposal sometimes rather difficult. Indeed, the whole foreign computer industry group working in the Socialist countries deserves much credit for having accomplished so much in so short a time without one of them ever having been suspect.

finding someone to sign

If the information gathering process is a problem, a more serious and frustrating one is establishing contact with the "right" people. Virtually without exception, more than one government agency is involved and more often than not, contract approval rests still elsewhere in some mysterious ministry office which is totally inaccessible to Westerners.



Naturally (?) this process takes a very long time, partially due to the fact that hard currency is involved, partially because of the number of interested agencies that have to approve, and last but not least because no one in the Socialist countries likes to take sole responsibility for a decision, let alone one dealing with Western suppliers. Consequently, impatient Americans have been relatively unsuccessful in obtaining contracts. [One American representing

a very large supplier was unsuccessful because he insisted on exclusive use of his firm's products in one country!]

To the extent that interest exists in using Western systems, this is principally due to the fact that peripheral equipment is much more advanced, although the improved technology in central processors is also a factor. One has to see, for example, a Minsk 22 tape unit in operation in order to appreciate the capabilities of those available in the Western world. For those not familiar with this device, just consider a low density, low speed system in which there is no



take-up reel. The tape from the input reel (120 meters) is fed into one of the columns, the operator taking care that (a) it doesn't run completely off as he has to take the tail end and feed it into the other column, and (b) that his fingers aren't caught somewhere in the process. At best this takes three minutes for each mounting and demounting, but consider, of course, the much more limited storage on each reel as opposed to Western versions. What's more, the Minsk units are not compatible with each other—a tape written on one drive can only be read by the same one. Mass storage devices are not available at all, and the speed and quality of high speed printers leaves much to be desired.

u. k. firms in the lead

Both English Electric Leo Marconi and ICT have been rather successful in penetrating this market. The recent merger of these companies into the ICL group should give them a significant edge over their competitors—Univac, NCR, Control Data, IBM, Saab and Bull/GE, roughly in that order. In the meantime, however, these countries are also trying to expand their own manufacturing capabilities. Furthest ahead is the Soviet Union, about to announce a Minsk 24, the German Democratic Republic with their Robotron, and Poland with their Odra. These systems have second generation characteristics, but it is generally well known that the Soviet Union is importing advanced integrated circuitry through Finland and has the capability to employ it. The East Germans wish to produce their own with an eye to becoming a supplier for the Soviet Union. In any event, there will be a market for Western computer systems for many years to come, based simply on limited productive capacity and the inability to catch up and keep pace with our developments.

The software situation is more confusing. At the compiler level, ALGOL is favoured but FORTRAN is being used. Most of the other manufacturers' software is also being used, but COBOL appears to be gaining acceptance for commercial applications.

Where our Eastern friends appear to be gaining much ground is in the area of education, especially in the Soviet Union and East Germany. Institutes have been established for the particular purpose of advanced training in the edp field. Notably those in Siberia and Dresden are well staffed and equipped. Graduates can expect to obtain (by Socialist countries' standards) well paying jobs, but these pay between six to seven times less than their counterparts in the Western world. One should note, however, that since items such as housing, medical care, transportation, etc. are state supported and are considerably less expensive than in the West, the real purchasing power difference is closer to a factor of three or four.

day-to-day living

From a personal point of view, working "over there" certainly provides seemingly endless new experiences as well as problems. Take, for example, the simple matter of having a suitable place to work and sleep. For the former, office



IBM headquarters, Room 124, Hotel Europeski, Warsaw, Poland.

space is available only in a hotel, and a rather long wait is normal to obtain a room. For the latter, it is virtually impossible to rent an apartment even if your stay is an extended one. Some have been lucky enough to obtain a room with a private family but these have been exceptions since apartments are normally quite small by Western standards.

Or take the matter of exchanging money. There is, of course, the official exchange rate of 24 rubles to the dollar, which, if you are careful and wise, is adhered to. But almost any Russian friend will offer you 40 rubles to the dollar, and the temptation becomes greater with black market prices ranging from 70 to 100 rubles. But even the official rate of

exchange varies from the 24 rubles depending on the goods purchased! Thus it is 30 for printed matter, 50 for computer systems and 80 for medical instruments. To a greater or lesser extent the same is true in the other countries. In Warsaw, for example, there is a store reasonably well known to foreigners where a kindly old man, given Western currency,



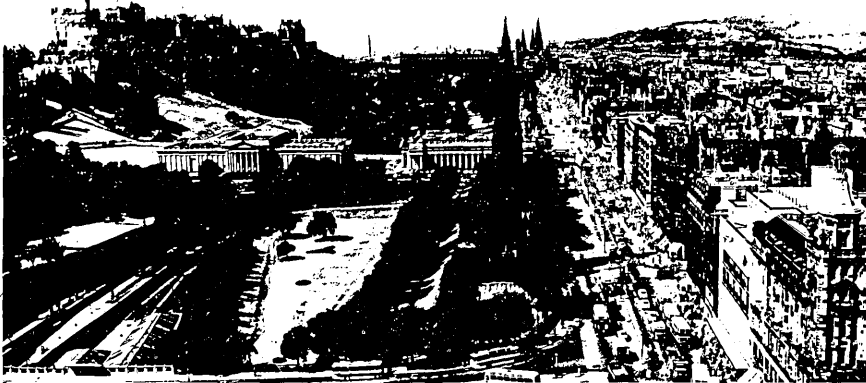
returns the change with a nice bonus, and in Prague one is accosted in the streets (I guess, no matter how hard we try, we dress differently) by black market money changers. This is a very dangerous game to play, as penalties are rather severe considering the nature of the crime.

Since this is not a touristic account of life in the Socialist countries, I will refrain from reciting the long list of interesting experiences and impressions, except to summarize these by suggesting that those who have not been there generally have a totally false (and poor) impression of what it is really like, and those who have made a visit have an equally false (and good) impression, because during their short stay they have been exposed to the touristic sights, lived in fine hotels in Budapest, Warsaw, Prague, Moscow and so on. But those of us who have to live and work there, who have the daily problem of finding a place to eat, calling someone on the telephone (directories are in the post office), getting a taxi, communicating—even if you are fluent in English, French and German—making appointments, fighting the incredible bureaucracy . . . we appreciate the easy way of doing business in the West. Still, the people are the same the world over, and in general it has been, from a personal point of view, a rewarding experience. In fact, you admire what they have accomplished under such often difficult circumstances, you admire their courage when you surprisingly hear a piano player in a Warsaw restaurant play the theme from the (forbidden) Dr. Zhivago, when you partake in increasingly frank debates in Prague . . . and you can't help but admire their open friendship expressed in so many ways and on so many occasions, even by the police in case of a traffic violation.

To an as yet unappreciated extent, the computer community from the Western world has not only contributed to the intellectual revolution, but to the basic friendship which should exist between peoples of all countries. In the final analysis, this will prove to be of value to future peace and understanding in our world. ■

IFIP CONGRESS 68

edinburgh
august 5-10



CONFERENCE PARTICULARS

From the edges of an extinct volcano, Castle Rock, sprawls the political, judicial, and cultural capital of Scotland—Edinburgh. It has been the home of religious reformer John Knox, King James the Sixth of Scotland and First of England, of the inspiration for “Dr. Jekyll and Mr. Hyde”—Deacon Brodie, and of men of letters and science like Sir Walter Scott, Arthur Conan Doyle, Robert Burns. Two-thirds of its history, we’re told, is found within the Royal Mile, an almost straight line which goes from Edinburgh Castle atop Castle Rock, past St. Giles Cathedral, Knox’s House and other landmarks, to Holyrood Palace, the Queen’s Scottish residence.

Fielding’s Guide tells us it is one of the very few bright spots of the Central Lowlands, a “narrow band which belts the waist of the nation, containing ¾th of Scotland’s 5 million inhabitants and nearly all its heavy industries,” including a very rapidly growing electronics industry.

As the site for a major information sciences conference—IFIP Congress 68—it sounds like one of the most pleasant mixes of “beauty and beast” ever chosen.

IFIP Congress 68, August 5-10, should draw nearly 3,000 professionals and observers of this field from all over the world. This is the fourth of the triennial congresses, sponsored by the International Federation of Information Processing Societies, which represents the national professional societies of 28 countries. UNESCO sponsored the first, held in Paris in 1959, which actually led to IFIP’s formation and the subsequent congresses in Munich (1962) and New York (1965).

The Congress, chaired by B. B. Swann of Ferranti Ltd. in London, of course features the technical programme. It is a dense and highly technical combination of invited and selected papers (about 250) and only four panel discussions. The 58 paper sessions can generally be categorized: *computer applications*, including physical and life sciences, engineering, linguistics, library science, management and business, social sciences, arts and the humanities; *mathematics*—computational methods in analysis, combinatorial and discrete mathematics, theory of machines, theory of algorithms; *hardware*—analog and hybrid com-

puters, computer systems, real-time systems, time-sharing; *software*—programming languages, compilers and other language processors, parallel programming, data structures.

Those attending from the U.S. will find many compatriots on the podium, as 100 papers are coming from here. Some 48 papers will be from the United Kingdom and 17 from France. Signifying the increasing representation from Eastern Europe are the nine papers from Czechoslovakia. Program chairman is F. Genuys, IBM, France.

The congresses aboard are seldom as exhibit-oriented as the AFIP spring and fall meetings, where the equipment demonstrations are reaching almost unmanageable proportions. The Edinburgh meeting will, however, have a substantial number of manufacturer and publications booths—76, at last count. These will be at the Waverley Market Exhibit Hall. According to a partial list of what will be shown, there will be some emphasis on communications-related products—crt’s, keyboard terminals, concentrators, along with computers (including the Israeli Elbit system), ocr equipment, plotters, printers, numerical control

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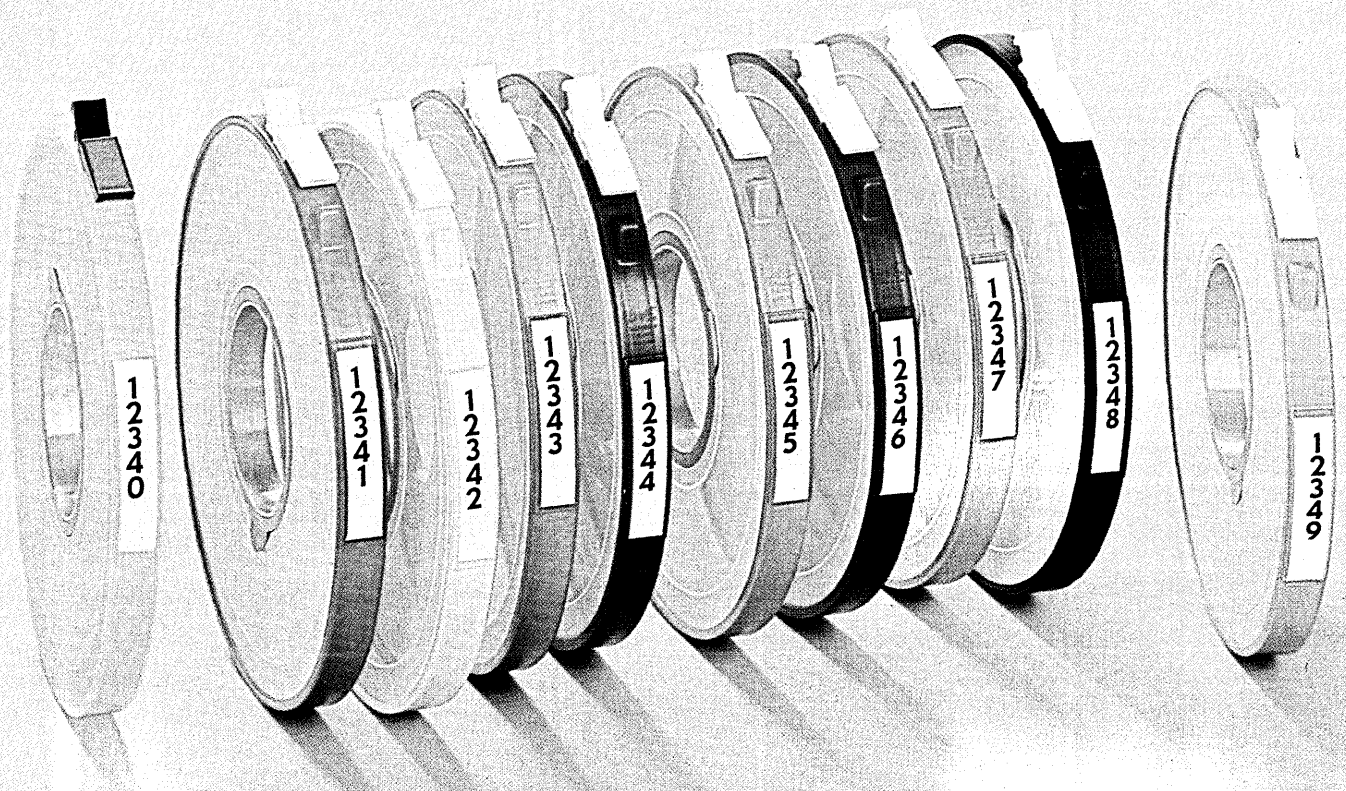
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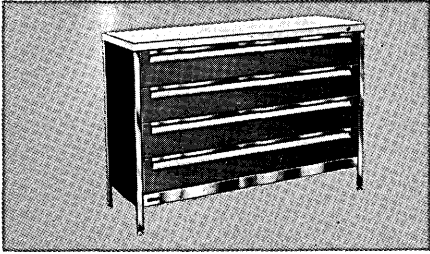
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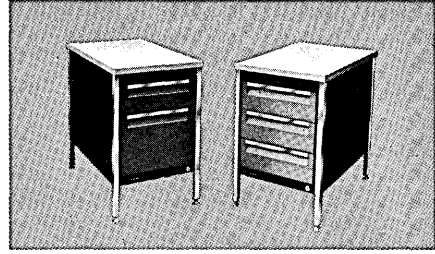
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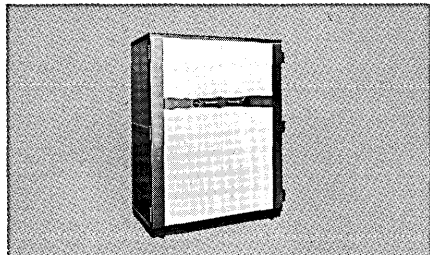
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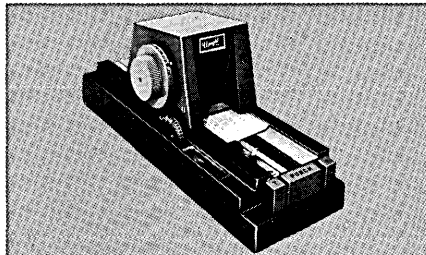
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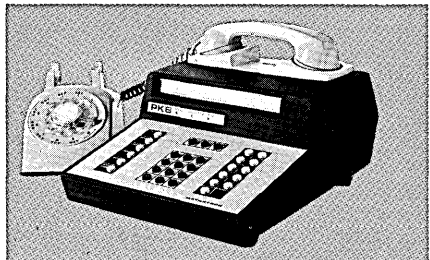
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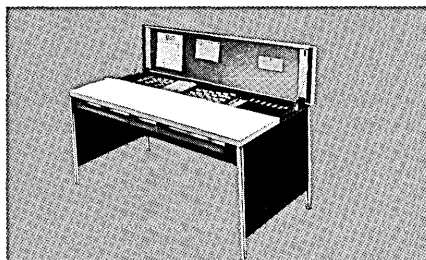
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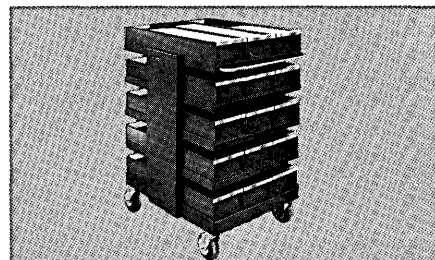
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systems, components, and software systems and services. The exhibitor most representative of U.K. activity will be the National Computing Centre, a public company sponsored by the Ministry of Technology and supported by manufacturers, users, and others to "encourage the use of computers in the U.K."

The Congress will officially begin Monday, August 5, at 10 a.m. with the opening session featuring an inaugural address by the Admiral of the Fleet, Earl Mountbatten of Burma. Ambrose P. Speiser, president of IFIP, will give welcoming comments. "Computer Science and Education" is the topic of a special address by George E. Forsythe of Stanford University.

From then on it is the technical sessions through Friday afternoon. Except Monday, 9-12 noon of each day will have one special session (invited papers) and four paper sessions running concurrently. In the afternoon, 2-4 will have the same fare; 4:30-6:30 will have a panel session, special session, and three paper sessions. The panels will deal with information processing education in schools, the computer utility, the economics of edp programming, and interaction among users, manufacturers, and designers.

The closing session on Saturday will feature three invited presentations by P. Suppes of Stanford University on "Computer-Assisted Education" and by A. Q. Morton of Scotland on "The Computer in Literary Studies," and by Sir Paul Chambers (UK) "The Long-Term Implications for Society of Information Processing." Following this, A. P. Speiser, will introduce the newly elected president of IFIP, P. A. Dorodnicyn of the U.S.S.R.

The sessions will be held in various Edinburgh University halls around the center of the city.

IFIP Congress plans several pleasant social events as well. On Sunday, August 4, an inter-denominational service will inaugurate the gathering. Wednesday afternoon, the Lord Provost of Edinburgh will host an afternoon garden party and reception at Lauriston Castle, a 16th century mansion overlooking the Firth of Forth (the mouth of the Forth River.) Thursday an orchestral concert will be held in the George Square Theatre at 8 p.m. and will include a performance of the prize-winning computer composition in the IFIP competition. (Charge: £1.1.0 or \$2.50)

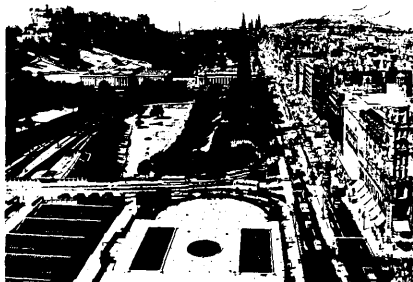
The informal-dress IFIP Congress 68 banquet on Friday at the Assembly

Rooms should be one hit of the week. For £4.4.0, get ready for a feast. Menu starts with Galloway prawn cocktail and cockieleeekie soup (chicken, leeks, sherry). And heralded in by a bagpipe orchestra will be the Haggis with champit and neeps and a wee bit o' sauce (loosely translated: chopped mutton in sheep's belly, potatoes, turnips, and Scotch). Now, the main course: cold roast East Lothian turkey, home-cured gamon, and Ayrshire potatoes with Beaujolais and Weirsteiner wines. Follow that if you can with soufflé ice Royal Stuart with coffee and Drambuie.

And follow that if you can with the Buffet Dance after dinner at the George Hotel.

The main social centre will be the Congress Club in the Assembly Rooms on George Street to which all delegates will qualify as members. Lunch, dinner, bar, and bank, postal, and tour information services will be available there.

For those going to Scotland early or remaining afterward and wishing to take a tour, contact Thomas Cook & Sons in New York or London. Particularly noted are four tours after the Congress in Scotland, three of historic and scenic interest. The fourth, August 11-15, is a technical and scenic tour between Edinburgh and London. Technical visits include the National



Computer Centre, Institute of Science and Technology, Manchester University, Ferranti, English Electric Computers, and ICT. Cost: \$88.

An outstanding, internationally famous event that is mandatory for post-Congress vacationers is the 22nd Edinburgh International Festival, August 18 to September 7. It is theatre, music and pageantry. Among the features: London Symphony Orchestra, U.S.S.R. State Orchestra, New Philharmonic Orchestra, Hamburg State Opera, English Opera Group, Scottish Opera; numerous theatre companies will do plays ranging from *Hamlet* to those of current established and new playwrights. Chamber concerts and recitals will feature musicians like

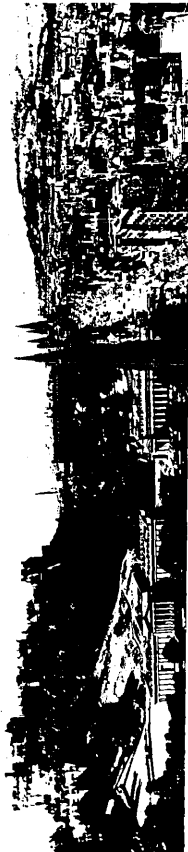
Daniel Barenboim, cellist, and violinist Isaac Stern. The military tattoo is another popular Festival event.

Other events during or around Congress time are the National Sheepdog Trials in Dorloch, north of Edinburgh, Aug. 1-3; the Royal Scottish Academy annual art exhibition, closing Aug. 4; and the Highland Games in Edinburgh on August 17. The latter has all the traditional highland contests of strength—tossing the caber, throwing the Scottish hammer and so on—as well as the highland dancing and pipe music. There's supposed to be a National Pipe Band Contest there, but the British Travel Service couldn't tell us about it; for bagpipe devotees, all we can think of is the Edinburgh fire chief, who, as a very gracious host to an IFIP committeeman from the U.S., staged an impromptu concert at the fire house.

About Edinburgh. Some of the many sights down the Royal Mile were noted above. Along the beautiful countryside are places such as Glamis Castle, Gretna Green, Loch Katrine, Dryburgh Abbey, and Loch Lomond. As we confess to never having been to Scotland (only lived it vicariously through "Brigadoon," Burns, and *Fielding's Guide*) here are some tips on food and fun, obtained second-hand. From friends: try the restaurant at North British Hotel, Hawes Inn at the Firth of Forth, and Mill Inn, a lovely old inn by a mill about 20 miles out of Edinburgh. From Fielding: Ambassadeurs at George is said to turn out gargantuan meals like Angus roast beef, potatoes and Yorkshire pudding for \$3.25; it also has a "swinging dance band" for those who love "Glow Worm" and "Nola." If you're wild about banquet fare, try MacGregor's "Own Scottish Dinner." Also recommended in Edinburgh is Cafe Royal & Oyster Bar (seafood).

In the suburbs, not far from the city's center, are Prestonfield House, a "beautiful converted estate gentled by somnolent grass, gaming peacocks, and grazing lambs;" excellent cuisine, fire-side bar, and very friendly management recommend it. And there's Cramond Inn, a 300-year old village tavern owned by tycoon Lindsay Gumley and offering good inexpensive fare. Rich dining on copper service is found at Howgate Inn (45 minutes away).

For food and a bit of gambling, it's Royale Chimes Casino and the Graf-ton in the city, but ask the concierge at your hotel for introductions. Nightclubbing is non-existent, though. Glasgow is said to swing more in this way. But for pubs try The Abbotsford (ask for Henry Kennedy), The Volunteer Arms, and The Golf Tavern out at



TECHNICAL PROGRAM

Bruntsfield Links. (Edinburgh's 20 golf courses include the Muirfield championship course which periodically hosts the British Open.)

For recreation, in addition to golf and fishing, there's the Scottish Council of Physical Recreation in the city which will teach you any sport "from mumblety-peg to rhinoceros lassoing," and—the Bureau for Investigating the Loch Ness Monster Phenomena Ltd.

Other tips: don't wander the moors alone, don't call a Scotsman "Scotch," eat breakfast before 9:30 a.m. or you won't get any, don't drink while in charge of a car—including the time you're in a pub with the keys in your pocket—and don't fear the Scottish merchant because the people are renowned for being honest "kirk" (church) goers.

And when you raise your glass of Glenlivet (100-proof) Scotch to the friendly Scotsmen, the toast goes something like, "Slans jeväh," "Slans jeväh" to IFIP Congress 68, too.

—ANGELINE PANTAGES

<p>MONDAY, AUGUST 5 10:00 A.M. OPENING CEREMONY 11:20 A.M. INVITED PAPER SESSION 2:00 — 4:00 P.M. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Special Topics in Compilers Information Retrieval Mathematical Linguistics and Its Applications Design Automation 4:30 — 6:30 P.M. INVITED PAPER SESSION DISCUSSION PANEL Education in Information Processing in Schools SUBMITTED PAPER SESSIONS Techniques in Commercial Programming Data Communications Approximation</p>	<p>TUESDAY, AUGUST 6 9:00 A.M. — 12:00 N. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Systems Planning Formal Languages and Definitions Linear Algebra Analogue and Hybrid Systems 2:00 — 4:00 P.M. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS System for Information Retrieval Numerical Analysis Component Technology Applications in Physical Science 4:30 — 6:30 P.M. INVITED PAPER SESSION DISCUSSION PANEL Structure and Operation of a Computer Utility SUBMITTED PAPER SESSIONS Management Aids Partial Differential Equations</p>	<p>Design of Software WEDNESDAY, AUGUST 7 9:00 A.M. — 12:00 N. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Computer System Organisation Artificial Intelligence Compiler Techniques Learning and Teaching THURSDAY, AUGUST 8 9:00 A.M. — 12:00 N. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Operating System Implementation Analysis of Computer Systems Real-Time Ultra Reliable Systems Discrete Mathematics 2:00 — 4:00 P.M. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS</p>	<p>Applications in Marketing and Production Applications to the Social Sciences Data Structure Manipulation Languages Mathematical Programming 4:30 — 6:30 P.M. INVITED PAPER SESSION DISCUSSION PANEL The Economics of Programming for EDP SUBMITTED PAPER SESSIONS Application Languages File Structure Theory of Computation FRIDAY, AUGUST 9 9:00 A.M. — 12:00 N. INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Son et Lumiere File Management and Data Banks Applications in Engineering Automata Theory 2:00 — 4:00 P.M.</p>	<p>INVITED PAPER SESSION SUBMITTED PAPER SESSIONS Picture Processing Applications in Biology and Medicine Ordinary Differential Equations Scientific Data Processing Systems 4:30 — 6:30 P.M. INVITED PAPER SESSION DISCUSSION PANEL Interaction Among Users, Designers and Manufacturers SUBMITTED PAPER SESSIONS Computer Assisted Training and Education Computer Networks Pattern Recognition</p>
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PROGRAM TESTING AND VALIDATING

test pattern

by FRED GRUENBERGER

The beginning student of computing—and the general public—ask “How can you tell that the answers from the computer are right?” The novice is probably really questioning the electronic reliability of the machine, but the question is still a good one. Offhand, it would seem to be of paramount importance to ensure correct results. The subject of program testing ought to be stressed in introductory courses; since it has been missing from our textbooks, it may interest experienced programmers as well.

The stages in the solution of a problem by computer can be named and isolated; they are analysis, flowcharting, coding, debugging, testing, documentation, and production. This is not to say that the programmer engages in these activities one at a time to the exclusion of the others, but rather that they can be described and discussed as distinct phases. Any discussion of documentation, for example, points out that documentation should take place during the other six stages, and should begin along with the problem analysis.

The testing phase of a program is vital, and has been almost totally neglected in the literature (except where it has been confused with debugging).

what is testing?

Program testing is the process whereby the programmer assures himself that his program solves the problem he started out to solve, and will continue to solve it as the data changes.

Debugging has been completed; the mechanical errors of coding have been tracked down and corrected. Logical errors that lead to mechanical troubles, such as overflow, have also been eliminated. The program now runs and produces results. The testing phase begins here. Testing is distinct from debugging, although testing might reveal the need for extensive reprogramming, after which the debugging stage must be repeated. The distinction between the two phases may be expressed this way: when debugging is completed, the program definitely solves some problem. Testing seeks to guarantee that it is the problem that was intended. Inci-

dentally, testing refers to the logic of the *program*; that is, we are not concerned with testing the reliability of the machine.

Testing a computer program involves partly science and partly art. The science involves being able to predict what will (or should) happen when the program is tested; the art lies in knowing what to test for, how to devise adequate tests, and when to stop testing.

It is not possible to draw up a set of all-purpose rules for testing a program. One splendid rule does exist: namely, never to rely on printing out masses of data to be examined by eye. Beyond that, testing is a matter of practice. The beginner is apt to put a great deal of faith into a program that is only partially tested and be embarrassed when his “tested” program blows up or delivers nonsensical results. Notice that even in those two situations (blowup and nonsense), at least the error will come to light. It is the subtle error, the one that produces almost-right results, that is to be guarded against.

One can, of course, test a program to death. The point about knowing when to stop testing is a subtle one, and comes about only with experience.

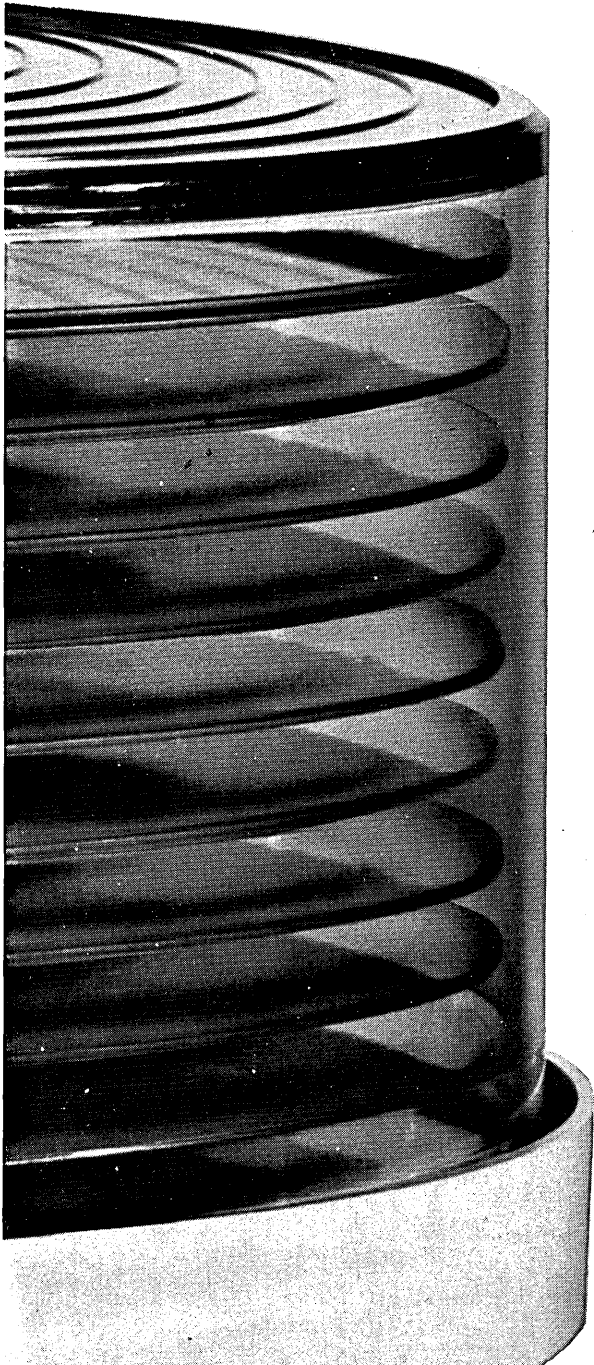
Testing a program boils down to this: the program must



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More to come

PROGRAM TESTING . . .

be run with known test data that lead to known answers.

Some simple examples will clarify the concept. Suppose that a program is written to sum the contents of 100 words in storage. We assume as always that debugging is completed; the program runs and produces a result. How can this program be tested?

an example of testing

A possible first test is to try all zeros for the data. (Zero data makes a good first test for many programs; if the data is read from cards, for example, blank cards may suffice.) In the case of our simple program for summing, the known result is zero. This gives a necessary but not sufficient test. But note: *all* tests have this feature of providing necessary but not sufficient conditions. The goal is to increase our confidence level in the ability of the program to perform its task. Using zero data, we should have some confidence in the program, but not much. We need another set of data, consisting of non-zero numbers. How about filling the data area with 100 numbers that are all sevens, say, to yield a known result of 700?

We are not headed in the right direction. Our program would undoubtedly be some form of loop, to be executed 100 times. Experience with loops shows that the following situations, for a loop with 100 iterations, are all easy to program:

1. 101 iterations.
2. 99 iterations.
3. Zero iterations (the loop never functions at all).
4. Infinitely many iterations (we never get out of the loop).
5. One iteration repeated 100 times (that is, we do not advance through the data, but operate solely on the first word).

Our test must verify that none of these errors has been committed. Data consisting of numbers that are all alike will not catch the fifth type of error. A better choice is data numbers that are all different. A sensible choice would be the numbers from 1 through 100, and these can be generated with another loop, rather than be read in from data cards.

Two objections arise immediately. Writing such a test procedure seems to be a task of the same magnitude as the writing of the program being tested. Moreover, it is natural to question how *that* loop will be tested.

The first objection is answered by pointing out that the example itself is trivial, so the amount of work in devising the test appears to be all out of proportion. In practical work, the testing procedure may be no more elaborate and be applied to a long and complex program.

The second objection is even simpler. If we generate systematic data and apply our program to it, and we then get correct results, we have tested both procedures at once. If either of them fails, the results will be incorrect. Systematic data is that which is readily generated (e.g., a progression), for which results can be calculated without having to repeat all the calculations of the program.

For our problem in summing, the known result (the sum of the first 100 consecutive integers) can be determined by the formula:

$$\left(\frac{1}{2}\right)(F + L)(N)$$

where F and L stand for the first and last terms, and N is the number of terms. In our example, we have $\left(\frac{1}{2}\right)(1 + 100)(100) = 5050$. For systematic operations with systematic data, there is frequently a formula to use to calculate the results. It is not necessary that the programmer *know*

these formulas: he need only know that they exist.

If we use the test described above (generate consecutive integers, sum them, and produce the correct result), can we be sure that the program (a) is working properly, and (b) will continue to work properly with new data? We can never be sure, no matter how many tests we devise. We have, however, reached a fairly high level of confidence that the logic of our program is correct.

There can still remain questions of mechanics, even in such a simple program. We do not know, for example, the limits on the data; that is, the size of the numbers that the program cannot handle properly.

In more complex programs, we will be concerned with testing the logical paths that can be threaded through the program. In such cases, testing is all art, and the programmer's ingenuity is strained to the limit to devise adequate tests. As with so many aspects of computing, the key to success is practice. If good testing procedures can be derived for simple problems, and the habit of doing testing is developed, then testing procedures for larger programs will become natural and easy.

methods of testing

The beginner usually approaches the subject of testing with a casual air. His approach to the problem is to subject the program to some data—any data—and examine the results by eye. There are several things wrong with eyeball techniques of testing.

First, the human eye can fail to note errors even when they are pointed out. It is a notoriously poor tool for this purpose. Second, the student thinks in terms of small amounts of data and results, because practice problems are made up that way. (The problem of summing 100 numbers could just as easily have been made to read 10,000 numbers.) And third, the whole concept of laborious keypunching (of input data sets), lengthy printouts, and tedious reading of results is in opposition to our whole approach to computers. Computers are tools that serve us. Whenever possible, we should use them. Thus, we don't want to key-punch test data; we want, if possible, to *generate* it. We don't want to read results by eye; whatever it is we would be looking for, the computer can be programmed to search for us.

Testing, as a new concept for students, can be explored through consideration of simple examples. One such is a program to calculate and print the roots of a quadratic equation, given the values of the coefficients on data cards. That is, for each card bearing the three values a, b, and c, the program should print them back out, together with the two roots of the equations $ax^2 + bx + c = 0$. As before, we postulate that we are already past the debugging state; that is, the problem has already been analyzed, flowcharted, coded, and debugged. Some test cases must already have been run during the debugging process. We want, now, assurance that our program can handle any quadratic equation that is presented to it in the form of its three coefficients. In order to localize our thinking about this problem, let us assume that the coding was done in FORTRAN and the input data cards have values of a, b, and c in floating point form.

Is it clear that such a program will be limited, during execution, to the speeds of the card reader and printer, if the input and output is on-line?¹ That being the case, test

¹ As opposed to off-line. In the latter case, card reading (to magnetic tape) is a separate operation, as is magnetic-tape-to-printer for the output. Large machine installations tend to have their input/output functions done off-line, to free the central processor from these time-consuming chores. For small machines, it is common to have the input and output units connected directly to the central processing unit (cpu); they are said to be on-line. Thus, the on-line situation for the quadratic problem would be I/O bound.

cases are cheap, and we can afford to fabricate many of them. Fig. 1 lists a set of possible test cases, with the values for a, b, and c given in fixed point form for convenience.

It is worth repeating the goals of testing in the context of this problem. With the program subjected to test data with known answers, we seek assurances that the program will solve our problem and that it will continue to solve that problem for any future data. Of equal importance is the consideration of when to stop testing; that is, at what point is our confidence in the program high enough to certify that the program is indeed tested?

With these points in mind, the reader is urged to consider

	a	b	c	Remarks
1.	0	0	0	The obvious first case; there is no equation. What should the program do?
2.	0	0	10	An error case. Is there an appropriate message?
3.	0	5	17	It's not a true quadratic equation. What should happen?
4.	3	7	0	Should be no trouble here.
5.	6	1	-2	Normal case.
6.	3	2	5	The complex root case.
7.	7	0	0	Is anything unusual here?
8.	0	13	0	Do we get two roots from this?
9.	Very large numbers			Seek the limits of the arithmetic system being used.

Fig. 1. Test data for testing the quadratic program.

the tests of Fig. 1 carefully. Are all the unusual cases cared for? If the program handled all nine situations properly, would you consider the program thoroughly tested? Putting it another way, would your confidence level increase with more test cases? If so, what cases would you try?

controls

Closely allied to the concept of testing a program is the topic of program *controls*. Controls should establish a running check that all is proceeding properly during processing. This includes edit checking of the input data, checks that all the data is there, and checks that all the output has been produced. Controls should provide a three-stage check:

1. Signal some sort of out-of-balance condition.
2. Indicate approximately where to look for the trouble.
3. Indicate when to *stop* looking.

Consider, for example, a file processing application to be run daily. Yesterday's run produced 20,000 records on a reel of magnetic tape. The first control in today's run should count the input records and verify that the count is, indeed, 20,000. If any number other than 20,000 shows up, the program should sound alarms, since no further processing can be expected to yield correct results. If the count is 20,000, the program is only eligible to yield correct results, of course. How can it happen that a run that produced 20,000 output records yesterday has some number other than 20,000 today? Ah, yes, how do these things happen? It's a form of McDougal's Law, and the programmer who neglects to check such things has strange and wonderful things owed to him—and the debt will be paid.

This is an elementary control, and answers only the first criterion; namely, that an error condition has been detected. If the record counts have been made by classes (e.g., by departments, in a payroll file), then the control has pinpointed the error to a smaller area than the entire file. But even so, the error is indicated only by a rough count, which is not enough. Suppose, for example, that two records were lost and one record had become duplicated; the record count might show 19,999, but *three* records need to be traced down.

A more stringent control is provided by various *hash totals*. Again, consider a payroll file. One part of each record in such a file is the employee's name, recorded in its usual alphabetic form. Instead of counting the records, the employee names can be added to form a hash total (the idea of arithmetic addition on alphabetic information seems odd, but recall that inside a computer all information is essentially numeric, no matter how it may be represented when fed to an output printer). The output hash total from one run must agree with the input hash total for the subsequent run. This is not essentially different from a check of the record counts, except that the control is much tighter and, when an error is indicated, we know when to stop looking. But notice also that an error in a hash total provides some clue, by its very nature, as to where the error might be. Suppose, for simplicity, that the hash total is taken on social security numbers, and the input hash total differs from the output total by 387093834. We then know that we're probably off by one record, and if we locate a record with that particular social security number, we know we can stop looking.

Controls include such things as sequence checks or consecutive number checks on incoming data (notice that these two are different), as well as reasonableness tests on the data. Most data values, in real life problems, have an acceptable range; it is a necessary part of a program to edit check the data for reasonableness.

In computer work, troubles proceed rapidly (this is where the great speed that the manufacturers claim becomes evident), and the program will be far from the source of the trouble unless controls are built in. Controls should not only trigger some kind of alarm, but demand some feedback in the form of corrective action (if only to kick the job off the machine). Program controls should be located within program segments, as a rule; the segment size is that from which you can readily recover.

Controls should be programmed to catch any errors at the earliest possible time. The goal, as with testing, is to increase the confidence level of the program's reliability and accuracy. It is easy to overcontrol, just as it is easy to overtest. The trick is to know when to stop; thus the writing of controls is also an art. The seasoned programmer thinks in terms of controls and tests, whereas it is one of the signs of the novice that he shows too much faith in both the machine and his programming ability.

summary

As has been pointed out, testing is more of an art than a science. There are no rules of testing (other than the general one of avoiding lengthy printouts to be read by eye). Each program to be tested requires a new approach, and the programmer's ingenuity. We must test every program, and every subpart of every program; we can never assume that our instructions to the machine will yield correct results just because we wrote them, or because they worked once. The cry of the novice is always "If it works for this case, I'll be perfectly satisfied that it will always work." The experienced programmer learns to be suspicious of his own programs, and becomes adept at inventing procedures that test his own logic as fully as possible.

The concept of program testing becomes clearer the more cases one considers. Thus, the exercises that follow are particularly important.

summary outline for program testing

1. Provide known data, preferably data generated by a short routine. The data is not there by itself ("see if the numbers are moved properly") nor will it be selected for you ("put some odd numbers into the input area").
2. Run the program being tested.
3. State the expected answers; you must know what you

Elaborate funerary stela "offering list" which was accepted as a substitute for actual gifts; 1,200 B.C. Courtesy of Lowie Museum of Anthropology, University of California at Berkeley.



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PROGRAM TESTING . . .

expect to happen (not "check to see if the results are correct").

4. Know when to stop. Perfect testing can never be achieved, but it is possible to plug most loopholes (see exercise I-d, for example). The test should cover the normal situations, of course, but it should also reveal that correct action will be taken for the unusual cases. Programs are usually tested by their programmer. He must satisfy himself that his program is tested. Thus, he must do enough testing to ensure not being embarrassed by having his "tested" program blow up, and yet avoid testing the program endlessly. The point at which to draw the line is a function of experience; first attempts at testing by beginners on extremely simple problems are usually ludicrous.

One rule always applies: any scheme of testing that requires human reading (and/or comparing) of many numbers is a poor testing technique. "Many," in this context, is six.

The program in question is the one to be tested, and not some other program that may be easier to test. Thus, a testing procedure that begins "Change the loop from 10,000 cases to 8 cases" is already wrong.

Three other suggestions might be helpful. All-alike test data is usually weak ("fill the given area of storage with 7's"). Testing methods that simply repeat the logic of the routine being tested will also be weak. Many poor tests are not equal to one good one (and two good tests are no better than one).

exercises

1. The storage area addressed at T , $T + 1$, $T + 2$, . . . , $T + 4999$ contains 5000 numbers. They are to be reversed in sequence; that is, the number at address T is to appear at $T + 4999$; the number at $T + 4999$ is to appear at T ; the numbers at $T + 7$ and $T + 4992$ are to be interchanged,

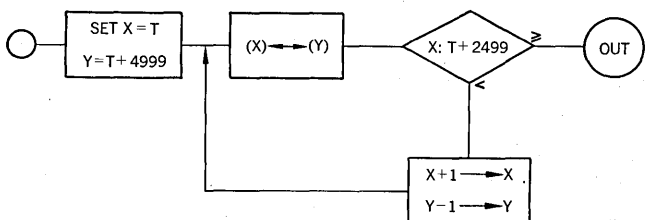


Fig. 2. Reversing the sequence of 5000 words in storage.

and so on. The flowchart of Fig. 2 shows the logic of the solution. A code has been written to follow the flowchart, and debugging is completed. The program should now be tested.

Listed below are various suggested methods of testing this program. Which of these would provide an adequate testing procedure? For those that do not, indicate wherein they are weak.

a. Read in to storage any 5000 numbers from data cards to the area between T and $T + 4999$. Run the program with this data. Print out the 5000 numbers and examine them to see that the reversal has taken place properly.

b. Generate, with two loops, the number 1 in words T through $T + 2499$ and the number 2 in words $T + 2500$ through $T + 4999$. Run the program, and examine the printout of the 5000 words to see that the program has executed correctly.

c. Generate, with a loop, the numbers from 1 to 5000 in the given storage area. Run the program. Write and execute another loop that checks that the numbers in the given area

are now in descending order; that is, that $(T_i) > (T_{i+1})$ for all i .

d. Load the storage area with any nonzero, different, numbers by any means. Run the program *twice*. Check that the data is now in its original order.

e. Generate the numbers from 1-5000 in the storage area. Sum these numbers and print the sum. Run the program. Sum the 5000 numbers and print the sum. The two sums should be 12,502,500.

f. Generate data as in b. Write loops to sum the first 2500 numbers and the last 2500 numbers. Run these loops, then the program, then these loops again. Print the four sums, which should be 2500, 5000, 5000, and 2500 in that order.

g. Clear the contents of the 5000 words to zero. Load words T , $T + 2499$, $T + 2500$, and $T + 4999$ with the numbers 1, 2, 3, and 4. Run the program. Print out the new contents of those four words, which should now be 4, 3, 2, and 1.

2. A program is written to calculate and print the sum of the cubes of the numbers in 299 consecutive words in storage. Outline an adequate test procedure for this program.

3. Numbers are stored at 300 consecutive addresses. A section of a program counts how many of these 300 numbers are odd, and how many are even. The following test procedure is suggested for this program.

Generate the numbers from 1 to 300 in the given storage area, using a simple loop. Add 1 to the 300th word. Run the program and print out the two counts. Now, with another loop, add 1 to the contents of every word of data. Run the program again and print. The four printed results should be (odd result first) 151, 149, 149, and 151.

(It bears repeating that in such exercises, the tests we devise may overshadow the program in size and labor. The point, of course, is to become familiar with the concept of testing.)

Is the testing procedure airtight? Would you have a high degree of confidence that the program performs properly and would continue to do so with any set of 300 numbers?

4. A beginning student can hardly be expected to appreciate the size, complexity, and multiple paths of a payroll program—even a simple one. Nevertheless, a payroll program is the epitome of business data processing work. Consider only the obvious elements of such a program: the calculations of gross and net pay, and the printing of paychecks. Indicate some of the elements of a test procedure for a payroll program.

Notice that we have moved out of the area of finger exercises into the real world. A payroll program runs to many thousands of instructions, and may represent several man-years of effort to get past the debugging stage. Adequate tests for such a program could well justify several man-weeks of effort. But we don't just try to run every combination of values, and we do try to use the computer as much as possible. We may, in this case, have to read long printouts carefully.

5. A program is written to sort 100 words, using an interchange scheme. Describe a test procedure for this program. Following is a list of possible sets of test data for the sorting program. Since an important part of testing is knowing when to stop, indicate which of these sets of data would be vital to the test procedure, and which could be neglected.

- 100 zeros.
- 100 nonzero numbers, all alike.
- The numbers from 1 to 100.
- The numbers from 100 to 1.
- Random numbers.

f. 100 numbers representing the real data that the program will be used on.

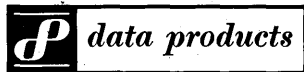
6. A popular activity, both casually (on college campuses) and commercially, is the use of computers to match

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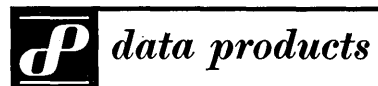
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CIRCLE 20 ON READER CARD

PROGRAM TESTING . . .

men and women according to their stated interests and backgrounds. Without dwelling at length on the detailed logic of such programs, consider computer dating as a problem in testing. The input to such a program is a file of information on a great many people. The output should show, for each person, a list of those of the opposite sex who most closely match on as many characteristics as possible (e.g., age, height, religion, race, sports, politics, literature, the theater and art, etc.). Given such files and the program, indicate what you could do to test the program.

7. For most modern computers there exists a program library (usually maintained by a users group) of useful programs that have been contributed by their writers. A catalog is issued periodically with a description of each program, its range and limitations, and the exact machine configuration needed to use it.

It is reasonable to assume that the writer of a library program subjected it to a thorough test. It is folly for any user to use such a program without thoroughly testing it himself. These two statements are not inconsistent. The writer of the program tested it for his purposes, on his machine. The purposes of another user might be quite different, and the machine will almost certainly be different. Although computers are mass produced, their construction is actually never completed. Engineering changes are made constantly during a computer's life, and there are always subtle differences between different machines of the same model. Moreover, modern computers are highly modular, with many options in their configurations, to the point where it is unlikely that two identical machines are installed.

To be specific, a user of an IBM 1620 gets from the library a program that will perform 40-digit floating point arithmetic. The program package includes subroutines for 40-digit addition, multiplication, division, square root, logarithm, exponential, and sine. All arithmetic operations have a range of ± 100 in the exponent, or so the program documentation indicates.

What sort of testing procedure should the user initiate for this package? He now wants to apply the program to a known problem, involving a great deal of arithmetic, having known results. What sort of problems would fit these requirements?

8. Another library program is available to perform rectangular to polar coordinate conversion (and vice versa). Indicate a test procedure for this program. It does not suffice to say "feed the program some known coordinates and see that they are converted correctly." Just what coordinates would you use? How many would it take to satisfy you that the program works properly and will continue to work properly?

9. It is not uncommon to read in the newspaper an account of someone receiving a check from a business firm, or a government agency, for some very large and incorrect amount. The check was printed as part of the output of a computer program. What controls should have been added to the program to forestall such errors?

10. Sets of numbers like (3,4,5), (5,12,13) and (39,80,89) are called Pythagorean triplets. They represent the sides of a right triangle. Calling them (X,Y,Z), they satisfy the relation $X^2 + Y^2 = Z^2$.

It is possible to generate all such triplets of numbers systematically by the following algorithm. Choose integers, R and S, having three restrictions:

- R is greater than S.
- R and S are of opposite parity; that is, one is odd and the other is even.

c. R and S have no factor in common; that is, their greatest common divisor is 1.

Given values for R and S, the values of X, Y, and Z are then given by these formulas:

$$X = R^2 - S^2$$

$$Y = 2RS$$

$$Z = R^2 + S^2.$$

For example, R = 15, S = 8 satisfy all three conditions, giving X, Y, and Z values of 161, 240, and 289. If R and S are generated systematically, then X, Y, and Z will be also, and a table of Pythagorean triplets can be generated. (Tables of these numbers have been calculated for thousands of entries.)

As a training exercise, a program is written to calculate and print the first thousand Pythagorean triplets. Outline a scheme for testing the program. Notice that the testing procedure should be applied before committing the program to production.

11. A biologist has some data in the form of 2×2 arrays as follows:

$$\begin{array}{c|c} a & b \\ \hline c & d \end{array}$$

where it is given that, in all cases,

$$a + b = c + d$$

and

$$N = a + b + c + d.$$

He wants the following formula evaluated.

$$\frac{N \left(\left| \begin{array}{c} a - c \\ b + d \end{array} \right| - 1 \right)^2}{(a+b)(b+d)}$$

(this is chi-squared, including a correction for continuity).

The biologist assures the programmer that his data will conform to the following specifications.

a. There will be exactly 50 sets in each batch he submits for processing.

b. The values of a, b, c, and d for each set will be punched on a card in columns 1-12, with each value being a 3-digit integer.

c. No value will be smaller than 005 or larger than 758.

d. $(a + b)$ will equal $(c + d)$.

e. The evaluation of the formula will yield a number that is positive and in the range 0-999; it is to be calculated to two decimal places, rounded from the third place.

The biologist's problem is coded and debugged.

A. What controls should be built into the program?

B. What procedure should be followed for testing the program?

12. A library program is available to solve sets of simultaneous linear equations up to 40 equations in 40 variables. It is written in FORTRAN, with the normal 8-digit floating point format for the data.

You want to use this program to solve 10 equations in 10 unknowns. Before using it, you proceed to test it. Indicate the test procedure you would use.

conclusion

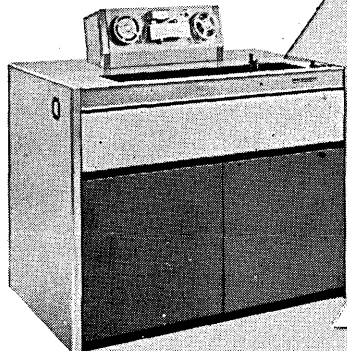
Exercise 1 has been given to many beginners, together with all the precautions about testing that are in this article. The most common solution is (e), and those giving it are somewhat hurt to discover that the step "Run the program" could be omitted without changing anything. It is a curious test that does not require the running of the program being tested.

In similar fashion, students are fond of devising elaborate tests that lack feedback; solution (c) is of this type. If the program and the test both functioned perfectly, nothing visible would happen. A good test should furnish positive feedback to the programmer, so that all possible loopholes are plugged. ■

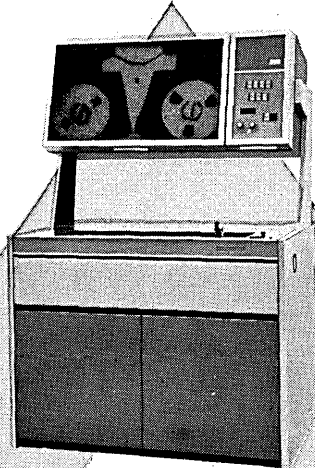
DELTA COMMAND SYSTEMS

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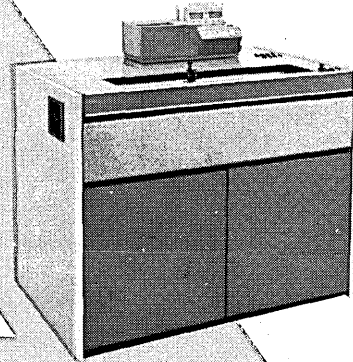
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CIRCLE 21 ON READER CARD

BUSINESS DP DEGREE PROGRAMS

a deficiency

by J. DANIEL COUGER

A recent study reveals that the quality of university programs on business data processing is inadequate. This condition exists despite the large number of bdp degree programs in existence. The report *Computers in Higher Education*¹ provides the results of a stratified random sample of 669 of the 2219 institutions of higher education and has been interpreted by some to indicate that the national shortage for bdp personnel will soon be resolved. However, closer analysis of the statistics in the report raises the question concerning the quality of such programs. The following table (Table 1) reveals the cause of concern.

The table indicates that a little over 89% of the bdp programs in existence in 1964-65 were aimed at producing associate degrees. Less than 7% produced bachelors degrees; 3% produced masters degrees, and 1% produced doctorate degrees. Programs planned for implementation during the next three years change these proportions only

Table 1; Table 2 at right

Curriculum Area	Semester Hours
Arts and Science Courses	54
Including math through calculus	
School of Business Courses	
Core Courses required of all business students:	36
Business Law (3), Accounting (6), Finance (6), Production (3), Personnel (3), Marketing (3), Statistics (6), Management Science (3), Computer Fundamentals & Programming (3)	
Business Data Processing Courses:	12
Systems Analysis and Design (3), Large File Design (3), Systems Simulation (3), Computer-Based Info Systems (3)	
Computer Science Courses	12
Computer Organization and Assembly Languages (3), Information Structures (3), Computer and Programming Systems (3), Elective (3)	
University Electives	10
	<hr/> 124

Name of Program	Degree Programs in Computer Science ²									
	Number of Schools With Program By Level of Degree									
	164-65					Planned for 165-68				
	Assoc.	Bach.	Mast.	Doct.	Total	Assoc.	Bach.	Mast.	Doct.	Total
Computer Science	0	11	17	12	40	17	81	59	26	183
Bus. Data Proc.	83	6	3	1	93	74	9	1	1	85
Info. Science	0	2	12	4	18	0	2	5	9	16
All Others	0	25	29	21	75	14	15	11	7	47

slightly. On the other hand, only 8% of the non-business computer science programs to be implemented by 1968 are aimed at producing associate degrees.

Although it might be argued that two years is sufficient to prepare a person to enter some bdp jobs, two years is inadequate preparation for a systems designer. The associate degree programs are appropriate only for training persons for lower level positions in the bdp field, such as computer operators and coders.

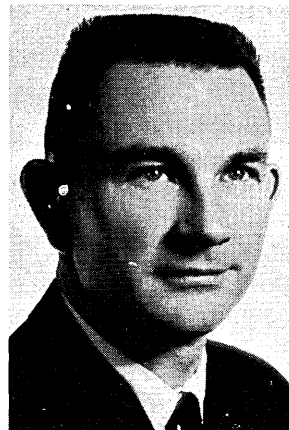
an approach to improved bdp curriculum

The following program (Table 2) for an undergraduate degree in bdp systems analysis and design is offered for consideration.

The core courses offered by the school of business provide the necessary background for business systems study. The

¹Computers in Higher Education, Southern Regional Education Board, Atlanta, August, 1967.

²Ibid., page 14.



Dr. Couger is associate professor of management science at the Univ. of Colorado School of Business. Before joining the CU faculty, he spent 13 years in industry, including eight in the computer field. He is co-chairman of the national lectureship series for the ACM and co-editor of the series on Business Data Processing published by John Wiley & Sons.

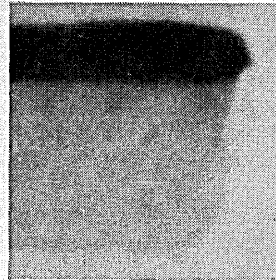
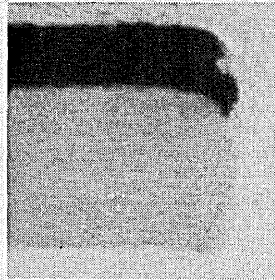
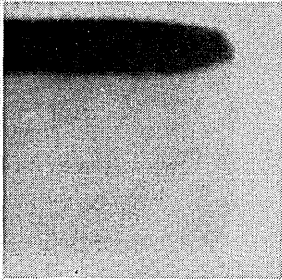
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1. The two ends of the tape were inserted into a plexi-glass tube.
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3. When completely cured, the cylinder was put on a lathe.
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- You have probably never worried about how your computer tape looks in cross-section, but believe it or not, it's an angle worth considering.
- The unretouched photos above are representative cross-section views (at approximately 500X) of three leading "premium" tape brands, together with Computron's new TVP2.
- You can see at a glance that, of the four specimens, only TVP2 displays a clean, rectangular edge. Why is this important? Primarily because in this way TVP2 greatly reduces the possibility of error-producing edge debris.
- When oxide overhang is present, small fragments are almost certain to break off in use. With a non-rectangular cut there is uneven edge wear between the oxide and backing, weak spots develop and the edges fracture and chip. This means an increased probability of dropouts, both transient and permanent.
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DEGREE PROGRAMS . . .

course on computer-based management information systems is already being taught in some schools of business as a part of the required curriculum for all students.

As to the contents of the four courses in bdp, the 12-hour option in information systems offered in the Wharton School of Business can be used to show the proper ingredients for such curriculum:³

The computer science courses are among those recommended by the A.C.M. Curriculum Committee on Computer Science. The contents follow.⁴

Computer organization and assembly languages. Logical basis of computer structure, machine representation of number and characters, flow of control, instruction codes, arithmetic and logical operations, indexing and indirect addressing, input-output, subroutines, linkages, macros, interpretative, and assembly systems, pushdown stacks, and recent advances in computer organization. Several computer projects to illustrate basic concepts are incorporated.

Information structures. Study of the information representations and relationships between the form of represen-

tation and processing techniques. Transformation between storage media. Referencing of information as related to the structure of its representation and implication for the design of the referencing language.

Computer and programming systems. Input-output and storage systems, structures and transformations of data bases, assembly and executive systems.

summary

First-generation bdp systems design concept emphasized computerizing existing manual or punched card operations. The large-scale, computer-based management information system is the objective in third-generation systems efforts. Analysis of the data in the S.R.E. board report reveals that the majority of bdp degree programs inadequately prepare a person to participate in design of third-generation systems.

The users of the academic product, governmental and industrial organizations, must impress upon the universities the need to redesign and upgrade bdp curriculum. The professional societies appear to be the best means to channel such action. The degree program suggested (p. 49) is offered as a starting point for discussion between practitioners and academicians. ■

M.B.A. Option in Information Systems University of Pennsylvania

I.S. 200. Computers and Computation

1. Concept of computation and algorithmic procedures.
2. Concept of a stored program computer.
3. Computer organization.
4. Computer languages (e.g., FORTRAN and PL/I).
5. Numerical methods and error estimation.
6. Number systems and information representation.
7. Characteristics of computers (e.g., fixed vs. variable word, decimal vs. binary, index registers, etc.).
8. Machine language programming.
9. Input-Output devices.
10. Storage devices.
11. Introduction to supervisory programs and the use of sub-routine packages.
12. Concepts of file organization.
13. Introduction to computer simulation.

A heavy emphasis will be placed on exercises in numerical analysis and problems involving relatively complex logic (e.g., simulation exercises).

I.S. 201. Information Systems Design

1. Characteristics of a system.
2. User requirements.
3. Data collection and error control.
4. Classification and compression of data.
5. Data transmission.
6. Data display.
7. Data base organization.
8. Design of sequential access systems.
9. Design of random access systems.
10. Design of on-line real-time systems.
11. System design languages: flow charts, decision tables, COBOL.
12. Sorting, indexing, and file searching.
13. "Software" for systems design (e.g., operating systems and application packages and generators).
14. Systems design techniques.
15. Simulation as a tool of systems design.

A heavy emphasis will be placed on exercises involving file maintenance, file organization, and data flow with an information system.

I.S. 202. Advanced Topics in Information Technology

1. Hierarchical storage and techniques of storage allocation.
2. Concepts of information retrieval.
3. Languages: simulation, list processing, and data management.
4. Role of programmed decision making.
5. Introduction to numerical optimization and search techniques (e.g., classical methods, gradient methods, mathematical programming).
6. Heuristic programming techniques.
7. Compiler design.
8. Software systems design.
9. Time sharing systems and information utilities.
10. Man-machine processes.

Students will be required to complete a project requiring independent work in one of the above topics.

I.S. 203. The Organization and Information Systems

1. The organization as a system.
2. Organizational planning and control.
3. Introduction to decision theory.
4. Role of analytical and simulation models for decision making.
5. Information for decision making.
6. Value and cost of information.
7. The concept of integrated information systems.
8. Steps in implementing a system: feasibility studies, specification of master plan, detailed design, conversion from existing system.
9. Security, back-up, and audit considerations.
10. On-line systems for planning and control.
11. Organizational and social implications of information technology.

³ Cauger, J. D., *Computers and the Schools of Business*. Business Research Division, University of Colorado, November, 1967, p. 23.

⁴ "An Undergraduate Program in Computer Science," *Communications of the A.C.M.*, Vol. 8, No. 9, 1965, pp. 543-552.

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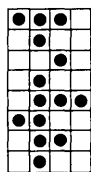
A PDP 10 to a mass storage installation. An FPS-16 Radar to an 8 bit processor.

A whole crew of auto analyzers and mass spectrometers to PDP8S's. Also . . .

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A NEW FACE IN PHOENIX

computer pro takes charge

Last April 16, General Electric appointed John W. Haanstra as general manager of the Information Systems Equipment Division. That's the arm of the company's Information Systems Group which builds and markets GE's computer systems in the USA.

The appointment was a double surprise: Haanstra, who joined GE only nine months prior to this new assignment, is the first man without an extensive GE background to head up computer activities. And he's the first in the post with long, heavy and broad computer management experience.

Haanstra spent 18 years at IBM in a wide range of assignments: he headed up engineering and production of the immensely successful 1400 series . . . later managed research and software activities. He joined GE last August as a staff consultant to ISG general manager J. Stanford Smith, then was named general manager of the Advanced Development and Resources Planning Division under Smith on Jan 1.

The appointment of a non-GE computer man to run the company's domestic computer business will be viewed by some industry observers as a dramatic reversal of GE policy. Haanstra's three predecessors in Phoenix seem to have been chosen according to an implicit GE policy which says that a good (proven) manager can manage anything.

At any rate, the computer industry—and GE top management—will undoubtedly be watching him with special

interest to see if an experienced computer man can salvage GE's massive investment in edp.

The following article, based on the first press interview granted by Haanstra since his appointment as GE's top domestic computer man, offers a preliminary look at the man, his management philosophy, and the tactics by which he hopes to create order and profitability in Phoenix.

John W. Haanstra, 42, is a big man (6'1", 220 lbs.), energetic and outgoing. Sitting in his shirt sleeves on a

couch in a corner of a large airconditioned office carefully shuttered from a late-May Phoenix temperature of 106°, Haanstra thoughtfully considers the opening question: "Why did you leave IBM?"

His hands go behind his head and he stares painfully at a spot in the ceiling. "Well, to look at it positively, because my perception of the business says that GE has a good chance to make it."

Words like cohesive and coordinated pop up often as he reviews GE's role in the computer industry. Implicit in Haanstra's remarks was the notion that GE has many assets; it's a matter of pulling them together.

The assets, as Haanstra sees them, include the association with Bull-GE and GE Information Systems Italia (formerly Olivetti-GE), the two European computer equipment manufacturers acquired by GE in 1964. "The association," says Haanstra, "gives us a worldwide organization, and we're



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Yet problems do arise when a company grows to the point where it has twelve plants throughout the world.

Inventory problem. A fantastic amount of items must be kept track of. Especially when most of them are seasonal in nature.

When styles change from year to year. When a line of goods must be completed six months to a year in advance

of the regular selling season.

When space and inventory expenses are skyrocketing to the point that

they are not only an expense but a major problem for the present and future.

At Spalding & Gros, the inventory and warehouse departments have decided what to do about it and what to do next.

Complained? No. They're applying a real problem to a common solution.

To solve it, Spalding selected a 12-year computer system.

It's the Spalding & Gros Spalding & Gros Inventory System.

It's an information system that can system-rates for merchandise in all of the warehouses, pricing inventory items which haven't moved well in a certain time

of the year, and that can be used to determine the best way to handle it.

It's a system that can be used to determine the best way to handle it.

It's a system that can be used to determine the best way to handle it.

It's a system that can be used to determine the best way to handle it.

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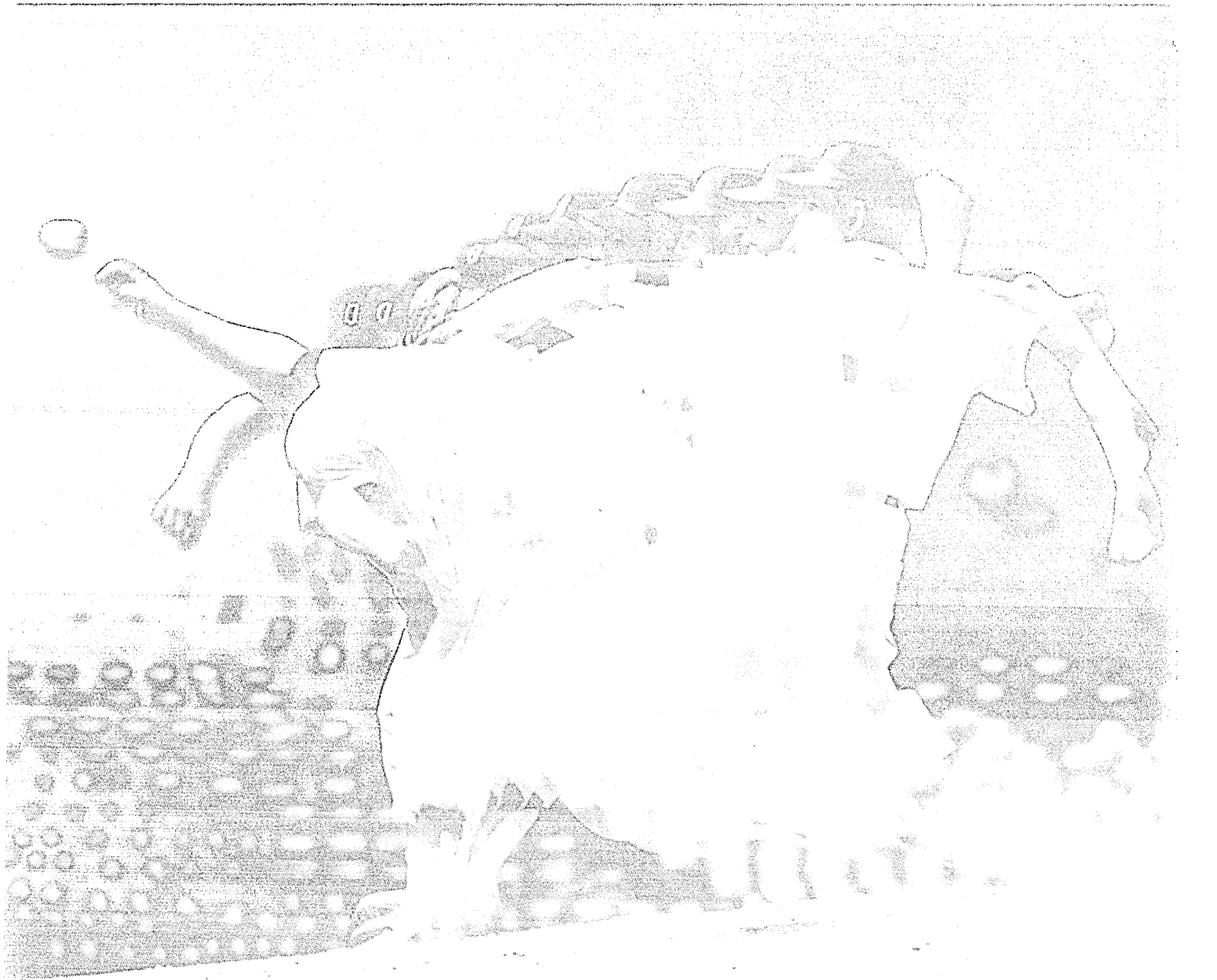
It's a system that can be used to determine the best way to handle it.

It's a system that can be used to determine the best way to handle it.

It's a system that can be used to determine the best way to handle it.

On improving delivery of the Spalding & Gros

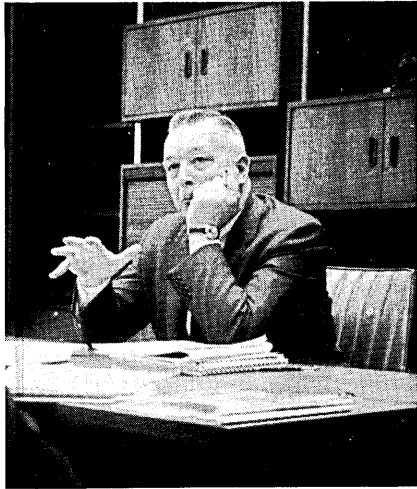
How many balls, bats, bats, shoes and gloves will it take to win a game? It's not a question that can be answered.



NEW FACE IN PHOENIX...

making good strides toward acting cohesively."

"Also," he continues, "GE has traditionally been a very aggressive, effective user, has a lot of user knowhow.



They're in a lot of businesses, have been effective in a lot of businesses, and we should be able to translate that into effective computer marketing." A GE public relations man in the room adds that the recently announced parts explosion package was developed in another GE division.

Haanstra then pointed out GE's "excellent position in time-sharing." (The company operates 11 GE 265 time-sharing service bureaus in this country under the direction of Jerome T. Coe, head of the Information Service Division . . . claims that all are profitable. Pertinent to the GE 600 sales picture is the fact that all of these—plus seven foreign centers, plus new centers undoubtedly planned—will probably convert to GE 600's. Haanstra says that his division will work with Coe on these sales in "a typical buyer-seller relationship with some concessions to genuine cost savings resulting from the relationship.")

from diversity unity

Continuing his catalog of strengths, Haanstra adds, "GE has a fundamentally broad technological spectrum. And computer technology is broadening, will make itself felt." We asked Haanstra if the singleness of purpose of an IBM or Control Data were not a strength. He agreed, but added, "The computer business is complicated and changing; computers are related to more and more things. Diversity is another kind of strength if properly managed."

How would GE approach this proper management of diversity? For one thing, says Haanstra, "it's the ap-

proach to staffing . . . the people you choose. We're not trying any single way. As we see a way, we'll take the appropriate steps." Pressed further, he cites some examples: "One such way is joint departmental activities. For instance, in the primary metals market, GE's industrial sales division salesmen are marketing GE computer equipment."

"Also, we've established at the Group level a set of policies which focus decision factors in the development of a program or product line in line with the requirements of this kind of business." Haanstra adds that there is a group technology coordination staff, and that the Internal Automation Operation (an in-house edp consulting service) has been renamed the Information Management Operation and now reports to Vern Cooper, Haanstra's head of sales and service.

We mentioned to Haanstra the reports that some GE customers were trying to acquire some of the software developed for the time-sharing service centers. How would such questions be resolved?

"It's a tough problem," sighs Haanstra. "On the surface, there's a certain antithesis: equipment competes with time-sharing in the marketplace." But, he points out, "GE is used to dealing at all levels, from components to sub-assemblies to products to systems. We sell refrigerators and refrigerator motors . . . and it's conceivable that a GE refrigerator could contain a non-GE motor. We can work both sides of the street. It does bring up issues to be resolved. The problem is getting them resolved."

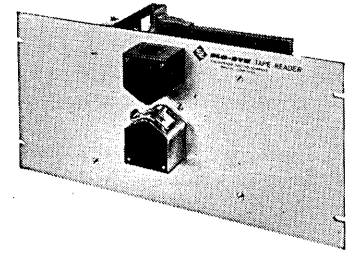
And, he suggests, GE may sell to some of its users "certain parts" of the software. "It's tentative, exploratory . . . we're not sure how it will resolve itself."

product line philosophy

How GE will resolve the question of the coordination of its product line is another matter. Haanstra says, "To be effective where you choose to be effective, you have to offer a complete line." The key words, of course, are "where you choose to be effective," and to Haanstra this means vertical market or application approach . . . manufacturing or data base management, for instance.

"But there are other ways to achieve full line compatibility than precise instruction sets," says Haanstra. And he points out that tacking a remote GE 115 into a GE 600 is one such way. He feels that we're moving beyond the concept of one kind of kludge equipment in one room, toward the involvement of the computer in the total sys-

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tems activities of a company. And he sees a specialization of traditional edp operations as the way of the future. "The 115, for instance, can serve as a card reader/punch/printer, as a (large system) terminal, and offering local processing as well."

How does a GE customer upgrade from a 115? He can go to a 130, says Haanstra. Where does he go from the 130? "Two 130's."

But the main question facing the industry, says Haanstra, is "How in hell you can keep the pace forward without reprogramming. This conversion is for the birds. That is not to say that it's for the birds for people to convert to GE," he adds with a laugh. And, he points out, there are a variety of tools—translators, sifts, emulators—to ease conversion.

Although Haanstra was closely associated with the 1401 at IBM, he is not to be classified as either a small- or medium-scale specialist. The 1401, as he sees it, brought edp to the masses, broadened the base of the industry, kept it growing. That, he says, is the important thing. But today's small machines—of the type produced by DEC, Varian, Hewlett-Packard, etc.—are sold and used as instruments. And the likes of the 360/20 and the new small Honeywell 110 are really aimed at mechanizing records for smaller companies.

Large machines, he says, have great strength... and some weaknesses, the result of trying to do everything. A fan of what he calls "appropriate specialization, instead of trying to pound everything into one stylized package," Haanstra thinks that broadening the base today—when computers are playing a more direct role in companies' operations—calls for new approaches. An example is his favorite one of tying a 115 on-line to a 600. Time-sharing is another.

no favorites

Haanstra refuses to indicate which part of the GE product line—small-, medium- or large-scale—will receive the most attention and dollars. "The size of a system is not necessarily a dimension across which you wish to make decisions," he says. "It's kind of dumb to have an A-Z program." And although the division's systems departments—which provide engineering, manufacturing and product planning as well as market support—are labeled by size, they are really more concerned with markets, he says.

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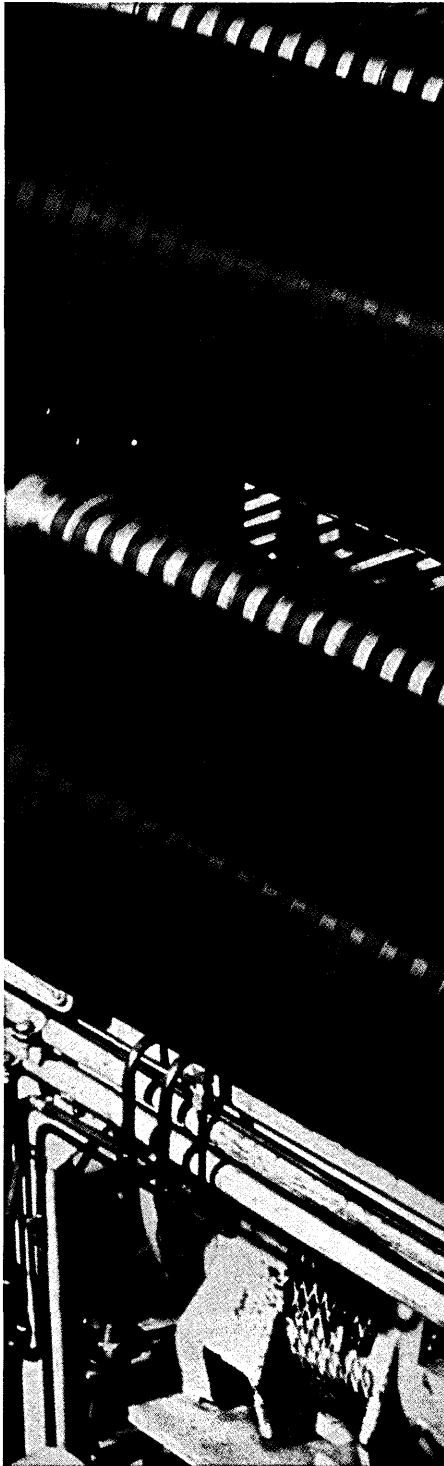
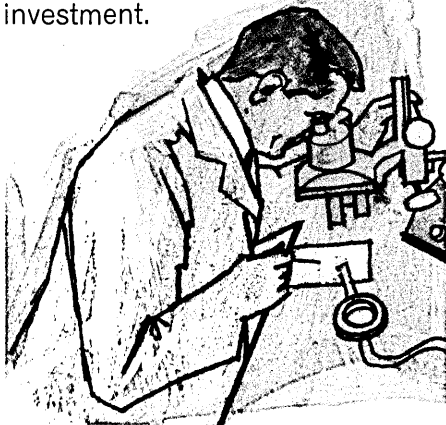
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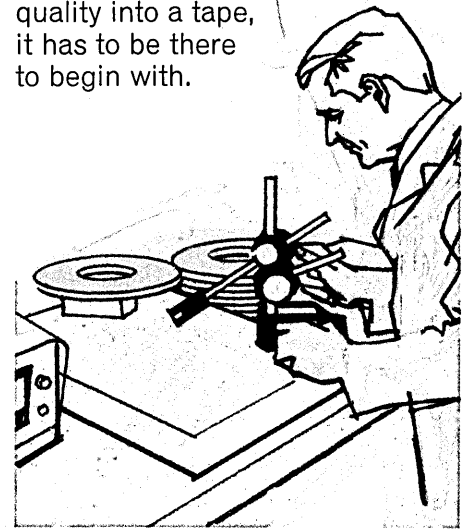
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The linking loader places object programs in core, performs data initialization, and loads and links required sub-programs from the system library. It is overlaid by the I/O editor prior to program execution.

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the most emphasis is "like asking which kid will get the biggest allowance." And, he adds, that depends. "Some are in kindergarten, some in college. We have customers on all of them. We love all our customers, love all our machines." But, he admits, "For the time and the life cycle and the features plus the capabilities for a long-range future, the 600 is our hottest horse."

The 600, with 2- and 1-usec core memories, may not match up on a straight speed basis with the 1108 or the 360/65, he admits. But he adds, "a lot of this gets washed out in a price/performance comparison. And if you compare on the basis of software, there's nobody else in the field." (The software referred to is GECOS III, the 600 operating system which will begin field installation this month.) "We're the only company which can do local, remote batch and conversational time-sharing computing all at once. And this is what the big users want."

Haanstra refuses to say if the 600 will be speeded up. "The 600 is alive and well and being shipped from Phoenix," he quips . . . but implies that improvements will be made.

Haanstra also refuses to say if the 645—the big time-sharing system which was withdrawn from the market although two prototypes are in use at MIT's Project MAC and at Bell Labs—will ever see light as a numbered product. But the results of the two cooperative development programs will be reflected in GE products, he says.

support philosophy

As for competing with IBM in support services, Haanstra indicates that "Our strategy is not based on offering anything greater to, less than, or equal to IBM." He questions how widely standard application packages are used, and adds, "We'll deal with it on a situation-by-situation basis. Sometimes you're successful in offering more, sometimes in offering less."

As for separate pricing of hardware and software, Haanstra thinks such a practice would be bad for the industry and the customer. "What's needed is a lot more imaginative pricing of different packages. 600 systems for retail and wholesale markets, for instance, might mean different systems with different prices."

Haanstra won't reveal the size of his division's marketing force (we've heard it's 170), but says it's "big enough. As we succeed it will be larg-

er. I'm not a believer in critical mass. Control Data and others prove that you can grow and be profitable on the way."

But he does feel that the sales force has not had as strong a voice in strategy as it should have had. This has begun to change, he says: marketing has a deputy-division status, a half-step above other departments in the ISED . . . and other steps will be taken to strengthen its role in formulating policies.

Haanstra comes, of course, from a computer company which allegedly gives sales a dominant role. But Haanstra thinks that at IBM engineering and sales each *thought* it played the dominant role. "That," he says, "is a sign of a healthy organization." As in product planning within different lines, Haanstra feels that conflicts are "logical and natural." Management's role is to "recognize the conflicts and make the right decisions."

tough management test

The company's conflict-producing capability would seem to be considerable. Besides the domestic medium- and large-scale product lines, both Bull-GE and GE Information Systems Italia offer a variety of peripherals and small machines. In addition, as Haanstra points out, GE makes instruments, communications equipment, plus a wide range of "broader-based peripherals." This and coordinating the corporation's vast and diversified research and development facilities can provide a tough test for the kind of cohesive management in which Haanstra believes.

It may be, he says, that GE had been too gung-ho for decentralization in the past, but that this has now been put "in proper perspective." He doesn't feel he can comment on the change in the corporation's philosophies in putting a computer man in charge (at last), but thinks "it helps" that he's a computer man.

Asked how long he has to make the Phoenix operation healthy, he says, "The company is too smart to deal with a pat formula of time. It's a long time-lag business, and GE is in the total business. We're more interested in the rate of change . . . there's no bar we have to get over. The goals are set, and so is a time for profitability . . . but by product line, not by total." It all really depends, he adds, on the manner in which deferred earnings are accounted for . . . "and GE's accounting practices are conservative."

It seems only fair to point out in conclusion that none of Haanstra's predecessors has lasted any more than three years.

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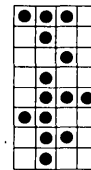
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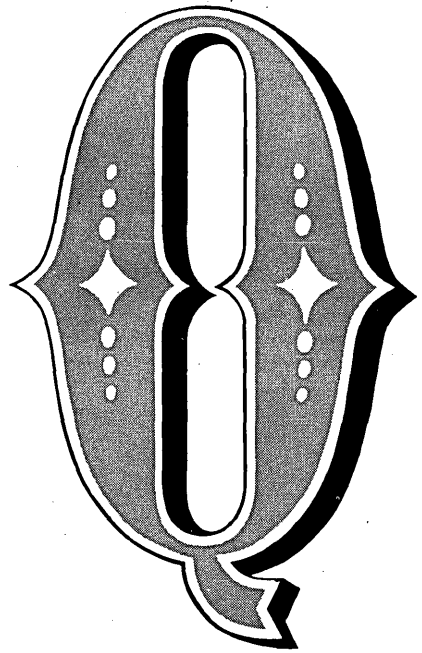
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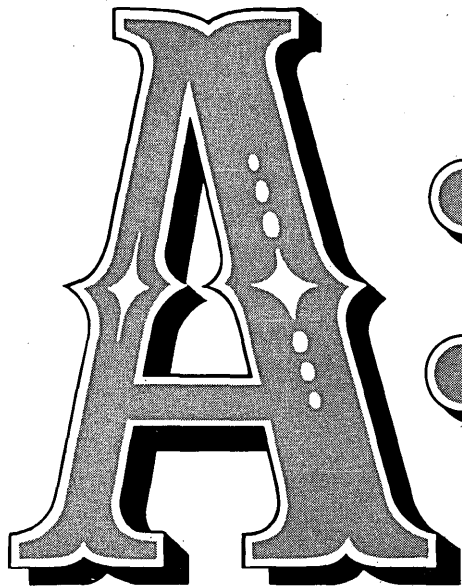


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FEDERAL BUYING AND THE INDEPENDENTS

Dick Caveney's crusade against federal dpe procurement practices entered a new and significant phase recently when he formally accused the Air Force of discriminating against independent peripheral makers.

Meanwhile, the General Accounting Office is evaluating the feasibility of buying system components from independents. A report to Congress is due this fall; it could change federal procurement procedures significantly.

In his Air Force complaint, Caveney—vp of Bryant Computer Products—said the agency doesn't allow enough time between the date an RFP is issued and the date bidders must respond; computer manufacturers can't contact independent peripheral makers, and the government loses the benefits of the independents' lower prices.

big potential savings claimed

Last fall, when he testified before Congress, Caveney indicated what the federal government might save if it encouraged independents to bid on dp system contracts. He cited a case in which a federal agency could have cut costs more than \$440K, better than 50% of the contract price, by purchasing a single memory controller from Bryant instead of several smaller units from the main frame manufacturer.

Caveney sent his recent protest to GAO, which is now awaiting a reply from the Air Force. It will take at least a couple of months for the Comptroller General to render a decision. If he recommends changes in procurement regulations along the lines advocated by Caveney, they could be adopted without further fuss. GAO has a direct line to Congress, where Caveney also has a number of friends. Also, GAO can prevent an agency from disbursing funds under any disputed contract.

Caveney documented his case against the Air Force bid schedule by

referring to an RFP which went out last Dec. 29; it involves a new payroll bookkeeping system, known as JUMPS, to be installed at the AF Accounting and Finance Center in Denver. By Jan. 15, 1968, according to the complaint, bidders had to submit letters of intent to perform benchmarks. "This 18-day period is unreasonable, even if one assumed a computer manufacturer could contact an independent peripheral manufacturer in 18 days . . . and negotiate engineering specifications and price," said Caveney. "The 18 days does not include the time necessary to evaluate an independent's equipment (compatibility with) a computer manufacturer's own system and this thereby (denies) independents the right to bid."


Caveney also asked why bidders have to demonstrate proposed systems before the Air Force makes even a preliminary source selection. The Defense Supply Agency's procedure is "far more appealing." DSA, according to the complaint, asks for a live test after making an initial selection, not before. Further, the time allowed to perform the demonstration is flexible, and permits a computer manufacturer to bid peripheral gear made by independents.

The Air Force system imposes "tremendous costs" on any main frame maker who might have the time and inclination to contact an independent, argued Caveney. The computer manufacturer "must purchase the equipment from independents . . . put the system together, and then hope (he) receives the award." The independent is effectively shut out because "the computer manufacturer doesn't want (to spend) thousands of dollars before an award and gamble (that) he will win the contract."

Caveney insisted that if DSA can create a fair procurement practice, it is difficult to understand why the Air

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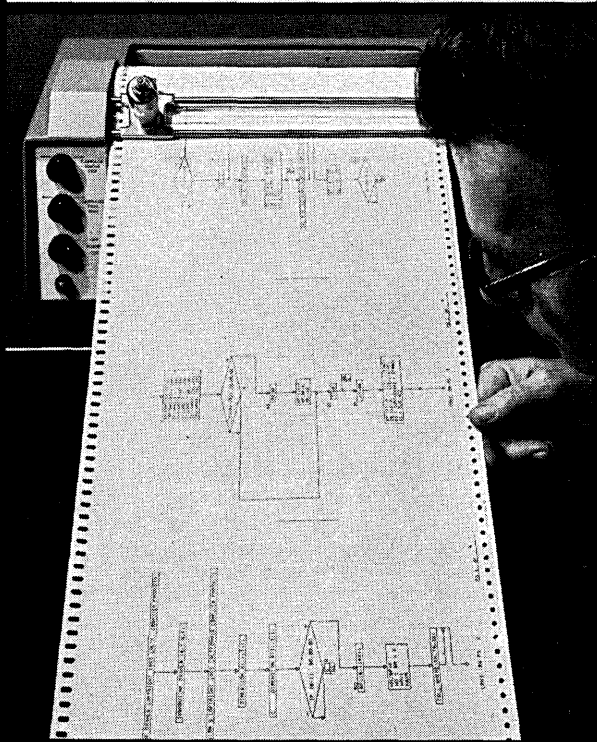
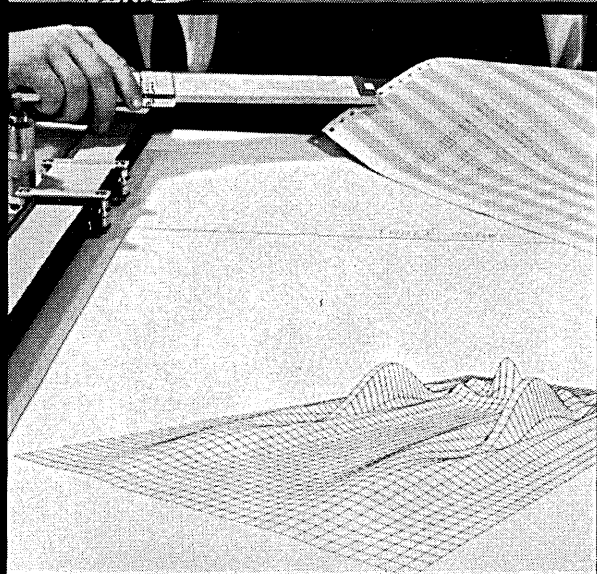
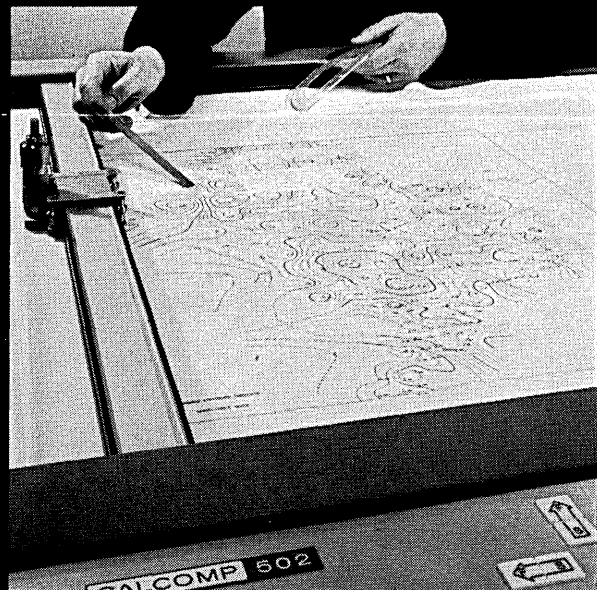
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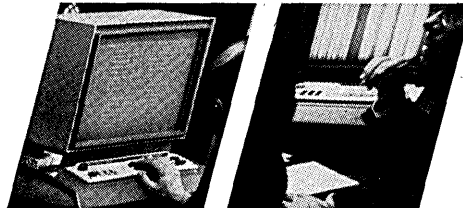
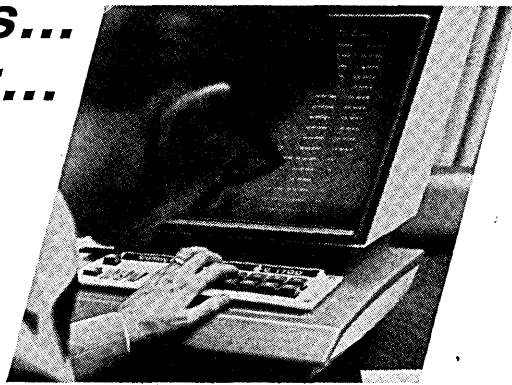
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FEDERAL BUYING . . .

Force must maintain such a restrictive policy.

But even DSA doesn't actively encourage prospective bidders to contact independent peripheral makers, he added in a recent interview. Nor does the General Services Administration encourage such contacts, even though it has the authority.

multi-source problems

One reason for this reluctance, he said, is that GSA thinks a multi-source dpe procurement would be hard to manage if the system failed to perform satisfactorily; the suppliers would blame each other and Uncle Sam would be left holding the bag.

Caveney says he has discussed this point with "at least two major computer manufacturers." They are willing to assume responsibility for a system containing foreign peripherals provided they are paid extra for the additional risk involved. Caveney argues that GSA, by "exercising its procurement muscle," could get any of the major main frame suppliers to accept similar responsibility.

At last fall's JEC hearing, GSA officials admitted that buying system components from more than one source is "possible," but "neither the practical nor the economic advantages . . . have been determined." Also, "GSA does not have the engineering staff necessary to assemble individual components, make modifications, and perform other work required."

Caveney appeared at the same hearing and insisted that GSA's complaint about lack of qualified technicians "is the same old excuse (the executive branch) has been using for five years. . . . The executive branch . . . is considered by industry to have the best caliber personnel available . . . The . . . excuses . . . appear to (come from) stagnant individuals reluctant to . . . change."

Caveney, when interviewed, attacked GSA's allegation that a lot of technical support would be needed. Bryant peripherals, he says, are now matable with RCA, CDC, SDS, and Univac computers. Other independents' peripherals are similarly compatible. At the JEC hearing, he reported that Honeywell "has designed, built, and is marketing a peripheral adapter (which allows 200 series computers) to transmit data to, and receive data from, a wide variety of peripheral equipment not included in the standard series 200 product line." This

adapter, he added, "is something that should be required . . . of all computer manufacturers doing business with the U.S. government."

The fuss Caveney kicked up last fall motivated JEC to ask GAO to study the feasibility of procuring system components from independent peripheral makers. The report due this fall is a direct outgrowth of that request. The timing could be significant, since DOD, about then, will be preparing to invite bids on its National Military Command System, a procurement that will involve more than 100 computers, extensive peripheral gear, and an investment of around half a billion dollars.

recommendations awaited

The Comptroller General's upcoming report probably will recommend that the federal government encourage independents to bid on dp system procurements. But the report will also contend that interfacing different manufacturers' peripherals and processors is not as easy as Caveney indicated in his JEC testimony. A distinction will be drawn between those units—notably tape and disc drives—which can be plugged in, and those that require hardware/software development.

The GAO report is likely to advise a technical evaluation of big system proposals, before source selection is completed, to determine the cost-effectiveness of using independent peripherals. Whether GSA, the government's chief purchasing agent, or the National Bureau of Standards, Uncle Sam's chief R&D agency, should provide this technical support hasn't been decided. In either case, the time and complexity of equipment acquisition would almost certainly increase, and federal dp system users might lose some of their present control over selection; they are likely to oppose the idea as a result.

Caveney says he has been trying to persuade GSA to issue a directive encouraging federal dpe users to solicit bids from independent peripheral manufacturers. His proposal incorporates features of the procedure used by the Defense Supply Agency: i.e., the time frame between RFP issuance and proposal would be flexible, and equipment would be tested after, rather than before, an initial source selection.

GSA, which says it hasn't yet received any such proposal from Caveney, has doubts about the widespread use of DSA's bid-processing procedure. "Responsive bidders might be eliminated in the first round," explains an official. "Then, you'd have another phase II situation to contend with."

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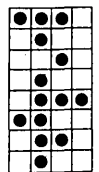
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INFO '68

INFO '68 showed that the Society for Information Display is an increasingly vital force in the nation's sophisticated computer and information technology. The Los Angeles meeting May 22-24 at the Ambassador drew record attendance of more than 1100 to its technical sessions and exhibits. During the symposium SID disclosed its membership rose 15% in the past year to 1516 (619 in the Northeast states, 503 Western, 184 Central, 149 Southeast, the balance in 14 foreign countries). World participation was evident in papers from Japan and Holland, and additional attendance from England, France and Sweden.

Louis M. Seeberger, general chairman of this 9th SID National Symposium, was particularly impressed with the similarity of emphasis by both keynote speakers. Each speaker was concerned—although in a different context—with the importance of technology in the immediate future as a tool to shape the course of mankind. Each spoke of historic and still accelerating growth in both population and technology, and of the importance of education.

Opening speaker Harry I. Davis, Deputy Assistant Secretary of the Air Force, began by saying the Stone Age lasted 50,000 years. He then emphasized compression of various ages

of man since that time—the Iron Age, etc., until 1945 when the Atomic Age began. In the past 23 years we have seen additionally the Missile Age, the Space Age, the Electronic Age, and stand now on the brink of the Age of Automation. Quoting Thoreau's comment, "Most inventions are an improved means to an unproved end," Davis then gave a terse forecast of events to come, admittedly inspired by Kahn's *The Year 2000*. Next he listed 18 capabilities in the area of information display, notably leading with techniques for adult education. The other 17:

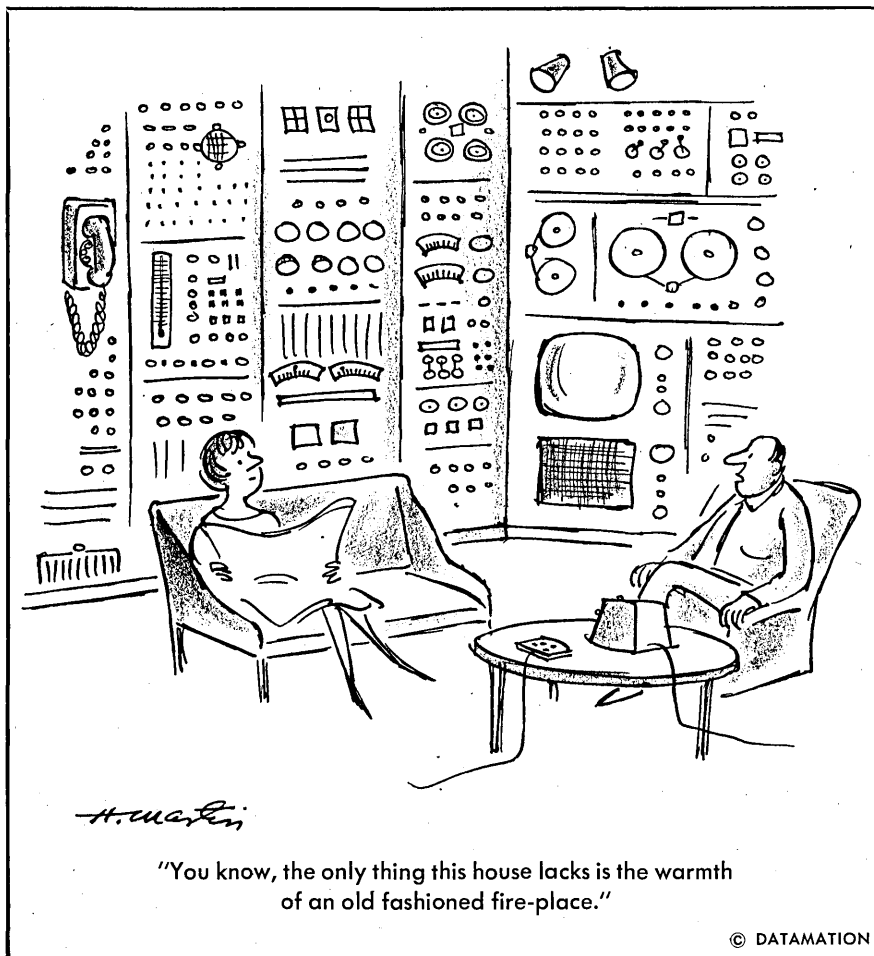
Extensive and inter-personal connections of business information with high-speed data processing; techniques, probably persuasive, for monitoring and surveillance of individuals and organizations; use of robots; means to improve human analytical ability; simple and inexpensive home video recording; time-sharing of computers with users on-line; indirect communications with computers; use of computers for intellectual and professional assistance — translations, teaching, literature research, medical diagnosis, traffic control, crime detection, design analysis and intellectual collaboration.


There should be home computations to run households; home education via video; inexpensive rapid color and monochrome reproductions for home and office use; conference TV; rapid language teaching; extensive use of high-altitude cameras for mapping, detection, prospecting and geological investigation; inexpensive designs of one-of-a-kind items by computer with automatic fabrication directly from computer printout; and last, three-dimensional TV, motion pictures, and art.

Davis next spoke of the urgent military need to better utilize the human eyeball—"the largest source of information concerning the enemy's deployment"—and presented two challenges:

1. Consider how to use the eyeballs of thousands of observers, to have them report their observations rapidly, accurately, with precise geographical position attached to these reports, and how to assemble all of these inputs into a large, real-time, wall-type display. Davis disclosed DOD is starting development of this device, called an "activity indicator," to better portray intelligence on enemy movement.

2. Consider how to display the output of sensors in an aircraft, "frequently a small aircraft with limited space available in the cockpit." Parameters cited include one-mile range, large field of view, resolution of 1 ft., which Davis conceded involves a display of





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dimensions measured in feet in order to accommodate the limitations of human acuity, especially under non-ideal conditions.

Davis next evaluated DOD requirements to meet its special needs in a changing world of small emerging nations. Concluding, he analyzed factors concerned in control of R&D growth (R&D now totals 3% of the Gross National Product): "The need to control the growth of R&D activity should not be regarded as a problem; it is the natural result of a healthy scientific and technical posture which the nation has attained."

deadline for survival

Dr. Peter C. Goldmark, president and director of research for CBS Laboratories, addressed the annual banquet on the theme that science faces a deadline upon which may hinge survival of billions of people. He drew a startling correlation between the development of communications and growth of modern problems, terming invention of printing with movable type "perhaps the most important development in the history of communi-

cations."

Graphically underscoring his comments were a series of development curves he showed, all strikingly similar—a long flat line beginning to edge upward about 1700, with marked increase after 1900, and reaching toward infinity today. They portrayed world population, life expectancy, destructive power, travel speed and, finally, books printed. The cause and effect relationships involving various eras of communication were uncannily—printed books since 1440, public mails and newspapers since 1700, radio since 1900, TV since 1945, and most recently comsats—each period increasing the slope of the curves.

Prior to the invention of printing, he said, man's life span was about 30 years . . . the time devoted today to a thorough education, with an average modern life span exceeding 70 years. Yet in that brief 30-year span, each early-day scientist (alchemist) had to begin from scratch to develop theory and formulate proofs, his life's work usually being lost when he died.

A child born 25,000 years ago and living to modern times would have an education about equal to that given in modern grammar school, through lack of communication. Yet that child's capacity to learn was little different

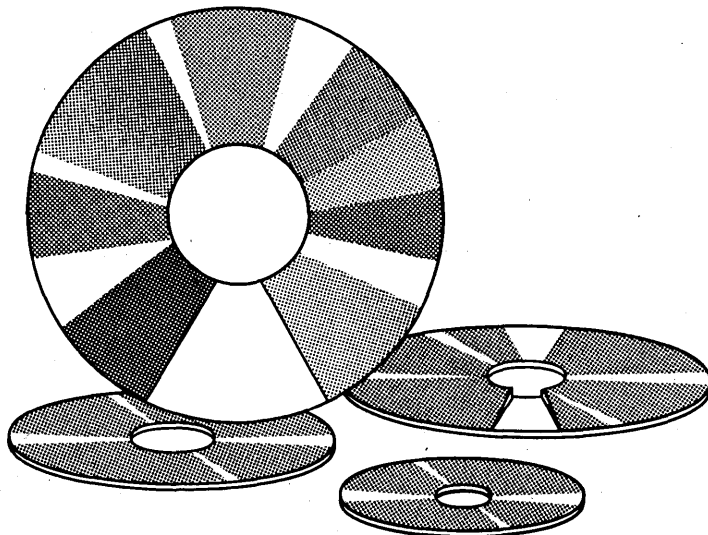
than that of a modern child. By contrast, a major problem today is how to read the ideas and facts being published. Modern communications have made the world a giant drum—"beat it anywhere, and it sounds everywhere."

Dr. Goldmark continued: "While technology has provided health, comfort and recreation, it is also responsible for many problems. For the first time, we face a deadline regarding the survival of billions of people . . . feeding and educating these people . . . teaching them how to get along with each other . . .

"There is not time enough to say we are going to merely improve our children: We have to educate today, and immediately, ourselves—the adults."

One means for such education is television. Dr. Goldmark said the average child in America views about 3000 to 4000 hours of television before he begins school, and the total is about 15,000 (three years of his waking hours) by the time he finishes high school.

Concluding, Dr. Goldmark emphasized: "On behalf of technologists and scientists, we have a commitment to put our talent to work, to combine forces with the best teachers, produce the best programs, so that education will result not in the survival of the



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fittest, but in the fitness to survive."

In marked contrast with earlier SID symposia, the bulk of the Los Angeles papers were applications oriented. The trend was illustrative of increasing maturity and broader acceptance of the information display discipline.

education graphics

Four education-oriented presentations were concerned with computer graphics. "Computer Animation as a Tool for Educators" by Thomas F. Penderghast, North American Rockwell Corp. (El Segundo), traced the history of computer graphics and illustrated technique and capabilities with film clips. Early work was done at Bell Labs, Sandia and Los Alamos. Languages now have been developed at Bell Labs, Syracuse, Johns Hopkins and Brooklyn Poly. The Bell Labs BEFLIX language was written by Dr. Kenneth Knowlton to operate within the structure of FORTRAN on an IBM 7094, a popular computer for the work because large core storage is required. The computer is programmed to iteratively solve a series of equations defining the model, and then to construct plotter commands to graphically de-

scribe status of the model after iteration.

Included at the end of the stream of commands for each frame is a command to close the shutter of the 8-, 16-, or 35-mm camera employed and to move to the next frame. Plotter commands are usually stored on a secondary storage device (normally mag tape) during the program, for later execution through the plotter, to resolve different execution times of the equipment. Passive transfer is best adapted, with the shutter open until the image is complete, then the frame is advanced. Black and white costs average 15¢/frame, or \$180/running minute; special effects and color raise costs substantially. The real value, according to Penderghast, is not economy, but the ability to convey complex equations and time-phase involvements to students in a more understandable manner. Compression of information is so great, Penderghast said, that it would be virtually impossible to match the presentations orally, supplemented by chalk and hard copy, with the clarity attainable in the films. An example was a multicolor computer graphic presentation of subjects photographed on two films, then merged through pin registration. It showed earth with continental outlines (white on blue), on which were superim-

posed changing weather patterns (deep blue), geopotential (white), 600 mb pressure (orange), temperature (red), and vertical air motion (purple), all animated for periodic change. Another film shown, entitled "Movies from Computers—An Interim Report," is available from UAIIDE Librarian, Stromberg-Carlson Corp., P.O. Box 2449, San Diego, Calif. 92112. This contains segments from Bell Labs, Educational Services, Mathematics Assn. of America, Univ. of California, and Boeing.

An extension of computer-graphic techniques was presented by luncheon speaker John Whitney, artist and filmmaker. He forecast regular scheduling of computer-graphic art on TV, and presented several examples of his work to portray development over the years. He noted that Albert Michelson predicted "a color art analogous to the art of sound," and added, "The eye has never seen pure color in such variations as the ear has heard sound for ages . . . and so it can be with the dot on the crt." The main benefit to his technical audience was a vivid illustration of possible display effects. Whitney presently works with analog devices of his own invention, and computers, under an IBM grant. To obtain 15 seconds of film, he utilizes 15 minutes of computer time, then waits 20 hours to see the images. Computational film constructions are first organized, then composed through a computer, and the crt images are photographed in black and white. Later, these are edited, merged and colored in Whitney's own studio.

A third education-oriented presentation, entitled "String Descriptions of Data for Display" by J. E. George and W. F. Miller, Stanford Univ., was supported by NSF and the AEC. The authors developed a Picture Description Language (PDL) and a Picture Calculus for the formal description and manipulation of pictures. These are applied through a display program which utilizes PDL string descriptions as the principal data structure. The process permits generation of drawings on a computer-controlled crt and allows transformations according to the rules of the Picture Calculus. The fourth education-oriented presentation was "Generalized Equations for Display System Design" by Solomon Sherr, Kearfott Products Div., General Precision Systems Inc. (Little Falls, N.J.). Sherr developed a display system model with appropriate mathematical expressions, analogous to communications systems. Several applications were discussed, including generalized, digital, and analog displays. The paper is based on a chapter of Sherr's book, *Fundamentals of Dis-*

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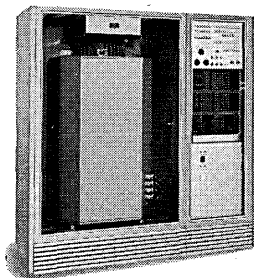
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civil applications

Computer-driven displays for civil applications concerned sophisticated areas such as automated highway information, fingerprint classification, and air pollution control. "Driver Performance Using an Experimental Route Guidance System" covered plans for a computerized roadside inquiry-response system which will be in limited operation at Washington, D.C., within one year; widespread use there in three years; and possibly in other U.S. cities in 5 to 10 years. Author William Leigh Gibbs, Traffic Systems Div., Office of R&D, Bureau of Public Roads, Department of Transportation (Washington), presenting personal views, discussed various elements of the system. These include roadside computers, separate-lanes transmission antennas, and vehicle-mounted pickups and displays. The system is based upon six-letter grid codes in a reference directory with which drivers can ask for route instructions by punching pushbuttons in the proper code. A query is transmitted to the computer as the car passes over the road-mounted antenna, and the computer responds with guidance information which is instantly shown on a dashboard display. Turnaround time is so fast a car traveling 80 mph travels 8 ft. between query pickup and response. This computer speed, plus multiple processing and antennas in each lane, provide capacity to handle peak traffic. Displays use 12 basic symbols, which portray the driver's next maneuver in sufficient time to make required lane changes with safety.

Surveys show urban needs are greatest for such aids, with 500 to 1000 automated intersections sufficient for a city of 500,000. (The same surveys show fully automated controls are impractical for cars because drivers would be required 80% of the time.) In-vehicle hardware costs are projected at \$120 to \$150, with discrete roadside computers at \$7000 to \$9000 in production (4 million intersections), all hardware built for 4000 hrs. MTBF. Programming is relatively simple, largely by hard-wire with paper tape. Hardware is in development by Philco-Ford, General Motors and Kollsman. Experiments in the Pentagon Loop indicate a system of this type reduces driver stress and errors, and cuts average transit time, aiding traffic flow.

"Computerized Fingerprint Classification" by Anthony Paolantonio, professional engineer (Reseda, Calif.), presented the author's own method to identify human fingerprints rapidly with the aid of a properly programmed digital computer. Underscoring urgent needs, the author noted the FBI files contain more than 175 million sets of prints, and California's files more than 5 million; 25,000 inquiries are processed daily in Washington where 1000 people visually check inquiries. Present turnaround time for complete sets is 48 hours to three weeks, while the Paolantonio system could reduce this to 53 minutes (including single prints) through automation. However, even if efficient and accurate, any new system would require conversion of all files, and court validation. A dozen corporations are working on computerized classification, and Cornell Aeronautical Laboratory has been engaged for a feasibility study of computerized processing. Paolantonio's system uses nine separate line counts to identify each print, performed through a basic scanner, pattern generator, timer, pulse shaper, counter and display unit. A digital computer used in processing could store a complete set of prints in 831 bits (including file number). All FBI print files could be stored in a memory of about 11×10^{10} bits (allowing for culling and duplicates), and the system would be amenable to hard-wire transmission of queries and responses.

"Iso-Echo Contour Circuit for Selective Threshold Display of Precipitous Video Targets on a Weather Radar RH/PPi Screen" by Albert A. Pedicini, Tektronix (Beaverton), discussed means to display video-target returns on a range-height indicator and/or an azimuth-range indicator.

The last civil applications paper and a military applications presentation discussed display design approaches. "Development of the Display Methodology for an Air Pollution Command and Control System" by Arthur F. Kochman, McDonnell Douglas Corp. (Huntington Beach), presented evolution of an adaptive system concerned with smog studies in the Los Angeles basin. The study utilized an IBM System/360 Model 65 with a 2250 display. Real-world data displays provide a basic pattern. When this pattern is matched with adaptive displays modeled on historical data that induced a known outcome, a predictive display may be projected. In smog studies, this could provide valid warnings of "alert-level" conditions in time to prevent possible disasters. Sampling costs are said to be the major limiting factor. Kochman said validation of such a system will provide legislators

with proof to enact controls.

"Derivation of Display Requirements by a New Methodology" by J. V. Murphy and J. J. Belcher, Litton Systems (Canoga Park), discussed a unique systems design approach for complex avionics interfaced with computers for an advanced v/STOL. Display units generally are designed independently. In the Murphy-Belcher systems approach, over-all problems are determined for all systems, available technology is established or anticipated, and parameters for each subsystem and its displays are set. Candidate solutions for each subsystem and its displays are next delineated. The approach provides a record of the design process, gives flexibility, allows successive iteration, and permits utilization of lower skill levels in final unit design and fabrication.

rapid progress

Rapid technical progress in the past year was indicated in three papers touching upon work discussed at the 8th SID National Symposium (see DATAMATION, July 1967, pp 54-58). "Holographic Real-Time Display" by M. A. Habegger, R. J. Harris and G. T. Sincerbox, IBM (Poughkeepsie), discussed use of holography for a carrier landing simulation display. Holography permits designers to reduce the bulky, conventional optics required to manipulate a filmed image or model which simulates the pilot's changing view of the carrier during a landing approach. "An Experimental 4000 Picture Element Gas Discharge TV Display Panel" by Th. J. de Boer, Philips Research Laboratories, Eindhoven (Netherlands), proved almost as popular as a similar prize-winning paper from the Univ. of Illinois presented in 1967. De Boer's panel uses orthogonal rows of round neon gas cells to display images scanned by a television camera. Unique with de Boer's setup is complete TV signal conversion circuitry. Converted TV signals actuate the plasma cells through circuit grids covering opposed ends of equally-spaced gas cells. De Boer plans additional experiments with triangular-shaped gas cells and phosphors to merge primary colors for full-color presentation and at the same time increase cell density. The present unit features high speed, brightness and reliability, but does not yet incorporate memory.

"Photoplastic Film Multi-Color Display" by J. E. Bigelow, General Electric R&D Center (Schenectady), introduced multi-color to related film studies discussed by a GE associate last year, all work sponsored by Rome Air Development Center. The new device is described by Bigelow as "a promising answer to remote terminal

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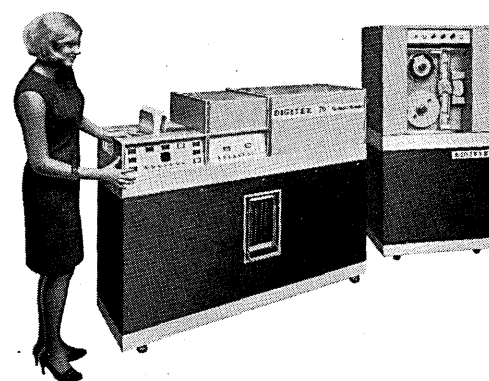
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requirements for high speed recording and display of computer-generated graphical information at rates to 15,000 characters/sec." The system has already demonstrated four-color display of alphanumeric information imaged from a crt onto a light-sensitive recording film. The photoconductive thermoplastic film can be exposed to light in air and processed in a fraction of a second by heat. Multiple colors were produced from a single frame of the transparent recording film by recording for each color a unique phase-grating structure within the character strikes; this effected a color selection in a special Schlieren optics projector designed for the project. GE used type 216 film with a P-22B phosphor for best spectral match, achieving writing rates to 750 characters/sec. Other films provide superior speeds. With type 216, frame speeds averaged 1/2 to 1 second.

Three papers on advanced technology involved crt developments. "Multi-Channel Colored Oscilloscope" by Koji Okajima, Nagoya Institute of Technology, and Hiroshi Furuta, Kobe Industries (Japan), discussed a "Mul-

tiscope" using a single "Colornetron" electron gun tube, developed at Kobe Industries. It is specially designed for the study of multiple phenomena, with each trace presented in a different color. Multiple phosphors are employed and color switching is possible through unique circuitry. Horizontal resolution is 400 lines on the central phosphor (blue), and 200 lines each on red and green in a 160 x 115 mm display.

"Dynamic CRT Spot Measurement Techniques" by Edward M. Sawtelle and George W. Gonyou, FAA (Atlantic City), presented a new method for spot size measurement using a two-slit technique which extends measurements from speeds of 10⁴ ips to 4 x 10⁶ ips. The work was in conjunction with upgrading FAA crt's through sweep-time compression of 5:1 (750 usec. stored, readout in 150 usec.). About 500 FAA crt display centers presently utilize P-7 phosphors, but a better phosphor is sought. The speed-up discussed was required as part of the FAA's urgent need to write alphanumeric data on displays. Conclusions from studies associated with the successful project include: line luminance varied directly with spot velocity; spot luminance increases by a factor of about 1.5 from low to high lumi-

nance; and, neither spot size nor focus are materially affected by writing speed or crt position.

"Some Notes on Stereoscopic Display, and an Isochromic Anaglyph CRT" by E. T. Ferguson, Philips Research Laboratories, Eindhoven (Netherlands), discussed a means to eliminate eye fatigue inherent in two-color stereoscopic displays. In this process a stereo image pair is displayed on crt phosphors so chosen that, when observed through corresponding filters, both images have the same color and each eye sees light from only one image.

Military papers included "A High Resolution Closed Circuit Remote Viewing System" especially designed for remote access involving photo imagery interpretation, including P.I. keys, textual matter, film chips, and comparative cover roll film. The system, discussed by Franklin I. Bolnick and Thomas J. Corbett, Fairchild Space & Defense Systems (Paramus), achieves resolution of 30 to 60 line pairs/mm (referred to a 5 in. film plane), and provides comfortable access by multiple interpreters. Elements include a control station, roll film viewer, multiple clip viewers and multiple remote viewing stations. "Computer-Addressed Displays for Helicop-

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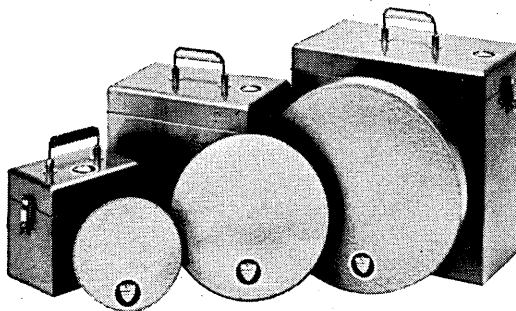
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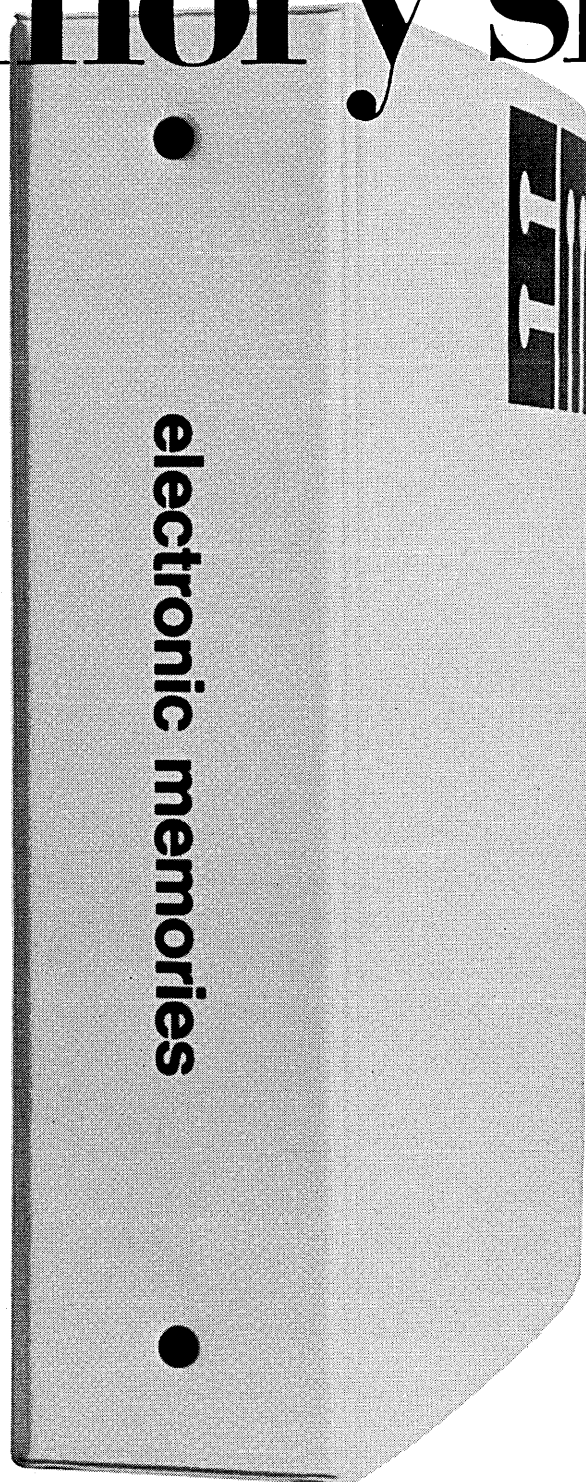
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ter IFR Station-Keeping Flight" described a simulation program for ONR in which helicopter instrument condition formation flight was evaluated with three specially-designed flight displays. Authors were Lcdr. Francis Cundari of ONR, Brad Gurman, U.S. Army (Ft. Monmouth), with Robert M. Nicholson and Charles A. Baker, Honeywell (Minneapolis). No "on-board" computation was involved.

Business applications were keynoted by Alan B. Kamman and Donald R. Saxton, Bell Telephone Co. of Pa. (Philadelphia) with "Bell Telephone's Business Office in Real Time." Kamman detailed a trial effort to eliminate most paper records used in business negotiations for 88,000 customer accounts. The working system processes 3000 customer contacts weekly. Data processing is handled by an IBM System/360 Model 40 with backup by a Model 65 used in billing. Software and a small specialized customer file are contained on five 2311 disc drives with the bulk of customer records (360 million characters) evenly divided on two 2321 data cells. Twenty-eight Raytheon Model 401 displays combining

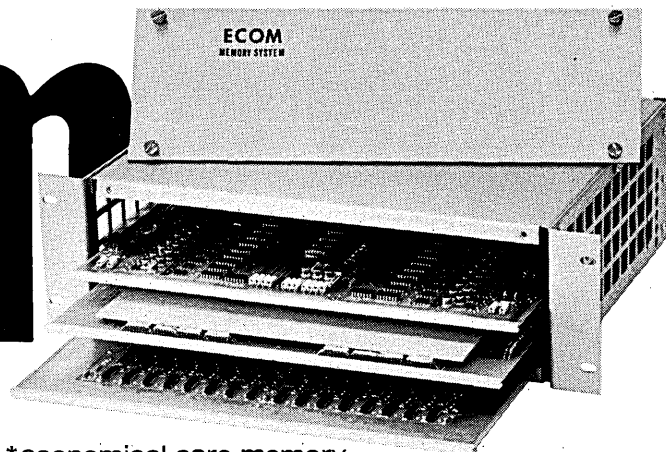
keyboard and crt serve 20 customer service operators who man the system. Customer calls are dialed directly to an automatic call distributor which places them at random to service operators. They key in a customer's telephone number and appropriate information code and data desired is displayed on a crt at that operator's station. Data over current and two past months are accessible and may be modified with entries by the operator. Kamman said near saturation of core on the Model 40 (70% of 262K) and the file division between disc and data cell preclude extending the system to other applications for a more economical operation. In present use the Model 40 is dedicated to updating about 20,000 accounts each night and to customer service operations by day. Kamman conceded "we bought too small a machine" and said he would like to upgrade to a Model 50 with 512K core to permit multiple use for greater economy. In response to a question, he stated periodic reliability problems have been encountered with the 2321, and outlined remedial procedures. He added, "Whether it's lack of training on the people's part, I don't know." The system described is being evaluated by a team from Bell Labs to establish a model for the Bell System.

Kamman said the ultimate system going into Pennsylvania operations "will probably be of the nature of one computer, handling about 600,000 accounts, with one set of files and six or seven different functions."

Two IBM papers discussed a new character generation system which is amenable to design of characters for displays involving foreign languages, as well as modern, easily read English characters. William R. Lamoureux, IBM Systems Development Div. (Kingston), described "A New Approach to Character Generation" utilizing a new trace character generator which combines advantages of the scan and stroke systems. Essentially it is a stroke-type digital curved-line generator involving 40 vectors per character. Read-only storage employs an extended capacitor-diode gate. The memory utilizes a rectangular array of batch-fabricated capacitors with double-clad, flexible circuitry. The thin memory card is about 7 x 10 in. and can easily handle 64 or 128 characters. Harold S. Rasmussen (Kingston), in "Graphic-Aided Design of a Graphic Device," told how an IBM 2250 display unit and its light pen were used with an 1130 computer in design, test and fabrication of the trace generator. The new device will be used in IBM's



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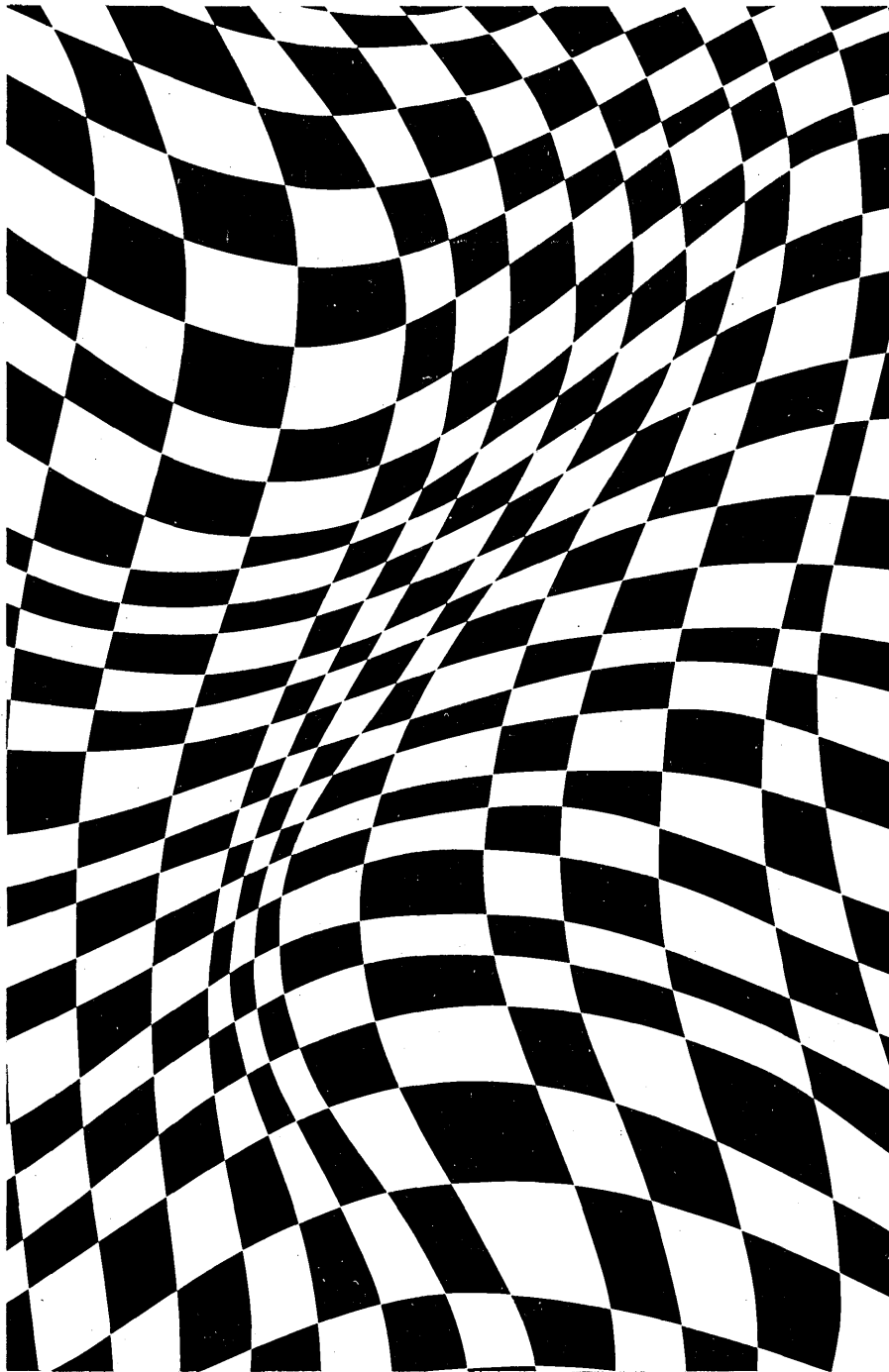
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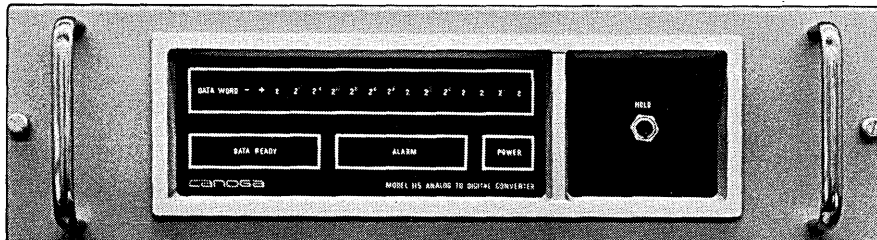
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2265 display, which employs a crt with low frequency (main) yoke and a high-speed character writing yoke. Beam commands are obtained from the memory.

Speaking of "character generation," character actor Vince Barnett brought his audience to the brink of rage during a luncheon address in which he posed as Prof. Eric Von Hogerstrom, a West German consultant, who criticized everything dear to the heart of SID, before unmasking.

summing up

Retiring SID president Bill Bethke urged the membership to establish a central repository for ID data, continue to improve rapport with colleges and universities, intensify efforts to establish standards and definitions, develop and sponsor short-term courses in ID technology, and expand membership. Bethke received a special award for two years of outstanding leadership as SID president.

Carl Machover, installed during INFO '68 as 1968-69 SID president, observed that rapidly developing graphic display technology is beginning to significantly affect the computer industry. Although the "overwhelming majority of the 20-odd-thousand computers in service are used primarily for book-keeping types of applications," Machover said, "display equipment output is playing an important part in facilitating direct computer usage in a whole new range of applications for industry, science and government."

Expanding interest was underscored when Machover said universities and colleges are beginning to organize courses in display technology, and the Univ. of Dayton is moving toward establishment of ID as a separate technical discipline. In addition, Brooklyn Poly will offer a five-day tutorial seminar on "Display Technology" Aug. 26-30 at its Long Island campus (contact Dean William Lynch), and Jan Engal of SID will chair a special display technology session during the Fall Joint Computer Conference.

Other new officers are Petro Vlahos, vice president; Carlo P. Crocetti, secretary; and Ernest N. Storrs, treasurer. New fellows elected at the meeting are Fordyce M. Brown, Robert C. Carpenter, and Phillip P. Damon.

The 10th SID National Symposium is scheduled May 27-29, 1969, at Mariott Twin Bridges Motor Hotel, Wash., D.C. The theme is MEDIA: Man's Environment—Display Implications and Applications.

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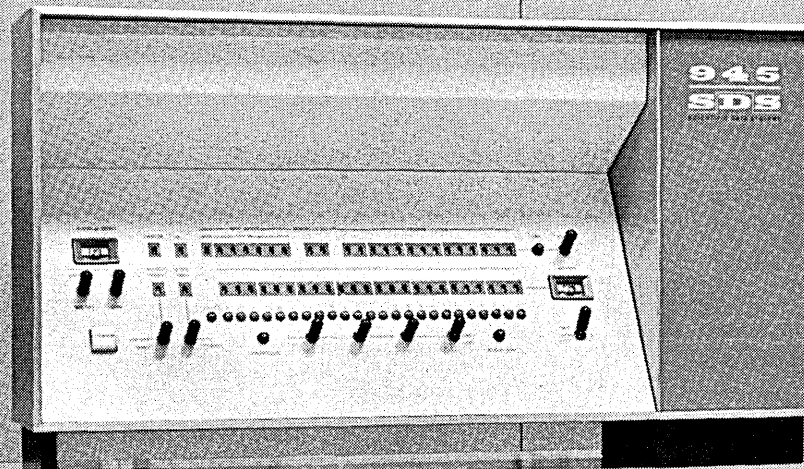
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AIRLINES APPROACH ON-LINE AGENT SYSTEM

After at least four years of discussion and negotiation, the airlines actually seem close to settling on a common automated reservation system for travel agents and commercial accounts. This is an effort that would involve thousands of on-line terminals and would probably mean revenues of \$16 million a year to the service agency.

In April, the steering task force of the Air Traffic Conference recommended that Automated Travel Agents Reservation Computer Systems, Inc., (ATARCSI) be chosen for final system negotiations. But before the firm can get under way, specifications must be revised, contracts submitted and accepted, the Civil Aeronautics Board must approve, and one-third of the 33 ATC-member airlines representing at least half the passenger-revenue miles must agree on the proposal.

The ATC selection surprised many observers, who had long assumed that Reuben H. Donnelly's DOARS, in development since 1964, would get the nod. ATARCSI, which was set up by Informatics, Hayden-Stone, and a group of private investors, actually was a late-comer to the proceedings; it was formed last November just to go after this contract. In fact, ATARCSI had, at the time of the proposal, one employee: President Frank Wagner, an Informatics vp.

The reason the airlines only "seem closer" is not only because of the negotiations that must be completed, but also because DOARS hasn't given up. Consultants to Reuben Donnelly—Turner & Moni—have reportedly taken over the proposal. The consultants made new arrangements for financing, revised the proposal, and were to have gone back to the airlines with this new offering about mid-June. ATC cannot negotiate with any other firm unless it fails to come to agreement with ATARCSI, but the final acceptance is up to the airlines themselves.

Both proposals offer essentially the same application. The system would store flight schedules and seat avail-

ability, allowing travel agents (up to 6,000 in the U.S.) and commercial and military air travel buyers to make reservations on-line. Airlines would be linked to the system to provide availability information. An optional service would be interline reservations. Service on international flights is also proposed, but poses problems because of data volume.

There were system and economic differences between DOARS and ATARS. The cost to the airlines of storing flight data was greater with DOARS, which planned to charge one fee for storing each flight segment and another fee for storing the flight availability by class. ATARS had only one charge—for each flight segment, or leg, of a trip. DOARS also involved a sharing of the financial risk between vendor and airlines as to the success of the system. Turner & Moni were supposed to correct these and other differences in their revision.

Another factor which helped ATARCSI was the availability of an IBM program package called PARS (Passenger Airlines Reservation System) for use with the proposed 360/65 system. Already adopted by five foreign and eight domestic airlines—and working at Alitalia—PARS offers fairly quick implementation. This is in line with the ATC requirement that the winner

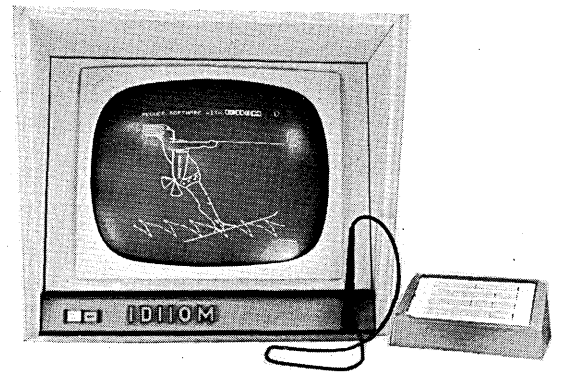
be operational 11 months after CAB approval. Mid-69 is the target date.

ATARCSI will have to modify PARS for its use, however. Allegedly, IBM spent \$8 million on PARS, and ATARCSI will have to spend about \$500,000 to modify it. DOARS had also claimed quick implementation of its system, which proposed Univac 494's, also in use by several major airlines. DOARS planned to store full flight data (the airlines guide) on a Houston-Fearless microfiche reader terminal, computer-storing only flight numbers.

The final configuration is not yet decided upon, but basically, ATARS will have a dual 360/65, with one serving solely as backup. Each system will include three 2314 disc drives and six million bytes of core storage. ATARCSI expects the service to have a market of 2700 terminals. Most will be IBM 1977 agent sets, a terminal with typewriter and function keys; crt terminals—not necessarily IBM's—may also be available for some of the larger agents and commercial accounts.

The initial cost of this central site—planned tentatively for Dallas—will be \$6 million. The cost of the terminals and communications links (concentrators may be used) is estimated at about \$20 million.

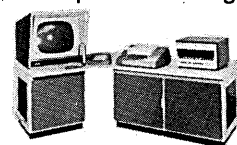
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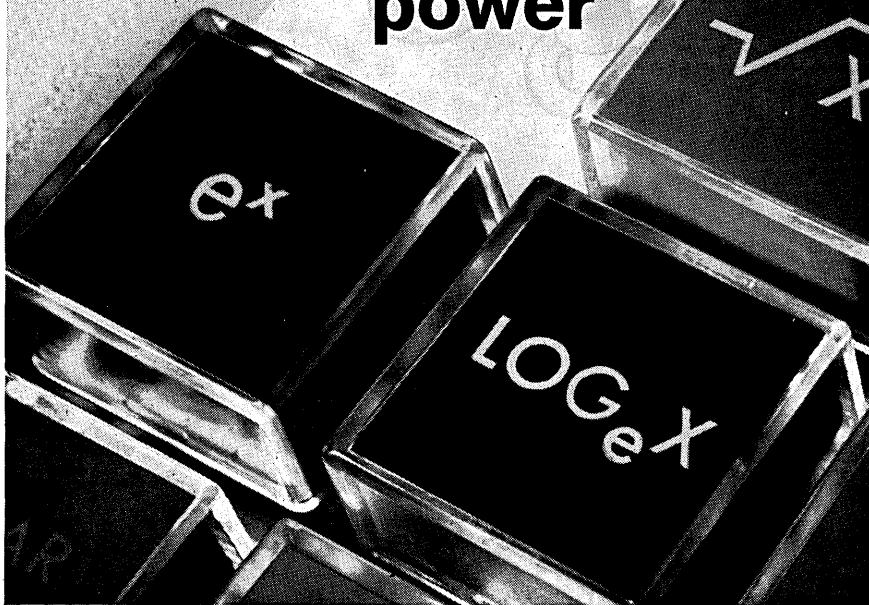
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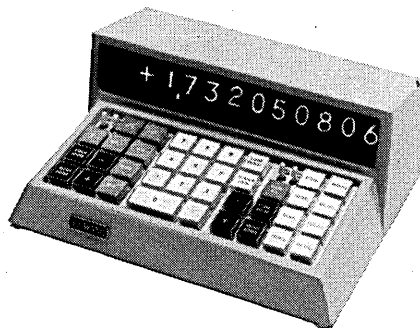


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AIRLINES . . .

come would be from three sources: a fixed charge each month to the ATC member airlines, for the storage and display of flight availability; charges for each inquiry concerning flights on other airlines and for each transaction between the ATARCSI computer and airline computers; and a monthly charge to each agent, commercial or military account. The basic fixed charge to the agent would probably not be higher than \$150/month; beyond that the customer would get a certain number of transactions free, then pay so much per transaction above that fixed number. All of this is still subject to negotiation.

One of the obvious extensions to the system would be the capability to print tickets. The major barrier to this is the complexity of fare construction. Another possibility is to tie in smaller agents to the system, which calls for a cheaper terminal than those now available.

In the meantime, ATARCSI will contract with parent Informatics to do the PARS software modification. The firm, with a small nucleus of a marketing vice president, systems designer, and programmers, will probably require about 100 people to run the operation. Informatics has begun to exercise its option to purchase majority stock in ATARCSI. (Informatics and Hayden-Stone each had 10% initially.)

There were several competitors for the contract. First, the "devil's advocate" that forced the airlines to act more quickly on the common system was American Airlines. Tired of waiting, AA announced in late spring of 1967 that it was going to put its SABRE sets in travel offices. It was then that ATC drew up the rules for carrier agreement on a common system. American was permitted to go ahead, with the provision that it would withdraw its installations or interface them with the common network when it was operational. American has more than 100 of these installed, and recently contracted to provide its flight data and availability to Telemax, which has an on-line network for hotel and car rental reservations. Telemax itself had discussed its proposal for a common system with ATC.

Other contenders were Control Data Corp., which offered a system based on SAFIR, a crt-oriented system proposed to the airlines last year by J. Shuler Co. Litton-RCA-Diners Club had thoughts of a MARS system, which would involve reservations for hotels, entertainment, and almost every travel service. Others interested were American Express, Computicket, and Ticket Reservation Systems. ■

*This announcement is neither an offer to sell nor a solicitation of an offer to buy any of these securities.
The offering is made only by the Prospectus.*

NEW ISSUE

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Price \$360 per Unit

Copies of the Prospectus may be obtained in any State only from such of the several underwriters, including the undersigned, as may lawfully offer the securities in such State.

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June 5, 1968

Introducing:

The CATT

It's a completely new computer tape from Ampex. We call it CATT not only because it's Complete-Area-Tested Tape, but also because it's smooth, clean and long lived.

CATT tape is 100% error free when you get it because we test all data tracks for drop-outs, as well as all the space between the tracks. An all new formulation makes the tape wear longer, highly resistant to contamination and redeposits, and greatly reduces headwear. For more detailed information, send your computer specifications to Ampex Corporation, 401 Broadway, Redwood City, California 94063.

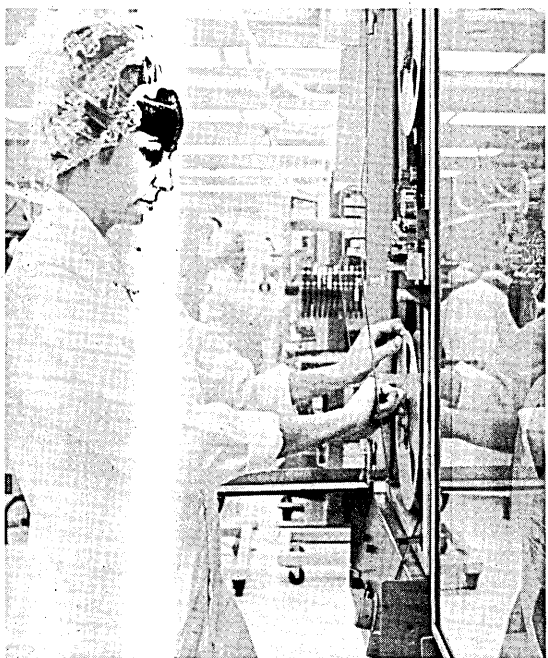


AMPEX

The CATT: COMPLETE-AREA-TESTED TAPE

Every time your computer stops due to a parity error, valuable computer time (and money) is lost. And at the higher bit densities developed by third-generation computers and the new ultra high speed NRZ formats, the minutest foreign matter can cause costly errors. That's the reason for CATT tape: to assure you the tape you use is 100% error-free when you receive it and that it runs cleaner as you use it.

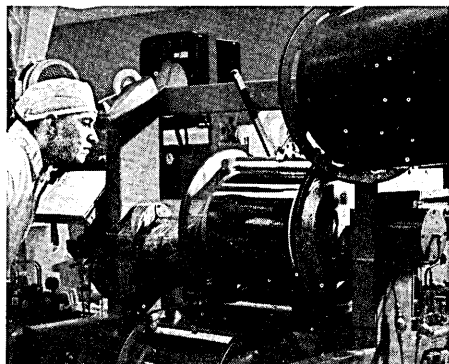
Tape which bears the CATT label has been fully tested across the entire width of tape on every reel—this means all recording tracks plus all the space between the tracks. During final tests, the tape is recorded and read back at its certified packing density. If a single uncorrectable error or dropout occurs, the entire tape is rejected.



Staggered 9-track heads test Ampex computer tape across the full width of tape on each reel.

THE CATT: A Ferrosheen® tape that protects heads, prolongs tape life, eliminates errors

Our exclusive surface finishing process not only levels out the microscopic hills and valleys that might cause dropouts, but it also prevents shedding and lowers head wear.

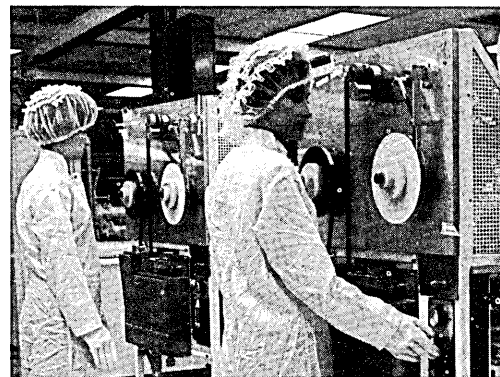


CATT computer tape also bears the trademark Ferrosheen®—an exclusive, controlled, surface finishing process that provides an ultra-smooth surface with a minimum amount of oxide exposure.

THE CATT: Supercleaned for error-free operation

Just before we package Ampex computer tape, we wash it in an inert fluid to eliminate all surface contamination or loose oxide particles that could cause problems. We call this procedure Supercleaning because it totally eliminates from the tape all foreign matter that could cause costly parity errors.

Ampex computer tape is passed through a special Supercleaning process during final winding.



THE CATT: A new formulation for long tape life and fewer errors

The Ampex new, exclusive coating formulation produces a tough, smooth surface that's highly resistant to the impact of particles that could become embedded in the tape and cause permanent errors and costly "write skips."

We have run exhaustive comparative tests of computer tape for endurance. Hundreds of thousands of passes have shown that Ampex CATT tape has the lowest error buildup rate of any tested tape. Costly read errors and data reconstruction problems are, therefore, greatly reduced.

Ampex computer tape comes in 7- and 9-track formats, with bit packing densities from 556 cpi to 1600 cpi/3200 fci.

For complete information and specifications, fill out and mail this coupon:

Gentlemen:

Here are some facts about my computer operation. Please tell me more about CATT tape.

Type of computer(s) _____

Number of computers in operation _____

Type of tape presently used _____

Bit density certification _____

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Mail to: Ampex Corporation, 401 Broadway, Redwood City, Calif. 94063

The NCR Century Series of computers.

When you learn how advanced they are, you'll know why others are old-fashioned.

It's going to change all your old ideas about computer costs and capabilities.

The Century Series offers a price/performance ratio unequalled in the industry.

It's the first truly compatible family of computers that incorporates the most modern technological developments. It's perfect for all levels of users. For both business and scientific applications.

The Century Series will meet your requirements today and tomorrow. You can expand capacity and power as your needs change. Just plug in a more powerful processor. Same peripherals. And no re-programming. True upward compatibility.

Internal memories range from 16,384 to 524,288 bytes. Future Century computers will offer memories with up to one million bytes. On-line processing and three-way simultaneity offered in the lowest cost member. It rents for less than \$2000 a month with

an extended contract. You can move up to multi-programming and nine-way simultaneity. Eventually to multi-processing and 17-way simultaneity.

You get the benefit of great technological developments. Monolithic integrated circuitry is used throughout. With the power of conventional or hybrid circuits but at a fraction of the size. Thin film, short rod memories. With speed in the 800 nanosecond range, yet lower cost than core memories because of automated manufacturing techniques. (Only \$375 for an additional 16,000 bytes of memory.)

A dual spindle disc unit that sets a new standard in the industry. With 45 ms average access time, it's the fastest removable disc unit in the industry. Each recording surface with 12 floating read/write heads.

Card Random Access Memory (CRAM) units each with on-line storage capacities over 125 million bytes. Magnetic tape drives

with transfer rates up to 240 kc. Line printers with speeds up to 3000 LPM. A wide range of peripheral devices: punched card and tape input/output units, MICR sorter/readers, OCR scanners and remote on-line devices.

Sophisticated software! No other computer in the same price range as the Century computer can offer as much. Compilers, operating systems, applied programs and utility routines. All written, tested and ready-to-go. Programming languages: COBOL, FORTRAN and NCR's own NEAT/3.

There's much more to tell. Call your NCR representative today for the story of the Century. Or write to The National Cash Register Company, Dayton, Ohio 45409.

NCR

THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO 45409 ©



news * briefs

ADR RECEIVES FIRST PROGRAM PATENT

The first patent on a software system *that is clearly identified as a computer system embodied in a computer program* has been granted to Applied Data Research by the U.S. Patent Office. The patent, #3,380,029, is for a software sorting system invented by Martin Goetz, ADR vice-president.

ADR president Richard Jones, a long-time crusader for program patents, said that the "Patent Office's action indicates that software systems and programs are entitled to patent protection in much the same way as computer hardware. A computer system is patentable whether in the form of software or hardware and whether made by a software company or a hardware company. The issuance of a software systems patent is another milestone in the coming maturity of the software industry."

Controversy has raged over the last two years over patents for programs. It is at best a muddled issue, with problems of semantics, attempted legislative roadblocks, and industry reticence and skepticism over desirability of such patents. The ADR success begins to clear the air. There have been patents for programs represented as special-purpose computer systems and described in hardware form via logic design, but the sorting system patent is unmistakable—the technical description is through a detailed flowchart rather than logic design. The "novelty" of the system is primarily a read-forward oscillating merge principle for the sorting of data on a computer and can be used with various computers. The feature, says ADR, can be embodied in hardware as well as software, so it is the concept which is protected.

This Patent Office move is also significant when considering that last year the patent law revision before Congress had a clause explicitly barring programs from patents. It was later withdrawn because of the ambiguities of its wording and the implications of an almost-eternal ban on software. It is hoped, but not assured, the patent will set a precedent which will apply to ADR's profitable proprietary package AUTOFLOW and, of course, to other program patent applications. (An application on AUTOFLOW was filed in

1966, less than a year after the sorter application.) Such protection is particularly significant where systems are marketed widely—by both software houses and hardware manufacturers. And, of course, it is in the publicly sold proprietary package that infringements can most easily be protected. The patent could also, through licensing, provide additional revenue for these inventors.

The Patent Office, which may have opened a Pandora's box, will have to man itself technically for the onslaught of applications that could result. If it is not to become bogged down in the complexities of flowcharts and other descriptions, says patent attorney Morton Jacobs, the onus will be on the applicant and his lawyer to explain clearly the unique concept behind the package.

THE WU/CSC MERGER: A LONG ROAD AHEAD

The latest chapter in what promises to be a long, continued story of the merger between Western Union and Computer Sciences Corp. tells of the merger approval by WU's board of directors. This followed an announcement several days previously that the board wanted to think it over awhile longer. This was preceded by University Computing's famous tender offer for 750K shares of WU stock at \$44 a share, which drove up the price of the stock, which coincided with the WU/CSC announcement, which appeared shortly after Fletcher Jones was quoted as saying that there were no negotiations under way and none planned.

So what's next?

Here are some of the known hurdles that must be overcome before final action: approval by the shareholders of both companies; a ruling from the Internal Revenue Service that the exchange of stock would be tax-free to shareholders; approval by various federal agencies, such as the FCC; and approval by state agencies, such as the New York Public Utilities Commission.

How long all this will take is a puzzle. For example, the companies have not yet even announced the date of the stockholders' meetings to vote on the proposal.

And some of the questions the pro-

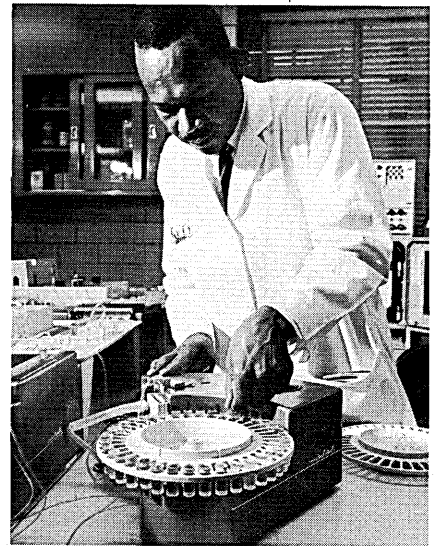
posed merger arouses are bafflers. If CSC is the surviving company, offering common-carrier services, wouldn't it be subject to regulation? If so, why should a bustling, successful company in the free-wheeling computer industry be satisfied with a regulated profit margin?

Meanwhile, University Computing's buy-in has been effectively stopped. In fact, we understand that UCC is considering a plan to actually set up a common-carrier subsidiary that would sell data-transmission services, using current technology, to the parent company and to others.

Still lurking in the background is the FCC computer utility inquiry. With these various computer/communications moves and proposals, the investigators should have a tangible situation to look into.

AUTOMATED MEDICAL LAB OPERATION SUCCESSFUL

The Institute of Laboratory Medicine at Perth Amboy General Hospital is now functioning on an automated basis, linking a Spear CLAS (Clinical Laboratory Automated System) 300 computer directly to automated laboratory instruments, a typewriter and printout equipment. The CLAS 300 is a revised version of SI's Micro-Linc II (DATAMATION, Dec. '65, p. 115), with an added pair of tape drives and a real-time clock, and is a general purpose



digital computer with built-in A/D conversion.

The system is designed for use by medium-sized community hospitals of around 500 beds, and reportedly triples output of patient test data. Programming is in assembly language and was developed over an 18-month period by Dr. Glenn Fellows of the Institute, and SI. It enables regular lab technicians to operate the system after only a short period of training.

One of the system's tasks is auto-

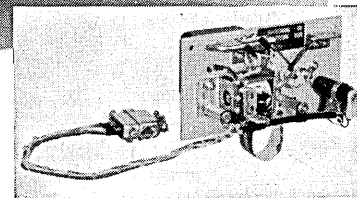
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The \$200 reader -
A design / price
breakthrough
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Don't let the size ($6\frac{3}{4} \times 3\frac{1}{2}$) fool you. Economark V is both rugged and reliable. This is the Reader to use in tight quarters (both space and budget) for such uses as...Numerical Control...Data Input...Machine Tools...Data Processing...Communications, etc.

A look at the specs tells why this Reader is so useful. 30 CPS ...8 level star-wheel reading... self-contained drive solenoid ...and the assurance of a full year's warranty.



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Further details on this "mighty mite"...or complete information on our full line of quality Readers, Punches, and collateral equipment are yours for the asking. Drop us a line -305 W. Grand Avenue, Montvale, New Jersey 07645...or call us (201) 391-7000.

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Warranted one year for parts and labor.
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mated biochemical testing, in which a Technicon SMA-12 Autoanalyzer (see photo) analyzes the ingredients in a patient's blood and translates the various amounts to voltages, which are converted and fed into the computer's memory. On demand, the computer prints out test results, together with all previous data on that particular patient.

The computer also is capable of making diagnostic interpretations based on test results by associating disease characteristic patterns and printing out the name of the most likely disease and others that are similar to the pattern.

In addition, the computer performs the major task of processing the data generated in the care of more than 100 patients a day, and keeping track of thousands of patient records processed for neighboring hospitals. Generating work lists and management reports are other jobs the computer performs, and it is estimated that over 30% of laboratory personnel time is being saved that was formerly spent on routine tasks.

The price for the system, including all equipment and software (except the programs for anatomic pathology, microbiology and cost accounting) is \$70K, or it may be rented for \$1,200 per month for five years. The three programs excluded from the software may be licensed from the Medical Development Corp. at the hospital for \$3,500.

SUSPENSE RETURNS TO ELECTION RESULTS

In the evening hours following closing of the polls in the California primary election, television newscasters, irritated and embarrassed by the scarcity of returns to report, nervously maligned computers and the machine age and reported the returns from the South Dakota primary so often that North Dakota should have equal time.

It was understandable. The networks are accustomed to a procedure whereby their representatives at key precincts make snap tallies of the important races and phone in results so that Cronkite and confreres can intone annoyingly accurate predictions (based on network computerizing). But this time automation played a major role in the vote counting of punched card and paper ballots and a vote for county librarian had the same weight in the tally as one for President. Thus, selective returns and early

results of significance were not available.

Overall, however, the various systems functioned efficiently. IBM reported complete returns from its punched card ballots by noon the next day in Los Angeles County, and Cubic Corp.'s Votronics in San Diego and the Coleman Electronic Vote Tally System, both of which count paper ballots, did as well.

However, there were some problems. In Fresno, the Honeywell 1200 was misprogrammed and Seiscor Corp. of Tulsa, designers of the punched card ballot system, had to fly in its chief programmer to try to straighten things out. Fresno election officials are pleased with the Seiscor system, which functioned well during the municipal election of '67, but plan to work out their own programming when using the system in the future.

In Los Angeles, initial delays were caused by write-ins on the envelope containing the card ballot. The Peace & Freedom and American Independent parties did not qualify candidates for members of the central committees by the filing deadline but were permitted to write-in seven names of their choice. These write-ins had to be hand tabulated at the precincts before the punched cards could be transported by sheriff's officers to 93 pickup spots and then to the two computer centers.

One of the computer centers was located next to the Ambassador Hotel, where some of the candidates maintained headquarters, and which was the scene later that night of Senator's Kennedy's assassination. These factors resulted in a serious traffic problem and the removal of several of the sheriff's marshals at IBM who were called to the Ambassador to help control the situation.

The IBM voting system in Los Angeles will cost the county \$9.5 million for the next ten years, with an estimated saving of \$4.4 million in election costs over that period. The Coleman system was first used by Orange County in 1964 and was expected to pay for itself in ten years. However, Orange County officials estimate it will have nearly done this after the Nov. elections.

CHECKLESS FRIDAY DAWNS IN LOS ANGELES

A plan to bring the delights of time-sharing to very small businesses has been hatched by Soliman & Associates of Beverly Hills, Calif.

Although the company, headed by Maher E. Soliman, has all sorts of programming systems under development, first up to be marketed is a payroll package that will lead to auto-

matic transfer of funds to the employee's bank—thus ushering in the golden age of "checkless Fridays." Processing will be handled through commercial time-sharers, such as GE and Tymeshare, and the plan will be marketed by a concern to be called National Payroll, Inc., fathered by the Soliman group.

Prime market target is the CPA with many small businesses already under his care. (There are 3000 of them in the Los Angeles area.) He gets a Teletype terminal hooked into the time sharing center where Soliman's programs and files reside. Starting from scratch, the user can build up a file for each company through conversation with the machine. Once familiar with the idea, the CPA then graduates to more sophisticated interaction routines that allow shortcuts to save time for both him and the computer. He can arrange for the paychecks to be printed directly by the terminal or, with a given customer's agreement, initiate the automatic transfer of the money to the employee's bank.

The system is already set up and being demonstrated; formation of National Payroll, Inc., has started—with a stock issue to come.

MULTI-MODE FINANCIAL TERMINAL ANNOUNCED

A desk top brokerage unit for financial market information retrieval was recently introduced by the Ultronic Systems subsidiary of Sylvania. The Ultronic Videomaster has a divisible keyboard and scope.

The detachable keyboard has 26 alphabetic keys, numbers 1-10, and special market symbol keys. It operates in several modes such as quote, limitminder, and marketminder.

Quote mode shows updated sale price and time, whether a stock is up or down from the previous quote, bid and asked prices, high and low, opening and closing prices, and volume traded.

Marketminder mode allows simultaneous selection and monitoring of market price performance of up to 18 separate stocks.

Limitminder notifies the user by a light whether the stocks being watched have exceeded the pre-determined limits set by the user.

There are several optional features also, including market summary mode and Reuter-Ultronic Report, which supplies news at 100 words per minute.

As a computer based unit, the Videomaster has potential for interconnection with other computer systems. For information:

CIRCLE 240 ON READER CARD

(Continued p. 95)

Who said a computer shouldn't get promoted from within?

All day long you manage a computer installation, and what happens? Management thinks the computer's a genius and you're its assistant.

This situation could go on indefinitely unless you do something a computer couldn't possibly do. Like promote a better deal on computers to your management.

For example, you can buy "used" computers for as little as 25% of new cost, perhaps saving your company hundreds of thousands of dollars.

Machines are available with known technical ability that have huge, easily accessible libraries of programs. And with hundreds of people already trained in their operation and programming.

And not only that, every "used" machine is

continuously maintained by the manufacturer and we guarantee the continuance of the service agreement when you buy it.

Certainly, there are jobs that require the unique capabilities of Third Generation equipment. We can even help there. But, if you're to get everything out of these new machines that they have to offer, using a low-cost Second Generation satellite system represents an important economy—for example, excess printing load and/or periodic management reports.

If what you need is more capacity and/or capability for your present Second Generation system, there's no more efficient way to get it than through The Computer Exchange.

Even those contemplating their first computer should examine this new alternative.

Talk to us, and the only problem you'll have is how to spend the extra money you'll be saving to build your department.

What about surplus equipment? That's no problem either. Be-

cause The Computer Exchange operates like any other exchange, commodity or stock. If it has value, we'll buy it.

So if you'd like to know what you should buy or what you should sell, or what the right market price is for equipment, or how to lower cost and increase performance, or what's available, or anything and everything about "used" computers, you can't find a better informed group of computer people who talk your language.

Give us a call. Or stop in. Or let us stop by to see you. We'll help you promote a computer and outsmart it at the same time.



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LENKURT DEVELOPS NEW PULSE CODE MODULATION COMMUNICATIONS SYSTEM

A communications system that converts speech signals into coded pulses for transmission over telephone lines and then reverses the process to recover the original voice conversation has been developed by Lenkurt Electric Co. Inc., a subsidiary of General Telephone & Electronics.

The 24-channel 91A system selects samples of signals at regular intervals 8,000 times a second; these samples are then measured and assigned a numerical value which is transmitted in the form of coded pulses. In the past, voice conversations have been transmitted by modifying a continuous electrical signal in proportion to variations in speech sounds. The system is capable of transmitting 400,000 bits a second over telephone lines; designed primarily for transmission between telephone offices, the 91A is, according to the company, most economical when operating at distances up to 50 miles, but it can transmit effectively beyond 100 miles.

In announcing the system, a spokesman for Lenkurt said the company expects to have future systems with transmission capability of more than one million bits a second; he also added that the company is now planning the development of a 4,000-channel digital carrier system.

TWO MORE T-S FIRMS APPEAR IN MIDWEST

The two latest entries in midwestern time-sharing are Direct Access Computing Corp., Southfield (a Detroit suburb), and Time Sharing Systems, Inc., Milwaukee.

DACC was formally begun in March by Robert M. Franklin, president, formerly manager of engineering and product development systems planning at Chrysler; Morton Chonoles, vp marketing, former manager of GE Information Processing Center Michigan-Ohio; and Robert D. Harrison, Jr., vp operations and systems, formerly operations manager IPC Eastern, Teaneck, N. J. The company expects mid-July delivery of a B5500 and will offer time-sharing, batch, and remote job entry as well as computer systems consulting. Software is Burroughs MCP-time-sharing oriented, will be modified in-house later. DACC plans to expand outside of Michigan within a year but will keep its headquarters in Detroit.

Time Sharing Systems went on the air with its B5500 Jan. 17. According to vp Jerry Haller, the system is working spectacularly after a nightmarish

period of getting software ready after the 5500 arrived last May. Burroughs and TSSI wrote the MCP time-sharing program, which has proved so successful that many other 5500 users (among them Chrysler, Kaiser Aluminum, and a military base) will be using it.

TSSI has 28 current customers, including the Milwaukee School of Engineering, where upperclassmen use eight terminals. Languages now available are FORTRAN IV (360-compatible) and ALGOL. Soon to be ready is a COBOL compiler (also 360-compatible) and BASIC. TSSI does not care how large a customer's program is; to prove it, the firm put on an academic demonstration using 25,400 source statements of a FORTRAN IV 360 program.

TSSI was formed in Feb., 1967, by George Morrison, president; William Nyback, secretary-treasurer; and Haller as vice president. Morrison was formerly director of the computing center, Milwaukee School of Engineering, and Nyback was also with the school. Haller formerly had been manager of sales, GE central region.

LIVING CELL SIMULATED AT UNIV. OF MICHIGAN

A Univ. of Michigan computer scientist has simulated a living cell with IBM 7090 through a program he developed over a 2½-year period. The model is of E. coli, a lowly bacteria commonly found in man's intestinal tract. The simulation program has 442 MAD instructions which cause the cell to "eat, grow and reproduce itself." A two-minute machine run is the equivalent of two generations of the bacteria, which normally reproduces every 20 minutes in real life.

Dr. Roger Weinberg, research associate with the U-M Logic of Computers Group, recently reported his work at a Detroit meeting of the American Society for Microbiology. He said he created the cell model by taking details of life processes and integrating them to see if they would function as a whole. He gave the computer more than 500 facts about E. coli's physical structure, enzymes, chemical makeup, inheritance factors, reproductive patterns, and temperature. The cell model had to be simplified to get it into manageable proportions, but once created it functioned much as it would in real life. The model is of the cell growing in a liquid medium; variations of its nutrients cause it to react. When diet deficiencies appear, the program compensates with more of the proper nutrients, but sometimes swings of overcompensations in both directions cause chaotic conditions. At that point Dr. Weinberg considers that the cells have died.

Other investigators have computer-simulated life processes in the past 10 years, but Weinberg thinks that his work is the first integration of all this information into a single functioning cell.

He is using the model to test and refine current hypotheses about cellular control of biochemical reaction rates and cell division. Later he plans to simulate the cell as if it had been invaded by virus, to see if it reacts as hypothesized. The model gives him a chance to test many hypotheses together and to make alterations under varied conditions. If the virological simulation works well, it may possibly lead to the simulation of cancer cell growth for study.

GSA PROCUREMENT ROLE MAY BE STRENGTHENED

GSA's control over federal dpe procurements will increase significantly this July 1, or soon afterward, when a new FPMR takes effect.

Basically, GSA will enter the acquisition process after DOD, NASA, or any other Executive Branch agency has tentatively selected a winning bidder, but before any supplier has been notified. GSA will help the agency make the final selection, and then will be helped by the agency in negotiating the procurement. Also, all RFP's will be reviewed by GSA contract specialists, who will order changes in provisions that don't comply with procurement regulations.

GSA's three-man negotiating teams—a lawyer, contract specialist, and dp technician—hope to participate directly in roughly 25% of the general purpose dpe procurements undertaken in fiscal '69 by executive agencies. Until now, GSA has been involved in only a handful.

Agencies probably will lose some control over general purpose dpe selection but the significance of this loss remains to be seen. In the past, an agency usually was able to consider only its own operation in determining the most cost-effective bid. Now, the overriding criterion will be the lowest overall cost to the whole federal government. Quantity purchases of a single basic system, for example, will be preferred even if one or more of the agencies seeking equipment has found another OEM more cost effective. Reportedly, exceptions are allowable, but they'll have to be granted individually by GSA, and each applicant will have to document his reasons.

I/O DEVELOPMENTS REVIEWED AT ABA MEET

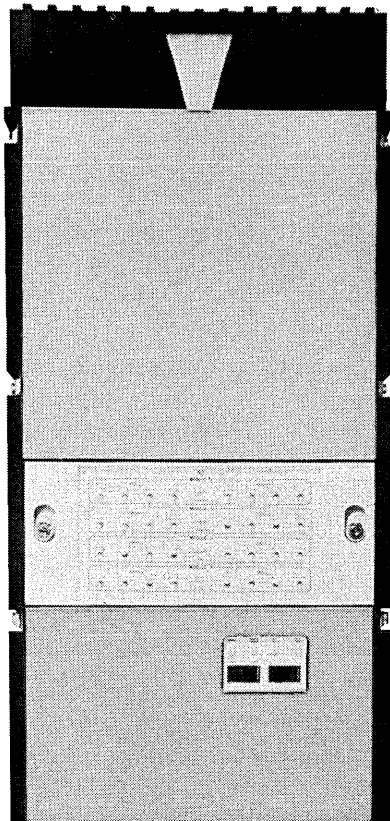
"Some devices or concepts" in audiovisual response systems "that appear



Peripheral quiz
for computer manufacturers

How many bits of head-per-track fast access disc memory in this sleek, compact matched companion for your computer?

- | | |
|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> 25 Million | <input type="checkbox"/> 50 Million |
| <input type="checkbox"/> 75 Million | <input type="checkbox"/> 100 Million |
| <input type="checkbox"/> 125 Million | <input type="checkbox"/> 150 Million |
| <input type="checkbox"/> 175 Million | <input type="checkbox"/> 200 Million |

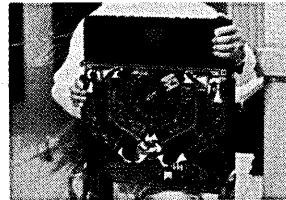


40" high, 24" deep to mount in your 19" rack. Decorator Colors to match your computer.

All 8 answers are correct:

Reason? The new CPC model DSU-8100 is a truly modular fast access disc memory system. It's designed for today's sophisticated computers. Ideal for real time response, program swapping, and message switching.

Four Sealed Disc Modules to Choose From

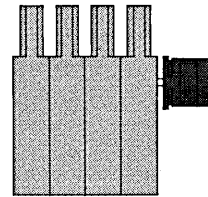


Fast access modules with individual heads for each track can locate data in 16.7 ms average. Available with 25 million or

50 million bits. In the two economy modules each head services 4 data tracks with positioning time of only 25 ms.

One Drive Serves Up to Four Modules

Because from one to four CPC memory modules are served by the single drive, 25 million to 200 million bits of ultra-reliable



disc memory fit comfortably in the compact chassis designed for slide-mounting in your 19-inch console. Field expandable to billions of bits.

Fail Safe Protection

No head avalanche possible here. Modules are ultrasonically cleaned, clean-room inspected then sealed. The flying heads never touch the recording surface and automatically retract if motor speed, internal voltages, or air pressure varies. Tamper-proof lockouts protect your data too.

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immediately promising or are unique enough to broaden our perspectives" were presented by Charles T. Webb of Litton's Mellonics Systems Development Division at the May America Bankers Assn. automation conference.

In addition to noting the crt's, voice answerback units, keyboards and other devices currently available, Webb discussed units being developed in these areas. In displays, several firms are working on a \$3-5,000 unit, and users are hoping for crt's that share buffers, control units, and character generators and cost \$1-2,000 each. Sylvania has a two-color one-gun tube for displays. General Telephone is experimenting with large, multi-color real-time laser displays. Stromberg-Carlson is providing color and three discrete levels of dynamic information on its multipurpose display system screen. The Univ. of Illinois has developed a plasma display panel that offers the properties of memory, display and high brightness.

Very few advances are being made in voice response, although some experimental work is being done in synthetic speech. Of more potential value to banks is the voice input system, Webb said. Mellonics, Bell, IBM, RCA, and Farrington's Voiceprint Labs are among those working in the field. Webb disagrees that voice systems will be infallible, but in the "typical controlled (and, therefore, limited access) environment in which such systems will be used, remarkable degrees of accuracy and reliability are possible."

In keyboard input devices, Webb singled out a "San Francisco Bay area radio ham who has developed a three-pound teletype unit, which he expects to market for less than \$50." Too, by mid-year Teletype will market its Inktronic Page Printer, which uses a stream of highly charged particles electrostatically deflected to trace out dots into characters at 1200 words/minute. By the end of this year, Teletype will market a send/receive model priced in the \$5,000 range.

Data Equipment Co. has just reduced the price of its Graphic 1010 input unit, making it more competitive with other I/O devices. This is geared to handwriting input. And Bell Systems is working on 12- and 16-button TouchTone phones to facilitate alphanumeric input.

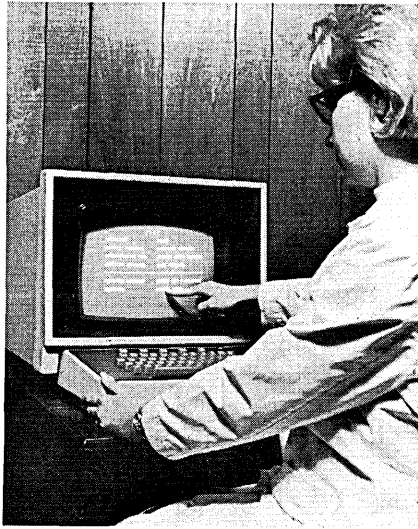
"In a grey area" around these systems are facsimile, closed circuit television, video tape recording, and video-file systems. Webb told bankers that there is much progress in these areas that ought to be studied for applications in document transfer or verifica-

tion, signature authorizations, management information systems, etc.

CDC DEMONSTRATES HOSPITAL SYSTEM

The Mediscope system was demonstrated by Control Data to the Minnesota Medical Association at its May meeting in Rochester. Mediscope consists of a special display scope, software, and computer as a package. It works with the CDC 1700 usually but can also operate with the CDC 3000 or 6000 line or with the IBM 360, mod 30 and up, as the computer end.

The most interesting aspect of the package is Digiscribe, a crt with 20



translucent strips under the face-glass which respond to the touch of a human finger (no light pen) to call forth programs, segments of programs, and function instructions. Digiscribe comes with or without a keyboard; the keyboard's function is to enter medical data or medical instructions. Instructions are said to be available through the touch method when medications, dosages, times, etc. are stored.

A typical Mediscope system will include a number of Digiscribes at various points in a hospital, all on-line by cable or telephone line. Doctors can issue their orders through the display unit, and as these affect the pharmacy, surgery, laboratory, food centers and other function areas they become interrelated to hospital accounting and patient billing.

Communications control is handled by one or more 1700 computers. This takes care of the inquiry and display requirements of the Digiscribes.

Software consists of SHORT (Shared Hospital On-line Real-time Time-sharing), which translates console selections into whatever action has been preprogrammed for those selections, and SETRAN (Selectable Element TRANslator) to allow the user to construct display sequences.

NASA, GSA SET UP JOINT SERVICE CENTER

After a seemingly endless struggle, NASA and GSA have finally worked out plans for the first federal inter-agency service center. To be located in Huntsville, it will be operated three shifts, at least five days a week, by Computer Sciences under a contract from GSA. NASA will take two shifts initially, then phase down. Other users include the Army ballistics command and the Air Force. Work from federal contractors will be accepted, although none has yet materialized.

GSA is mulling over proposals for additional centers in New York, Philadelphia, and San Francisco, among other cities. Los Angeles is another possibility. Originally, a joint use facility was planned there, at the new federal building. A 360/20 owned by the Veterans Administration was to be upgraded to a Mod 40, providing capacity needed by NASA's western support office and six other occupants of the building—e.g., subdivisions of Justice, IRS, and Interior, some of whom are now buying commercial machine time. But budget cuts are forcing NASA to close its western support office, so the joint use idea has been abandoned. Within the next few months, a GSA team plans to assess the need for an inter-agency service center. VA, unlike NASA, is eager to cooperate, so establishing a facility would probably take far less time.

IBM STENOMARK READER SPEEDS TRANSCRIPTIONS

The IBM Stenomark Reader, an experimental machine that automatically reads and encodes tapes for English transcription from stenographic recorders, was described by IBM engineers Scott R. Gilpin and Donald R. Mason at the recent IEEE Region Six Conference in Portland. A complete steno pad containing two hours of transcription dictated at a rate of 175 wpm can be read and stored by the machine in four minutes, and an English printout from a 360 can be produced in a total process time of 15 minutes, compared to five hours for a typist. The reader uses a split-manifold vacuum drum to provide constant tape speed, and two small core buffers to synchronize the input data rate with magnetic tape.

In addition to its application in the reduction of courtroom backlogs, the reader can be used for foreign language translations; a linguist can dictate a direct translation as he reads to a stenotypist, thus eliminating the complicated programming necessary to make a computer bilingual.

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operation for 1½ years and system accuracy, disregarding human error, was over 90%.

COMPILER TESTING MAY INTENSIFY COMPETITION IN GOVERNMENT BIDDING

Congressman Jack Brooks, in a letter to Secretary of Defense Clark Clifford, has proposed a move that could make big federal dp system procurements far more competitive. If the recommendation is adopted throughout DOD proprietary software would no longer give individual suppliers nearly as much advantage in bidding on particular applications.

Brooks suggested testing each bidder's compiler to make sure it faithfully executes the source program. The aim would be to bring all bidders' compilers up to the same performance level before selection of a system begins; the selection team would then have a wider choice than they do now, and system specs could be less machine-dependent. Another benefit, said Brooks, is the possibility of "segmenting" big buys into separate contracts awarded to different suppliers.

The first buy reflecting the use of

compiler audit packages is likely to be the Worldwide Military Command and Control System (wwmccs). This probably will be the biggest general-purpose computer procurement ever undertaken by DOD. It involves more than 100 small, medium, and large computers, and will cost in the neighborhood of half a billion dollars.

Brooks' proposal is particularly significant because much of the work needed to develop operational compiler auditors has already been done. As the Congressman mentioned in his letter to the Defense Secretary, the Navy recently developed a COBOL compiler tester. Within the next few months, the Air Force expects to complete two more. The Army has begun development of another.

One of the upcoming Air Force programs will test JOVIAL compilers. It is being written by Data Dynamics, Inc., Los Angeles, and is due to be delivered in October. This package will evaluate the compilers offered by bidders participating in the wwmccs procurement. The Army has also contracted with Information Management, Inc., San Francisco, to develop a COBOL audit package, and, at press time, was about to sign an agreement with the National Bureau of Standards covering development of a FORTRAN

compiler tester.

The Navy COBOL package came from a team led by Dr. Grace Hopper, working under Norm Ream, Special Assistant to the Secretary of the Navy. Essentially, this program compares the results executed by any COBOL compiler against the results specified in each level of CIB 9, the COBOL language standard which USASI is on the verge of adopting. If the compiler doesn't conform, the Hopper package also reports which modules are deficient. As part of this Navy effort, translators are being developed to convert older COBOL versions into compilers conforming to CIB 9. Also, the Navy is refining a COBOL flow charting package developed at the Charleston, S. C., Navy Yard. One of Dr. Hopper's objectives is to make all Navy applications machine-independent, so that when they are upgraded or modified, system bids can be obtained from the maximum number of vendors. Another aim is to make Navy programmers freely transferrable among COBOL-programmed installations using different central processors.

The package IMI is building for the Air Force is due to be delivered in August. It has successfully analyzed the COBOL compilers offered with the GE 635, Univac 1108, Burroughs

3500, and CDC 6400, plus the F-level compiler IBM has developed for the 360.

The Air Force and Navy developed their COBOL auditors independently, but non-competitively, explains an AF spokesman. Managers of both efforts are cooperating closely with each other, and with a third team—USASI's X 3.43 task group—which is nearly finished writing a third COBOL test package. The Air Force intends to cull the best features from each of the three and end up with a standard audit package which will evaluate all COBOL compilers offered by its bidders. This package will also be recommended to DOD for use by the other services, and a description will be sent to USASI in the hope of getting it incorporated into CIB 9.

A standard test package for JOVIAL compilers is only a little farther down the pike. The program DDI is now writing for the Air Force measures performance against the J3 manual which the Air Force adopted last year as its official JOVIAL language specification. Since then, J3 has become a de facto DOD spec, and conversations are underway between the Air Force and USASI's X3.4.2 working group which, hopefully, will lead to development of an official American standard from J3.

A standard FORTRAN tester is also a strong possibility, after the Army-financed NBS project is completed. That audit package will utilize USASI's FORTRAN IV standard as the basis of evaluation. The project team is headed by Betty Holberten.

The two test packages are part of a much broader AF programming effort which encompasses source languages, documentation, codes, character sets, operating system, interfaces, and data management, as well as additional work on compilers.

Next year, the Air Force data automation directorate plans to survey available COBOL compiler diagnostics, and develop specs defining the errors that should be detected by an acceptable diagnostic routine, as well as the detection method. If funds are available, the directorate may contract for development of an improved standard diagnostic routine.

The following year, officials plan to evaluate major source language compilers in terms of how fast they generate object codes, code execution time, and hardware overhead, among other criteria. Here again, the Air Force may underwrite improvements in commercially available compilers.

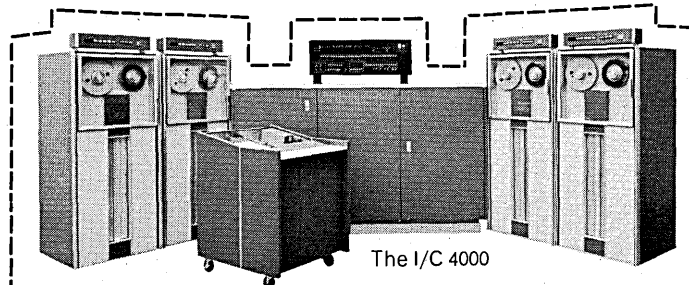
A survey of JOVIAL users, to find out what they like and dislike about the

present language, and what changes are needed, is already under way. "From this study, we hope to develop modifications in the J3 manual which will make the language more responsive," explains an AF spokesman. The survey has been contracted out to Data Dynamics.

Logicon Inc., San Pedro, Calif., under another AF contract, recently compared PL/I against COBOL, FORTRAN and JOVIAL. After programming seven benchmark programs in each language, Logicon found that PL/I requires fewer statements and less coding, but demands more expertise from the programmer. The choice of a language depends less on these factors, Logicon concludes, than on compiler and operating system considerations; "it is in this area that improvements are most urgently needed" in all four of the languages tested.

LESSOR SUES LENDING FIRMS

Restraint of trade and "corporate spying." These are the charges in the \$9 million suit by Datronic Rental Corp. against two commercial lenders. Datronic, a small computer-leasing firm, claims that Commercial Discount Corp., Chicago, and James Talcott, Inc., N.Y., violated the Sherman Anti-



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Trust Act by conspiring to destroy its financial arrangements and gathering confidential information from its vital records using "spy" techniques. This was done, said the plaintiff, because both financiers had plans to enter the computer leasing field.

Talcott allegedly did its part for the "conspiracy" by investigating Datronic's corporate records under the guise of gathering data needed to grant the company a loan. Talcott spokesmen noted that such investigation is routine for all loan applications; the loan was turned down. In addition, Talcott notes that the investigation was made after the lender had publicly announced its plans to enter computer leasing, so there was no reason for Datronic not to know of these plans.

CDC allegedly loaned Datronic money under terms that would restrict the lessor's ability to arrange other financing. The details here are unclear; a spokesman for Datronic says that a "whisper campaign" by the defendants "berating the character of the officers and operation" of Datronic was what kept Datronic from obtaining loans from other sources. CDC has made loans to the plaintiff in excess of \$900,000, granted partially because of recommendations of banks dealing with Datronic. CDC too has made "routine" investigation of the firm's records. CDC denies that it has plans to enter computer leasing, although it has had a non-computer leasing subsidiary for several years.

Datronic will not disclose further details on the claims, wishing more "latitude" in presenting its evidence before the court. There is no date set yet for a review of the claims and decision on whether the suit will go to a federal jury trial requested by Datronic. Also sought is a court injunction restricting further violations by the defendants. Datronic, a wholly owned Chicago subsidiary of Canteen Corp., has over \$6.5 million in dp systems on lease. Talcott, still organizing its operation, does not yet have systems on lease.

STANDARD OFFERS CHEAPER BUT SLOWER CORE MEMORY

Standard Memories, Inc., Santa Ana, Calif., is now marketing ECOM (Economic Core Memory), a slower unit than the same company's Micro-STOR memory. Like Micro-STOR, it is an off-the-shelf item. Designed for use in small process control computers and outstation peripherals, ECOM is a 256 to 4K (8- to 16-bit words) memory, expandable by parallel connections to 16K. Access time is .80 usec, with a

cycle time of 2.5 usec. Cost of the unit ranges from \$600 for the smallest to \$3,300 for 4K.

Standard Memories was formed two years ago by John Flood, Arthur Weber and William Barnes, who decided not to aim at specific system projects but to concentrate on building a memory that would fit many applications. Such an off-the-shelf stance, according to Barnes, marketing vp, has enabled the company to standardize its product and come through with quick delivery—less than 30 days. The firm has experienced a rapid growth and will gross \$3/4 million in volume shipped by the end of its fiscal year this month.

The company was acquired in May of this year by Applied Magnetics Corp., which specializes in the manufacture of heads for tape, disc and drum, and also manufactures seismic equipment. For information:

CIRCLE 239 ON READER CARD

NSF SUPPORTS NATIONAL INFORMATION STUDY BY AIP

In an effort to narrow the spread between the rapidly increasing amount of technical information being generated in the science of physics and the diminishing accessibility to that information, the National Science Foundation is sponsoring a program undertaken by the American Institute of Physics to develop a national computerized information system.

An initial stage of the program is the design of a new classification system, to be used in conjunction with free-language index terms, for the intellectual organization of the physics literature to facilitate retrieval, with a minimum of translation, from any of three sources: a primary journal index, an abstract journal index, and a computer store. After the classification system is developed and accepted, an author may classify his own document, subject to review, and it becomes definitely identified for computer processing.

The AIP Journals, which comprise over 85% of the physics literature in the U.S., will be produced by computer-aided photocomposition under the projected information system, and a by-product will be tape input to storage of the published data. This data would also be supplied to AIP's Physics Abstracts publication, which would, in turn, provide information from non-AIP journals to the computer store. The store will contain bibliographic information, classification, index terms, citations and, possibly, abstracts for each unit of data. Selective dissemination and special searches on demand will be features of the classifi-

cation system.

The AIP program parallels similar efforts on the part of scientists in other fields to mitigate the problem of information identification and accessibility. The American Chemical Society, with its comprehensive Chemical Abstracts Service, has begun a major project to modernize and automate the National Chemical Information System.

FINANCIAL T-S SERVICE DEVELOPED

Computer Research Corp., Newton, Mass., and The Boston Company have jointly developed a financial time-sharing service which was shown to 1800 attending the Financial Analysts Federation in Boston in May.

Lewis Clapp, president of CR and its subsidiary Dial-Data, said that the new service allows analysts to dial the computer (an SDS 940) to get financial information as well as data on the state of the economy. The analyst does not need to know anything about computer programming to format special reports through a terminal.

The programs have been commercially operational since May and the service already has half a dozen customers: investment counselors, banks, and an economic research organization.

There are 200 different kinds of data stored in the computer memory. These range from daily stock market prices since the beginning of 1968 to other financial data going back 20 years. Data are drawn from such sources as Standard & Poor's, the Federal Reserve Bank, and the Census Bureau, such as cost of living index, car loadings, automobile production, etc., as well as stock market reports.

Programs available include portfolio management, a financial report generator, and a search program, where the user can specify criteria for certain stocks; e.g., stocks which advanced 5 points in a specified period, that pay at least 4% dividend, and trade at a low price/earnings ratio. The computer searches the data on all traded stocks for those criteria and reports the findings in a printout.

SOFTWARE FIRM FORESEES GROWTH

Brandon Applied Systems expects to earn better than \$1 million from training activities this year, about 2.5 times more than it took in last year from the same source. Publishing revenue should grow nearly seven-fold, to \$241K, reports President Dick Brandon. The company expects its recent acquisition, Ehlers, Maremont Co., to

contribute \$750K this year. Other new activities, and their expected revenues, are: proprietary software, \$50K; advanced training, \$100K; new acquisitions, \$300K.

The advanced training will consist of courses for programmers and for the highest level of corporate management—groups BAS has not approached yet. The company may also expand the limited training it now provides outside the dp field.

During the past year, Brandon's increased the number of courses it offers by close to 50%, and expanded from two to seven the number of cities where classes are regularly convened.

The \$300K BAS expects to glean from new acquisitions will come at least partly from a deal that, at press time, was on the verge of being consummated.

Total revenue for Brandon's current fiscal year, which ends Feb. 28th, 1969, is projected at about \$3 million, better than three times the '68 figure. Dick Brandon expects his firm to be grossing \$10 million by 1972.

CHINESE WRITING FINALLY CODED FOR MACHINE STORAGE

Chinese writing is done with two-dimensional characters that have been impossible to encode for machine storage until some scheme of representing this non-linear information could be devised to serialize it. A project at the National Bureau of Standards Center for Computer Sciences and Technology has developed a way of dividing this two-dimensional information into components. The six-year study, supported by the Army Signal Corps and the Air Force, evolved a scheme of showing how Chinese characters are formed. This became a "grammar" for placing in all allowable combinations the components given in an accompanying lexicon.

The scientists of the center have experimented with means of serializing two-dimensional information whether it is from road maps, drawings, chemical configurations or Chinese characters. They have tried to read such information into digital computers by a scanning system producing a chain of digital data. Another approach was MAGIC (Machine for Automatic Graphics Interface to a Computer), identifying each point by its rectangular coordinates, and by linear notation for all anticipated two-dimensional configurations in storing chemical information.

The picture syntax concept developed at the bureau in the late 1950's suggested that two-dimensional data could be treated by formal grammars in much the same way as one-dimen-

sional information. The subsequent study of the structure of Chinese characters in terms of component combinations showed that characters had at least three kinds of combination possibilities: vertical, horizontal, and surrounding-enclosed combinations.

The picture syntax concept showed that most Chinese characters are written as if in parts of a frame that can be divided and subdivided, with embedding in frames or subframes. The component lexicon was developed by showing the components, their position in relation to the entire character, and the extent to which each component occurs with other components and subcharacters.

CANCER PATIENT REGISTRY STARTED

The beginning of a registry of cancer patients, previously begun as an IBM 1440 program, is being transferred at Good Samaritan Hospital, Cincinnati, to their new 360/30. So far the registry contains about 1800 patient records on mag tape, compiled over two years. This will be supplemented by other Good Samaritan patients and later from records of other hospitals in SHAS (Shared Hospital Accounting System), which Good Samaritan has instituted.

By the fall of next year two Colorado hospitals, Penrose in Colorado Springs and St. Mary Corwin in Pueblo, are to tie into the system, and their records will become part of the data base. They treat an average of 15,000 cancer patients a year.

The registry records contain complete histories of the cancer patients, including data of first treatment, kinds of treatment (radiation, cobalt or chemotherapy) and dosages of each. The types of cancer are classified as minutely as possible, and the treatment that appears most effective for that type is noted. As part of the program, new drugs are administered on a selective basis and complete results recorded in the interest of cancer research. The conclusive report of the cancer register will eventually be prepared for the U. S. Dept. of Health, Education and Welfare, which funded part of the research.

Other hospitals participating in SHAS are St. Joseph's, Mt. Clemens, Mich.; St. Vincent's in Santa Fe; St. Joseph's in Albuquerque; and Good Samaritan, Dayton.

NEW HONEYWELL SOFTWARE AIMED AT SMALL IBM USERS

Honeywell, which likes to be regarded as the Avis of the computer industry, has intensified its marketing war on No. 1 by moving two more big guns

into the front line: an RPG-COBOL translator and a Disc Liberator package.

The new Disc Liberator expands a marketing effort that began several months ago, when Honeywell introduced its Mod 2 Extended software. That package was designed to convert 1410 users, and 360/40 users operating in a 1410-compatible mode, into H2200 or H1250 users. The recently introduced Disc Liberator is aimed at 1440 users, together with 360/25 and /30 users operating in a 1440-compatible mode. Honeywell wants to convert them into H120 and H125 users. Those who switch get approximately equal performance for about 20% less in monthly rental charges, says a Honeywell source. A representative 120 system costs \$4,235/month; a representative 125, \$4,400.

The new Disc Liberator translates programs written in Autocoder, SPS, or mixed SPS/Autocoder into Honeywell's Easycoder. Harry DeSmet, peripheral group product manager of Honeywell's edp division, believes the potential market is "up to 3,000 systems." Another source said the company hopes to do at least as well with the Disc Liberator as it did three years ago with Easytran, a comparable mag tape liberator. That marketing effort replaced "more than \$100 million worth of 1400-series machines with series 200 systems," according to a Honeywell news release. Another source reported that most of this business came from 1401 users. Easytran dislodged about 500 1401's, he added—roughly 7% of the total number then installed.

The new RPG-COBOL translator is designed for users of card-oriented 360/20 systems who want to upgrade to tape or disc pack. There are "12,000 card computer systems installed and on order, valued at more than \$1.5 billion," says Honeywell. How many of these are likely to be upgraded is a mystery, but a recent survey conducted for Honeywell among 60 representative users of card-oriented 360/20 systems may be indicative.

Thirty-eight of the 60 said they were planning to convert to tape or disc within 18 months. More than half felt an RPG translator was "necessary." Respondents were also asked to rank the computer manufacturers they'd like to deal with, after IBM. Honeywell received 36 votes; Univac, 23; Burroughs, 9; RCA, NCR, and GE, 7 apiece, and CDC, 1.

"A typical third-generation card system," like those employed by 90% of all RPG users, rents for about \$2900/month, according to Honeywell. By comparison, an H110 system, with 12K characters of core memory,

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CIRCLE 70 ON READER CARD



news briefs

three magnetic tape drives, card reader/punch, and line printer, rents for about \$2,600/month.

Along with the two new software packages, Honeywell announced that its special products division is moving from the Boston area to larger quarters in San Diego; at least partly, the transfer is due to unexpectedly large orders for the company's new Keypape units. Honeywell reportedly expects to be producing 500 Keypapes/month by September; the first deliveries were made in June, one month ahead of schedule. At press time, Honeywell was planning to announce a substantial expansion of the Keypape line, to include line printers, adding machines, and check digit verifiers among other components. A paper tape reader is being readied for possible release in September.

Meanwhile, the company announced it has delivered "more than 1,000" of the six-high disc packs that went into full-scale production last February. A 10-high pack, compatible with IBM's 2316 drive, and a single disc that mates with the IBM 2315 drive, probably will be announced before the end of this year. Honeywell drives for these units will be supplied by CDC.

TRAFFIC PROJECT SHOWS COMPUTER CONTROL EFFECTS

In spite of a 10% increase in traffic volume since the start of a ramp metering program, speeds have gone up 30% and rush hour accidents have been cut nearly in half on a 6½-mile stretch of northbound freeway through downtown Houston. The pilot project involves entrance points at eight major on-ramps to the Gulf Freeway where Texas Transportation Institute (part of Texas A&M's College of Engineering) installed on-ramp traffic signals controlled by an IBM 1800 data acquisition and control system.

About 80 magnetic loop detectors are embedded in pavement of the ramps and along the right-hand freeway lane (about 1,000 feet before a ramp). The freeway detectors locate and estimate the size of traffic gaps and advise the computer, which turns the ramp signal green so that incoming motorists can merge into the freeway gap. The size of the gap determines how many cars are allowed to leave the ramp. Ramp sensors detect whether cars are present; if there are more than 15 waiting vehicles a sensor signals the computer, which orders a search for smaller gaps so that cars may be moved out. At the merging area a sensor holds the signal red until

cars ahead have merged.

At present the ramp signals operate independently but will eventually be integrated for faster traffic flow by holding cars at some ramp points. The same stretch of freeway is monitored on 14 closed circuit TV receivers at TTI's traffic surveillance office. Accidents and other traffic mishaps can be spotted as they occur and police units dispatched as needed. Ultimately a completely computer controlled traffic flow will eliminate the television monitoring.

The 1800 is also compiling information on freeway traffic speed, volume and density for engineers developing and evaluating traffic control theories. The projects in Houston are sponsored by the Texas Highway Dept. and the U.S. Bureau of Public Roads.

HOSPITAL SYSTEM INCLUDES COMPUTERIZED LAB TESTING

The City of Memphis Hospitals has installed an IBM 360/40, with a network of terminals for admissions, nursing stations, and emergency rooms. Also included in the system for the 900-bed complex is one of the nation's most modern laboratory testing systems.

The system is expected to cut time and costs of some lab work by more than 90%, speed patient admissions, free nurses and technicians from much paperwork, and maintain updated records.

On-line terminals at admission stations create patient records which include patient name, doctor's name, insurance company, medical history and reason for hospitalization. This record is updated during the patient's stay with reports of lab tests, physician's diagnosis and instructions, nurses' notes, and progress reports. These records become the basis of reports for out-patient or readmission use.

One of the main data sources for the computer is the hospital's laboratory, which does automated testing under the monitoring of an IBM 1080 data acquisition system. The 1080 reports the results via punched tape to the computer which checks the tests and enters them into patient records. The automated system has cut blood testing, for example, from 90 minutes for each test to nine minutes. In addition, a typical 12-test series which used to cost about \$60 a patient is now performed from a single sample for \$5.

CONTROL DATA ACQUIRES HONOLULU SOFTWARE FIRM

Shareholders in Pacific Technical Analysis, Inc., Honolulu, have voted unanimously for acquisition by Control Data Corp. in a deal that calls for an exchange of four CDC shares for each of the 7,001 shares of PTA common

stock, which is entirely owned by the company's 150 employees. Robert Behnke was named general manager of CDC's Western Pacific Div. and remains as president of PTA.

The software firm was formed four years ago and has specialized in programming services with CDC 3100 computers for DOD's military construction activities in the Saigon and Bangkok areas. The company grossed \$1 million last year and expects to double that figure for the current year. Future focus will be on planning and research for business applications, with additional branches in Singapore, Kuala Lumpur and Jakarta.

CONTINENTAL AIRLINES GETS BIG RESERVATION SYSTEM

SONIC 360 (Systemwide On-line Network for Information Control) is Continental Airlines' newly inaugurated flight reservation system. The first unit of the system operational was at Los Angeles (also servicing Tucson, Phoenix, and El Paso). This was shortly joined by offices in Denver and Houston with the Chicago office expected on-line by late summer.

The \$7.2 million system is based on tandem IBM 360/65's, which are able to deal with half a million reservations normally and can be expanded to handle a million. One 65 is solely for reservations with the second for backup, reporting and data processing chores. Other hardware in the system includes two 2314 discs, 12 2401-2 mag tape units, 290 2915 crt agent sets, and 120 1977 terminals, which produce printed records. There will be more than 400 communications units when the system is completed.

The Central Reservation Control at Los Angeles will have 10 2915's and two 1977's to monitor passenger traffic across the entire Continental domestic system, coordinate special requirements (extra sections, rescheduling), and manage unusual occurrences (advising local agents to contact passengers about delays or other flight changes).

SONIC allows the airline to establish a single reservation record available to all sales agents. It combines communications facilities for both reservations and switching in a single system. It provides coordination of flight planning, flight control, and reservations. And it is the basis of statistical reports on reservations, flight operations and general management reports.

BURROUGHS INTRODUCES TC500 TERMINAL COMPUTERS

Burroughs Corporation has started production on its new TC500 terminal computer, a data communications oriented machine designed for on-line

use with data processing systems. The TC500 has the capability to edit and concentrate data that is to be transmitted, and to expand data received, thus relieving the central processor of formatting tasks.

The TC500 features a unit printer with an interchangeable 64-character set and two-color ribbon control. The control console provides communications through its program select keys, operational control lights, standard alphanumeric typewriter keyboard and ball typewriter, 10-key numeric keyboard and operational control keys.

The terminal's disc storage capacity is 512 words of 15 digits and sign, 256 of which are firmware and 256 for stored programs and data. The disc operates at a speed of 6K rpm, with a 30 msec add time. The machine features a 25% increase in typing speed over the IBM 1050, according to Burroughs, and can accept 20 8-bit cps from memory. The data communications processor is capable of transmitting up to 2K bps. Integrated circuits are utilized throughout.

Variable field length transmission and a buffering system enable the terminal to operate on-line at rated line speeds with simultaneous reception or transmission of data while the operator handles previous data or inputs a new message in memory. The unit features a forms control function that can independently control dual pin-feed forms, for instance, through internal program instructions.

The five models of the TC500 vary in size of memory and program capacity, and range in price from \$9,900 to \$14,400, with lease rates from \$250 to \$360 per month. For information:

CIRCLE 237 ON READER CARD

NEW SOFTWARE FIRM OFFERS STRUCTURAL ANALYSIS PACKAGE

A new software house, Programming Sciences Corp., has been formed in Sherman Oaks, Calif., and will offer scientific and commercial programming services. The president is Patrick Meehan, formerly of Jet Propulsion Laboratory, Pasadena. Off to a good start, PSC already has a structural analysis programming package, STRAP-PAC, which it is offering on a service bureau basis.

STRAP-PAC, currently operational on a GE 635, 1108, 360/50 and /65 and the 7094, may be used to solve problems in the static and dynamic analysis of linear elastic structural systems. STRAP-PAC employs the direct stiffness formulation of the equilibrium equations of motion for a structural system and develops coefficients for the equations using the finite element approach. Both line elements and trian-

gular plate elements are available in the program. The program performs internal checking of input data and has a built-in checkpoint/restart capability which minimizes the need for reprocessing in the event of errors. Restrictions on the size of systems which may be analyzed by STRAP-PAC are: a maximum of 4,095 gridpoints; and for the static analysis a maximum of 10K degrees of freedom may be considered. For information:

CIRCLE 238 ON READER CARD

SDS WILL HAVE T-S SOFTWARE FOR SIGMA 5

Scientific Data Systems has announced time-sharing software for the Sigma 5, to be available in the third quarter this year. This gives the company four t-s systems of assorted sizes; the others are the 940, 945, and Sigma 7.

The pitch for the Sigma 5 system is that it will primarily handle batch work but allow up to eight conversational users with Teletype terminals. Assembly language and FORTRAN are available, with editing and debugging facilities.

An eight-user t-s system takes 48K words of core, six million bytes of disc, and the usual peripherals. The company says that the whole package, including the terminals, can be had for under \$13,500 per month. This is slightly less than the 945, at \$15K/month, and the Sigma 7 at about \$17K/month.

23RD ACM CONFERENCE WILL GO INTERNATIONAL

The venerable Association for Computing Machinery will hold its twenty-third National Conference and Exposition in Las Vegas Aug. 27-29, with emphasis on the international comput-

ing scene and probably as many as 50 exhibitors.

An example of the international flavor is Dr. Walter Bauer's International Computer Discussion Panel, to be held Tuesday night. It will include representatives from Japan, France, Great Britain, and Russia as well as the U.S. They will deal with hardware and software developments, applications, standards, and governmental effects on the industry in their various countries, then consider the marketing trends of the future.

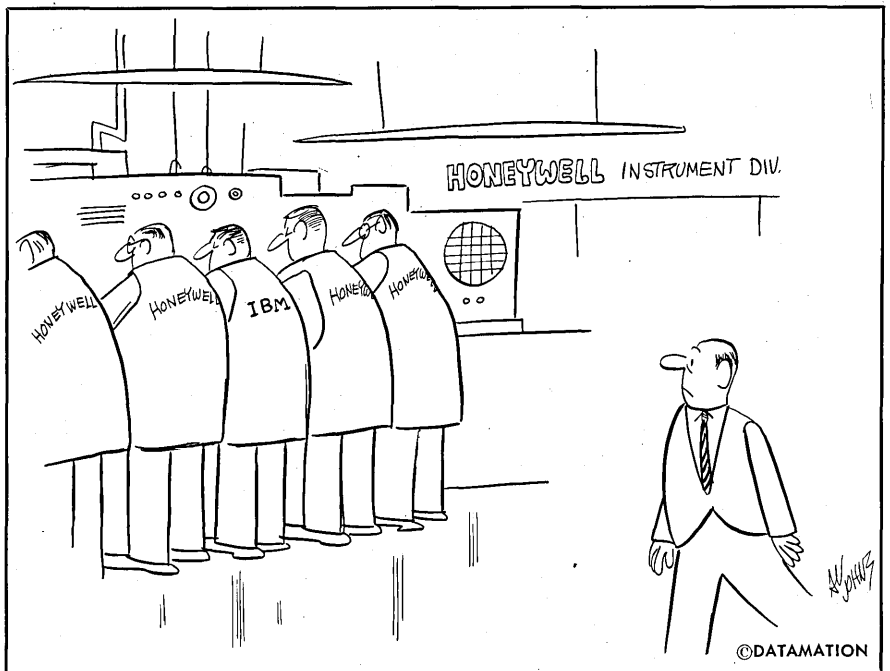
Lt. Gov. of Nevada and Senate candidate Edward Fike will be the speaker at the conference luncheon on Wednesday, talking about the use of large-scale edp equipment as applied to state affairs. Dr. Richard W. Hamming of Bell Labs will open the conference with this year's A. M. Turing lecture.

General chairman Richard B. Blue, of TRW Systems, reports that 193 technical papers were submitted for the conference, from which 80 have been selected for presentation during the 29 technical sessions scheduled. In addition to these papers, there will be three from the IFIP conference, by authors from Denmark, Japan, and Australia.

The proliferating SIG's and SIC's will also meet and more may be spawned. And another added attraction is a series of five professional development seminars on Monday and Friday, before and after the conference.

MEDICAL SCHOOL STUDIES LONG-DISTANCE ECG ANALYSIS

Overcoming problems of long-distance computer processing of electrocardiograph (ECG) information is the sub-



machines that make data move

"all set" for ASCII plus...

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

* * * *

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

Features Galore

The Model 37 types 'in upper and lower case. Will print two colors if desired. In time sharing situations

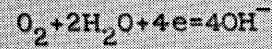
the terminal's capability in printing graphs, equations, text material and tables is uncommonly fast and efficient. It will have half-line feed—both forward and reverse. Puts everything you need for programming, problem solving, cataloging, and information retrieval at your fingertips. And you get all this flexibility from a keyboard arrangement that is similar to the familiar keyboard found on a typewriter.

Traveling Tabs

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



$$(a + b)^2 = a^2 + 2ab + b^2$$

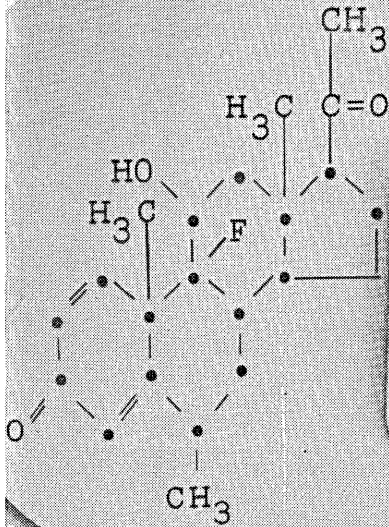


STRAIN

STRAIN



THE QUICK BROWN FOX
JUMPED OVER THE LAZY DOGS BACK
The Quick Brown Fox
JUMPED OVER the Lazy Dogs Back



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

The Line's Complete

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

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

news briefs

ject of a pilot project at the Univ. of Nebraska Medical School, Omaha. The experiment is being conducted by the medical school and the Good Samaritan Hospital, 175 miles away in Kearney. The feasibility study is part of the U. S. Public Health Service's Nebraska-South Dakota regional medical program.

At Good Samaritan, the patient sensors are connected by telephone lines to the IBM 1800 site in Omaha. For a press demonstration, the project director, Dr. Robert Stratbucker, showed how the system operated in spite of the added problem of a fascinated telephone operator staying on the line after the connection was made and adding to the noise. Noise is particularly unwelcome when trying to find the small P wave signals of the ECG. Dr. Stratbucker was an engineer before becoming a doctor and is now also associate professor of physiology at the Univ. of Nebraska College of Medicine.

After keying in patient ID information by telephone pushbutton, an eight-second ECG is recorded for the 1800 and simultaneously on the ECG graph paper at the bedside machine. When the doctor wants the analysis, he uses the Good Samaritan Teletype from which he dials the computer. (Dialing will also eliminate the confused telephone operators who disconnect when hearing the computer's response signal.) With the pushbuttons he keys in patient information and the amount of analysis he wishes.

Of the three projects now under way in this country—VA hospital in the D.C. area, U.S. Public Health Services, Bethesda, and Univ. of Nebraska—the Nebraska approach differs from the other two remote computer analyses in that it uses a method which records simultaneously from three points to give a stereo view of the heart's electrical activity: front to back, side to side, and up and down. The usual ECG reading is from 12 points and sequentially recorded.

The Nebraska ECG analysis program was developed by the Mayo Clinic, together with IBM. The program uses simultaneous three-channel data acquisition. Pattern recognition techniques extract the significant ECG waves from background noise. The information is reduced and stored on tape for computer input. The analysis establishes broadly whether the ECG is normal, borderline, or abnormal.

Fast computer analysis is also being tried in Nebraska in another experimental project which involves using special ambulance helicopters for res-

cuing accident and disaster victims. Communications are by radio and microwave.

The plan for Operation Sky-Aid (which began last March) is that interns or doctors will accompany the flying ambulances. When necessary, on-board ECG equipment can be used for cardiographs which can be radioed to Omaha for computer analysis. The rapid analysis can either come back to the ambulance for immediate corrective action en route to the hospital, or the hospital can be alerted.

The feasibility study, the first in the nation, is sponsored by the U. S. Transportation Dept. to determine the usefulness of evacuation helicopters in emergencies.

In addition to the remote ECG programs, the 1800 at the Medical College computing center is time-shared in other ways. Spirogram analysis (pulmonary functions) reduces data for diagnosis and provides doctors with a list of probable diseases. Anemia analysis, developed at Nebraska by Dr. Perry Rigby, involves blood chemistry analysis inputs keyed from remote terminals; depending on the indexes, the computer follows one of 80 different diagnostic trails before suggesting probable diseases. There is cardiac output analysis, and techniques are under development for remote computer monitoring of blood pressure and skin temperature gathered from patients in ambulances.

UNIVAC GETS \$10 MILLION CONTRACT FROM AIR CANADA

Univac has won another major airline contract. This one is for a \$10 million dual 1108 II reservations system for Air Canada. The carrier's network, called RESERVEC II, will involve initial contracts totalling \$22 million (including communications, facilities, etc.) and is expected to be fully operational by spring, 1971. Univac will be systems manager for the network and develop all programming internally.

RESERVEC will store all Air Canada's flight schedules, maintain seat inventory and availability, keep passenger name records, and produce management reports.

Raytheon crt's will be the agent terminals, installed in 47 of the 61 cities served by the airline internationally. The central system will include the 1108 II with 196,608 words of core, plus disc, drum, magnetic tape and communications systems.

Univac also has operating systems at British European Airways and Northwest Airlines, with installations going into Air France, Scandinavian Airlines, United Airlines, and Iberia Airlines.

Message switching systems are in use or on order at Sabena Airlines, TWA, and SITA, which service more than 130 international lines with a communications network.

LIBRARY INFORMATION NETWORK ESTABLISHED IN NEW ENGLAND

NELINET (The New England Library Information Network) is now providing computer-aided library services on an experimental basis to five New England libraries. The initial participants are the state university libraries of New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. The network began its operating phase in December, 1967, with the initial connection of New Hampshire.

Development and pilot operation of the center is being carried out by Inforonics, Inc., a Cambridge, Mass., computer applications firm specializing in text processing (computer typesetting, library science, information retrieval), under contract to the New England Board of Higher Education and funded by the Council on Library Resources, Inc.

When the project is completed, it is expected that 30 member university libraries will participate in a time-sharing system which will use a PDP-10, replacing the temporary three-day-a-week batch processing on Inforonics' PDP-1 of the pilot study.

Participating libraries query the Cambridge computer center by Teletype for cataloging information and services relating to current English language materials. NELINET uses Library of Congress MARC tapes as its data base, and these are searched for the requested information. The libraries indicate on their request the number of copies of the book to be processed, and the branch locations where they will be shelved. The program operates on this request, and on a library and branch "profile" extracted from memory, and produces the appropriate number and kind of catalog cards, book labels, and book pocket labels, with individualized overprinting and local information as required. The participants' Teletypes connect to both a Dataphone line for computer requests and a TWX line for inter-library loan.

The project is now converting to the new MARC II format (see this month's New Literature department) in which the Library of Congress will begin its full coverage of current English language monographs later this year. Cataloging information on 100,000 titles per year will be made available. Later, NELINET activities will include computer aids to acquisitions and serials processing.

WESCON '68 OFFERS COMPUTER SESSIONS

The Western Electronic Show and Convention (WESCON) returns to Los Angeles for its '68 spectacular, which is expected to attract over 50,000 people from the electronics and aerospace industries. Spread over four days (Aug. 20-23) and three locations (1,150 exhibits are divided between the Sports Arena and Hollywood Park; technical program sessions will be held at the Biltmore Hotel), the show is co-sponsored by the Western Electronics Manufacturers Assn. and the L.A. Council and San Francisco Section of the IEEE.

Sessions of particular interest to computer people are: Session 8 (Wed., Aug. 21, 9:30, Renaissance Room) "Digital Encoding Systems"; Session 9 (Wed., Aug. 21, 9:30, Biltmore Bowl) "Integrated Circuits: How Do You Test Them?"; Session 12 (Wed., Aug. 21, 2:00, Renaissance Room) "New Developments in Digital Communications"; Session 13 (Wed., Aug. 21, 2:00, Music Room) "The Computer as a Control Device for Testing Equipment"; Special Session C (Thurs., Aug. 22, 9:30, Ballroom) "Systems for Law Enforcement"; Session 16 (Thurs., Aug. 22, 9:30, Music Room) "Optics and Electro-Optics in

Computers"; Session 18 (Thurs., Aug. 22, 2:00, Ballroom) "Electronic Devices for Law Enforcement"; Session 21 (Thurs., Aug. 22, 2:00, Music Room) "Computerized Pattern Recognition and Communication"; Session 23 (Fri., Aug. 23, 9:30, Biltmore Bowl) "Advancement of Urban/Regional Systems with Aerospace Technology"; Session 25 (Fri., Aug. 23, 9:30, Music Room) "Qualitative Pattern Recognition Through Image Shaping"; Session 27 (Fri., Aug. 23, 2:00, Renaissance Room) "The Computer's Impact on Power Systems"; and Session 28 (Fri., Aug. 23, 2:00, Music Room) "The Impact of New Technology on Data Communications." The \$2 registration fee is good for all sessions.

Exhibits keyed to the dp industry are components and microelectronics (Hollywood Park), and at the Sports Arena: computers and edp, science systems and communications equipment, and microwave equipment and laser systems.

In addition to WESCON's regular technical session, a special symposium on "Designing with Hybrid Microelectronic Circuits" will be held Aug. 21-22 at the Statler Hilton Hotel in Los Angeles. The \$40 registration fee for this session includes luncheon, the

symposium record of 19 papers, and admission to WESCON exhibits and sessions.

JPL CHOOSES DUAL PROCESSOR 1108 II

Univac's Federal Systems Div. has won a \$5.5 million contract from NASA to outfit the Jet Propulsion Laboratory in Pasadena, Calif., with a multiprocessor 1108 II.

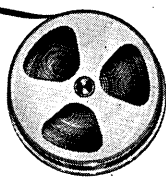
The contract has two phases, with the first cpu to be delivered in August and the second one next spring. The two processors will share a 262K core unit. Auxiliary disc storage will total over 2.1 billion characters.

Set up for time-sharing, the installation will include a variety of remote terminals scattered through the JPL facility. About 10 Uniscop 300's are included in the order, along with eight 35KSR Teletypes, two DCT 2000's, and one 1558 graphic display terminal. Univac's 300 is an alphanumeric crt unit and the DCT 2000 is a remote terminal that includes a 250 lpm printer, 200 cpm card reader, and 75 cpm card punch.

ACM ELECTS 1968-70 OFFICERS

The membership of the Association for Computing Machinery has elected Dr.

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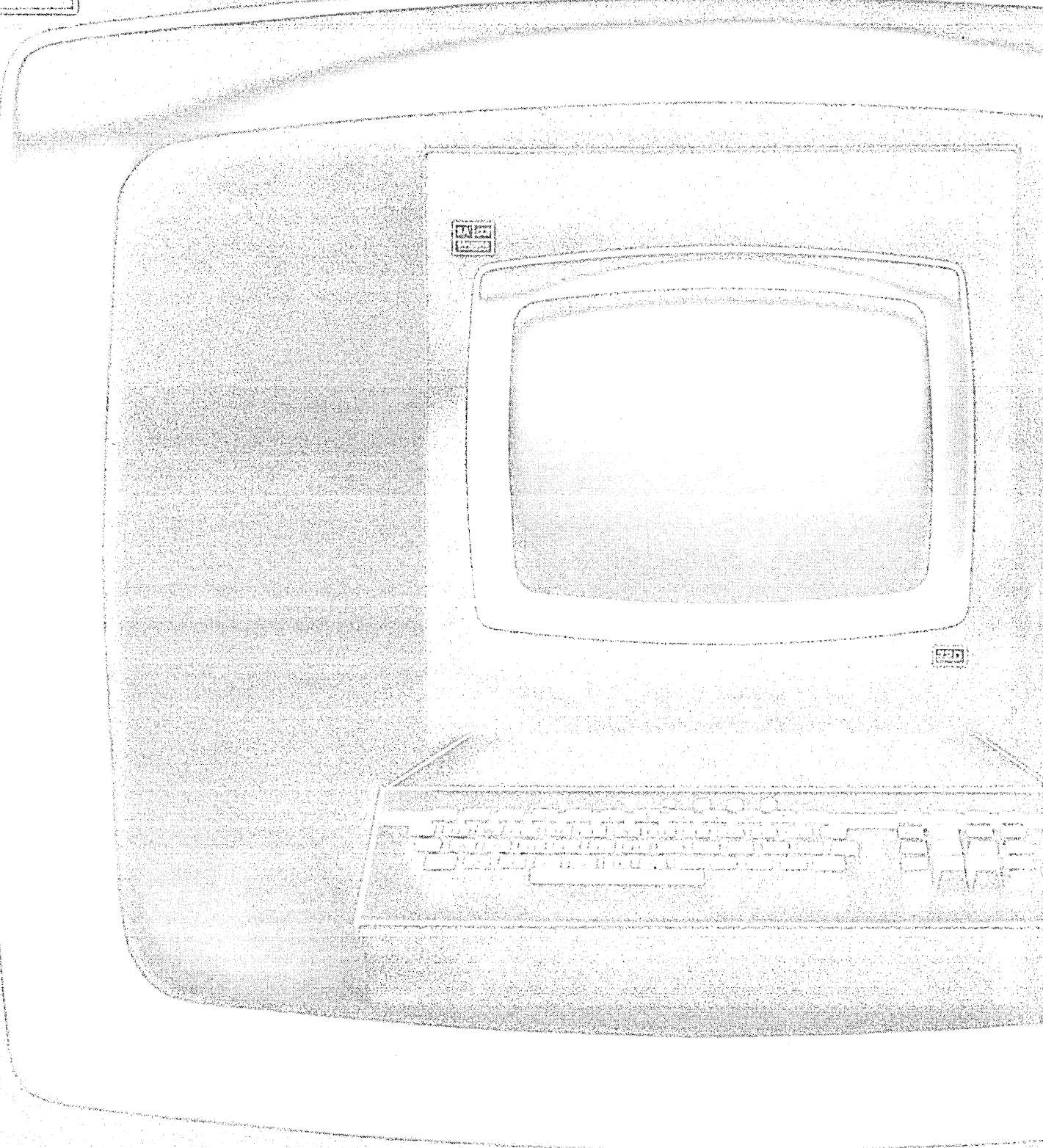
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news briefs

Bernard A. Galler, of the Univ. of Michigan, as president and Walter M. Carlson, IBM consultant on information technology, as vp. Donn B. Parker was re-elected secretary. Walter Hoffman remains as treasurer and Aaron Finerman as chairman of the editorial board.

The selection of Galler will be viewed by some as continued evidence of university domination of the ACM. His victory over Richard G. Canning, an independent consultant/publisher interested in the "real" world of business data processing, may be interpreted as a defeat for those who think that ACM is too narrow and theoretical in its interests and its publications.

The election also saw the defeat of another business data processing specialist, R. George Glaser, McKinsey & Co. consultant and chairman of the ACM Special Interest Group for Business Data Processing.

But others point out that the outgoing president, Harvard's Tony Oettinger, was hardly typically ivory tower. Oettinger, probably the most energetic and effective ACM president in recent years, spearheaded a number of moves to broaden ACM's base, to make it a more effective voice on Capitol Hill, and to provide greater educational services for members.

Galler, it is hoped, will similarly escape stereotyping.

NOTES FROM AUSTRALIA

SILLIAC, the second computer to be installed in Australia, was retired last month from its home at the Basser Computing Dept., Univ. of Sydney. Based on a modified design of Univ. of Illinois' ILLIAC, the 2,000-tube machine was installed in 1956. It had a 1,000 word (40-bit) memory and paper tape and typewriter I/O peripherals . . . The Royal Australian Air Force will install a \$700K message relay system based on two CDC 1700 computers. The system, which will link the Darwin area with AF HQ in Sydney, is expected to be operational by late '69 . . . Dynamo Electronics Pty. Ltd., a North Sydney systems house, has delivered a data recording system to the Bureau of Meteorology in Melbourne. The system will be used to record data from the bureau's upper-atmosphere wind velocity measurement experiments . . . British Petroleum Co. of Australia Ltd. has ordered a 1905E computer system, valued at \$1 million, from ICT Australia Pty. Ltd. The leased system will consist of a 65K cpu, three eight-million-character

discs, six 60 KC mag tapes, a card and paper tape reader and two line printers.

DPMA COMMITTEE TO STUDY PROBLEMS OF PRIVATE EDP SCHOOLS

The Data Processing Management Association has formed a 14-member committee to consider the problems associated with private data processing schools that affect the entire dp community. At its first meeting May 2-3, four subcommittees were formed to make detailed studies of management and sales methods, instructional personnel qualifications, curriculum development and implementation, and graduate placement.

Committee chairman is R. Calvin Elliott, of the DPMA. Subcommittees are headed by John J. Marshall, Jr., Honeywell EDP Div.; Anton G. Myse, GSA, Chicago; Mark Sheldon, CDC; and George R. Smith, GE Phoenix.

The committee plans to make recommendations for improvements which can be offered as guidelines to the private edp school industry. Next meeting is tentatively scheduled for this month.

call for papers . . .

Australian Computer Conference, Aug. 11-15, 1969, Adelaide. Summaries of papers suitable for presentation at business sessions are particularly invited and are due by Sept. 14, 1968, to: Dr. G. W. Hill, Programme Committee Chairman, A.C.C. 69, Computing Science Bldg., Univ. of Adelaide, Adelaide, S.A.

1969 Spring Joint Computer Conference, May 14-16, Boston. Papers on all aspects of the computer and information processing field must be submitted by Oct. 7, 1968. Five copies of the entire paper (text not to exceed 7,500 words) and a 100-150 word abstract should be sent to T. H. Bonn, Technical Program Committee Chairman, 1969 SJCC, Honeywell EDP, 200 Smith St., Waltham, Mass. 02154.

correction

The June News Briefs story reporting on the proposals for the National Association of Securities Dealers was in error. Bunker-Ramo has a contract to develop an on-line quotation system for the National Security Traders Association but the vendor for a similar NASD system has not yet been selected.

● Recently announced peripherals of the Mohawk Data Sciences type seem not to have affected MDS orders, which are still coming in at 170 units

per week as they have for the past six or seven months. In fact, MDS expects upping of orders as it increases the number of salesmen in the field from the present 80 to a year-end goal of 125-150. MDS is still actively scouting for other I/O's or communication devices to take into the family.

● DOD's adp management directorate has been transferred to Comptroller Bob Anthony's office. Before it was under ASD (I&L) Tom Morris. Major General Wendel Carter, Anthony's deputy for resource management information, will be the directorate's chief. Carter undoubtedly will have more clout than Al Bishop, his predecessor, but Carter's career—which was launched with a master's degree in business administration from the University of Wichita—suggests less technical knowledge of computer systems. A lesser chief in one of the armed services believes the organization change is a step backward because it puts DOD dp management policy more firmly in the hands of accountants.

● To benefit the very small user, Allen-Babcock Computing, Los Angeles, has announced a "no minimum" policy for cpu usage in the RUSH time-sharing system. This will enable the user to make a small commitment for fixed costs, such as terminal rentals, telephones, etc., to evaluate the system. For higher volume users a committed guarantee will enable their taking advantage of a variable discount of from 12-20%, based upon cpu time and core.

● The Texas Youth Council, which operates the state's training schools for delinquent children, is training selected institutionalized youths as programmers and computer operators. The course, which meets three hours a day, five days a week, and takes about a year and a half to complete, is said to be the only program of its kind in the world. The program began with two IBM 1401's, but results have been so encouraging (not one parolee has been returned in the two years of the program) that the council is updating the equipment to an 1130 and a 360/20, which, like the 1401's, will be devoted entirely to classroom use.

● NCR and Ultronic Systems Corp. have reached an agreement covering NCR's marketing of datasets made by Ultronic for use with on-line Century Series and 315 computers. Made to NCR specifications, the datasets, to be known as the NCR 753, will be used in such applications as on-line banking.

Is he for you or against you?



CHRONOS—GOD OF TIME

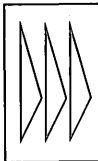
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subsystems is ready to meet almost any requirement.

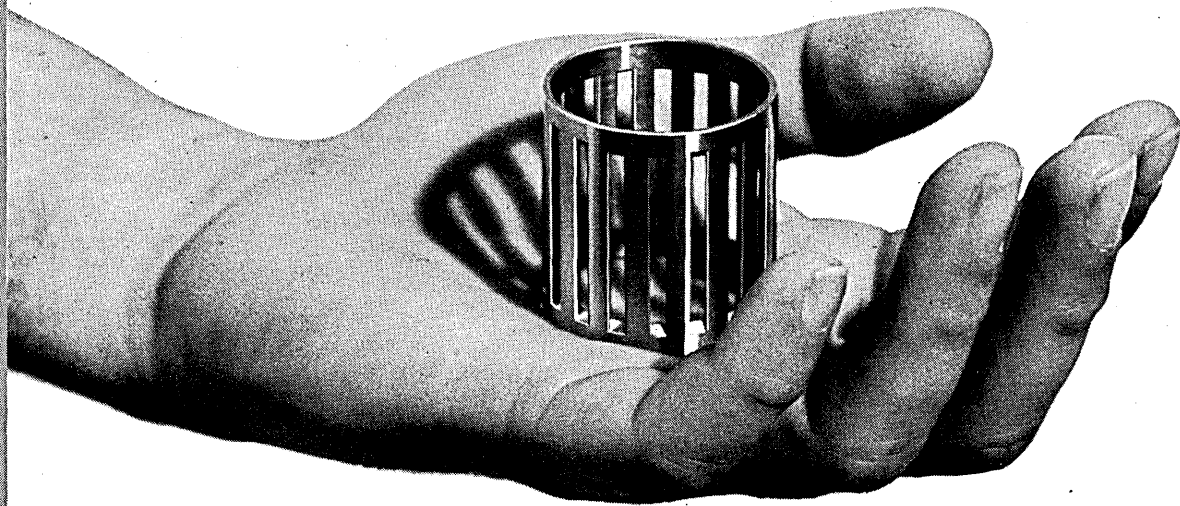
The H632 can grow with you . . . from a minimum 8K memory with one central processor and one input/output processor to a maximum system of 131,072 words of memory, four central processors, and four input/output processors. I/C construction throughout adds to system reliability (we're I/C people from way back).

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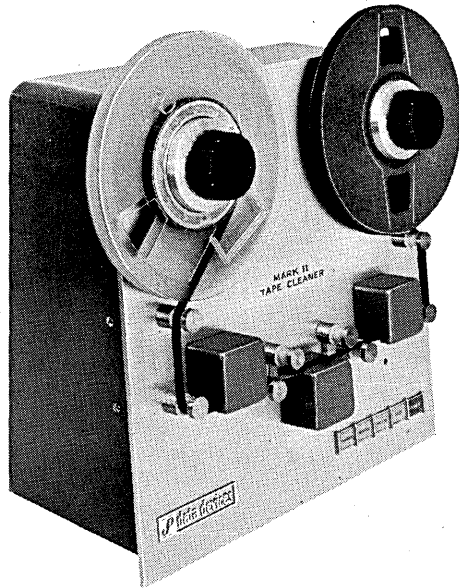


This is the heart of the Data Devices Mark-II Tape Cleaner. No one else has anything like it. It removes dust, dirt, oxide clumps and other foreign particles from your computer tape, and whisks them away with true vacuum action. You never see the dirt, and neither does your tape. The Mark-II cleans your tape thoroughly and efficiently, but doesn't scrape away the oxide as it goes after the dirt, can't damage the tape, and will not create magnetic fields.

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PERIPHERAL

CIRCLE 75 ON READER CARD

news briefs

The agreement is for two years.

● The first stage of a system for encoding fingerprint identification for the FBI has been completed by the Dept. of Commerce's NBS Center for Computer Sciences and Technology. A computer produces compact descriptors based on the fine details of the fingerprint impression. (A "typical" fingerprint contains about 80 details, depending on how much the finger was rolled when the impression was taken.) The computerized system will characterize fingerprints by comparing certain groups of minutiae from among ridge endings, bifurcations, incipient ridges, islands and enclosures. When completed, the system will produce a matching score for each fingerprint comparison. The FBI currently has over 60 million sets of fingerprints in its civil file and about 17 million in its criminal file.

● Data Processing Financial & General Corp. has made a deal with Ampex to become the exclusive distributor of Ampex tape drives. First-year orders are estimated at \$15 million. DPF&G president Harvey Goodman

says that we are entering a new era of marketing and the user "will no longer be bound to the acceptance of an entire computer system from a single manufacturer." For this reason, Goodman said, his company may also contract for other Ampex peripheral equipment.

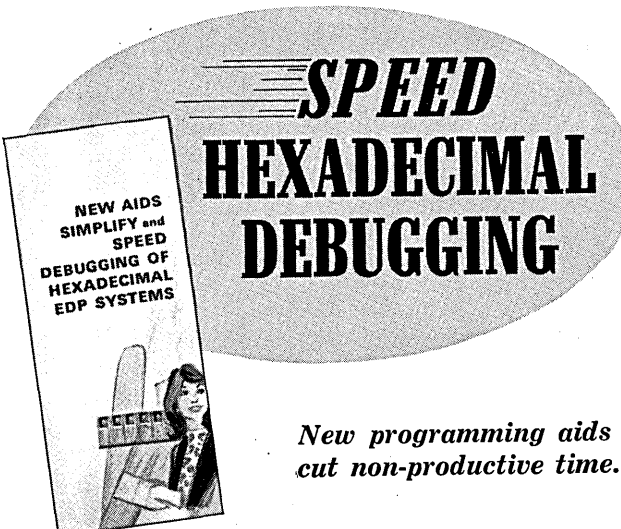
● Digitek Corp., Los Angeles software house, has reached an agreement to acquire Distribution Control, Inc., Gardena, Calif., for an undisclosed amount of stock. Under terms of the agreement, Distribution Control will be operated as a division of Digitek and serve as that company's entry into time-sharing. DC markets a wide range of proprietary computer t-s services for the distribution market with annual sales of about \$400K. The 1½ year old DC, using two disc B 300's, now has 41 terminals for four customers on line and is adding more. The capacity of the 300's is 64 terminals each.

● *The Computer Analysis of Amorite* (an ancient Semitic language unspoken for 3½ millennia) may become the first complete grammar in any language. It is the product of a six-month cooperative FORTRAN programming effort between a Univ. of Chicago Pro-

fessor, UC's IBM 7090, and a visiting Czech scholar. Amorites wrote on damp clay in word-syllabic writing, a cross between picture and alphabet writing.

● Illinois Bell Telephone Co. estimates it will save \$100K yearly by storing information for intercept operators on two Univac 418's, replacing the daily updated directories that had cost the company \$400K annually to print. Intercept operators come on the line when someone dials a non-working telephone number in the Chicago area. The operator keys that number into the computer and receives all information on that number on the screen in front of her: whether the number is still in service, or is disconnected, or has been changed and to what. Illinois Bell has about 5½ million phones (adding 115 each hour); its intercept service is growing about 5% a year. The 418's with Fastrand drums of 132-million-character capacity, hold identical information for backup.

● Four research centers in London will be time-sharing a B5500 being installed at the General Post Office's telecommunications headquarters. The multiprocessor will be used for such diverse applications as calculating



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news briefs

satellite orbits for trans-Atlantic communications, mathematical models to simulate and optimize telephone networks, properties of a new microcircuit, and research in postal mechanization. About 95% of the work will be in ALGOL; other services include a desk calculator language, remote compilation facilities, and program library maintenance.

● The Palo Alto Research Laboratory of Lockheed Missiles & Space Co., has developed a conversational applications monitor language for non-numerical data retrieval that will permit the user to perform his own computation on-line, eliminating the necessity for a coder to prepare the program. Called, not too briefly, LACONIQ (Laboratory Computer Online Inquiry), the software is designed to serve as a time-sharing monitor allowing several users to be on-line to the computer concurrently, without interference or interruption, operating on an event-driven basis, rather than clock-driven. It was tested on a 360/30 and exploits 64K bytes of memory. Lockheed expects to market the monitor, although arrangements have yet to be worked out.

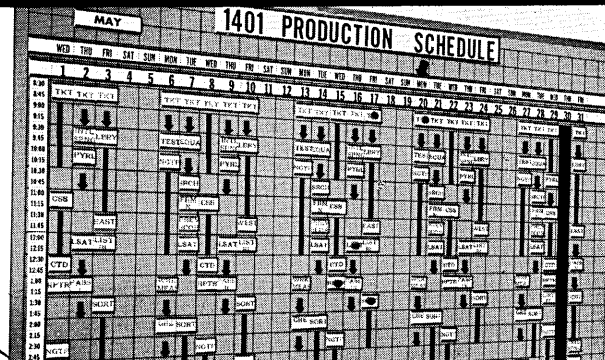
● The Hagan/computer systems division of Westinghouse has moved into its new plant in O'Hara Township, a suburb of Pittsburgh, where over 500 employees will be engaged in the design and manufacture of process control systems and computers, including the division's Prodac line. The plant occupies 10 acres of a 20-acre site and plans already are on the boards to double its size. The division has sold nearly 200 computer control systems since its formation in 1962; and claims that during this period it has reduced software costs by 20%. The company produces small-, medium- and large-scale systems and expects the average cost to drop from \$170K to \$130K in 1970.

shortlines . . .

"Within the next year," Bunker-Ramo plans to offer a new service to stockbrokers combining price quotes with buy-sell order processing. B-R's Telequote 70 system does this now—for brokers with in-house computers. The new package, utilizing B-R's Manhattan telecenter, would be offered to smaller firms, and would cost "somewhat more" than Telequote 70 (\$80/month). . . . Burroughs and Friden have asked Sangamo for marketing rights to its new direct-entry tape recorder, but both suitors have

been rejected, at least for now. Sangamo seems to be doing quite well on its own; currently, the company is accepting orders for the new equipment only from customers willing to wait nine months for delivery. . . . Logic, Inc., Detroit, plans August revealing of a parallel acoustic coupler they are now testing. This moves six bits in parallel simultaneously in longer term burst to give faster and more accurate transmission of data over ordinary voice grade lines. As far as is known, there is no other parallel acoustic coupler yet available. . . . IMPEL (Insurance Management Performance Evaluation, Life), NCR's program designed for use with the Century Series computers, requires the basic Century 100 configuration of a 32K-character, 300-nsec thin film main memory, two dual-disc files of 8.4 million characters each, a high-speed printer and a punched-card reader. . . . Purdue Univ. will introduce an undergraduate degree program in computer science next fall at the Lafayette campus. Similar programs will follow at the regional campuses, which now have two-year degree programs. Prof. S. D. Conte, head of the computer sciences department, is chairman of the ACM's committee on undergraduate programs. ■

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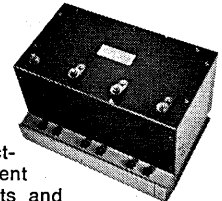


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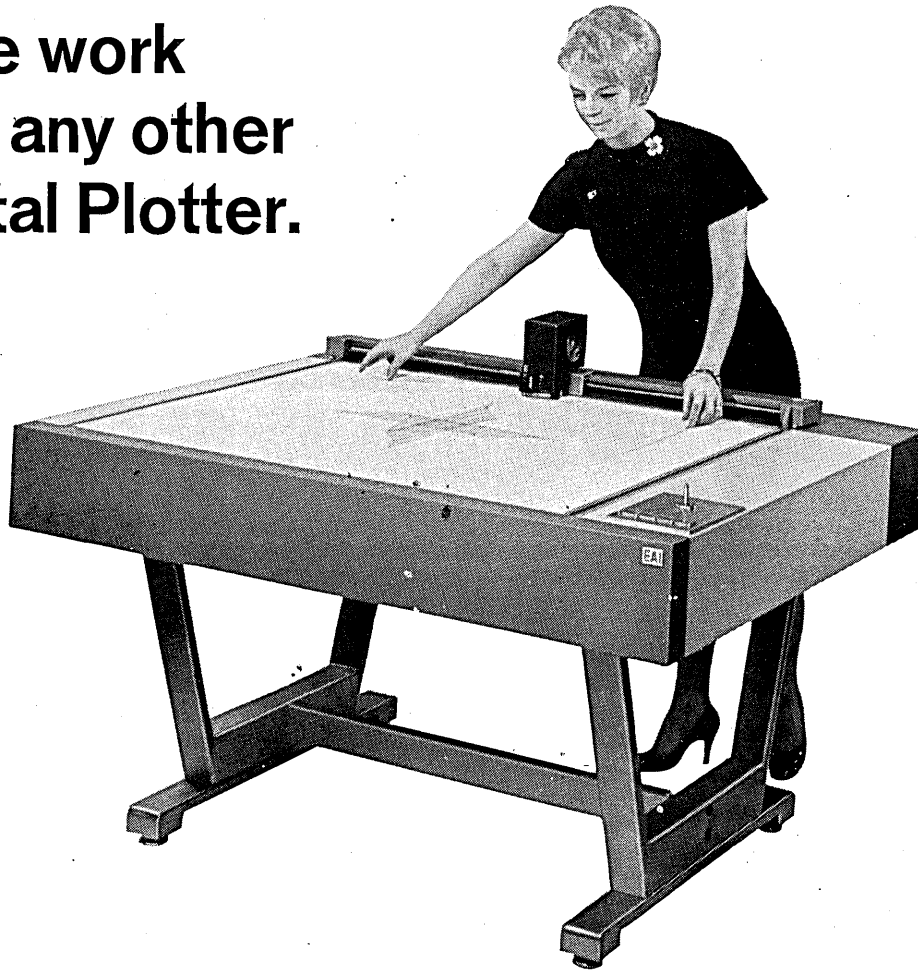
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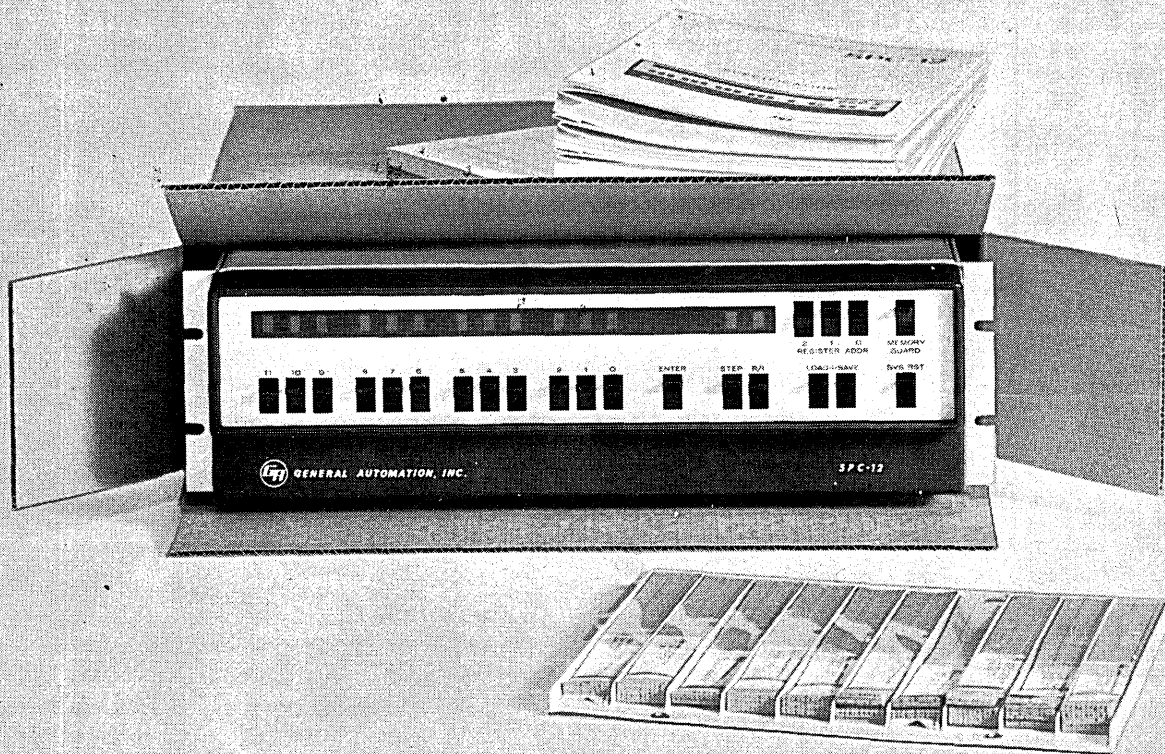
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remarkable new *shared command* concept that increases memory efficiency by up to 35%.

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world report

IFIP WILL SEE FULL-SCALE TIME-SHARING FROM ICT

The first commercial European time-sharing service which embodies a mix of multi-access with remote job entry and batch processing has been developed by ICT. Its public debut will be at the IFIP 68 conference, Edinburgh, when the company will have taken on the mantle of dominant partner in the new International Computers Ltd. -- the merger of ICT and English Electric Computers coupled with \$40 million plus from the Government and a shareholding to the Plessey communications and electronics group.

The time-sharing development comes with the release of the bulk of operating systems to which ICT is committed for its 1900 series. Multi-access is through the 1900 Minimop operating system which offers Fortran, Algol and Jean. The last of these is an ICT natural language for conversational working. To combine multi-access and batch processing Minimop will be run with George 2, the operating system for 1900's with 32K upwards and discs. Minimop allows for private file management and for a program developed from a terminal to be stored in the batch dp queue and run off accordingly.

EXPORTING PRODUCT AND PROFIT CONCEPTS

Over the past year or so some of the big six have had European happenings which were later transferred into the United States domestic market. GE pulled small machines out of its subsidiaries and has yet another small product in its French labs. (This may suffer a delay in arrival because of setbacks through worker occupation of the research labs and factories during the French mini-revolution last month.)

Burroughs' banking terminal, the TC 500, is a product development which was a European special to help mop up nearly \$75 million worth of orders from U.K. banks.

But the latest word of the "mighty one" hints that IBM is preparing to split hardware and software so that it can scoop up the same sort of profit from its egg-heads that it has from nuts and bolts. The decision has been made about where IBM support for its airline package Pars stops and either the customer or a hired software house takes over maintenance and extension of packages for new jobs. For a maneuver like this to come out of Europe is not surprising, since IBM has four of the major airlines wrapped up with Pars as the base for integrated management systems costing a conservative \$5 million a year each in software development. Also having borne some heavy development costs on PL/I with its European software groups without much to show in return, there are signs that the language is up for grabs in the same way.

BIG T-S SYSTEM PLANNED IN JAPAN

A huge time-sharing system with perhaps as many as 500 terminals is under consideration by the Nippon Telegraph and Telephone Public Corp. (The telephone company has the inside track there on time-sharing, because legal restrictions prevent any other organization from linking companies.) Some of the terminals may be a variation of the touch-tone phone,

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world report

a 12-key model now being tested. Projected budget for the first fiscal year is \$3 million, with some 200 programmers needed; primary language will be Fortran.

IBM DETERMINED TO STORM U.K. BANKS

That IBM banking terminal similar in style to the TC 500 may cost only \$7000. What's more, it's for sale -- no rental terms available. Designed to hook onto model 65's, the terminals are organised to feed a buffer concentrator, which does some editing and formatting before squirting the data over line to the cpu.

IBM has waxed fat on the U.K. banking with a minimal effort. But the Burroughs fright has brought ruthless reorganisation. And the first switch back to IBM is likely to come from the National Provincial Bank, which recently merged with a solid IBM customer in the Westminster Bank.

BLIND PROGRAMMERS GET MORE HELP

Several developments have been completed in the U.K. to help blind programmers. A general software package for converting alphanumeric on six-bit and eight-bit systems into the contracted form of braille used by blind programmers has been produced from the Royal National Institute for the Blind in conjunction with a group in the Management Services (Computers) division of the Treasury. There are also efforts to get companies who could employ blind programmers to allow tape recordings of the usual meetings at which systems specs are initially drawn up. This has been used as a way for the blind programmer to write his documents on a typewriter from a dictaphone.

Several major companies have been employing programmers who have completed the first training course organised by the Institute. And in converting from Leo 326's to Univac 1108's, the giant Shell-Mex BP oil company has specified conversion software for its blind programming packages. A package has also been completed by the Institute to help in faster production of braille literature. This is a program for converting text punched onto cards to be processed to produce another pack in braille code which can be fed into an automatic engraving machine.

CEIR U.K. LOSES LAST LINK WITH CEIR U.S.

Remaining connections between CEIR Inc. and CEIR U.K. have been severed with the change in name of CEIR U.K. to Scientific Control Systems. The change follows the acquisition by CEIR Inc. of a Dutch software house jointly owned by the two. Scientific Control Systems will now set up its own European operations. Under chairman and managing director Dr. Maurice Kendall, the British company changed from American to U.K. parentage when it was bought by British Petroleum.

SCS is one of the largest software houses with a turnover approaching \$5 million. But its areas are much more management science, operating systems and language development than bread and butter data processing. Its latest hardware interest is a Univac 1108, which may be extended to multi-access service and remote job entry.

BITS & PIECES

The first major practical application of the European OCR-B optical font has come in a system for processing parking tickets by the police force in London...With mounting interest in optical character recognition, Farrington's U.K. subsidiary has opened a bureau for data conversion.

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BASED ON EXPENDITURES OF NONFARM FAMILIES AND SINGLE CONSUMERS

ITEM	TOTAL	GEOGRAPHICAL REGION		
		NORTH-EAST	NORTH-CENTRAL	SOUTH
DISTRIBUTION OF ALL FAMILIES (PCT.)	100	26.5	27.0	29.0
1 HOUSEFURNISHINGS AND EQUIPMENT	100	27.5	26.0	28.0
2 HOUSEHOLD TEXTILES	100	31.5	24.5	25.0
3 SHEETS	100	29.5	23.5	28.0
4 PILLOWCASES	100	33.0	24.0	26.0
5 PILLOWS	100	28.0	23.5	22.0
6 BEDSPREADS, COMFORTERS, QUILTS	100	30.0	18.5	32.5
7 WOOL BLANKETS	100	16.0	16.5	33.0
8 ELECTRIC BLANKETS	100	23.5	26.0	25.5
9 OTHER BLANKETS	100	34.0	30.0	23.0
10 CURTAINS	100	35.5	23.5	25.5
11 DRAPERIES	100	60.5	19.0	28.0
12 TABLE CLOTHS, PLACE MATS, NAPKINS	100	28.5	25.5	22.0
13 SLIPCOVERS	100	33.0	24.5	23.0
14 BATH TOWELS	100	35.0	24.0	23.0
15 OTHER TOWELS	100	28.0	26.0	27.5
16 OTHER HOUSEHOLD TEXTILES	100	27.5	28.0	29.5
17 FURNITURE	100	28.0	28.0	24.0
18 LIVING ROOM SUITES	100	25.5	29.0	26.5
OTHER LIVING ROOM PIECES	100	28.5	26.5	32.5

CONSUMER EXPENDITURES FOR HOUSEFURNISHINGS AND EQUIPMENT

ESTIMATED 1966 DISTRIBUTION OF DEMAND BY SELECTED FAMILY CHARACTERISTICS
BASED ON EXPENDITURES OF NONFARM FAMILIES AND SINGLE CONSUMERS

ITEM	TOTAL	GEOGRAPHICAL REGION				COLOR	
		NORTH-EAST	NORTH-CENTRAL	SOUTH	WEST	WHITE	NONWHITE
Distribution of All Families	100%	26.5%	27.0%	29.0%	17.5%	88.5%	11.5%
1 HOUSEFURNISHINGS AND EQUIPMENT	100	27.5	26.0	28.0	18.5	91.0	9.0
2 Household Textiles	100	31.5	24.5	25.5	18.5	89.0	11.0
3 Sheets	100	29.5	23.5	28.0	19.0	88.5	11.5
4 Pillowcases	100	33.5	22.5	26.0	18.0	87.5	12.5
5 Pillows	100	33.0	24.0	22.0	21.0	91.0	9.0
6 Bedspreads, Comforters, Quilts	100	28.0	23.5	29.5	19.0	83.0	17.0
7 Wool Blankets	100	30.0	18.5	32.5	19.0	77.5	22.5
8 Electric Blankets	100	16.0	16.5	33.0	34.5	97.0	3.0
9 Other Blankets	100	23.5	26.0	25.5	18.5	88.0	12.0
10 Curtains	100	34.0	30.0	23.0	14.5	89.0	11.0
11 Draperies	100	35.5	23.5	25.5	15.5	93.5	6.5
12 Table Cloths, Place Mats, Napkins	100	60.5	19.0	28.0	18.0	88.5	11.5
13 Slipcovers	100	28.5	25.5	22.0	20.5	90.0	10.0
14 Bath Towels	100	33.0	24.5	23.0	18.0	91.5	8.5
15 Other Towels	100	35.0	24.0	23.0	18.0	93.5	6.5
16 Other Household Textiles	100	28.0	26.0	27.5	18.5	90.5	9.5
17 Furniture	100	27.5	28.0	29.5	20.0	86.5	13.5
18 Living Room Suites	100	28.0	28.0	24.0	20.0	93.5	6.5
Other Living Room Pieces	100	25.5	29.0	26.5	19.0	89.5	10.5
	100	28.5	26.5	30.5	14.5	92.5	7.5
	100	24.5	24.0	32.5	19.0	86.0	14.0
	100			23.5	23.5	89.5	10.5
	100			22.0	22.0	92.0	8.0
	100					11.5	25.0



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CIRCLE 40 ON READER CARD

washington report

DEFENSE CONTRACTORS FACE TIGHTER CONTROL

Legislation that could tighten federal control over many dp contractors to the Pentagon is likely to be enacted soon by Congress. It would direct the Comptroller General to "develop uniform accounting standards" applicable to "all negotiated prime contract and subcontract defense procurements in excess of \$100,000." These standards, says a knowledgeable source, would cover leased as well as purchased dpe, and formally advertised system procurements which involved price negotiations after the vendor had been selected. Contractors who use government-financed computers would also be included.

Several weeks ago, when the House extended the Defense Production Act for two years, it simultaneously authorized the Comptroller General to develop uniform economy standards. The House bill says Congress must approve the standards before they can become effective.

WEMA, EIA, and other contractor groups are violently opposed to the measure. During hearings, spokesmen for these groups complained about "harassment" and "government dictation." The chief advocates of uniform accounting standards are Sen. William Proxmire, Wis., and Rep. Henry Gonzalez, Texas.

SENATE CONSIDERS EXPORT RESTRICTIONS

U.S. computer firms are losing important orders in the Eastern European market, Hugh Donaghue of Control Data Corp. told the Senate International Finance Subcommittee recently. The subcommittee has scheduled hearings through July on a "sense of Congress" resolution to relax existing export and financing restrictions. Though U.S. computer and edp parts manufacturers had over \$430 million in sales abroad in 1967, less than \$5 million came from the Communist areas in Europe. French, British and Japanese firms have taken over this growing market.

One problem is Commerce Dept. refusal to rule in advance on export license eligibility, Donaghue charged. Another is departmental consideration of each application on a case-by-case basis. And licensing policies depend "apparently on day-to-day State Dept. political attitudes" toward a country, he alleged.

In related testimony, Chairman Harold Linder of the Export-Import Bank complained that new financing restrictions on his agency provide further roadblocks to sales of capital goods in Eastern block countries. A new law prohibits Eximbank financing with any country trading with North Vietnam, thus barring government-sponsored loans and export insurance to all of Eastern Europe except Yugoslavia.

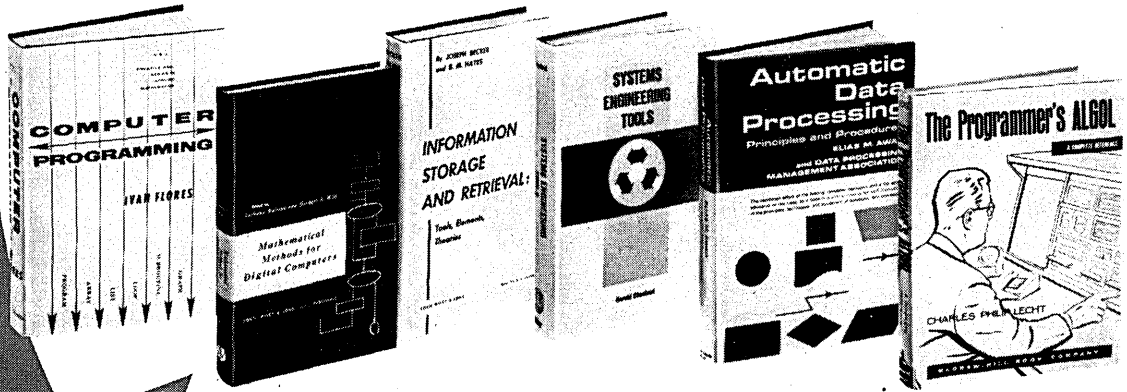
Donaghue rejected the contention of some Senators present that export embargoes are necessary to protect our technology. "If they copy our present products, they are locking themselves into technologies that are three to ten years old," he argued.

GSA EXPANDS SERVICES TO OTHER AGENCIES

In a major reorganization, GSA has converted its ten regional adp divisions into federal data processing centers -- with an expanded mission of providing dp services for other government agencies. The shake-up, effected quietly by internal order dated May 16, puts the \$40 million GSA adp operation under the Federal Supply Service -- heretofore the major internal user of GSA computers. Plans for replacing the GE 425's and Honeywell 200's at the regional centers will await workload estimates.

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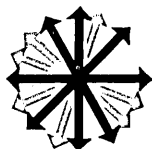
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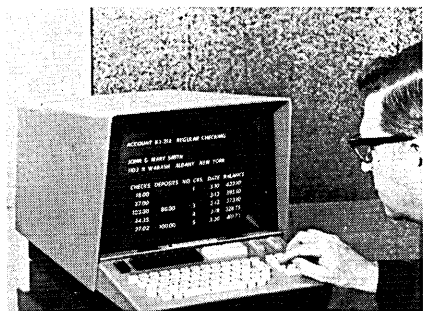
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new products

remote terminal

The BR 2204 is a remote terminal with a crt display screen and a detached keyboard. It operates at speeds up to 2400 bps over Dataphone circuits with any computer that has OLRT capability. The crt has a maximum character capacity of 960 (80 characters a line, 24 lines); and a 64-character reper-

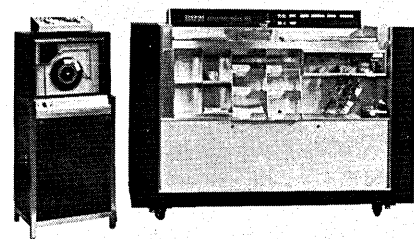


toire. Viewing area is 9" x 6 $\frac{1}{4}$ ". Characters are generated by a 5x7 dot matrix, and refresh rate is 54 frames/second. An entry marker can be positioned at any point on the display for tabulation, deletion or insertion of characters or lines by use of the A/N keyboard and an optional 10-key numeric block. BUNKER-RAMO CORP., Stamford, Conn. For information:

CIRCLE 160 ON READER CARD

optical scanner

The Scanak 216 optical scanner is a combination of a mark reader, a bar code reader and a perforated character reader. The character reader also has a special feature which allows it to read the company's own 5-level "One" binary decimal code which can be



printed by any line printer and patched into existing programs. The scanner can read from two to four of these codes on the same document in a single pass. Reading speeds are 375 documents a minute with mag tape and 225 documents a minute with pa-

per tape. No character recognition is required; sorting capability, and a listing and totaling accumulator are optional. The system is available on a purchase or rental basis. CUMMINS-CHICAGO CORP., Chicago, Ill. For information:

CIRCLE 161 ON READER CARD

source data system

The 2025 Magnetic Tape Compiler collects, edits, verifies and reformats data from CDC remote input stations and badge readers. The system's computer can be used off-line for other data processing. Up to seven trunklines are accepted by the 2025 system; additional multiplexors may be added for up to 200 input terminals. The 2025-1 comes with single magnetic tape transport (a second can be added). The 2025-2 has two transports and a line printer. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 162 ON READER CARD

data management package

PRISM is a data management system which is hardware independent and is said to cost 25% less than Mark IV and 10-15% less than COGENT. The clue to this independence is use of a COBOL compiler and "shorthand" COBOL input language. The compiler incorporates all the features of a standard COBOL compiler used by manufacturers; for those special features unique to one computer-maker's COBOL, Cybernetic Applications Inc. has developed subsets which will be provided to the user free. (CAI says the compilers of all manufacturers are 95% similar.)

The basic \$22.5K system works under disc operating systems and requires a 64K system in any configuration. Upgrading to operating system use costs an additional \$5K.

PRISM basically provides for file creation, maintenance, and updating, for cross-referencing between multiple files, and report generation. The user's files can be in fixed or variable length formats, with no restrictions as to size. The user writes any request in the short-hand COBOL on a single specification form, which is then punched on parameter cards for execution. The PRISM compiler then produces a program which, after execution, can be stored for use again. Each short-hand statement actually generates eight to

PRODUCT OF THE MONTH



The Model 800 portable terminal includes an acoustic coupler, strip printer and standard TTY 63-character keyboard weighing less than 25 lbs. including case. The weight was determined in part by a New York law forbidding female employees to lift anything heavier than that. The unit will also fit under an airplane seat.

The strip printer puts out alphanumeric characters on a $\frac{1}{2}$ "-wide paper at the rate of 10-15 cps. A

switch allows selection of duplex or half-duplex transmission over voice grade lines. The unit operates in USASCII. Delivery is quoted as 60 days.

Potential applications include use by insurance salesmen at the home of a prospect for on-line policy selection, and claims adjustment. Use by programmers too lazy to get out of bed is another possible application. OMNITEC CORP., Phoenix, Ariz. For information:

CIRCLE 163 ON READER CARD

new products

10 COBOL statements.

PRISM has three basic elements: extraction or retrieval from files, sequencing of this data into desired form, and presentation. Each element has subfunctions, such as, under extraction, additional operations like translation or summarization can be performed. Some specific features under each element are as follows. Retrieval: ability to update multiple data files from various input sources; automatic reformatting of extracted data into machine-useable format, and ability to vary retrieval criteria at object time.

In sequencing: the system can merge output from various files, internally sort and re-sequence data, and summarize. PRISM will produce an unlimited number of consecutive reports from a data file, will accept multiple file data for one report, and can concurrently act on different files at the same time. An example of the latter is that it will, say, update one file, generate a report from another, and output data from yet another file onto mag tape for entry into another file—concurrently.

PRISM has "complete print formatting facilities" which will allow the user to specify the format or default to the general formats PRISM will automatically generate. PRISM also has internal processing controls, i.e., record counts, hash totals, and check-point and restart facilities.

The programmer trainee, says CAI, can be taught to use PRISM in three days. The non-programmer user with some edp knowledge can be taught in 5 days. Support includes provision of systems engineers for two weeks of on-site training and installation, documentation, monthly visits by S.E.'s for 11 months, PRISM users publication, and updating and error correction throughout the life of the system. PRISM can be installed one week after contract.

The package is not leased. It has been available in the New York and Boston areas since July 1. Nationwide: third quarter '68. CYBERNETIC APPLICATIONS INC., New York, N.Y. For information:

CIRCLE 164 ON READER CARD

disc drive

The 1600 disc drive is a removable storage unit for the OEM market that uses a standard six-high disc pack, such as the IBM 1316. The drive features a hydraulic head positioning mechanism and an enforced time delay during start-up cycle to allow tem-

perature stabilization and avoid errors. The unit has a capacity of 7.68 million (6-bit) characters or 7.25 million (8-bit) bytes. Average access time is 75 msec. GENERAL ELECTRIC INFORMATION DEVICES, Oklahoma City, Okla. For information:

CIRCLE 165 ON READER CARD

digital computer

The new Univac 418 III isn't a rehash of the II, but a mix of hardware and software designs used in the II, 494 and 1108. Major features: simultaneous processing for two I/O modules and the control/arithmetic section, each linked to a separate memory bank; each I/O module, with its own i.c. buffer control, having a transfer of 1.3 million words per second (vs. the II's 125K); up to 32 I/O channels configured in any mix of multiplexors and selectors; 32-132K (18-bit) words of core available in one to four banks; memory cycle time of 750 nsec (vs. 2 usec) and index storage in 125 nsec i.c.'s; eight index registers; 13 classes of priority interrupt and completely privileged I/O instructions. The exec system and compilers are completely drum resident. The III is only source-code compatible with the II. Price range is about \$14.9K-40K per month. Delivery is scheduled for second quarter '69. UNIVAC, DIV. OF SPERRY RAND., Philadelphia, Pa. For information:

CIRCLE 166 ON READER CARD

disc pack

The 11-High Stack Disc Pack is compatible with the IBM 2316 pack and is available for "immediate" delivery. ATHANA CORP., High Point, N.C. For information:

CIRCLE 167 ON READER CARD

time-sharing system

The HP 2000A time-sharing system is composed of the 2116 computer with 16 user terminals. The 16K (16-bit) word computer (augmented by a 348K word disc) has a cycle time of 1.6 usec; 500-1,000 "average-sized" programs can be stored on the disc. The system is restricted to conversational BASIC; the terminals are ASR-33 or -35 teleprinters (with Dataphone interface). Response time boasts a maximum of one second delay on preliminary repartee; and a maximum delay time of three seconds on computations (absolute worst case, according to company, is 15 seconds delay during computations). The system guards against telephone-noise errors by use of full duplex inputting. The executive software maintains two program librar-

ies on the disc—a public library, available to any user; and individual libraries maintained for each user. The 2000A t-s system sells for \$89,500; a price the manufacturers claim is "a 90% reduction in hardware costs, while retaining 75% of the capability of similar systems." Delivery is scheduled for late '68. HEWLETT-PACKARD, Palo Alto, Calif. For information:

CIRCLE 168 ON READER CARD

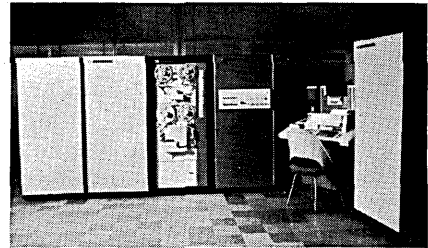
programming language

AIMS v is a programming language which generates a complete COBOL source program. Currently operational, the language will operate on 360/30's and up under DOS or OS; it reportedly requires no flowcharting, takes less keypunching and fewer computations than COBOL. The company also claims faster debugging time. AUTOMATED INFORMATION & MANAGEMENT SYSTEMS, INC., Cincinnati, Ohio. For information:

CIRCLE 169 ON READER CARD

process control system

The LN5000 digital computer system includes an I/O assembly, a cpu and peripheral equipment, and can be used in such applications as digital control of processes, process monitoring and alarm logging, automatic start-up and shut-down of production units and industrial dp. A multiprogramming capability allows the computer to operate on process control programs



while "simultaneously" operating on general-purpose programs in a lower priority.

Software includes compilers in expanded FORTRAN IV and in CODIL (Control Diagram Language) which is an encyclopedia of control and process-related subroutines which allow engineers to develop solutions in block diagram form. In the hardware, a minimum core capacity of 8K is required for the FORTRAN and a minimum of 12K for the CODIL programs. Memory cycle time is 900 nsec. The I/O equipment scans analog inputs at rates up to 1,000 points a second and accepts digital input at 2,000,000 points a second. Accuracy is .1% of full scale at the 3 sigma variance limits. A memory protect feature prevents one program from altering another when both are

stored in core; the system also includes a power fail-safe device.

The system can be supplied with a manual input console for direct digital control, as well as status indicators, trend recorders, system back-up stations and an operator communication panel. LEEDS & NORTHRUP CO., North Wales, Pa. For information:

CIRCLE 170 ON READER CARD

payroll package

A payroll package, offered for sale (no rentals), can handle multi-state tax problems, and can process shift differentials, temporary rates and multi-pays in its normal routine. An employee's earning record can be prepared whenever required by the user. Both hourly and salaried personnel can be processed at the same time. The program was originally programmed on a 65K 360 with four tape drives and two discs. With minor modifications, the company says, the system can be used on a one-disc drive in a combined disc/tape configuration. A card reader, punch and printer are also required. The system operates under DOS and is written in COBOL. COMPUTER USAGE BUSINESS SERVICES, INC., Mount Kisco, N.Y. For information:

CIRCLE 171 ON READER CARD

time-sharing service

As predicted in June Look Ahead (p. 17) IBM has announced its CALL/360 BASIC, a time-sharing service which will allow customers to communicate with a 512K 360/50 in BASIC. The system will offer a choice of keyboard terminals (including teletypewriters): IBM's own 2741, or TTY models 33 and 35. A minimum monthly charge of \$100 covers combinations of system use time, storage utilization, establishment of the user's own library, and access to a "public" library. Terminal and line costs are additional. Test centers in New York, Chicago and San Francisco have been using the service since April; additional centers in New York and Chicago will open this summer, and plans are to extend the service to 34 cities by the end of the year. An upgraded CALL/360 DATATEX was also announced; the new version will center around a mod 40, which replaces a 1460. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 172 ON READER CARD

tape print utility program

A utility program allows each tape character of a record to be printed as upper case, lower case, hexadecimal value or overscored characters. It also allows a tape produced on any com-

puter to be represented in 360, BCD, EBCDIC or hexadecimal notations. The tape print utility permits fixed length blocked, unblocked or variable length records. SOFTPAK, INC., Lanham, Md. For information:

CIRCLE 173 ON READER CARD

portable calculator

The Mathatron PKB system links a portable keyboard unit to a central computing station via two-wire connections, standard telephone receivers, radio or any combination of the three. The calculating equipment is all located in the computing station. The



keyboard incorporates a serial strip printer which prints all entries from left to right exactly as they are entered, with mathematical signs, parentheses and decimal points. The system is designed to follow algebraic rules and perform multiplication and divi-

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new products

sion before subtraction or addition. A power-of-ten exponent key allows the entry of large numbers and extends the number range to 100 columns, eliminating overflow. All answers appear as the nine most significant digits plus an exponent in the range of 10^{58} to 10^{-41} . Standard units will execute log, trig and statistical functions. The system's memory will store up to eight constants, as well as any number the system can compute. It also has a programmable formula storage memory that will store up to 48 steps of algebraic instruction. Cost of a four keyboard system is under \$2K per keyboard. WRIGHT LINE, DIV. OF BARRY WRIGHT CORP., Worcester, Mass. For information:

CIRCLE 174 ON READER CARD

data acquisition system

The DT-1000 is a digital data acquisition system to multiplex input signals at remote locations over phone lines. The system may be used over DDD phone lines with automatic telephone answering and coupling built-in; point scan provides a continuous real-time presentation of any remote data point. Terminals report data one-way, thus eliminating the need for interrogation. The DT-1000 will accept input from analog, digital or manual sources. A six-digit display provides data readout at the receiving terminal; it is computer-compatible for automatic polling. APPLIED PERIPHERAL SYSTEMS, INC., Houston, Tex. For information:

CIRCLE 175 ON READER CARD

disc packs

The 849 and 851 disc packs store from 2,890,000 (7-bit) to 8,192,000 (6-bit) characters. The 849 is compatible with the CDC 852 disc storage drive, IBM 1311 drives and equivalents. The 851 is compatible with CDC 853, 854 and similar drives. Features include replaceable filter at pack bottom, a metal insert in release knob to prevent thread stripping, and special coating techniques which allow recording heads within 50 micro-inches of disc surface. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 176 ON READER CARD

rpg-to-cobol translator

An RPG-to-COBOL translator for the Honeywell 200 series computers and competitive equipment converts RPG programs into standard COBOL programs operating in either a mag tape or direct-access environment. Minimum required configuration is 12K

characters of core, three mag tape drives, a card reader/punch and a line printer. The translator will be ready for delivery in December '68; it will be free to users of 110, 120 and 125 computer systems. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 177 ON READER CARD

time-sharing system

The SDS 945 time-sharing system is a 48K (24-bit) byte computer with a 1.75 usec cycle time. It will accommodate 24 simultaneous users and can service 64 users with a total file space of 8 million characters (this compares with the 940's accommodation of 32 simultaneous users; 512 users can have access to its 60-million-character storage). Software-compatible with the 940, the 945 is supplied with seven on-line language processors which include CAP, FORTRAN II, Conversational FORTRAN, BASIC, TAP, QED, and DDT. The new system will lease for "under \$15K/month." SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For information:

CIRCLE 178 ON READER CARD

random access memories

The MDM-X series of random access memories includes four models with one to four random access prime movers each handling one head according to the "X" designation. MDM-1 has a single positioner servicing either the top surface of the disc or the lower; MDM-2 has two head positioners, each servicing one disc surface; MDM-3 and MDM-4 have 3 or 4 positioners, and incorporate two head positioners in the lower disc surface and the remainder in the upper. Total capacity of all models of the memory is 25 million bits; maximum access time is 25 msec. INFOTECHNICS, INC., Van Nuys, Calif. For information:

CIRCLE 179 ON READER CARD

source record punch

The 1635 source record punch's 10-bank keyboard enters 10 digits of numerical information into a plastic badge. Each unit handles one of two standard badge sizes— $2\frac{3}{16}$ " x $3\frac{3}{4}$ " or $2\frac{1}{2}$ " x $3\frac{3}{8}$ ". STANDARD REGISTER CO., Dayton, Ohio. For information:

CIRCLE 180 ON READER CARD

cartridge recorder

A magnetic tape digital recorder uses endless loop cartridges in 300', 600' or 1200' sizes, and records in phase-encoded format at 256 bpi, 4 bits parallel

per byte. The recorder can handle I/O data up to 8-level code, serial or parallel. Incremental write is 400 steps a second; synchronous read and write is 2,500 characters a second. The unit requires 150 watts of power. RWP CORP., Cupertino, Calif. For information:

CIRCLE 181 ON READER CARD

timber industry software

LOG-IN (Log-Inventory), a software package for the timber industry, is written in COBOL and can be operated on any Honeywell 200 computer system (minimum configuration is 32K core, five mag tape units, card reader and a 132-print position line printer). The program, a punched-card-to-computer system, records, classifies and summarizes truck-ticket log records and provides management with reports for accounting, inventory and analysis of log production from each tract. AUTOMATED SYSTEMS, INC., Olympia, Wash. For information:

CIRCLE 182 ON READER CARD

banking software

CL/1 is a software package for handling commercial loans. It operates on a 360 under DOS or OS with 64K capacity, two disc units and four tape or disc drives. A report generator included in the package will produce reports in the formats specified by users or create its own formats. Special features of CL/1 handle multi-bank processing, division and branch accounting, indirect liabilities, account relationships, collateral. Output offers 56 types of reports; 42 are optional. Required reports includes statements, daily transaction journals, notes with zero principal and active interest listings, changes to interest accruals, daily accounting summaries and general ledger transactions. COMPUTER SCIENCES CORP., Los Angeles, Calif. For information:

CIRCLE 183 ON READER CARD

utility program

An OS version of the Utility Coder/360 compiler occupies 37K bytes of core and can run on any 360 under OS. A one-pass compiler, UC/360 includes capabilities for handling variable length records, algebraic computations, packed, binary and hexadecimal as well as character data, interactive control via console typewriter, and calls to external subroutines written in other languages. Users can specify creation and maintenance of data sets on any medium, report generation in any format, analysis and reduction of data sets, routine transcription and de-

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new products

tailed reformatting and editing of records. CAMBRIDGE COMPUTER ASSOC., INC., Cambridge, Mass. For information:

CIRCLE 184 ON READER CARD

600 lpm printer

The 9350, a 600-line-per-minute printer for the OEM market, is designed for use in remote terminals of communications lines and with small computer systems. It has a 64-character font, line width from 80-136 columns, direct reading forms alignment scale and line indicator. Line spacing of six and eight lines per inch is standard; up to six parts may be printed, with more if special carbons are used. A 12-channel photoelectric paper tape reader is used for vertical format control. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 185 ON READER CARD

tape certifier

The 686 tape certifier cleans and certifies at all standard tape densities and testing formats. It handles 1/2" mag tape at 150 ips and tests 7 or 9 tracks. Tape densities can be 556, 800 and 1600 bpi. The unit operates in normal

mode, permanent error mode and count total error mode and has combination "write" and "erase" heads for switching of test formats. Visual tape inspection is by microscope and inspection table next to control panels. Special options include error-location printer, tape wear-test facility, zoom microscope for 5x-30x magnification, and additional tape density between 556-1600 bpi. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 186 ON READER CARD

flowchart template

The T-803 plastic template measures 10 1/2" x 6" and includes all standard logic symbols as designated in MIL-STD-806. An inch scale in eighths and tenths is included along with a card scale. THE C-THRU RULER CO., Bloomfield, Conn. For information:

CIRCLE 187 ON READER CARD

random access memory

The 470 random access core memory system offers storage capacity up to 4,096 (6- to 26-bits) words a module; module addition allows expansion of up to 32,768 words. The memory operates at speeds of 1.75 usec cycle time

and 750 nsec access time. A Memory Select control input simplifies decoding of memory blocks. Interface circuits are compatible with the logic levels of small- and medium-sized computer central memories, interface buffers or control memory systems. FABRI-TEK, INC., Edina, Minn. For information:

CIRCLE 188 ON READER CARD

mag tape system

The PI-1250-1 IBM-compatible, 7-track mag tape system is for PDP-8 computers. It includes a PI-1207 read/write recorder and an intercoupler which transfers data to and from the computer under programmed instruction or program interrupt operation. The recorder reads 200 and 556 bpi and writes 200, 556 and 800 bpi. The entire system transfers data bidirectionally through the accumulator on a word-by-word basis, on a slow speed continuous basis, or at 37.5 ips on a gap-to-gap basis. PRECISION INSTRUMENT CO., Palo Alto, Calif. For information:

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flowchart generator

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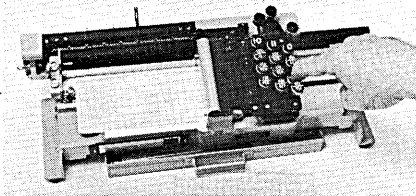
new products

of COBOL programs before they are compiled. The package allows the programmer to see his flowchart and printout in final form with one pass of the source deck. AUTODIAGRAMMER II will accept a COBOL source program before it has been compiled and will generate a flowchart, logic chart, I/O diagram, formats of defined records, Sample Formats, and a series of diagnostic tables and cross reference lists. Although designed primarily for 360's, the program can be adapted to Univac 9300's; BAL and FORTRAN are available as options. ARIES CORP., McLean, Va. For information:

CIRCLE 190 ON READER CARD

portable manual punch

The BSC 007 hand punch requires no electrical outlet and can be used to punch cards in any location. It has a



standard keyboard with 15 keys and is manufactured by ICT Ltd. BUSINESS SUPPLIES CORP. OF AMERICA, New York, N.Y. For information:

CIRCLE 191 ON READER CARD

hexadecimal ruler

The HEXA-ADD ruler contains the hexadecimal addition table; by tilting the ruler, the sum of each entry is reflectorized. The device measures 6" x 1½". G. A. DIPILLO, Canton, Mass. For information:

CIRCLE 192 ON READER CARD

read-only memory

The 9034 read-only memory is a bipolar 256-bit unit with an access time of 50 nsec. It is being offered in two standardized code units, coded for figures 1-6 or figures 7-0, a comma and period. The memory can be used in character display driving, arithmetic subroutines, microprogramming, random logic control and high-speed code conversion. The 9034 uses a 5-V power supply with a dissipation of 420 mW maximum. FAIRCHILD SEMICONDUCTOR, Mountain View, Calif. For information:

CIRCLE 193 ON READER CARD

plotting system

PTD is a punched paper tape incremental plotting system for plotting engineering variables from time-shared

computers at remote terminals, and for verification of tapes for NC machine tools. The unit features multiple-step programming which allows up to 127 incremental steps in either of two 2-dimensional directions from one input command. The system uses either a 12" or a 30" plotter. GRAPHIC SYSTEMS DIV., COMPUTER INDUSTRIES, INC., Van Nuys, Calif. For information:

CIRCLE 194 ON READER CARD

incremental recorder

The 1600 incremental mag tape recorder has a 7-track IBM-compatible recording format and a recording speed of 0-300 characters/sec. Skip rate is 1000 increments/sec.; density is 200 or 556 bpi. Gap generation on the unit includes internal BOT, EOR and EOF. Available variations offer incremental write 0-300/sec., incremental write/continuous read, and 0-500 character/sec. write. KENNEDY CO., Altadena, Calif. For information:

CIRCLE 195 ON READER CARD

i.c. tester

The 997 integrated circuit tester checks i.c. devices with up to 10 inputs and six outputs. Total test time is less than 100 msec per device. The

instrument measures VIN high, VIN low, VOUT high, VOUT low, and VCC, on a go/no-go basis. BECKMAN INSTRUMENTS, INC., Richmond, Calif. For information:

CIRCLE 196 ON READER CARD

a/d converter

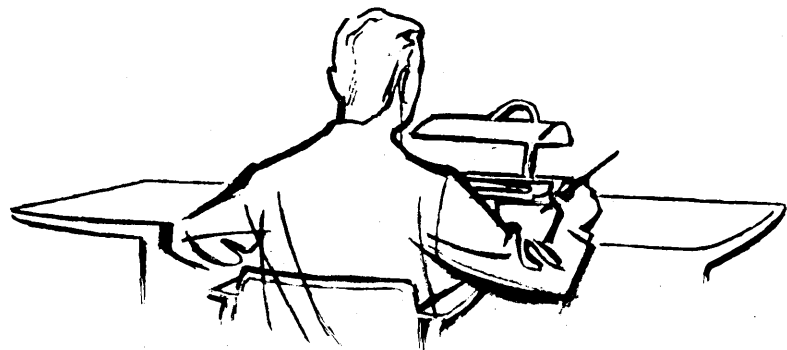
The 770-750 12-bit analog-to-digital converter offers a conversion rate of 20K/second with up to 12-bit accuracy. Control inputs and digital outputs are designed for DTL, TTL compatibility; coding is available in offset binary, one's or two's complements. Signal inputs can be ±10 volts or 0-20 volts. REDCOR CORP., Canoga Park, Calif. For information:

CIRCLE 197 ON READER CARD

tape reader/spooler

The 4010/4020 tape reader/spooler operates at 300 characters a second and can store 800' of .0025" paper tape and rewind it at 40 inches a second. The unit handles 8-channel tape, and can stop on character with stop/start speeds from 0-240 characters a second. FERRANTI-PACKARD ELECTRIC LTD., Toronto, Ont. For information:

CIRCLE 198 ON READER CARD



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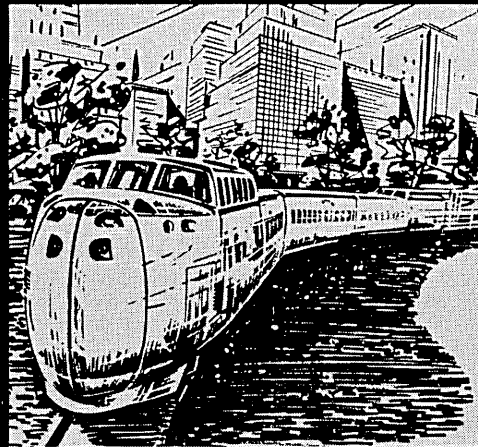
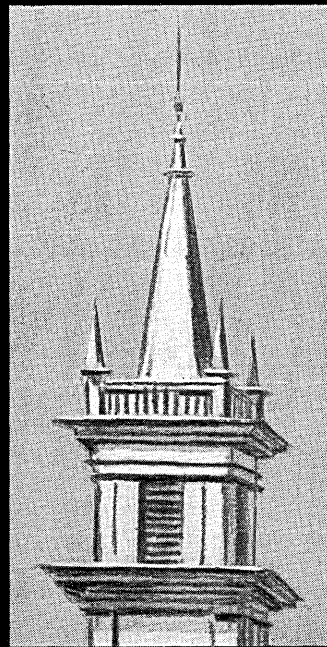
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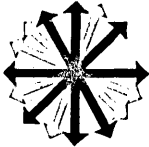
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new literature

TERMINAL SURVEY: Reprint of June, 1968 DATAMATION article gives results of a survey of low-cost remote crt terminals from 18 U.S. manufacturers, giving 44 characteristics on each, including transmission characteristics, multi-station and stand-alone configurations, editing features, memory statistics, and general characteristics. F. D. THOMPSON PUBLICATIONS, INC., Pasadena, Calif. For copy:

CIRCLE 200 ON READER CARD

EDP CAREERS: 48-page booklet is an introduction to various edp careers, including dp manager, systems analyst, programmer, computer operator, etc., and gives data on average salaries and preparation needed for each category. Included is a glossary and sources of further information. Cost: \$1.48. SCIENCE RESEARCH ASSOCIATES, 259 E. Erie St., Chicago, Ill. 60611.

IS&R: 504-page report contains a detailed analysis of the retrieval evaluation results obtained with the SMART system for document retrieval in aerodynamics, computer science, and documentation. The various components of fully automatic document retrieval systems are discussed, and the complete test environment and the parameters which enter into the evaluation process are described. PB-177 812. Cost: \$3; microfiche, \$.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

TEST EQUIPMENT: 32-page catalog describes more than 90 different pieces of aerospace ground support and testing gear and includes test schematics, dimensional diagrams, and tabulations. One section details highly sophisticated customized system test gear; the other describes standard equipment for testing such components as synchros, resolvers, potentiometers, and gyros. KEARFOTT GROUP, GENERAL PRECISION SYSTEMS, Little Falls, N.J. For copy:

CIRCLE 201 ON READER CARD

COMPUTER DOCUMENTATION SYSTEM: 20-page booklet describes AUTOFLOW, a proprietary software system which translates the source language of a

program (COBOL, FORTRAN, PL/I, or Assembly) into a two-dimensional flow chart document depicting the program logic as well as indicating all referencing within the program. APPLIED DATA RESEARCH, Princeton, N.J. For copy:

CIRCLE 202 ON READER CARD

INTEGRATED CIRCUITS: 100-page loose-leaf brochure includes current data sheets for 56 MECL II integrated circuits (29 different functions). MOTOROLA SEMICONDUCTOR PRODUCTS, Phoenix, Ariz. For copy:

CIRCLE 203 ON READER CARD

CRT DISPLAY TECHNIQUES: 12-page booklet contains four articles on crt displays covering present status of displays, opinions of manufacturers on raster-scan techniques, technical considerations influencing crt display design, description of a crt console for re-

mote computing, and use of magnetic disc with TV monitors for low-cost graphic displays. DATA DISC, Palo Alto, Calif. For copy:

CIRCLE 204 ON READER CARD

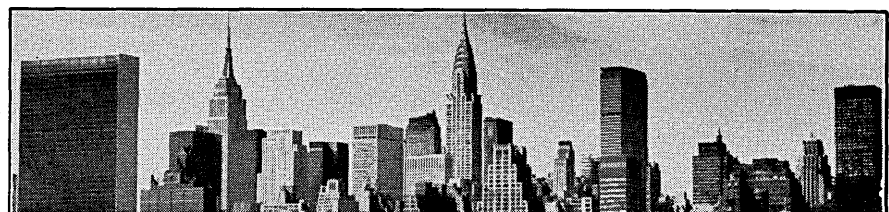
TEACHING DEVICE: Six-page brochure describes low-cost (\$445) digital logic teaching device and summarizes 10 experiments detailed in the accompanying workbook which provides up to 50 hours of laboratory training. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:

CIRCLE 205 ON READER CARD

DATA ACQUISITION: Ten-page brochure describes the company's line of digital data acquisition systems which provide monitoring, automatic scanning, recording and limit detection for a number of industrial applications. HOWELL INSTRUMENTS, INC., Ft. Worth, Tex. For copy:

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TELETYPEWRITER MODIFICATIONS: National Bureau of Standards has pointed out certain minor deficiencies in standard teletypewriters when used for data recording and as remote terminals, and has suggested additional accessory equipment which may be con-



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new literature

structed to increase the efficiency of the units when used in a reactive or conversational mode. A 20-page booklet documents some of the modifications and describes accessory equipment. NBS Technical Note 419. Cost: \$.20. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

DATA COMMUNICATIONS PRODUCTS: Folder describes model 4400 data sets and companion equipment. Data sets are available in models transmitting digital data at rates of 2000, 2400 and 4800 bps over unconditioned voice frequency channels. MILGO ELECTRONICS CORP., Miami, Fla. For copy:

CIRCLE 207 ON READER CARD

POWER INDUSTRY INSTRUMENTATION: 146-page book contains the proceedings of the 11th International ISA Power Instrumentation Symposium held May 1968. Aimed at engineers active in instrumentation, control and automation of electric, gas, steam generation and distribution facilities, the 13 papers focus on recent trends in the power industry. \$7 for ISA members; \$9, others. INSTRUMENT SOCIETY OF AMERICA, 530 William Penn Pl., Pittsburgh, Pa. 15219.

REGIONAL FEDERAL PROCUREMENT: 146-page study on the relationship of federal procurement policies to regional economic activity covers the impact of these policies on each of the states and on all counties in eight states. PB-177 679. Cost: \$3; microfiche, \$.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

CRT DISPLAY: Data sheet gives physical and functional descriptions of model 7580 crt display device for use with Sigma 5 and 7 computers. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 208 ON READER CARD

PROGRAM CONTROLLER: 20-page brochure gives operating specifications, application information, peripheral equipment and options/accessories for SPC-12 stored program controller that can be used as a full-scale digital computer in the decentralized portion of a centralized-decentralized computer complex. It is a binary, parallel, single address processor containing 4096 (8-bit) bytes of memory with a 2.2 usec

new literature

cycle time and has seven 12-bit registers, 6 addressing modes, and 400 commands. GENERAL AUTOMATION, INC., Orange, Calif. For copy: CIRCLE 209 ON READER CARD

BIBLIOGRAPHIC FORMAT: The MARC II format, being used in one of the nation's major projects for recording and distributing bibliographic information in machine-readable form, is described in 167-page publication. Cost of "The MARC II Format" is \$1.50. SUPERINTENDENT OF DOCUMENTS, Government Printing Office, Washington, D.C. 20402.

DATA SET: Four-page bulletin describes the T401E data set which combines a data transmitter and telephone set in one integral housing to provide alternate voice/data operation. The device transmits parallel data codes over regular telephone lines at up to 20 cps. SANGAMO ELECTRIC CO., Springfield, Ill. For copy: CIRCLE 210 ON READER CARD

IC CORE MEMORIES: Two-page bulletin summarizes operating specifications for the company's line of integrated circuit core memories. Full cycle times for the systems vary from 600 nsec to 1.5 usec; word capacities range from 1K to 32K words per memory module. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For copy: CIRCLE 211 ON READER CARD

PROCESS CONTROL: Six-page publication lists features and specifications of the M/97600B process control system, which uses a computer for large-scale data acquisition and monitoring and other functions including automatic turbine start-up and performance calculations. THE FOXBORO CO., Foxboro, Mass. For copy: CIRCLE 212 ON READER CARD

360-COMPATIBLE CRT'S: Report provides 360 users with analysis of various display lines and their compatibility with IBM hardware and software on both local and remote applications. PROGRAMMING SCIENCES CORP., New York, N.Y. For copy: CIRCLE 213 ON READER CARD

INTEGRATED CIRCUITS GUIDE: 100-page book, written for electronic management, corporate planners and financial analysts and engineering managers,

covers the salient economic, technical and industrial factors involved in the utilization of integrated circuits. It is divided into six sections: impact of integrated circuits; integrated circuit fabrication highlights; system considerations; "make or buy?"; facilities for integrated circuit fabrication; and future of integrated circuits. Cost: \$75. INTEGRATED CIRCUIT ENGINEERING CORP., 2900 E. Indian School Rd., Phoenix, Ariz. 85018.

DATA SETS: 18-page bulletin describes family of data modems for voice channel, group and supergroup digital communications and the company's line of data sets with modulation rates from 60 to 230,400 bps. A building block design concept uses standard plug-in printed circuit module and all silicon solid-state circuitry. GENERAL ELECTRIC COMMUNICATIONS PRODUCTS DEPT., Lynchburg, Va. For copy: CIRCLE 214 ON READER CARD

CURRICULUM STUDY: 52-page booklet provides specific recommendations for undergraduate programs and a discussion of graduate programs in the computer sciences. Cost: \$1. ACM, 211 E. 43 St., New York, 10017.

A THEOREM IN GOOGOLGY

A googol is defined as the radix of a positional number system raised to the power of its square. Laymen tend to think of this only in decimal notation; however for the purposes of modern computation, the properties of other googols should be investigated. A particularly important googol is the binary number 10 raised to the binary power 100, which I designate as the Barney Googol in honour of the author.

The Barney Googol Commutation Law is stated as an unproved theorem:

$$\begin{array}{ccccc} & & 10 & & \\ 100 & & 10 & & 10 \\ 10 & = & 10 & = & 100 \end{array}$$

This commutative property is of great value to those persons who always get precedence relations backwards, and who cannot get bracket counts to come out even. It is for this reason that the Barney Googol has been used as the radix for the notation employed by the designers of such modern computers as the LGP-30 and the IBM-360.

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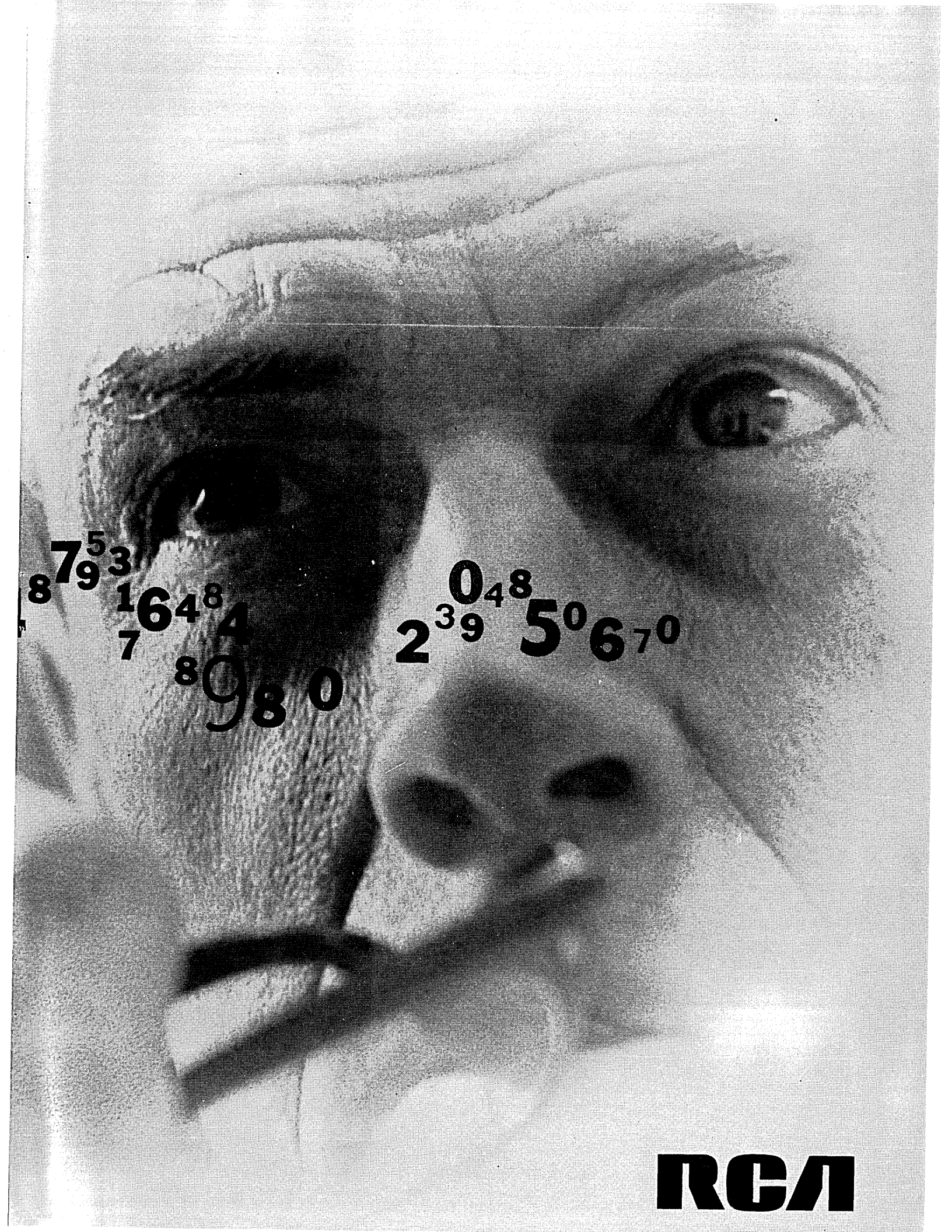
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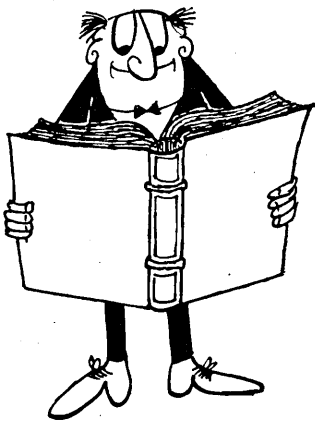
books

Programming the IBM 360, by Clarence B. Germain, Prentice-Hall, Inc., 1967, 360 pages.

This two-pound, softcover book has, by a marvelous coincidence, 360 pages. It also has a wealth of accurate, well organized information on System/360, to the point where it could become the definitive reference manual on the machines, their operating systems, and how to program for them. It is not too much to say that Germain puts to shame the entire mass of official IBM publications that attempt to cover, in helter-skelter fashion, the enormous detail that must be dealt with in order to put a 360 to productive use.

Germain's style is terse, almost telegraphic, which is appropriate to a reference manual. (He has a passion for using three-letter abbreviations to condense even further; these abbreviations become annoying and obtrusive within a paragraph of their original definition. One short section introduces ten of them within a page.)

The book opens with excellent material on fundamentals: the punched-card world and its notation; mathematical notation; and the nature of computer and programming logic. Then



follows the full spectrum of System/360 topics: input-output programming and devices; PL/I, FORTRAN, and COBOL; assembly language; BOS, DOS, TOS and JCL. (The topics may be difficult to locate in a hurry, since all but two of those mentioned are not in the index.)

One should not judge a book of this

type, however, on the basis of petty faults. Germain has produced a monumental compendium of facts on the 360 and its use. The book's preface is an accurate description of the contents, especially in stating "It is the purpose of this book to bring the reader up to the point where he can profitably read the various IBM manuals." The aging programmer will have the constant feeling that life was simpler (and more productive) in the 7090 days, which lends a double meaning to the back cover blurb: "If you must learn to program the IBM System/360, this is the book for you."

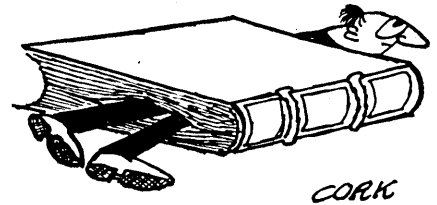
System 360 Programming, by Saxon, Englander, and Englander, Prentice-Hall, Inc., 1968, 231 pages.

This book is written in the finest bit-mongering tradition. It plunges immediately into minute detail and stays there for all its 231 pages. Its subtitle bills it as "A Self-Instructional Manual" (meaning questions and answers immediately following each section).

It is actually a fair reference manual on System/360 and can provide a quick overview of the 360 logic as a supplement to the Principles of Operation booklet. As an aid to learning 360 programming, its approach and em-

phasis would seem to be very wrong. There is, for example, a consistent emphasis on absolute numbers and locations, etc., that does not represent current programming knowledge. System/360 was designed to be programmed through an operating system; it is difficult to see the point of avoiding OS. One would have trouble finding out that a discussion of OS is missing; the book has no index.

Some parts of the book ("if the root is double, branch to the print-out routine at location 3000") are downright



archaic. Moreover, the failure to advance the concept of equating most registers to symbols—thus getting an invaluable cross-reference listing of register usage as well as location and data mnemonics—is inexcusable. In spite of the ample number of specific examples of each instruction code, it is doubtful that the true flavor of 360

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books

programming is adequately expressed without at least some recognition of the existence of its software and the impact of its conventions and features.

The book is reproduced by offset from typed copy. Great pains were evidently taken in the typing (although some spurious spaces were introduced between operands, thus creating a format that would not be acceptable to any 360 assembler), but the result is still difficult to read.

The 360 assembly language is covered somewhat briefly in the book's last unit. A mass of detail is presented, quite accurately, but in a manner lacking any semblance of a disciplined expository approach. Anyone in doubt about programming for the 360 would have difficulty putting the pieces together without much skilled help.

In the introduction, the authors say ". . . the study of this book will not, in itself, develop *expert* computer programmers" (emphasis theirs). This sentiment may be publisher's hyperbole, but it is indicative of the book's main fault: misdirection. It is a reference manual, and actually an excellent one, for use by experienced programmers in ascertaining quickly the basics of 360 logic; they can ignore the question and answer sheets. The appendices contain a great deal of condensed material that might be worth the price of the book.

—KENNETH SEIDEL,
FRED GRUENBERGER

book briefs

(For further information on the books listed below, please write directly to the publishing company.)

Critical Path Networks, by Dr. R. L. Martino. MDI Publications, Wayne, Pa. 1967. 157 pp. Price not given.

The preface states "This book is intended as a basic primer . . . it is directed towards considering the basic concepts, their application, and the ramifications of such application." The book is unusual in that it not only accomplishes the objectives stated in the preface, but it presents this material in a manner so interesting and so thorough that the reader is left with a neat confidence that all his loose ends and dangling possibilities can be diagrammed into a meaningful plan of action.

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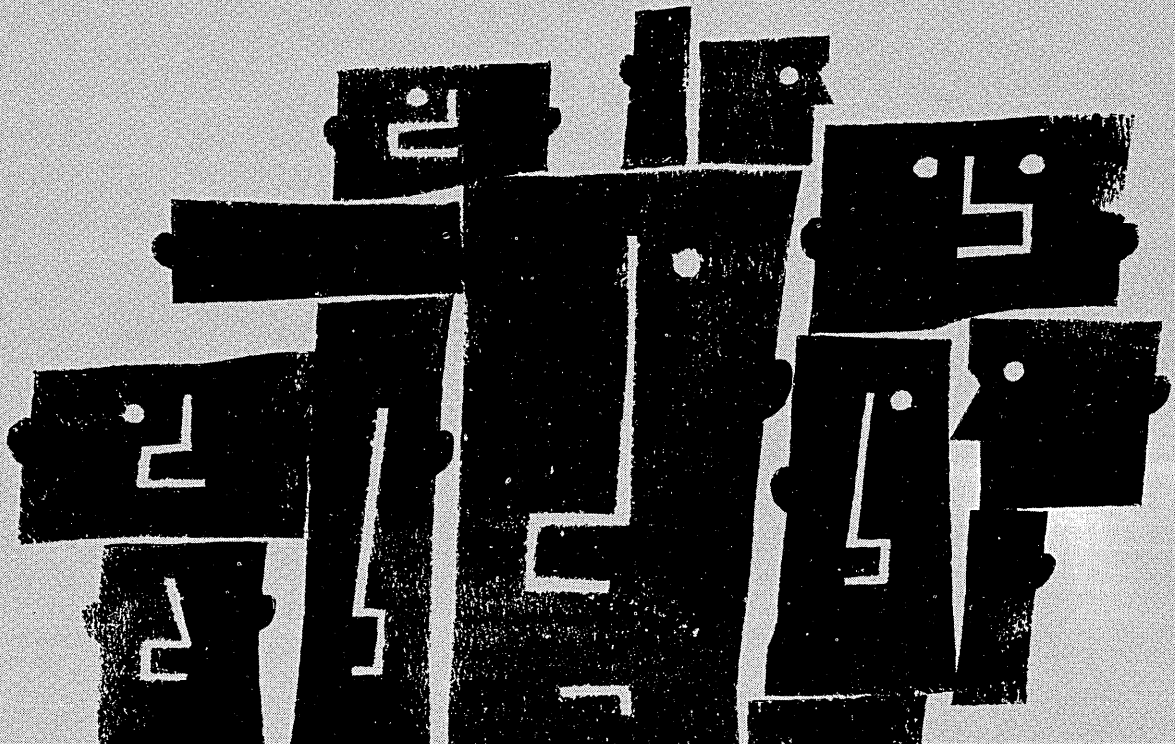
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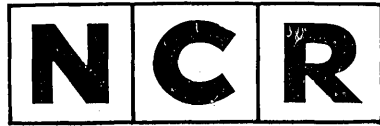
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look ahead

Univac's now reporting four hours between failures on low-activity systems. Too, throughput is still less than that with the EXEC 2. Among missing features are: a service routine to allow the user to parameterize the system according to the configuration; a "link-unlink" feature to aid in re-entry problems; and a feature to allow the user to control the amount of core used.

Univac says each of these and other trouble areas will be corrected or improved in the next two revisions due out in the fall and at the end of '68.

A FRENCH MIDGET FROM GE

A French-made desk-size computer, product of GE-Bull, made its debut in a mid-July test marketing project in Detroit and Philadelphia. The GE-55 incorporates, in its desk height, 36" x72" frame, 10K core, keypunch, verifier, 150 cpm reader, 40 cols/sec punch (or 20 cols/sec as interpreter), and 140 lpm printer. The marketing target is smaller companies using accounting machines.

The \$50K price includes six accounting applications, now being readied. Long-term leasing will be arranged through third parties.

THE WMMCCS PLOT THICKENS

DOD, in its reply to Congressman Jack Brooks' recent letter (see News Brief, p. 98), agrees that developing compiler performance yardsticks is a good idea, but disagrees that these yardsticks, alone, will permit the worldwide military command and control system buy to be divied up among a number of suppliers. This disagreement is crucial because Brooks' main purpose in writing the letter was to promote what he called "segmented" procurement of WMMCCS.

"For command and control applications...high order [source] languages...will satisfy only part of our compatibility need," said the DOD letter.

"[These] applications characteristically employ complex operating and data management software [that] must be [programmed] in a machine-dependent language, [due to] the inadequacy of present-day software."

A source close to the Brooks subcommittee insists the letter is "extremely encouraging" because elsewhere it explicitly recognizes the need for transferable software and for specifying hardware and software in non-restrictive terms.

A non-Congressional source says the real issue is not inadequate software, as DOD suggests, but inadequate data management. "Private industry has segmented large system acquisitions after developing common data definitions and then enforcing them. DOD, admittedly, has a bigger chore, but DOD is also less willing to knock heads together."

NEW ACTION IN ARIZONA

Graphtek Corp., a firm planning to offer custom packages for individual graphics applications, is the newest software house in the Phoenix nest. Formed by two GE-nurtured managers, Dr. Marvin Ling and Walter F. Cook, Graphtek announces services will include development and support of such systems as remote or interactive APT, design automation, systems simulation, and general display systems. President Ling was formerly in charge of development of display systems at GE's Advanced Systems and Technology Operation.

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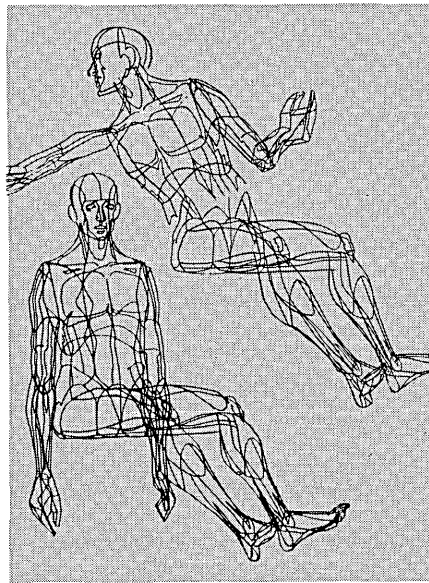
The Computing Staff plays a major role in the design, development, test, manufacture and marketing of all Boeing jetliners. Computer applications in various stages of development and use at Boeing include matrix methods of structural analysis, master dimensioning, mission profile programming, digital simulation, and long-range price and cost forecasting. In addition, techniques such as computer graphics, remote input-output, time-sharing, economical mass storage, and increased processing speeds are being applied to advanced communications and decisional networks.

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Boeing 747 superjet is typical of advanced jetliner programs supported by Commercial Airplane Division's Computing Staff.

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look ahead

Pacific Corp. Founded about four months ago in Portland, Ore. the company has its assembly plant there -- but marketing headquarters for its line of data collection gear in Phoenix. The company is headed by Jim St. Claire; Marlowe Mattison, formerly with Univac's Phoenix office, is vp and general manager for marketing. Western regional manager is Bob Meyers.

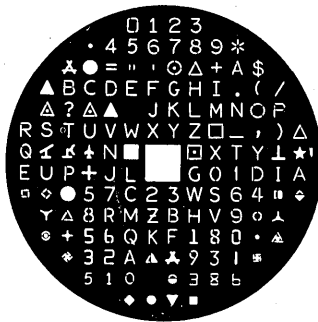
First two products are being unveiled this month, with initial demonstrations in Portland followed by Los Angeles and Phoenix presentations. Their portable DP-1000 systems take a prepunched card for constants, have a keyboard for variables, and produce punched tape in computer format.

RUMORS AND RAW RANDOM DATA

If Bryant Computer Products vp Dick Caveney wins his battle to change government dpe procurement practices, he may end up losing the war. To keep system business in their family, main frame makers intend to get together and submit joint venture bids, we hear... A new paper tape code standard, RS 358, encompassing an ASCII subset for numerical control programs, has been adopted by EIA...B6500 deliveries are reportedly slipping because of hardware bugs. One system, originally scheduled for shipment in September, 1969, is now promised for the following April. Burroughs is said to have nailed down "at least 12" 6500 orders. Meanwhile, it has begun development of a PL/I compiler for the new system...Norm Ream is reportedly leaving the Navy in September. His decision was made last March, before the segmentation hassle began. Proponents of segmentation are trying to persuade him to stay...Are the PL/I workers hoping to outdo the COBOL promoters? We hear a version now in the works at IBM includes such features as a Sort verb and facilities for telecommunications interface -- the latter still absent in COBOL...At a seminar given for the users at one big-company installation, the IBM representative is said to have conceded that PL/I was just too complicated for general use. His suggestion: the installation should set up a systems programming staff to decide what sort of subset the "ordinary" programmers were capable of using -- then modify the system accordingly...A very large, nationwide consulting firm has preliminary plans for an internal administrative system but no intention of buying their own computer; GE time-sharing centers are the best bet to get the job, on a regional basis...RCA's mod 2 version of the 70/45 should be announced early this month; it offers four-byte fetch instead of two on the original. Later this year, the firm will announce a 2314-type disc drive, to be produced at the new Marlboro, Mass. plant...Bryant is supposed to be coming out with a crt display later this year... Besides its other omnipresent activities, Computer Sciences is taking on the chore of building a PL/I compiler for Control Data at a price of \$375K... Lou Bright, associate commissioner for research at the U. S. Office of Education, and Dr. Robert Morgan, a key deputy, are both leaving next month. Bright is going to Baylor, Morgan to Florida State. Their departure is likely to handicap the government's budding plans for computerized educational networks.

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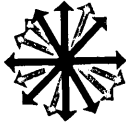
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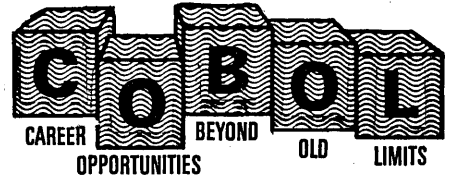
C. J. Kunz, Jr., has resigned as senior vp and director of Ferroxcube Corp. to become full-time president of Circuit Science Corp., Denver, founded late last year. . . . **Curtis W. Fritze**, formerly corporate director of planning, has been promoted to vp, corporate planning, for Control Data. . . . **Lewis R. Caveney**, former assistant to the vp of Bryant Computer Products, has been appointed director of government marketing, a new post. . . . **Paul S. Mirabito**, a member of the board of directors of Burroughs, has been elected exec vp of the company. Succeeding him as vp and group executive of the defense, space and special systems group in Paoli will be **E. Gary Clark**. . . . **Edward F. Kearns**, former western regional manager, has been appointed division vp, marketing programs, for RCA's Information Systems Div., Cherry Hill. . . . **Dr. James L. Goddard**, Food & Drug Commissioner for the past two years, has joined EDP Technology as vp in the Atlanta office. He will be in charge of the company's nationwide program for the application of data processing and management sciences to health services. . . . **John A. Devine**, former Ferroxcube western sales manager, has joined Standard Memories as sales manager. **William B. Barnes**, Standard marketing vp, announced that the company's national sales office has moved from the Santa Ana plant to Sherman Oaks, Calif. . . . **Philip A. Cramer**, assistant to SDC's computer center dept. manager for the past three years, has joined McCall Information Services, Fullerton, Calif., as gm, western region, of the company's computer management div. And **Max L. Mueller**, former gm, has been promoted to vp in New York City. . . . **Lou Marienthal** has joined Peat, Marwick & Livingston, L.A., as head of a small group which will produce package programs, the first of which is for lawyers' time accounting. PM&L specializes in operations research. . . . **Dr. William L. Everitt**, dean of the College of Engineering at the Univ. of Illinois, will chair the Committee on Telecommunications

which has been formed to conduct a study of developments in communications technology through 1980. The committee will advise the President's Task Force on Communications Policy and the Dept. of Housing and Urban Development in order to provide policy makers with a framework of technological options. . . . **George W. Armerding** has been named associate head of The RAND Corp.'s computer services group. He has been with the company since 1960. . . . **Dr. Jerrold R. Zacharias** has been appointed director of the Education Research Center at MIT. . . . **James A. Callahan**, project engineer on Mercury and Gemini spacecraft programs, has been appointed to the new position of manager-computer sciences at McDonnell Automation Co. . . . **Charles W. Adams**, most recently president of his



shared service bureau firm (now named Keydata and Adams Assoc., Inc.), has formed a new company—Computer General Corp. Other officials include board chairman **Jesse X. Cousins**, formerly a Dasa vp, and **Richard Hamlin**, vp. The company will offer hardware/software packages and turnkey services for special applications markets such as process control. HQ will be in the Boston area. . . . **James Talcott**, Inc.'s new computer leasing division will be headed by **Truman F. Rice** as vp and gm. Rice had been with IBM for the past 20 years in various executive posts. . . . **Samuel Nissim** and **Dr. James P. Nicklas** have left Bunker-Ramo to join

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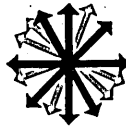


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DATAMATION

people

Electronic Arrays (Feb., p. 85). Nissim will head the company's new systems division (to be located in Woodland Hills, Calif.), assisted by Nicklas, who will direct the computer systems lab. . . . **Richard M. Greene, Jr.**, has been elected president of Execudyne Corp., L.A. firm specializing in advanced executive development programs. . . . **William R. Rave** is now vp, field support, for IBM's Field Engineering Div. . . . **George H. Clement**, former RAND Corp. operations manager, has joined SDC as vp of space operations. . . . **Anthony J. Penta**, former president of Computer Progress Inc., has formed Penta Computer Associates, Inc., NYC, a software organization which will specialize in commercial dp and communications systems. . . . **Donald B. Thompson**, 17-year IBM veteran, has joined Potter Instrument Co. as vp-business planning and development. . . . **Richard A. Hagberg** has been named vp-finance of Computer Sciences Leasing Co. He had been assistant treasurer of Litton Industries. . . . **Arthur L. Malcarney**, exec vp and member of the board of directors of RCA, died at his Haddonfield, N.J., home at the age of 55. . . . **Stanley Mitnick** has been promoted to assistant to the president of Computer Usage Development Corp., Mt. Kisco, N.Y. . . . **Steve C. Mulle** will direct Westinghouse Electric's new manufacturing information services dept. which will offer computer-based information services to manufacturing firms, emphasizing services for users of numerically controlled machine tools. . . . **Frederick E. Trust**, president of Doctors' Automated Billing Services, Washington, D.C., will serve as president of DRS, Inc., a new firm formed by his company and Computing and Software, Panorama City, Calif. The new organization will offer computerized patient billing services to the medical, dental and related professions. . . . **Pierce B. Michael** has formed Datran Associates, Inc., an edp consulting firm in Chevy Chase, Md. . . . The Australian Computer Society has elected **P. M. Murton**, chief computer officer of Colonial Mutual Life Assurance Society in Melbourne, as 1968-69 president. . . . **Maj. Gen. Joseph J. Cody, Jr.**, takes command of the Air Force Electronic Systems Div., Hanscom Field, Mass., August 1 to replace **Maj. Gen. John B. Bestic**, who is retiring. Most recently Gen. Cody was Chief of Staff of the Air Force Systems Command, Andrews AFB, Md. ■



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letters

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R. B. MACDONALD
West Lafayette, Indiana

our error

Sir:

In the May issue (p. 113) is a considerable misstatement of fact regarding the merger of Standard Computers Incorporated with Computer Leasing Company. The stockholders of both companies have not approved the merger; and in fact, they have not yet even been asked to vote on it. In addition, the exchange of stock currently agreed upon by the respective Boards of Directors is 1.9 shares of Computer Leasing common stock for each share of Standard.

HERMAN A. AFFEL, JR.

President

Standard Computers, Inc.

Philadelphia, Pennsylvania

Ed. note: Since publication of that item, the two firms concerned have formalized the agreement; the plan will be submitted to stockholders for approval sometime this month. The terms, however, do call for SCI stockholders to receive 1.9 shares of common stock in the new company for each Standard share, and not 1.8 as we reported in May.

the fallibility factor

Sir:

While agreeing in principle with Julius Honig (The Forum, May, p. 182), I must take exception to two of his statements. Having worked in SAGE for three years as a programmer, I can assure you that the programs in which "a large part of our country's defense is" are anything but unchanging!

Again, while "data that is either incorrect or damaging can be put into a system," often it is not the data itself but the system which is in error. For ample proof of this statement, see Bryan Wilkinson's article, "Some Problems with Time-Sharing," (May, p. 43). Particular attention is called to the third paragraph down on p. 45, concerning the two different statistical programs, both of which provide a multiple correlation coefficient, and yet gave different answers when the same data were used.

As Julius Honig points out, to err is human. But let's not forget who writes the programs for the computers.

ROBERT T. LAYTON

Los Angeles, California

pardonnez-nous

Sir:

The expression "Mon Générale" has appeared several times in DATAMATION in the past months. Please note the following:

1. Instead of "mon" (my) the word "le" (the) would be more appropriate. The article "mon" is used solely when someone actually speaks to the officer.

2. More important is the spelling of "Général" which in that meaning NEVER has an "e".

YVES M. DE SAINT GILES
Mercer Island, Washington

poetic license?

Sir:

Shame! The May cover shows a square made of the seven tangram figures, but in each of the three sets, the rhomboid shown is the reflection of that in the square.

PAUL L. CHESSIN
San Jose, California

The Art Director replies: the "infinite" number of combinations possible from this ancient Chinese game didn't seem adequate to the design problem. Hence the trip through the looking glass in search of the element of tension necessary. Glad reader Chessin came along.

ge & t-s

Sir:

The article on the introduction of General Electric's new Mark II commercial time-sharing service (May, p. 92) presented some inaccuracies which should be pointed out to your readers.

Mark II service is now being implemented nationwide on specially configured GE-635 computer systems operating in the conversational time-sharing mode. As has been the case with all new product and feature improvements introduced for the GE service during the past two years, Mark II is fully operational to meet the right now problem-solving needs of our customers. Referring to the service as "batch only at this time" is erroneous and would be inconsistent with our established marketing policy of not announcing futures.

Without wanting to quibble over language, the choice of the words "a pretty stiff increase in rates" to describe the charge of 40 cents per second of cpu for Mark II service is also misleading.

The article correctly noted that Mark II programs will run 10 to 15 times faster than on standard GE-265 time-sharing service. As a result, customers generally experience less on-line terminal and computer times.

With this trade-off customers in many instances realize no increase in net billing and quite often a lower cost for the same program run on both services.

While it should be pointed out that Mark II is intended to supplement rather than replace the standard GE-265 service, comparisons can be made for the sake of illustration. A case in point is one of our stored library programs called MULFIT, which is used in statistical analysis problems.

The program used with our standard service takes 12 seconds of cpu time. At the rate of 4 cents per second, the charge would be 48 cents. Using Mark II service, the same problem would require only 1.19 seconds of cpu at 40 cents per second for a cost of 47.6 cents. In this example there is a better than 10 to 1 improvement in processing time with no increase in price for the customer's use of a more powerful third-generation system valued at more than \$3 million.

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E. L. MCCLEARY
Manager-Marketing
General Electric Co.
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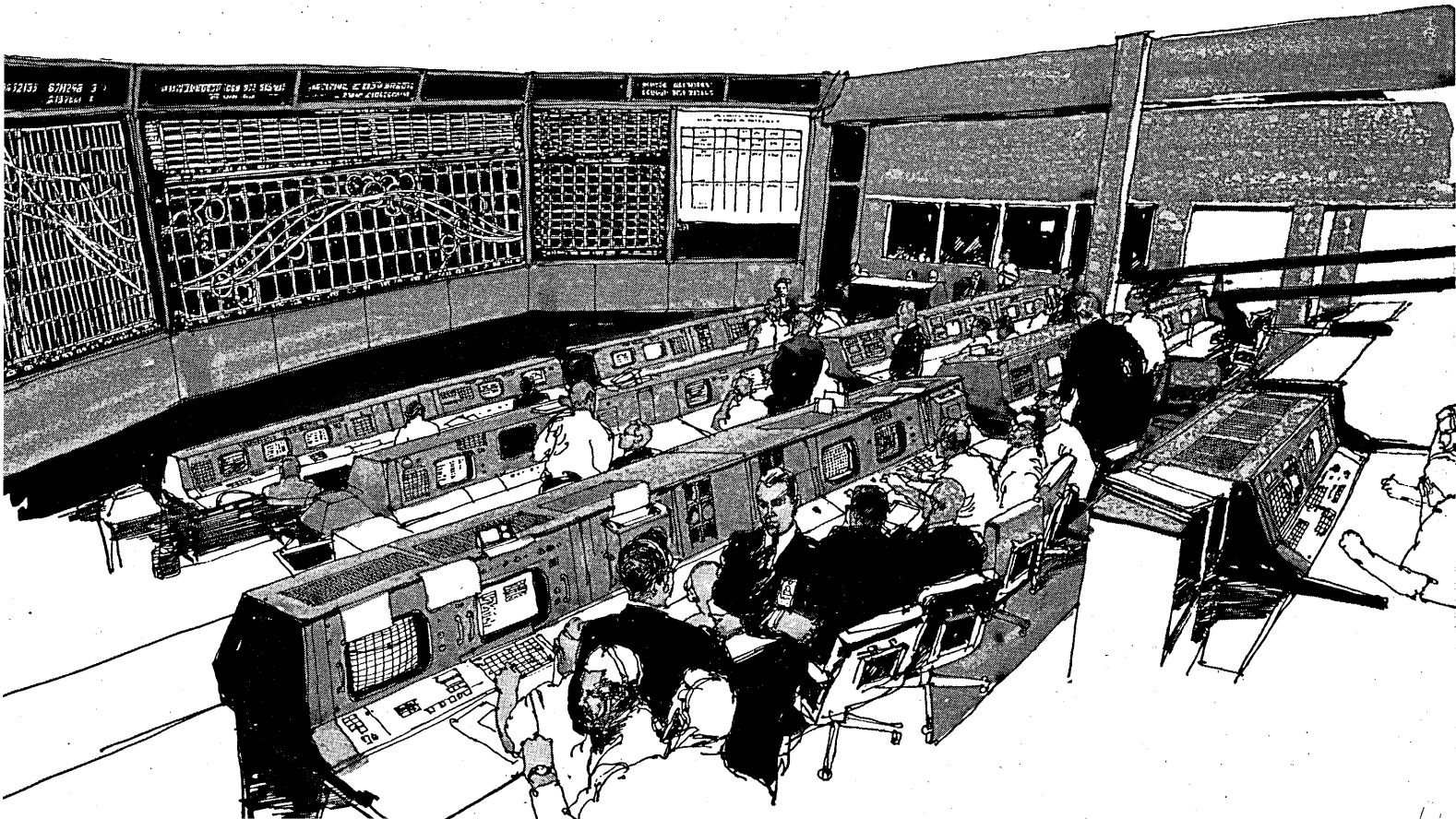
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the forum

THE MEANING OF IMPRECISION

Mr. Pollack has replied in the March issue to my Forum article published in February. He makes a number of points, valid in themselves, which suggest that he has misunderstood my thesis. May I try again?

Firstly, let me clear up one point immediately. Like Mr. Pollack, I am strongly in favour of using decision tables. I don't think that they necessarily impose a rigorous methodology on the user; on the contrary, I believe that they offer one of the few avenues of escape from the rigours of procedural programming. But they must be properly used.

There are many problems which cannot be successfully handled by techniques relying on rigorous, consistent, complete and non-redundant program specifications. Decision tables provide an opportunity for developing alternative techniques for those problems, with a better chance of success. The present danger is that we may be turning our backs on that opportunity.

Secondly, my proposal is not that we should develop new kinds of computer programs. No computer program (none, at least, for any machine available today) can meaningfully or usefully be incomplete or inconsistent: it can't be incomplete because something specific must happen under any set of circumstances—even if what happens is a program-check interrupt; it can't be inconsistent because the machine is fully determined. I am not proposing new kinds of programs: I am proposing new techniques of program creation—new ways of specifying, writing and developing programs.

Thirdly, these techniques would not be of universal validity. There is a large class of applications which are best programmed by rigorous and precise methods; most current business dp systems fall in this class, and I am not suggesting that we should strive to replace order by chaos. But there is another class of applications which cannot be successfully tackled by rigorous and precise methods, and for these we must look for different techniques; my thesis is concerned with these applications and these tech-

niques.

Rigour and precision fail when the job to be programmed cannot be completely specified. There are several possible reasons why complete specification may be unattainable. We cannot specify a practicable chess-playing program of grand-master quality because we don't really understand what the grand masters themselves do. We cannot specify a program for reliable translation of natural languages because the problem is too diffuse: there is no difficulty in specifying the desired translation for any particular sentence, but any set of general rules proves to have exceptions, which themselves have exceptions, and so on. Nearer home, a payroll program may defy complete specification simply because the rules themselves are imperfect: management may have negotiated several agreements with different labor unions; in marginal cases these agreements may be in conflict with each other or with statutory legal requirements. A business information and control system may require development on a tentative "try it and see" basis; management may be unable or unwilling to specify in advance what elements of the system are to be open to change.

In the business dp environment the systems analyst is strongly tempted to adopt a high-handed approach to the computer user. The advent of the computer is seen as a catalyst which brings the chaotic and undisciplined manager into contact with the clear-thinking precision of the computer men, and so provides an opportunity to enforce a rigorous rationalisation of out-of-date methods. Often enough, this approach is justified. But sometimes it is simple arrogance, used as a cover for the inadequacy of the computer methods. No one in his right mind would suggest that the difficulties of machine translation prove that the English language ought to be rationalised; we must be very sure of our ground before we castigate the manager whose business systems defy our present dp techniques.

I would dearly like to describe in detail the techniques I want to see. But I am not announcing an achieve-

ment; I am proposing an endeavour. I can only point to one or two crude examples of what seems the right approach.

Mr. Pollack's point about the ELSE-rule in decision tables is well taken; it is an excellent device for allowing the analyst to provide an incomplete specification. And its value is enhanced by the distinction between the "intentional" ELSE-rule inserted by the analyst and the alternative "default" rule inserted by the preprocessor. I am happy to accept these facilities as examples of the techniques I advocate.

I am less happy with Mr. Pollack's strictures on contradictory rules. He writes, "As for contradictory rules, I don't see how computers or people can decide which one of two or more contradictory rules should be followed when a transaction acted on by those rules occurs." Surely there is at least one useful prescription that can be adopted: follow the rule that seems to be more specific; probably it is an exception to the more general rule.

A decision table processor can be constructed (and has been constructed) which incorporates the ability to recognize which of two rules is more specific, and ensures that that rule will be followed in cases of conflict. In use, this processor allows a program to be developed by a series of successive approximations. At the outset, the known (or supposed) rules are processed into a program, and the program is run. It becomes apparent that certain cases are being incorrectly handled, and a rule to cover them is added to the table; the existing rules are left undisturbed. The processor recognises the new rule as an exception to the old, and builds the program so that the exceptional case is correctly handled. The analyst is not required to recognise or to resolve the conflict of rules; he need only state the change in result that is required. By running and adjusting the program several times, the analyst can arrive at the correct algorithm (or a close approximation to the correct algorithm) without ever formulating it explicitly.

This facility is relatively crude; we will need to develop techniques of far greater sophistication. But it is clear that such techniques can be developed and used successfully, and that they could be very powerful. If we cling to the constraints of rigorous methods, we will never solve the difficult problems; we won't be able to get the programs right because we are too frightened of getting them wrong.

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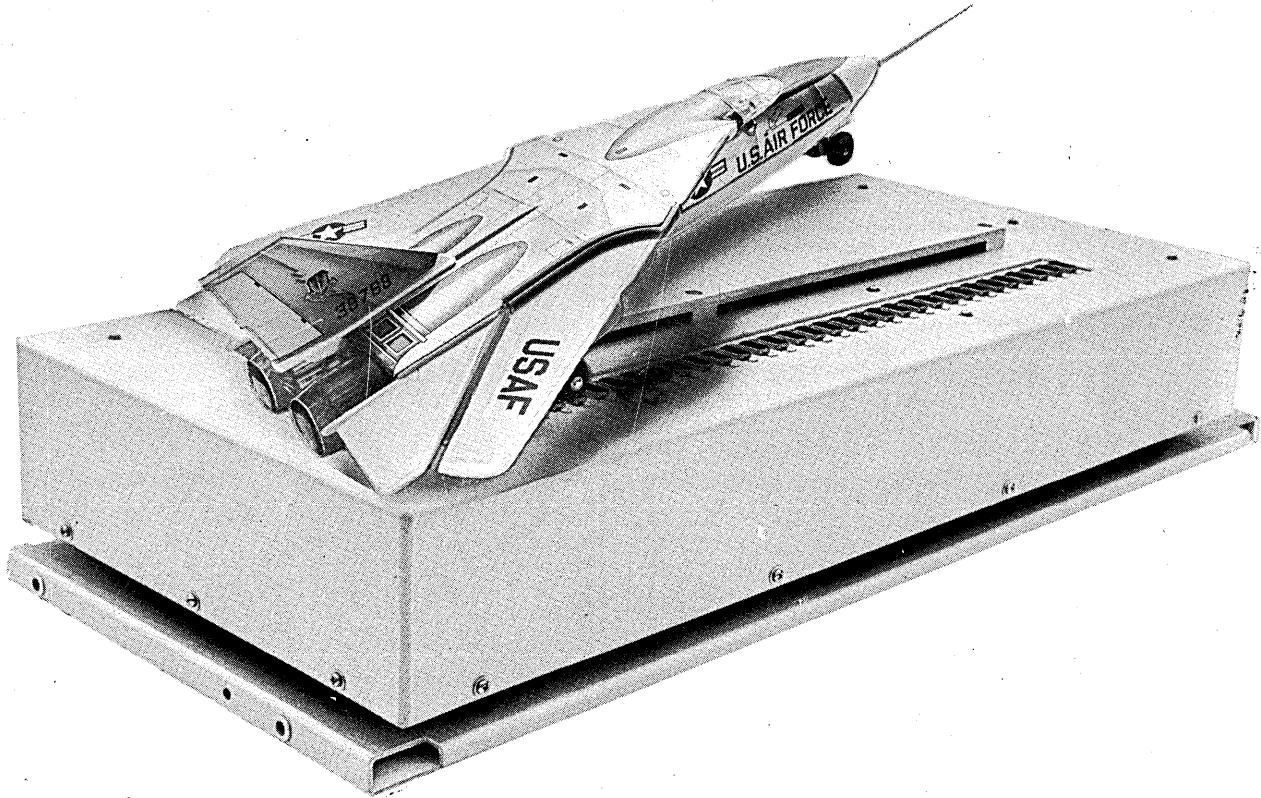
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