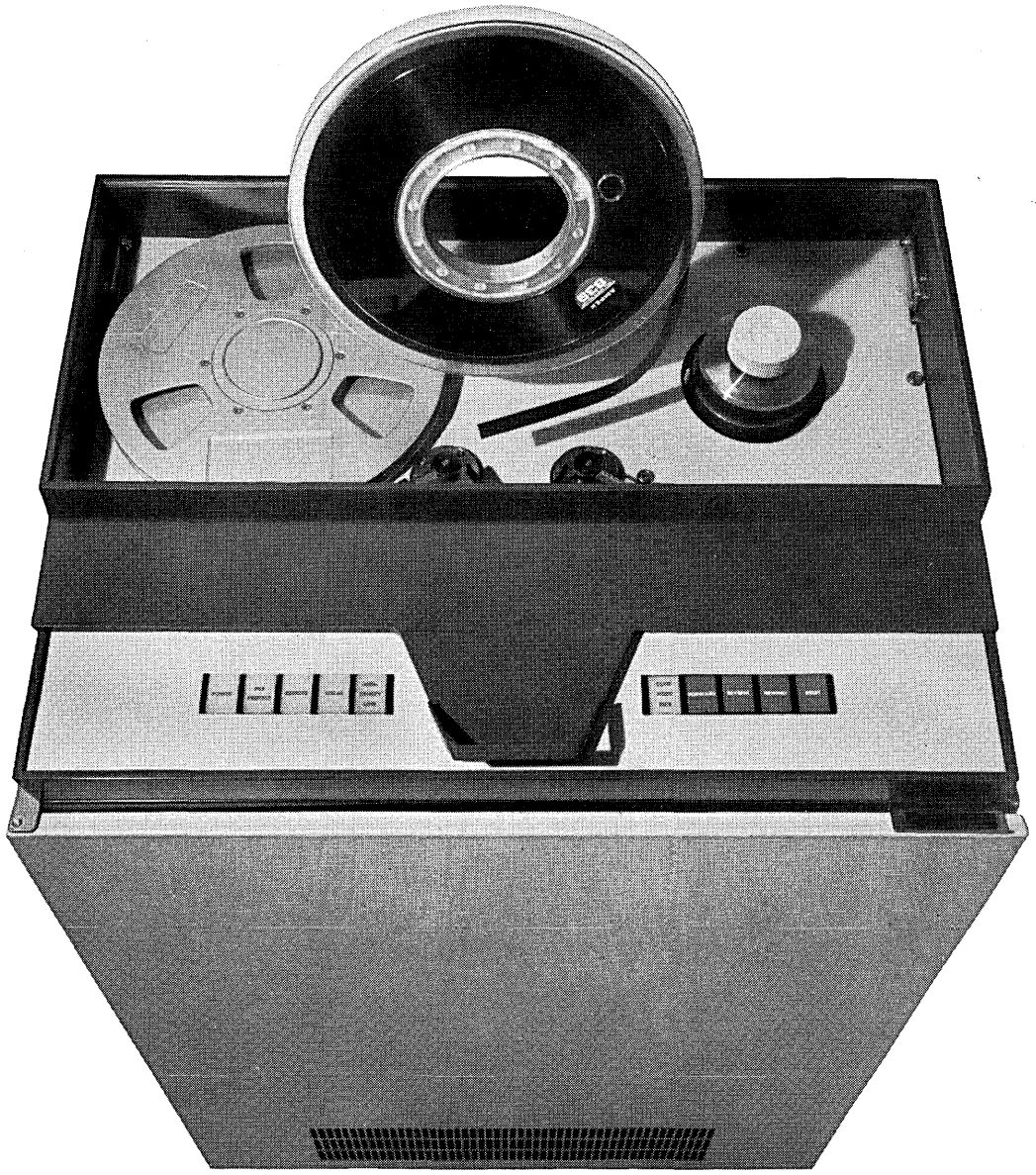
DATAMATION®

67

March

state and local government

200,000 dropout-free passes of this tape on one of our single capstan digital tape transports impressed everybody.

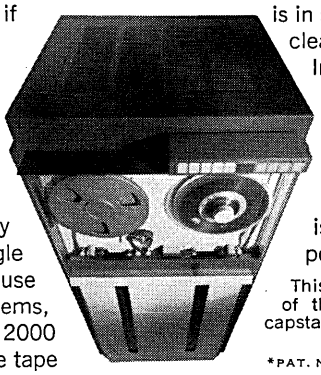


Now we've passed 552,176

We'll be glad to put this tape on the air for you if you'd like to talk about the reliability of the Ampex tape transport family.

In this continuing series of tests we record 32 data blocks of 1024 IBM 1's at 800 cpi. Then we read and re-read these blocks cyclically. In our most recent test we reached 552,176 passes without generation of any permanent errors.

How we make a tape transport this reliable is partly secret, partly hard work, but mainly our patented single capstan electronic servo control drive system*. Because it has only 1/5th as many parts as other drive systems, you have far fewer mechanical problems. (MTBF is 2000 hours; at least one billion start/stop operations.) The tape is in sliding contact with only the read/write head and tape cleaner, so dropout errors are virtually eliminated.



In sum, our tape transports are *at least as reliable as your computer.* And if you have multiple systems, you can benefit from our design commonality; each of our tape transports is interface interchangeable with all the others. They cover the entire range of data transfer rates and speeds. There is much more you should know. Write Ampex Corporation, 401 Broadway, Redwood City, Calif. 94063.

This is the TM-11, big brother of the TM-7 above — members of the Ampex family of single capstan tape transports.

*PAT. NOS. 3,185,364 AND 3,251,563

AMPEX

CIRCLE 1 ON READER CARD

ONLY HONEYWELL OFFERS
TOMORROW'S BREED OF I/C COMPUTER...

...AND THEY'RE BEING DELIVERED TODAY!

I/C construction . . . 16-bit word . . . 960 nanosecond speeds . . . strong software support — unprecedented computer capability in a low cost compact. And these are only some of the features that put 3C's two new μ-COMP machines in tomorrow's computer class today.

THE DDP-516, at $25,000, is the most advanced I/C 16-bit computer now available. Both hardware and software are already operational. Hardware includes high-speed multiply and divide (optional), a 4096-word memory (expandable to 32K), 960 nsec cycle time. The command repertoire includes 72 instructions with such capabilities as byte manipulation, skip-branch conditioning, and extensive memory reference and control.

250 field proven programs are available with every DDP-516 . . . including ASA FORTRAN IV compiler, selectable one- or two-pass assembler with a unique DESECTORIZING loader that lets you ignore memory restrictions. DDP-516 delivery: as few as 90-days.

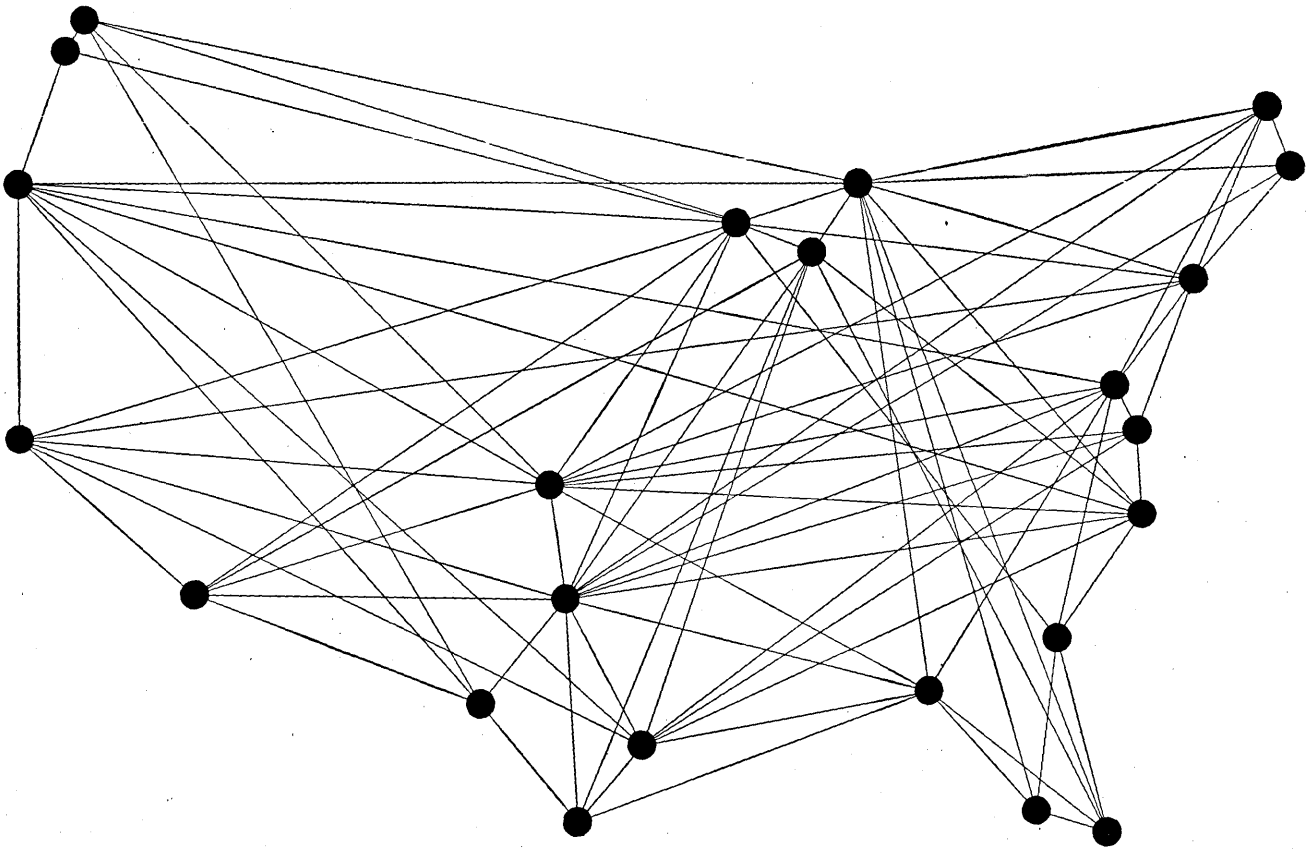
THE DDP-416, at $16,900, was engineered for a price/performance ratio that can't be beat by any other on-line real-time computer. Hardware features include a 4096-word memory (expandable to 16K), 960 nsec cycle time, 1.92 μsecs add, with indirect addressing.

A 30-command repertoire, priority interrupt and power failure protection are standard. Both the DDP-516 and the DDP-416 may be mounted in standard 19″ racks. Best of all, if you decide to get the more powerful DDP-516 in the future, you can continue to use your DDP-416 programs because of direct compatibility. DDP-416 delivery: second quarter of 1967.

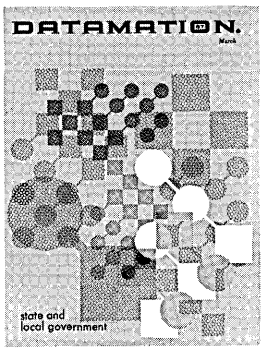
Write today for information on both μ-COMP computers. You can't go wrong with either one. Honeywell, Computer Control Division, Old Connecticut Path, Framingham, Massachusetts.

Honeywell

3C COMPUTER CONTROL DIVISION



Your decentralized company



march
1967

volume 13 number 3

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This issue 70,561 copies

Strangest library in the world.

1700 requests a day, and not a book in sight. In fact it rarely has a visitor. And the only sound in the reading room is from IBM computers duplicating programs to serve IBM customers. Located 28 miles northeast of New York City, this country library is a computer-age phenomenon. Its bookshelves are loaded with programs on tapes, cards and disks... programs developed by IBM and its customers.

The library began operations nine years ago when it started acquiring programs for distribution. Since then, computer technology has moved so swiftly that thousands of programs—complete with documentation—have been added. Now it takes the power of an IBM SYSTEM/360 to maintain, update and distribute the programs currently in the library. And it requires four trucks each day just to ship them out.

It even takes special equipment to handle the volume. Like a newly developed tape duplicator to process as much as 4 billion characters of information daily... the equivalent of 7000 books. And miniature tape reels to speed automatically updated program information to IBM customers.

Strange little library. None other quite like it.

It's there when you need it... like all IBM services.

IBM®

CIRCLE 8 ON READER CARD

What's the matter? Is your computer too busy to talk to you?

It's probably nothing personal. Like many other firms, you might very well have outgrown the computer you started with. If you started with NCR, your solution is relatively inexpensive. A system expansion . . . or maybe a faster processor, will give your system the breathing room to chat with you all you like.

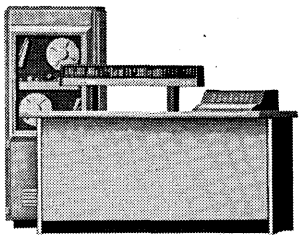
That's the beauty of the 315 family. You don't have any problem with obsolescence. No matter how small you start in the 315 family, you can move right up without recompiling or reprogramming.

You have an advanced operating system with automatic run-to-run control assuring the right file name and date version, and including dating flag options for any program in the system.

You can move up to the newest RMC (Rod Memory Computer), with a choice of 20 to 160K character memories. Even Multiprogramming, if you have a lot of conversation on your mind.

You can get your information to the 315 or RMC from the widest range of input devices available . . . all from NCR. So if you are in the market for a computer that's fast, powerful and flexible . . . and doesn't have a fancy price tag to start, call NCR. Let's get a conversation started.

NCR



THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO 45409 ®

DATAMATION 67®

march
1967

volume 13 number 3

automatic
information
processing
for business
industry & science

datamation departments

Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't make time on company time. Or use the office for intimate tete-a-tetes. Or be a social butterfly. But it *can* read. And gobble data at the rate of 2400 typewritten characters a second. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

Our machine reads upper and lower case characters in intermixed, standard type fonts. It handles intermixed sizes and weights of paper, including carbon-backed sheets.

An ordinary computer program tells our reader what to do . . . to add, subtract, edit, check, or verify as it reads. Lets you forget format restrictions, leading and trailing zeros, skipped fields, and fixed record lengths. And our reader won't obsolete any of your present hardware because it speaks the same output language as your computer.

Our Electronic Retina Computing Reader can replace all—or almost all—of your keypunch operators. At least that's what it is doing for American Airlines.

If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.

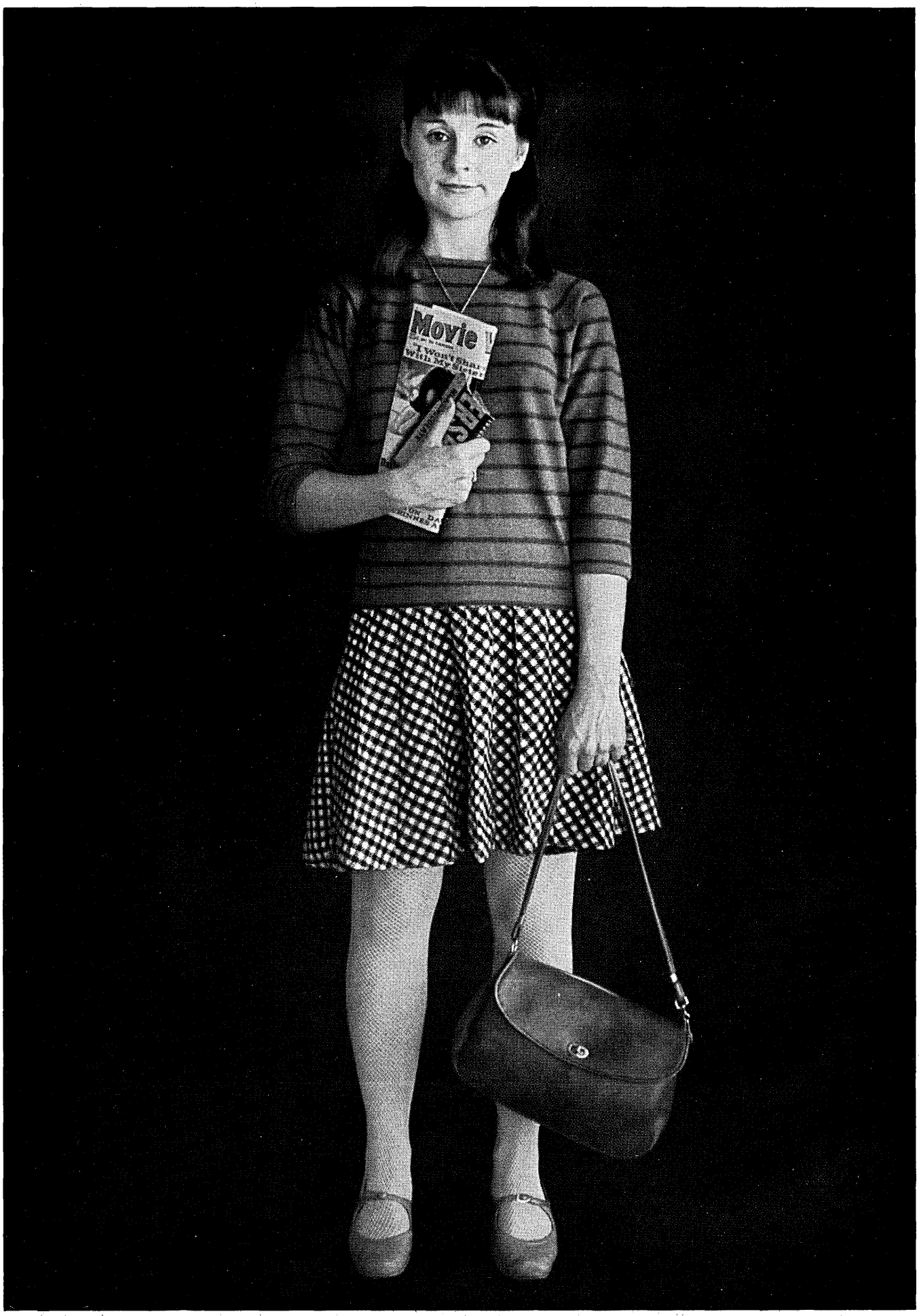
RECOGNITION EQUIPMENT Incorporated

U.S. Headquarters: Dallas, Texas 214-637-2210 Offices in principal U.S. cities and Frankfurt, London, Milan, Paris and Stockholm

CIRCLE 10 ON READER CARD

calendar

April 4-7	Users Conference	Bellevue Stratford Hotel Philadelphia, Pa.	Honeywell H-800 Users
April 4-7	Users Conference	Fontainebleu Hotel Miami, Fla.	Univac Users & Scientific Exchange
April 6-7	Systems Conference	Americana Hotel New York, N.Y.	Systems & Procedures Assn.
April 8	Conference: Management Scientists	American Univ. Washington, D.C.	Society for Advancement of Management
April 10	Paper deadline: IEEE Computer Conf.	—	Prof. S. S. Yau Dept. of Electrical Engineering Tech. Institute Northwestern U. Evanston, Ill.
April 12-14	Users conference	San Francisco Hilton San Francisco, Calif.	VIM-6 Control Data 6000 Users
April 12-14	Conference: Electronic Information Handling	Univ. of Pittsburgh Pittsburgh, Pa.	U. of Pittsburgh, ACM SIGIR, O. N. R., Goodyear Aerospace, W. Mich. U.
April 17	JUG Workshop	SJCC Headquarters Atlantic City, N.J.	Joint User Group of the ACM
April 17-28	Course: Advances in Digital Systems Design. $300.	Univ. of California Los Angeles, Calif.	—
April 18-20	Spring Joint Computer Conference	Chalfonte-Haddon Hall Atlantic City, N.J.	AFIPS
April 24-26	Conference: Machine Records	Sheraton Western Skies Albuquerque , N.M.	U. of New Mexico
April 27-28	Conference: Tools of Management	Hotel Muehlebach Kansas City, Mo.	Systems & Procedures Assn.
April 27-28	Conference on Management	Radisson Hotel Minneapolis, Minn.	DPMA
April 28	Seminar: Computer in Local Government Accounting & Management	McGregor Center Wayne State Univ. Detroit, Mich.	Governmental Accountants & Analysts Assn.
May 7-10	Conference on Data Processing	Americana Hotel New York, N.Y.	American Bankers' Assn.


Movie

She must be trained.

She makes mistakes.

She quits.

Install our new Datafinder on her IBM card punch (or verifier). She will train herself in 1/3 the usual time, make 70% less errors, and if she quits, you'll only miss her smile.

Datafinder solves the card punch people problem. It puts the operator under total, automatic instruction. *Any* job becomes simple and easy. ☐ With Datafinder, the newest operator can punch complex documents faster than old-timers on standard machines. Card punch operations remain consistently accurate and efficient, no matter who comes and who goes. ☐ If you have card punch people problems—high turnover, overstaffing, inexperience—send in our coupon. We'll send you all the facts on Datafinder.

Please send complete information on Datafinder and how it can improve my card punch operations.

Name_____

Title_____

Firm_____

_____ Phone_____

Street_____

City_____ State_____ Zip_____

DM

TAB PRODUCTS CO., Machine Division, P.O.Box 1119, Menlo Park, California 94025

CIRCLE 12 ON READER CARD

Captain Paul M. Wolff, USN, knows the world's weather

. . . as well as he knows the back of his hand. Captain Wolff is the officer in charge of the USN Fleet Numerical Weather Facility in Monterey, California.

The facility gathers weather conditions from over 4,000 observation stations all over the world. Makes about six billion computations on them. Translates these results into charts and maps. And relays the resulting contour charts to several hundred operating Navy units the FNWF services. The brains behind this operation: five Bryant Auto-Lift Memory Systems and a commercial EDP system.

Why Bryant? The Navy reports: reliability, low cost per bit and dependable interfacing capability. A pretty good rating in any branch of the service. So if you've got a memory problem forget it. Just remember Bryant and drop us a line at 850 Ladd Rd., Walled Lake, Michigan 48088. We'll make a Bryant believer out of you, too.

BRYANT
COMPUTER PRODUCTS

XLO

EX-CELL-O CORPORATION

CIRCLE 13 ON READER CARD

letters

recruiters & snatchers

Sir:

In reading your mention of the situation regarding GE's search for a loss-trimming formula (Jan., p. 17), I noted with a great deal of repulsion the manner in which you referred to "body snatchers and other recruiting vultures invading Phoenix."

If you were referring to the many major computer manufacturers and users throughout the U.S. that either sent representatives to perform a recruiting function for them, or even appeared on the scene in Phoenix via their own personnel recruiters, it appears to me and many of my client companies that you described them rather shoddily and without too much regard for their reputations.

Furthermore, many of these so-called "body snatchers and invading vultures" are, and have been, listed in your advertising index month after month, year after year.

Reporting on the news is one matter; but being impudent, indiscreet and sarcastic about the people and organizations that support your effort in printing DATAMATION is another. A three-year-old child can tear something down, but it takes education, training and performance to build something.

I've always felt that DATAMATION did a professional job and that this *faux-pas* is probably the result of a psuedo-professional attempting to over-colloquialize.

FRANK DANIELE
President
La Salle Associates, Inc.
Philadelphia, Pennsylvania

We don't like to think of ourselves as "psuedo-professionals," but your assumption that we were attempting to be colloquial is correct. Your other assumption, that we were referring merely to personnel agencies and their representatives, is incorrect. We talked to representatives of software firms and other organizations as well as to some professional recruiters, and were referring to all of them.

DATAMATION has respected and continues to respect professional recruiting organizations such as yours. But there are practices in recruiting by agencies and non-agencies which have led to the extensive use of such terms as "body snatchers." As we see it, such terms attack the bad practices, not the recruiting profession itself.

ring in the old

Sir:

Ascher Opler ("Fourth Generation Software," Jan., p. 22), predicts that microprogramming will become a major factor in future computers. He points out that preparing microprograms is considerably different from writing programs as it involves a much more detailed knowledge of the function of circuits and registers, and indicates that there is a limited supply of microprogrammers.

This must have a familiar ring to plenty of old-timers like ourselves who entered the computing game before the availability of stored program computers, and did our calculations by wiring "microprograms" on 604 and CPC boards. We even had floating point arithmetic, as well as square root, log and exponential functions available. We gratefully thought the kind of intricate logic design we went through in those days to fit the available relays, diodes and registers while decreasing running time was gone forever, but now it appears that modern microprogramming involves the same kind of skill. Even with computers, history can repeat.

DONALD W. PEACEMAN
HENRY H. RACHFORD, JR.
Houston, Texas

automation & unemployment

Sir:

Thank goodness someone finally stood up for our side. The article on economic growth and unemployment (December) did a fine job of present-

letters

ing the positive aspects of automation.

For years we have accepted the label of job destroyers with a quiet *mea culpa*. Now the statistics have turned on the automation critic as employment reaches new highs and unemployment recedes to where even a campaigning congressman can't use it.

Your articles were timely, pointed and in the public interest; let's hope others catch the spirit and continue the discussion. A problem as serious as unemployment deserves to be examined from all sides and we who have such intimate knowledge should never stop presenting our side.

J. K. SWEARINGEN
Past International President
Data Processing Management Assn.
San Jose, California

credit's due

Sir:

In my article, "A Machine Aided Drafting System," (Jan., p. 49), I neglected to mention that the manufacturer of our coordinate digitizing equipment was the Benson-Lehner Corporation. This equipment is a very important part of MADS, and the omission was nothing but an oversight on my part.

HARVEY N. LERMAN
Daytona Beach, Florida

more PL/I

Sir:

Mr. Dorn, in his letter (Jan., p. 12), suggests two or three inaccurate facts which should not remain unchallenged since he purports to represent an influential, if sometimes paranoid, programming group.

The first error that he makes is the infinitive he uses to describe X 3's efforts regarding ASCII. In terms of both its operating rules and its membership, it would be difficult for X 3 to "foist" anything on the data processing community. By definition, the membership of the X 3 represents the data processing community and not a narrow segment of technicians who act as high priests to the machines.

The second alleged fact is the phrase that "the ASCII set is not particularly useful for programming." This is an unsupportable statement unless Mr. Dorn means the ASCII set is not particularly useful for programming PL/I, which may be true, but rests solely on the basis that the designers of PL/I chose to ignore the existence of ASCII which was approved in its initial form in January, 1963, after long and arduous public debate. This date is somewhat before the three-year period cited by Mr. Dorn for PL/I's germination, and the argument smacks of extremely sharp hindsight.

Finally, there is a paradox in Mr. Dorn's eloquent diatribe in that attacking X 3 on the one hand, he then castigates Dr. Burkhardt by citing X 3.4.2.C as the focal point for public participation. I would hope that three years hence we will not hear the cry that this organization, a proper subset of X 3, will be charged with foisting PL/I on the data processing community.

In short, I feel an extreme lack of sympathy for those whose technical competence is as sharp as a razor, and about as broad, who would have the dp community conform to a set of arbitrary and rigid parameters established for the benefit of the programmer rather than the user.

VICO E. HENRIQUES
Washington, D.C.

fourth-generation clarification

Sir:

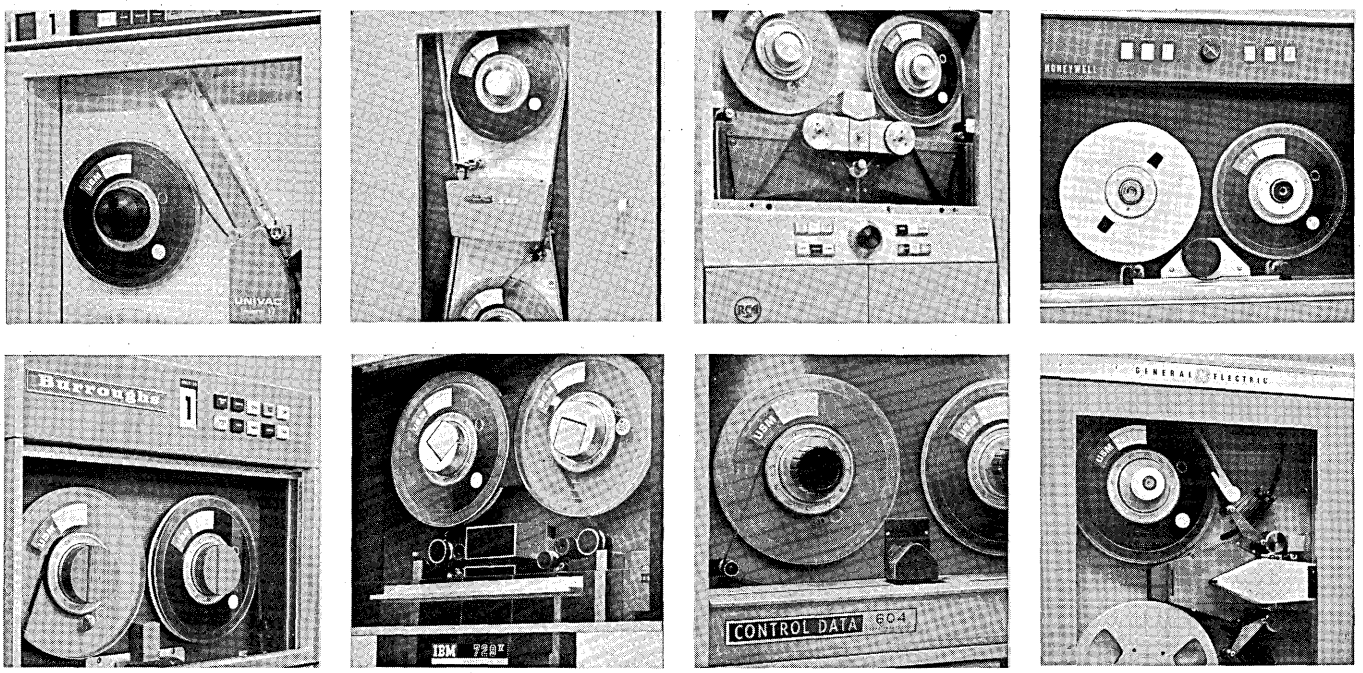
Thank you for the undeserved importance you attach to my views on hardware technology, a subject in which I have no special competence. Let me state these views explicitly, rather than as checkmarks which can be ambiguous and erroneous.

I do *not* believe fourth-generation computers will be cyrogenic. I believe fourth-generation technology, whatever it is, will *not* appear before 1971. I doubt if any commercial computers will be cyrogenic before 1975, *if ever*. Should cyrogenic computers appear, they will indeed "warrant a fourth-generation billing," as your question asked. Many other developments would also warrant such billing.

FREDERICK P. BROOKS, JR.
Chapel Hill, North Carolina

Datamation welcomes your correspondence concerning articles or items appearing in this magazine. Letters should be double spaced . . . and the briefer the better. We reserve the right to edit letters submitted to us.

First cost of digital computer tape? Forget it!



The real cost is the price-per-pass.

And on that basis, U.S. Tape with exclusive Duramil 7 may well be the lowest priced tape on the market today!

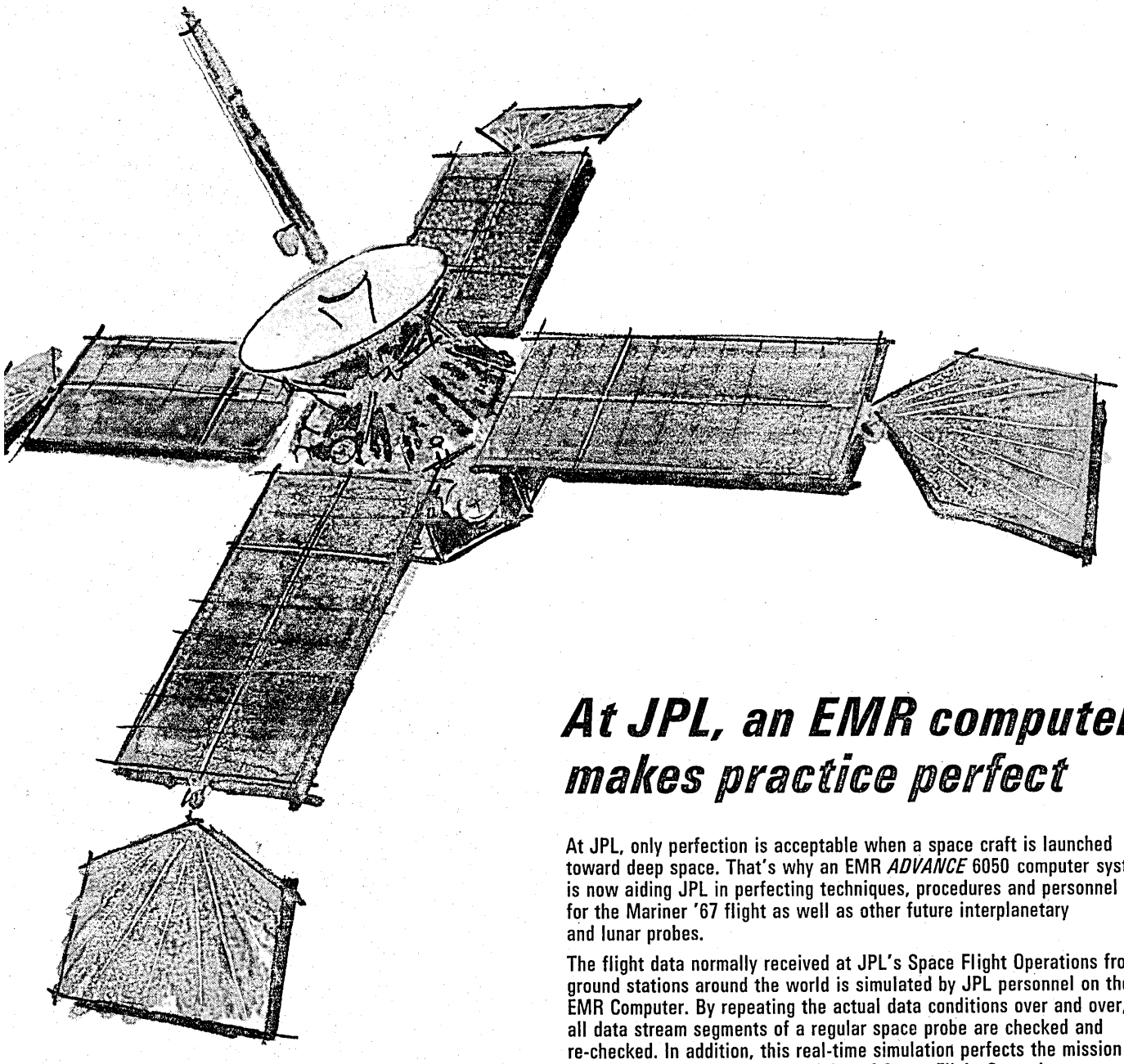
Duramil 7 makes possible the manufacture of computer tape with superior abrasion resistance and oxide adhesion . . . excellent scratch resistance. Coupled with **8+8 Total Surface Testing*** — a forward step in truly error-free tape certification — U.S. Tape with Duramil 7 records and maintains your data pass after pass after pass after pass. More passes, you'll find, than any other tape you can buy.

Give us a call to arrange your own evaluation program.

** Write for free booklet: "The facts about testing magnetic tape for digital computers."*

US TAPE

U.S. MAGNETIC TAPE COMPANY
HUNTLEY, ILLINOIS 60142 / *A Subsidiary of Wabash Magnetics, Inc.*



At JPL, an EMR computer makes practice perfect

At JPL, only perfection is acceptable when a space craft is launched toward deep space. That's why an EMR *ADVANCE* 6050 computer system is now aiding JPL in perfecting techniques, procedures and personnel for the Mariner '67 flight as well as other future interplanetary and lunar probes.

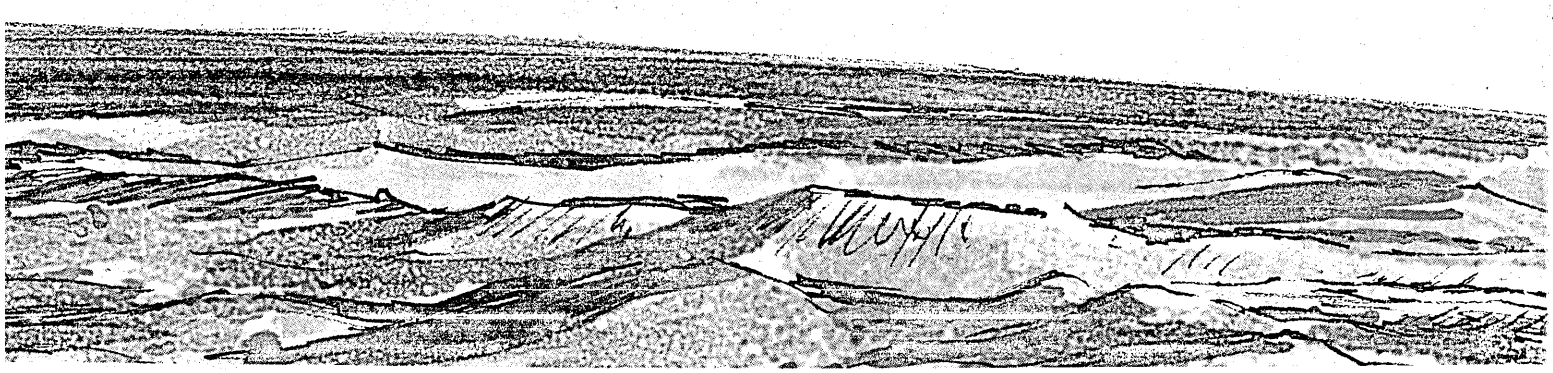
The flight data normally received at JPL's Space Flight Operations from ground stations around the world is simulated by JPL personnel on the EMR Computer. By repeating the actual data conditions over and over, all data stream segments of a regular space probe are checked and re-checked. In addition, this real-time simulation perfects the mission control programs as well as training of Space Flight Operations personnel. After months of simulations, actual missions become extensions of practice.

EMR's Computer Division offers down-to-earth solutions to all kinds of out-of-this-world scientific problems.

Yours could be one.

COMPUTER DIVISION EMR

8001 Bloomington Freeway, Minneapolis, Minnesota 55420



CIRCLE 17 ON READER CARD

look ahead

$100-200 MILLION FOR FADAC REPLACEMENT

The Army is looking for a replacement for its FADAC (Field Artillery Digital Automatic Computer), which is still in production at Magnavox (see Feb. '64, p. 61). By the time this is in print, the Automatic Data Field Systems Command will have awarded contracts to two or three mainframe manufacturers. And later this year, one of these will get what's estimated to be a $100-200 million contract for the TACFIRE (Tactical Fire Direction) system, hardware & software.

With the big contract (100 megabucks is the current order backlog of Burroughs), the Army envisions a family of computers. It starts with the TACFIRE processor (maybe 1-2 usec cycle time), data link, displays, other peripherals plus software. But the computer must also be easily reconfigured for use in other Army tactical data systems.

Current schedule is for delivery of the prototype in April '69. Delivery of the new processors will free FADAC's for use at the battery level, down from the battalion level where they're now being used.

SHARE ATTENDEES PLAY BUTTON, BUTTON ...

Over 1800 hard-working, fun- and button-loving SHARE members invaded fun-loving, topless San Francisco last month, with no winner declared. Earlier announcements on the "decommitment" of TSS (see Feb. Look Ahead) triggered buttons reading "TSS/360 Keep the Faith, Baby," "Deconceived," and "Promises, Promises." Some TSS pioneers will move boldly ahead on their own, while others will watch. PL/I came in for its usual criticism, summed up by one observer as "I expected PL/I to be bad and it wasn't, so I'm disappointed," or, "We're faced with an insurmountable opportunity." According to one critic: "PL/I isn't dead; it's being tortured by OS." The absence of PL/I for the 1800 or the 360/44 makes some users wonder at the extent of IBM's commitment. They feel that the language might be at the crossroads; they remember the bath some users took when IBM decommitted Commercial Translator not too many years ago.

Not noteworthy for any signs of a revolution or even an uprising, the meeting was marked by more than casual interest in ASP (the direct-coupled 360), especially on the part of '67 users. And there was renewed talk of progress being made in talks with GUIDE concerning a possible merger of the two influential IBM user groups.

GE GETS BIG ORDER, THINKS SMALL

Latest skinny is that GE, looking for ways to beef up its faltering edp effort, will establish a new small systems marketing operation. As we understand it, the operation will push Bull-GE and Olivetti-GE small-scale systems and peripherals in the States. It's rumored that the operation will be headquartered on the east coast, will be headed by R. I. Grove, former New York City district manager for Information

Systems marketing. He now reports to Harrison Van Aken, head of the Information System Division's overseas activity.

Meanwhile, it appears that GE has won a 10-plus megabuck order from Weyerhaeuser. The order, which includes dual 635's, 415's and 115's plus beaucoup remotes, will be used to implement the Pacific Northwest lumber company's nationwide network for an ambitious management information system.

UNIVERSITY COMPUTING HAS TERMINAL, IS TRAVELING

Fast-moving University Computing Co. is branching out into equipment manufacturing, beefing up its leasing operation ... is hot on the acquisition trail.

To be announced soon is the Cope .45 -- "fastest terminal in the west" -- a combination computer, card reader/printer, keyboard and modem which will offer overlapped two-way transmission over four voice-grade lines, simultaneous read/write. The company claims the unit will offer five times the speed and throughput of a 1004, reduce line costs 50%. Invented by UCC's Leroy Towell, the Cope (Communications-Oriented Processing Equipment) .45 will be offered to UCC's on-line service center customers and other interested parties for around $2-2500/month.

UCC's subsidiary Computer Leasing Co. is now being run by Bob Holland, ex-CEIR president, who will serve out of Wash. D.C. as chairman and chief executive officer. Art Phinney has been promoted to senior vp, and Lee Meadows, formerly with Union Carbide, joins as a vp. The company is seeking two more vp's to help it grow to $25 million worth of equipment leased by the end of the year. The firm leased $5 million worth of gear, mostly non-IBM, in the last five months.

Holland has turned over to CEIR refugee John Ankney his consulting operation, Holland Associates, which has set up Associated Ventures, Inc., an investment firm.

UCC is also conducting merger talks with Dallas' Scientific Control Corp., and Benson-Lehner, a division of United Gas which is, in turn, controlled by Pennzoil. SCC and B-L would make an attractive matching of computer-peripheral product lines, give SCC a much-needed marketing and service organization. The UCC money wouldn't hurt.

LARGER THAN A BREADBOX, SMALLER THAN A MOD 20

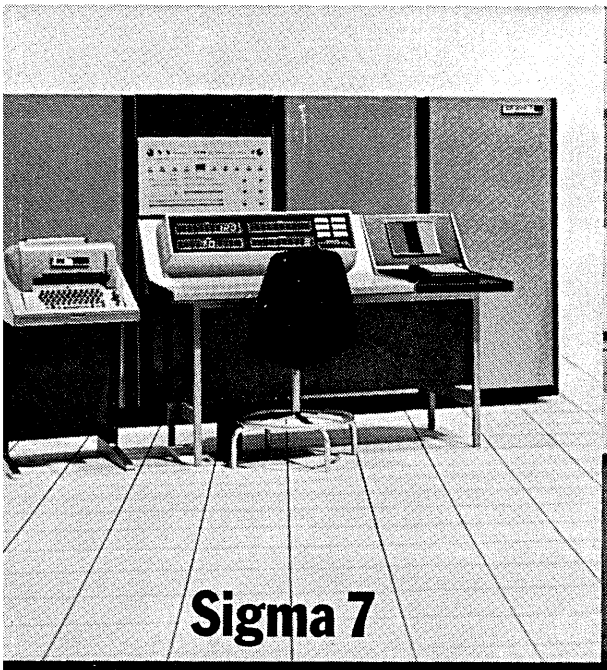
Following their tradition of getting the most mileage possible from machines in production, IBM is beginning to push the 1130 as a business machine. The relatively fast binary processor, first aimed just at the scientific market, can be had for a price well below the 360/20. To make it suitable for business applications, IBM supplies Ideal, a program that provides double-precision integers and thus allows decimal use. The company is also making use of Type 3 and 4 application programs -- those that are distributed but not maintained by IBM. A commercial subroutine to handle card and printer functions for business purposes is available, as are a set of commercial additions to Fortran. In addition, Bonner & Moore Associates, Houston-based software firm, is finishing up MISSIL, a management information system for small machines, including the 1130.

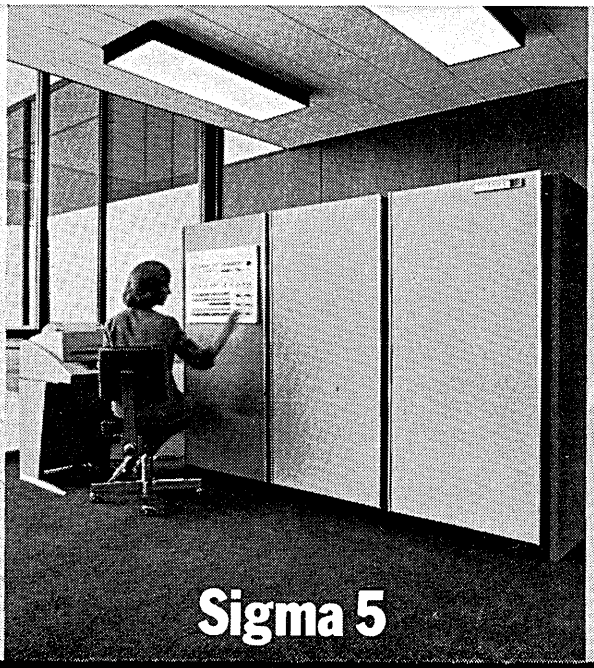
INFORMATION FOR INFORMATION PROCESSING?

The industry may yet develop some statistics about itself. AFIPS societies and the DPMA have developed

(Continued on page 121)

There are now three computers in the Sigma family.


Sigma 7


Sigma 5


Sigma 2

Sigma is the only family of computers designed for multiprogramming.

Every Sigma does a lot more work than any other computer in its price class.

Sigma systems cost from $26,000 to $1,000,000.

Scientific Data Systems, Santa Monica, California SDS

editor's readout

BAUDS VS. BITS

One of those rare semi-formal confrontations between the computer and communications industries took place in January at an IEEE-sponsored one-day symposium reported on elsewhere in this issue.

It was an important event, because it is becoming increasingly apparent that the destinies of the two industries are inextricably intertwined. It's clear that as time-sharing becomes more of a commercial reality, as load-sharing and centralized edp continue their brisk advances, as data bases and management information systems and the amorphous computer "utility" take shape, communications will play an increasingly vital role in information processing. Western Union's Robert Francisco estimates that the number of private 4kc data circuits will increase 100-fold by 1975, while voice-grade circuits will less than double in the same period.

Despite such evidence, the dialogue between the two industries' specialists charged with the task of talking to each other sounds more like cold war parley than peace talk. Every other phrase is "But you don't understand our problem."

Computer folks charge that the phone companies are super sluggish, timidly dedicated to voice transmission, have neurotic compulsions about "foreign attachments," have no setup to permit experimental services. They feel that technical jargon is used to cover bureaucratic reasons for failing to meet the communications requirements of computing.

The communications firms, however, look at their tremendous capital investment in current facilities, note that they are dedicated to the on-demand concept, which means they have to provide a uniform service even in the face of roller-coaster demands with spotty geographic representation.

As J.C.R. Licklider sees it, it's a conflict between an industry dedicated to devoting 10 years to developing facilities which will be run for 10 years . . . and an industry which is changing too fast to stabilize. The computer industry wants many consoles and communications lines while the communications industry wonders if there is enough communicable data to warrant the investment.

As Dick Mills of Project MAC sees it, the computer industry must "establish a body to act as a knowledgeable mouthpiece to pull together and cleanse the technical communications requirements of the industry and to transmit them to the communications people in a rational, unemotional, helpful way." He's head of an *ad hoc* ACM committee which is trying to do just that.

The ACM and Mills & crew are to be congratulated for trying to help the information processing community offer a single face to the giant communications industry. But the industry's communications problems exceed the bounds of the ACM and of time-sharing, the most persistent and strident voice in the attempt to accelerate computer communications developments.

The phone companies undoubtedly share a great deal of the blame for the current cold war. We hate to let them off the hook. But we feel that until that loose collection of special-interest groups we euphemistically call the information processing industry begins to talk to each other and work together—to *act* like an industry—any attempts to communicate anything to anybody are doomed to something far short of success.

AUTOMATION IN STATE & LOCAL GOVERNMENTS

an overview

by DENNIS G. PRICE

One index of the growth of a particular field is the amount of literature which discusses the field. If this is the case, then one would gather that not very much has been done in automating state and local government systems! The number of books on the subject could easily be counted on one hand, and the number of articles on the subject is probably less than one hundred. It is partly to remedy this defect that the articles in this issue of DATAMATION are intended.

Everyone is aware that the federal government is "big business." Fewer people realize that direct expenditures of state and local governments are now approaching the $100-billion mark ($98 billion in 1964-65)[1]—close to the expenditures of the federal government ($119 billion in 1964-65). But while the federal government in 1965-66 spent about $350 million in equivalent annual rental[2] for 2,600 computers, state and local governments are spending only about $60 million in equivalent annual rental for about 630 computers. Other costs (for punch card equipment, personnel, etc.) are roughly in the same proportion. Thus while the federal government's total expenditures are only about 20% greater than those of state and local governments, in the adp area they are over five times greater.

The most obvious reason for this discrepancy is the size of federal applications compared with those at the state level and more particularly with those at the local level. The problem of size is one of those discussed below.

problems facing state, local governments

We have already indicated that state and local government is "big business." It is also a growth business. And this growth poses state and local government's biggest problem. Whatever one's view on the role of government in the economy, one cannot help but agree that for the foreseeable future the government's role is going to become increasingly more important. The dramatic increase in our urban population has intensified the problems of crime, unemployment, pollution control, welfare, poverty, housing, transportation, etc. It is an almost endless chain.

These problems are interrelated, and solutions to them must be found through coordinated and well-integrated programs (facile phrase!). Unfortunately the vested interests of the various state and local government agencies which have dealt with these problems are separate entities in the past, have served as effective barriers to greater cooperative action.

With this growth in activities, it is not surprising to find that in most state and local governments, the computer has been used only to mechanize basic record-keeping functions, noted above. Crime control is one exception to this, and several government jurisdictions have developed or are developing sophisticated applications in this area—see, for example, Gordon Milliman's article in this issue.

Tremendous sums of money are now being expended by the three levels of government in coping with these problems in our "Great Society." Unfortunately, for the most part, the money is being expended in an uncoordinated manner. Certainly there are very few sophisticated information systems concerned with the impact of programs in the area of crime, welfare, poverty, etc. at the three levels of government.

If we were to examine the various "vertical programs" (which link the federal, state and local governments in particular functional areas), we will note they have grown up in a piecemeal fashion, and the federal agency has established its own reporting requirements with the corresponding state and local government agencies. This in turn has meant that much information sent to the federal government is collected with little regard for its possible use at the state and local level.

impact of federal government

To obtain some idea of the impact of the federal government's program at the state and local level, one need only reflect on the fact that in 1966-67 the federal government is spending about $15 billion in grants-in-aid. (The Health, Education & Welfare Department accounts for $7 billion of this total.) Of course, "he who pays the

Mr. Price is director, State Computer Systems Development in the Div. of the Budget for New York State, which includes responsibility for development of the state's dp activities. He is also a representative of the Council of State Governments on the X3 committee of the U.S.A. Standards Institute. Previously, he was a senior consultant in the Management Services Div. of Touche, Ross, Bailey and Smart. He holds a BS in economics from London U., and an MS from Carnegie Tech.

[1]Source: Governmental Finances in 1964-65, U.S. Bureau of the Census.
[2]Equivalent annual rental converts the cost of purchased equipment to rental.

piper calls the tune," and part of the tune is to render information. Vast amounts of information are now flowing upward from local and state governments to the federal government in the areas of education, health, poverty, crime, Medicare, etc. In addition, new federal agencies are being developed which will also require information. For example, the Office of Regional Economic Development is studying how to assemble data on federal, state and local public investments. This is a nationwide program and the information will be collected on a county by county basis.

While the impact of these programs is severe at the state level, at the local level the impact can be near catastrophic. The reasons for this are brought out very clearly in a publication called "Modernizing Local Governments."[3] Specifically there are 80,000 separate local governments in the country today, most of which are too small to do an effective job in many areas with which they are concerned. They overlap one another—municipalities within counties, independent school districts and special districts within these. Because they are small, they are also usually poor, which means in turn that they cannot afford adequate administrative organizations to implement their programs and take advantage of modern technology. This is very evident in the area of data processing. In addition, at the local level the "spoils system" is still much in evidence, which means that important jobs are often filled by amateurs. To a lesser degree, these statements are also true of the smaller states.

When the federal government imposes its information demands, related to new programs, on this local government structure, the results are often chaotic.

response of state and local governments

We have already noted the piecemeal development of so-called "vertical programs." It is evident that the speed with which these projects have been put into operation has allowed too little time for considering the need for standardizing information requirements. In response to the need to develop the necessary information, the usual response of state and local governments has been to request new information. This has had the following effects:

- Duplication of information: Even though the agency charged with obtaining the information may be aware that another agency has that information, it doesn't bother to obtain it from this source, because it may not be quickly available (the usual bureaucratic red tape), or it may not be in the actual format or frequency that is required by the new agency.

- Increasing requirements at the source of information: the new agency goes immediately to the source of information and requests this source to cooperate. Even though the source may be providing the same or very similar information to another agency, it has very little choice other than to provide what is requested. This is very burdensome to the prime sources of information—the taxpayer, private industry, or other governmental organizations.

- Increasing difficulty in relating information concerning a given entity such as a taxpayer, or a parcel of land: Once the original source has given what may be the same information to two or more agencies, it becomes progressively more difficult for these agencies to relate information concerning the same entity. Once the information is received, manipulated, digested, and generally played around with, it is usually unrecognizable, and almost certainly irreconcilable.

- Increasing cost of information: Since the same information may be generated several times from the same source and processed by several agencies, obviously the cost of the information is much higher than need be. Perhaps more important, the information is now stored in an incompatible format, so that the cost of reconciliation (even if possible) is very high.

data elements and codes

This lack of integration of data requirement raises another topic, which has become very much in vogue in the last year or so, and that is the need for the standardization of data elements and their codes. It seems that very often there is an inverse correlation between the amount of talk about a subject and the amount of action on that same subject, and in this area the inverse correlation is very high! This lack of compatibility among data elements is probably the greatest barrier to the flow of information among the three levels of government.

Although the problems posed by this lack of standardization have existed and have been discussed for many years, with any systems change problems become highlighted. Since the impact of the computer brings about a dramatic systems change, the problems in this case are highlighted to a greater degree.

One of the problems which immediately arises if and when compatibility of information is obtained, is the invasion of privacy. Clearly as it becomes possible to relate information (i.e., make it compatible) from many sources concerning an individual, the issue of invasion of privacy will become even more important. Representative Cornelius Gallagher (D., New Jersey) conducted hearings recently on the proposal for a computerized National Data Center to centralize government statistics. This proposal is being studied by the Bureau of the Budget. And as is sometimes the case with Congressional hearings, a good deal of smoke was generated by persons who were perhaps not as close to the subject as they should have been, so that the emotional aspects of the problem tended to be stressed the most. However, it is a familiar theme that as one problem—data compatibility—is solved, another problem—invasion of privacy—arises.

There are two other problems which impede progress. The first concerns the nature of government itself in respect to the civil servant. Because in most government organizations the civil servant has permanent status, he is usually less than enthusiastic about the promise of better things. The "recumbent incumbent" is a major problem in installing new systems in government. Resistance to change is at a premium in many government installations because, while there is little incentive on the part of the individual to make changes (which after all always mean headaches and hard work), mistakes can be costly to him. In many cases the "good old days" are still with us.

The other problem is concerned with the edp area itself. Changes are implemented at the detail level by systems analysts and programmers. I often think that today in many government installations we have third-generation equipment with second-generation software and first-generation personnel. Not only are many dp personnel behind times, but very often they are intrigued with the equipment itself and hence suffer from "microsecond miasma." (With the faster third-generation equipment, they suffer from "nanosecond inertia.")

From what has been said above, it is obvious that there is a tremendous amount of work to be done in solving the information processing problems of state and local governments.

possible steps to solutions

Since these problems exist in the state and local governments, most of the effort toward a solution must come

[3]Published July, 1966 by the Committee for Economic Development, New York.

from these governments. The Council of State Governments has a Committee on Information Systems (formerly the Committee on Automation, Technology and Data Processing) which was formed in 1965. Its role is to act as a catalyst in encouraging the development of modern information systems in state governments. To this end it has conducted several projects, such as the mailing of an annual questionnaire to all state governments concerning the status of their equipment installations, applications, personnel and organization for edp. It is also negotiating a standard lease contract for all vendors of computing equipment, similar to the General Services Administration approach.

In May 1966, the Committee on Information Systems requested each state to establish a state-local advisory council to take "an active leadership role in working with representatives of its political subdivisions to identify joint state-local programs and, where there is a joint interest, assure that the interests of local governments are accommodated when planning for data processing systems."

Today only a handful of state governments have established such councils on a formal basis, although several states do have active plans for developing much closer ties with their local governments. California has developed long-range plans for a "statewide federated information system" which will develop local government data processing capabilities in various regional or functional areas, and these will be tied in electronically to state computer systems. New York state, Illinois, Wisconsin and the Commonwealth of Puerto Rico have similar plans.

vertical projects

Clearly the development of these federated information systems should be tied in with the development of the "vertical programs" referred to above, and thus bring the federal government into the act. What is therefore needed is a tripartite development, with teams of analysts and administrators from the three levels of government responsible for developing design criteria in each functional area (such as crime, health, education, etc.). These teams should define in each functional area the information that flows among the governments: this would involve the standardization of data elements and their codes, the contents of files, etc. Unless this is done, and done soon, the proliferation of incompatible information will become worse, thus making the eventual task (which is inevitable) even more difficult.

At the state level, more and more states are developing positive programs of central control for the development of information systems. In New York state, for example, the Division of the Budget has developed control and guidance along several lines to assist departments in all aspects of computer acquisition and use: for instance, in the areas of information studies, issuance of specifications, realistic evaluation procedures, monitoring of installations, development of a central computer, etc. Similar developments have taken place in California, Hawaii, Michigan, Ohio, Texas, Wisconsin, and the Commonwealth of Puerto Rico.

In New York state, we have recently developed a statewide master plan for information systems development which includes a data element inventory for all important master files (mechanized or not) in the state. This inventory is being circulated to potential users and we shall soon be implementing a much more effective interagency use of information, with the accompanying data standardization which this entails. Although the plan also encompasses the development of new computer applications for the next five years in state departments, we believe that the analysis of the "micro" level of the data elements and files is essential to any further sophistication of our data processing system.

the supply of personnel

Presently the situation concerning personnel is deplorable, not only in government but in industry too. The state governments should take the initiative in encouraging (with money!) the development of data processing curricula in their state universities, in the private universities, and even in high schools. This will increase the long-term supply of high quality personnel for the total market. In addition, state governments and large local governments could establish training schools or institutes to increase their own "captive" supply, the resulting pool of trainees to be assigned to computer installations. These in-government schools could help in training personnel in departments which are converting to a first computer when it is usually important to utilize departmental personnel because of their knowledge of operations.

Of course, it is no use increasing the total supply if it cannot be attracted to government service. With very few exceptions government salaries are not competitive with private industry, so that governments act as a training ground for industry; as soon as a man is competent, he is seduced by attractive offers from industry. In most governments, too, the salary gap widens as the experience increases, so that the best programmers, analysts and managers may leave.

But apart from salaries, governments have to overcome their poor image with outsiders. This image is of a dull, pedestrian operation, staffed by dull, pedestrian people in dull, pedestrian offices. Furthermore, while a private firm can recruit a prospect in one or two weeks after the initial interview, most governments take months: to schedule exams, give exams, grade exams, allow appeals, and produce eligible lists.

software packages

With the development of information systems in local governments, there should be the possibility for developing common software packages in certain areas. This will not be an easy task since the individual idiosyncrasies of local governments will be brought to the surface. To standardize systems will be a great problem, but one which must be overcome if we are to develop integrated state-local systems. Within the next five years there will undoubtedly be considerable progress by the more advanced states in developing networks for information systems with local governments. There we shall see regional computers performing all the work of large local governments, or groups of smaller local governments; the systems described in this issue of DATAMATION for Alameda county and Detroit are good examples. We shall also undoubtedly see regional computers which perform the work for local governments in one functional area only. This seems to be a trend today in the education area where regional centers are processing the work of several school districts—for example, in California and New York.

summary

The prime source of the information problems of state and local governments is the rapid expansion of their own social programs, together with the massive impact of federal programs.

Major steps to solution for the state and local governments include the development of vertical programs in

every function which involves the three levels of government. These vertical programs should be developed in cooperation with the federal government (the General Services Administration or the Bureau of the Budget), and should involve the development of pilot programs in several states and the local governments in those states. Such pilot programs will undoubtedly cost plenty, but it seems to me there is absolutely no alternative. The need is recognized, the tools are available, and all that is necessary is for a few top federal government officials to summon up their courage and take the plunge.

For their own part, those states (i.e., most states which have still not organized their computer systems development) had better jump to it, or be swamped by the information demands which are now being generated by the federal government and their own jurisdictions. In this regard, the Council of State Governments' Committee on Information Systems can act as a clearing house of applications which have been successfully developed in other states. The Council of State Governments should build a library of applications, described in enough detail to enable another state to develop a similar computer application. To date, most state governments have adopted an apathetic attitude towards the CSG Committee on Information Systems, and not all have followed its recommendations—for example, to create a position of a central adp coordinator for the state government, or to establish a state-local advisory adp council to help their local governments. Many states still don't even bother to complete (or are incapable of completing) the annual questionnaire concerning their adp programs. The states should also band together to develop common software packages for their local governments.

There is an awful lot to be done by the three levels of government and the time for talking of general principles is past. I am reminded of a quotation which states, "This principle is so perfectly general that no particular application of it is possible."[4] In the information area we must develop particular applications at the three levels of government . . . and soon. ■

[4]George Polya, "How to Solve it; A New Aspect of Mathematical Method," Princeton Univ. Press, 1945.

social & physical files

DETROIT'S DATA BANKS

by HAROLD BLACK and EDWARD SHAW

City government is big business. Like business, a city government is complex and diversified; it deals annually with huge sums of money, and every day its administrators have to make hundreds of decisions. And, like businessmen, city administrators must have at their disposal enough information (and the right kind of information) to make their decisions quickly, effectively, and meaningfully. While it is true that a city does not deal predominantly in the currency of profit and loss, it does deal in something of equal importance and sensitivity: the health and well-being of its people, the vitality of its economy, and the physical integrity of its buildings. So effective decision making is as crucial to city administrators as it is to businessmen or management personnel.

The need for data, for facts and figures and analyses, in the city of Detroit is felt nowhere more keenly than in the city's urban renewal program. In the last decade Detroit has spent or committed more than $200 million in renewal work, and the projects and programs for which this money was spent have affected the lives of over four million people (the population of the Detroit metropolitan area.) In the decades to come, even more will be spent, and much more will be done to make Detroit a safe, decent, and beautiful city in which to live and work.

In order to carry on its renewal programs effectively—in order to maximize all the available funds, manpower, and know-how—Detroit will have to gather a good bit of data about its people and its buildings. Information about mobility, income, employment, health, substandard

With the Detroit city government since '42, Mr. Black is currently community development coordinator. He has also served as director of the Mayor's Committee for Community Renewal, and as a consultant for market analysis and economic base studies, and in feasibility studies for urban renewal. He has a master's degree in both sociology and urban planning from Wayne State Univ.

housing, obsolescent structures, crime rates, and much more will have to be compiled continually over the years. In addition, of course, systems will have to be developed to sort, analyze and store this data, and to retrieve just the right information for any given problem or study.

the data banks

The problem of data collection and processing is not new to Detroit, for over the last few years the city has carried on a number of studies, surveys, and research programs that have involved huge masses of data. In order to solve the problem of organizing and storing this information, we have devised what we call the physical and social data banks. These two data processing and storage systems are precisely what their names imply: repositories for the physical and social data gathered by the city over the last few years.

The hardware we have been using in our dp systems consists primarily of the IBM 7040 installation at the Wayne State Univ. computing center. (The city's equipment, an IBM 1401, has too small a memory—8K—and is too busy to be of service.) Our computer programs—both for data storage and statistical analysis—are written in COBOL, which will facilitate transfer to the new system Detroit is soon to install (an IBM 360, mod 40 computer.)

The physical data bank was designed by a users group composed primarily of planners and economists in the city government. Since, when we began, we were not particularly sophisticated in our understanding and application of dp techniques, the data system that came out of the initial design has tended to be somewhat inadequate. Our editing procedures, for example, were quite rudimentary, and, as a result, we are faced now with gaps in the data file and, in some cases, with "dirty data." Nonetheless, the physical data bank has proved to be a tremendous improvement over anything we had before, and it has been one of the most useful planning tools we have ever been able to use. And we did, moreover, learn a valuable lesson about data processing from our experiences with it.

the physical data bank

The physical data bank contains such information as the condition of the city's residential, commercial, and industrial buildings; property assessment figures; age characteristics of various structures; type of structure; the estimated costs of various kinds of physical treatment of residential structures (e.g., conservation, redevelopment and code enforcement); population characteristics and occupancy patterns; and many other kinds of data. The information in this bank is collected from census material, local surveys and studies, and our board of assessors' records (Detroit, for example, rated most of its residential areas, structure-by-structure, on a seven-point scale ranging from "sound" to "extremely dilapidated" in order to get an idea of the extent of residential blight in the city).

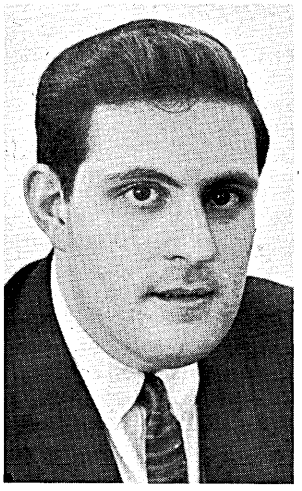
Most of the data in the physical data bank is now two to six years old, and the bank must soon be updated, improved, and expanded. But it has already served us well. The blight ratings have been especially useful helping us to make decisions about such things as where clearance projects might be started, where rehabilitation might prove most effective, what our city's overall housing resource is, and so on. Because of the great flexibility we have gained through the use of the 7040, we have been able to obtain printouts of an area as small as one city planning area (about 100 acres), as well as various summaries and compilations on a city-wide basis. Moreover, since so much of our physical data is so readily at hand (and so easily manipulated), Detroit has enjoyed something of a head start in applying for federal grant-in-aid programs. Many of the grant applications require a great deal of physical information, in a number of different forms, and with our computerized data processing systems we have been able to come up with the necessary data in short order.

Soon the assessors' office will have its records on tape. This will make it possible to update our physical data bank annually at a modest cost.

When we decided to extend our dp approach in urban planning to the realm of social data, we called in professionals in the field. We hired the firm of Touche, Ross, Bailey and Smart in the initial design stages of the social data bank. Their personnel, in cooperation with a group of city people, made a careful study of all the possible sources of social data, what kind of information might prove most helpful, and what sort of edp system might best suit our needs. When the appropriate data sources had been identified, individual forms and reporting procedures were designed for each kind of raw data. A systems flow was developed that spelled out the individual steps that were to be taken from the point of data collection to the eventual merging of the data in the computer. While the various computer programs were being written at Wayne State Univ., our consultants acted in a management capacity. When the system became operational, their job was finished, and we took over the social data bank completely. (It is, incidentally, our intention to bring this same kind of professional attention to our physical data bank when we face the problem of annual updating.)

the social data bank

The social data bank is a little over a year old. It is designed to bring together various social statistics (which are gathered on a monthly basis from a number of public and private service organizations), and to provide statistical summaries of this information. The bank was originally designed to report and store information according to city planning areas, but the geographical base has now been changed to the census tract. (The change was made because most of the agencies from whom we collect data report their findings according to census tract,



Mr. Shaw is on the staff of the Detroit Community Renewal Program. His background and interest is in information storage and retrieval, having completed several research projects in this field. He is a graduate of Antioch College, Yellow Springs, Ohio, and has done graduate work at both Syracuse Univ. and Wayne State.

and thus a good deal of interpolation was required to merge incoming data with the existing data files. The task was becoming far too time consuming, so the social data bank was modified.)

The data stored in this bank includes statistics on crime rates, welfare, births and deaths, school truancy and drop-out rates, the occurrence of venereal diseases and tuberculosis, and other information. Printouts are obtained quarterly, although data on any given census tract can be retrieved whenever it is needed.

application of data

Detroit's social data bank, while still only in its formative, rudimentary stage, has already proved to be an immensely useful tool. Although it has been used until now primarily as a descriptive aid, we have been able to greatly expand and improve our renewal programming because of the flexibility and data resource the social data bank gives us.

Recently, the bank has been particularly significant to the various city departments who are engaged in writing Detroit's application for a grant under the new Demonstration Cities Act of 1966. This new federal program calls for a massive, coordinated, concentrated attack on *all* the problems of certain areas within each of the participating cities. This means, very simply, that we must design programs for both social and physical improvement. It means we must improve the quality of life in our city, as well as the physical environment. This kind of in-depth, total planning must be based on information, for we cannot improve a neighborhood's social vitality if we do not know what that neighborhood's social problems are and how its people live.

We have been able to get much of this information from our social data bank. We don't know everything we would like to, of course, but we do know a good deal more than, for example, the census data could tell us. We can get a good, general idea of the social well being of any area in the city by retrieving the requisite data from the social data bank. There is no doubt that if Detroit is successful in obtaining a Demonstration Cities grant, the social data bank will have been a significant part of that success.

In addition, the bank has been extremely useful to other agencies in Detroit, such as the board of education and United Community Services, all of whom can use the bank to determine (generally, at least) which areas need the most help and which kinds of programs might be most successful in various sections of the city. The board of education, for example, can use the crime and truancy data to see if more emphasis might be put on school-oriented after-hours activities (such as athletics, special vocational training, teen club programs, and the like).

early benefits

Specific city programs have already benefitted from the social data bank. In our neighborhood rehabilitation effort, for example, we have been able to judge with some degree of confidence what areas might respond favorably. For it is clear that if one can get some idea of the comparative social well-being of various neighborhoods, he can make some estimation of which of those areas might be more amenable in improvement. Renewal involves people (and their social behavior) as well as buildings; it involves the attitudes, motivations, and social characteristics (migration patterns, income, education, etc.) of the people, and all these things are extremely important factors in any improvement effort.

We know, of course, that the social data bank must be improved a good deal before it can become a truly effective analytical or problem-solving tool. At this point, we really haven't the knowledge or the experience with social data processing to make the best possible use either of the data or the dp system we are using.

As a first step, we hope to bring in experts (sociologists, epidemiologists, systems analysts) who can analyze the existing data and draw meaningful conclusions from it. It may well be that we have already collected truly significant data—that we have already captured on tape some important trends—and that we simply have to submit what we have gathered to the scrutiny of professional data analysts. Such experts may be able to tell us that, in time, even the data we have (and are collecting) will be able to indicate whether an area is getting "better" or "worse" in terms of social variables. We may find that with the proper manipulation we can develop a "social stability scale," based on various combinations of social statistics.

We might discover, on the other hand, that we may not be tapping the best data sources. We might wish to expand or limit the data we collect, to change the time or geographical base of our data collection, or devise trend-deriving programs based on social data combined with other information. In time, we may even be able to devise an "early warning system" which could alert us to a neighborhood drifting into instability or social decline.

acceptance & use

Whatever the future holds for the social data bank, we know at least that we have happily discovered what might be called a new "dimension" to urban planning. We know that the equipment, the knowledge, and the technical know-how is available to gather and use social data in a meaningful, fruitful way. We know, too, that we have a lot to learn in this field, but we are dedicated now to the task of learning much more as quickly as we can. We feel that, in a very real sense, the age of computers has ushered in a new age of urban planning.

The development of the two data banks brought to Detroit not only an exciting new capability in planning, but the need to re-orient much of our thinking as well. Our users group, for example, not unlike some edp-oriented groups in business and industry, had to learn to curb their enthusiasm about the new tools at their disposal. We had to learn not to make such requests as, "Give me all the data you have on Planning Area #3." We had to teach ourselves to specify precisely what kind of data or analysis we wanted, and to be able to justify the need for what we asked for. We also had to learn to flow-chart our problems so that we could communicate effectively with our programmers. We found it simple indeed to eat up valuable computer time on badly delineated problems or with problems insufficiently understood either by the user or the programmer.

We have solved many of these problems, and the social and physical data banks have gained wide acceptance throughout the city goverment. Department heads and administrators have expressed great interest in our dp systems and our data files, and have indicated their continuing support of the overall information processing project. (The data banks are available to any department of the city, and to any non-city agency that can make profitable use of our data.) In all, it has been an interesting, sometimes frustrating, and very valuable experience for all of us who designed and use these data banks. ■

ALAMEDA COUNTY'S "PEOPLE INFORMATION SYSTEM"

by GORDON MILLIMAN

State and local government is being engulfed in a paper blizzard that increases hand-in-hand with the population explosion. New tools and techniques are needed just to continue present functions. And an increasing number of people see the tantalizing possibility of what can be done with the vast amounts of data collected by local government, if only it can be organized into meaningful, readily accessible information.

One answer is an automated state and local government information system. A book by Hearle and Mason, blueprinting such a system for the 1970's, pointed out that government deals with three kinds of information: information about people, places and things.* Following this lead, several California counties are looking at their information handling needs as being divided into these three separate but related areas. And in Alameda County we put an embryonic "People Information System" on the air in January, 1965.

background

This "People Information System" is being integrated with a wide variety of batch processing jobs in our Data Processing Center. The center was created by bringing together the decentralized computer and unit record installations of several county departments. It has been a truly centralized operation since 1964. Today a staff of 160 operates the center 24 hours a day, 7 days a week, 52 weeks a year. It never closes. Most county departments are customers, including the assessor, auditor, tax collector, treasurer, retirement board, civil service, central service, public works, registrar of voters, surveyor, engineer, courts, sheriff, welfare, probation, health, hospitals, etc., as well as San Francisco Bay Area law enforcement agencies.

Bread-and-butter jobs are processed centrally on a batch basis for decentralized customers, several of whom formerly operated their own edp shops. Current applications include employee and retirement payrolls; inventory accounting; public works accounting; tax assessment, billing and collections; welfare budgeting and accounting; preparation of calendars, notices, warrants, jury lists, etc. for courts; health dept. reports on immunization, cytology, sanitation; etc. The full index of current jobs is a 60-page listing of about 1,000 COBOL programs, 700 SPS and AUTOCODER programs, 500 unit record and 400 keypunch jobs. Turnaround time for most high frequency jobs is 24 hours or less following the rule "in one day, out the next."

The present hardware configuration is built around five IBM computers. The main one, a 7044, is used simultaneously for on-line and batch processing. Its 32K word core is "segmented" into three parts: upper core houses a teleprocessing monitor used in our real-time systems, lower core contains the operating system, and middle core is reserved for main-line batch processing. I/O devices include ten tape drives and a 2302 disc file. The 7044 is supported by two satellite computers—a 1460 and a 1401—used for batch processing, plus real-time backup when the 7044 is down. The other two are communication control computers, 7740s, used to perform the line handling, polling and other related functions needed for the real-time systems. The 7740s are duplexed to assure continuous uninterrupted service to Bay Area law enforcement agencies. The usual assortment of unit record, keypunch and tape-to-card conversion equipment makes up the balance of in-house hardware. The registrar of voters maintains a battery of 80 electronic vote counters for tabulation of election returns and the subsequent supplying of voting information to the data processing center in machine readable form. Data is also captured in machine readable form at the source by the tax collector, auditor, assessor, hospitals and other county departments

*A Data Processing System for State and Local Government, Edward F.R. Hearle and Raymond J. Mason, Prentice-Hall, 1963.

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through paper tape devices attached to cash registers, adding machines, bookkeeping machines and so on. And more than forty 1050 teleprocessing terminals are on line to the real-time systems.

real-time systems

The present "People Information System" consists of two parallel but separate subsystems. The first is a central index for social services created by order of the Board of Supervisors to better coordinate the line activities of social service agencies like welfare, hospitals, health and probation. This electronic index containing key information about people served by these agencies resides on the 2302 disc file. Input to the index is initially gathered and subsequently maintained and updated as a by-product of the batch processing systems serving these agencies. Index information is accessed on line from remote terminals in these agencies to identify people, locate their records, and thus respond to the thousands of inquiries pouring in each day by telephone, by letter and by walk-ins. The central index has been on the air since January, 1965, and today contains over 200,000 names (total county population exceeds 1,000,000).

The second real-time system is called PIN, or Police Information Network. It was created to serve the 93 law enforcement agencies in the Greater San Francisco Bay Area (an area embracing nine counties with a population in excess of 4,000,000). PIN has been on the air since July, 1965, and today contains upward of 200,000 warrants of arrest.

Both systems work in about the same way. Inquiries keyed into remotely located 1050 terminals are transmitted over voice grade phone lines to the on-line communication control computer in the center, which assembles the incoming query and passes it on to the teleprocessing monitor in upper core of the main computer. The monitor in turn searches the disc file for the desired information, formats the response, and sends it back by the reverse route. A typical inquiry from one of the six Welfare Dept. terminals would be generated if a man named John Jones walked in and applied for assistance. This would lead to an automatic search because many of the thousands of people applying each month do not furnish adequate information for identification. The operator would key in a four-digit code, the name "Jones John" and probably a couple of other identifiers to help select the desired John Jones from the several hundred on the file. About three seconds after the operator hit the "end of transmission" key, her 1050 would start printing out what the computer knows about any John Jones satisfying the search arguments.

While terminals in welfare, health, probation and institutions are searching the central index file, law enforcement agencies throughout the Bay Area are searching the PIN file. For example, a San Francisco patrol car spotting a suspicious looking vehicle might ask the San Francisco communication center for a moving check on car license "ABC123". His Com Center would probably key a code "DQ", meaning double query, and the number "ABC123" into a 1050.

This double query would cause a simultaneous search of two files: the center's PIN file and a file called AUTOSTATIS. This stands for Automatic Statewide Auto Theft Inquiry System, a stand alone 7740 on-line system maintained by the California Highway Patrol in Sacramento. It contains information on stolen cars, plates and parts as well as cars associated with major crimes for the entire state of California. The center's on-line 7740 is linked by three Telpak lines to its counterpart in AUTOSTATIS.) The PIN file would respond in about three seconds, printing out any information on warrants of arrest associated with that license number; and AUTOSTATIS would respond a few seconds later indicating if the car was stolen or connected with a crime. Under normal circumstances, the average response time to a patrol car query for a license check is about 30 seconds. Thus before stopping the car he was following the San Francisco officer would receive a full status report from PIN and AUTOSTATIS. Those systems are saving lives; before their advent California law enforcement agencies traditionally lost one, two or three officers each year to bandit gunfire.

Most of the currently on-line terminals are within 30 miles or less of the center. But it makes little difference whether a terminal is five feet, five miles, or five thousand miles away, the response time is about the same. PIN is frequently demonstrated from points all over the continental United States, Canada, and the Hawaiian Islands. And last year it was successfully demonstrated from Western Europe. A 1050 terminal equipped to operate on European 50-cycle current was installed at an international police chiefs' meeting in Hanover, Germany. The transatlantic cable was used to connect the United States and European phone lines and European modems (modulation-demodulation units) were used on both ends. Inquiries were entered in Germany, the PIN file searched in Oakland, and the response printed out in Germany, completing a round trip of 12,000 miles about as quickly as a corresponding inquiry entered by Oakland police.

file use

Information about a person can be logically divided between data identifying the person and data describing his status. Accordingly, three basic types of files are used in the "People Information System": an identification or I/D file to identify the person; an agency file describing the person's status with respect to each agency connected with the system; and cross reference files to link related I/D and agency records.

The I/D file contains common identifiers like name, sex, race, date and place of birth, physical descriptors and identifying numbers. Minor differences exist between the two subsystems, reflecting differences in availability and normal use of data. PIN uses the common law enforcement identifiers of driver's license number, color of eyes and hair, height and weight; the central index does not. The central index, on the other hand, uses "mother's first name" as a tiebreaker; PIN does not.

A separate agency record file is maintained for each agency. For example, the welfare record, being an "index," contains skeletal data pointing to where more information can be obtained, including the social worker number, which leads to the worker handling the case, and the case number, which serves to locate the hard copy file. The PIN warrant file contains all key data from warrants of arrest. Cross-reference files link persons to their aliases, to their family groups, and to their agency records. They allow for any desired degree of agency record chaining.

A compressed phonetic code is used to organize the name-oriented I/D file. The computer automatically calculates the code using the first letter of the last name and three digits coded from the remaining letters as follows:

CODE	*LETTERS*
1	B,F,P,V
2	C,G,J,K,Q,S,X,Z
3	D,T
4	L
5	M,N
6	R

Vowels and silent consonants are ignored, while two or more letters with the same value are treated as one. This

coding solves the common problems of incorrectly spelled names and names that sound alike but are spelled differently. For example, JOHNSON, JOHNSEN and JENSEN are all coded as J525, forming a cluster of sound-alikes. To further fracture the file, the computer adds the first letter of the first name—the full compressed phonetic code for GEORGE JOHNSON is J525G.

For absolute identification in cross-referencing, the computer automatically assigns a unique I/D serial number to each new I/D record added to the file. Each phonetic code group, like J525G, is grouped together on the direct access device in I/D serial number order.

Agency files are sequenced by unique agency numbers, and cross-reference files are sequenced by cross-reference information.

To find an unusual name, like Opialdo, all that is needed is a four-digit code, telling the computer the kind of search argument to expect and the kind of response desired, and the person's last name. However, for more common names additional identifiers must be used to uniquely identify the person. Any or all of the person identifiers may be used as additional search arguments, but generally the use of two or three is sufficient. Where agency or I/D numbers are used as search arguments, only the number and the appropriate four-digit code are needed.

Because of the many possible combinations of person identifiers, positive and negative weights have been assigned to each. The weights vary to reflect relative uniqueness, reliability and changeability. For example, "last name" has a positive weight of 90 and a negative weight of 10; while "sex" has no positive weight and a negative weight of 80. In comparing I/D records with the search arguments, the teleprocessing monitor adds the corresponding positive weight if the argument matches, and subtracts the negative weight if it does not. The response returned to the terminal is an absolute match if all search arguments correspond, or the most probable records based on accumulated weights in the absence of any absolute matches.

The real-time files may be updated by on-line input from terminals on a real-time basis: for example, to change the status of a warrant when it is served; or by on-line input with batch update, to change the address connected with an unserved warrant; or by in-house tape input with batch update, as when adding a new warrant.

Currently, the on-line update features are used on a restricted basis. But their use is being gradually expanded as proper safeguards are developed to insure file integrity and the capability of file reconstruction.

When a warrant of arrest is served by a participating law enforcement agency, it is the serving agency's responsibility to immediately update the warrant status on a real-time basis to prevent subsequent false arrest for the same warrant. In many cases, three agencies are involved: the serving agency, the responsible agency (the one holding the actual warrant), and the assigned agency (the one assigned the responsibility of attempting to serve the warrant because the wanted person lives in that area). When a real-time update is made, the system automatically generates and sends notifying messages to the responsible and assigned agencies. And all agencies can use the message switching capabilities of the system to communicate with each other. File security is maintained by a variety of techniques involving hardware, software, line control and secret codes.

future plans

The present embryonic "People Information System" will be expanded to embrace other county people files where economically justifiable and the customer department wants and needs such on-line capabilities. Most residents of the county have contact with county government, in one way or another; thus the number of names in such a system could theoretically approach the total county population (currently over 1,000,000). The types of people files range from registered voters, through property owners, to a great variety of files related to people served by the various social service agencies. Note that the capability exists today to load any number of these people files into the on-line system, with any desired degree of completeness, linking and cross-referencing of records. But while the technology is here, the cost justification is not. Today's direct-access storage costs too much to warrant the indiscriminate loading of files onto an on-line system just because it can be done. However, costs are going down. It will cost us less to store about 234,000,000 characters on a 2314 direct-access facility than it does today on a 2302 disc file. And where the slower speed is not a problem, it will cost considerably less to store the same amount of data on a 2321 Datacell. The trend is in the right direction, and I for one am convinced that the cost of on-line direct-access storage will continue to decrease in the future to the point that all files that should be on-line can be maintained on-line at a reasonable cost.

long-range goal

Against this background, our long-range goal may be defined as an expanded "People Information System" joined together with a "Property Information System" and with what the County Supervisors Association of California's EDP Committee now called "Administrative Services System."

Because these systems are still in the developmental stage, their definitions are still changing. The most widely publicized definition of a "Property Information System" in California is contained in Santa Clara County's LOGIC (Local Government Information Control) publication, which points out that such a system would include all data describing the land of the county and its uses—information historically accumulated, stored and processed separately by 13 county departments. Such a system would also permit valuable cross-comparison, such as the relationship between the Planning Department's land use and zoning information and the assessed valuation of the parcel as shown from the equalization roll.

The definition of the "Administrative Services System" is still in the formative stage. As conceived by the CSAC-EDP Committee, it will have much in common with the management information systems of private industry. It will cover such functions as accounting, inventory management and control.

These three subsystems will jointly form a unified information system with the following features:

File. A countywide data bank containing needed information about "people," "places" and "things," residing on a yet-to-be-announced type of direct-access storage facility capable of holding the equivalent of, say, 15,000 reels of tape.

Terminals. Much of the incoming data stream will be input directly to the data bank from terminals located in customer departments, supplemented by data input from in-house devices. The data stream will update the file on a time-triggered batch basis, or a real-time basis if needed. The same terminals will be used for inquiry. Many of the terminals will be CRT devices, but remote hard copy output will be provided when needed.

Hard copy. The computer will automatically select and summarize information from the data base to prepare customer reports as needed on either a time-triggered

or demand basis. Reports to other governmental agencies will, to the greatest extent practical, be provided by other than hard copy: for example, on magnetic tape or directly from computer to computer.

Federated system. Our regional center, as a member of a federated system, will be connected by means of line-switching centers or directly computer-to-computer to other governmental centers. This will permit automatic reporting to state and federal agencies on a computer-to-computer basis where warranted, eliminating much of the present paperwork.

Planning and control. The up-to-date data base combined with the use of mathematical models and simulation techniques will provide county management with the necessary tools for planning and control. Like private industry, local government is faced with a whole spectrum of rapidly changing problems—not only in the arena of day-to-day administration. Long-range problems have overtones of urban control, community health and social well-being. There is an urgent need for automated social research to identify social ills before they become advanced cases of social chaos. There is a need to identify trends and anticipate public needs years in advance. An accurate and reasonably complete data base coupled with techniques for extracting meaningful statistics and properly using mathematical models will make possible the simultaneous consideration of a wide range of variables in planning and decision making.

intermediate steps

We plan to reach our long-range goal a step at a time, allowing for an orderly transition from our present predominantly application-oriented batch processing environment to the on-line information system environment. Steps toward this goal include:

Third-generation hardware. Present hardware is currently being replaced by a fully duplexed third-generation configuration built around two IBM 360's—a Mod 50 and a Mod 40—both 256K. A pair of 2314 direct access facilities, supported by a 2321 Datacell, will replace the present disc. Two 2703 transmission control units will replace the 7740's, and a mixture of CRT devices and 2740 communication terminals will replace the 1050's.

Teleprocessing monitor. The monitor, perhaps the most vital link in our real-time systems, has been rewritten for the 360. It will occupy a part of one or the other of the 360's at all times. Being core resident, it will continue to provide fast responses. And because it is generalized, it will allow for relatively easy modification of file design and for changing inquiry and transaction definitions at the data format level.

Selective update. We will take advantage of the additional power of the third-generation hardware and software to update files on a selective basis. That is, we will use an input stream of current transactions, in either a random or sequenced order, to select and update the affected "master records" on a direct-access basis, instead of serially processing entire master files. To update on a direct-access basis, we will use whatever devices are most appropriate, either in-house or remotely located, on a time-triggered or real-time basis.

File sharing. To the extent that sharing of information through common files will provide better service to customer departments at reasonable cost, and without violating any considerations of security or confidentiality, we will combine such files. Note that most information handled by counties is of a nonconfidential nature and security requirements are not involved. For any files that are confidential, access is carefully controlled by permitting only authorized terminals, and where necessary authorized persons—by means of secret codes—to inquire into such files. Future plans also call for monitoring techniques to determine what terminals are accessing any given file.

county-state-federal linking

Because no unit of government is an island unto itself, we believe it is essential to communicate, cooperate and coordinate with the data processing efforts of other governmental units at the county, state and federal level. The following are cases in point:

CSAC *participation.* We actively support and participate in the work of an edp committee created by the County Supervisors Association of California to guide the development of uniform computer systems in California counties. This parent edp committee in turn created a standards committee as well as "people", "property" and "administrative services" committees to assist in the development of broad-based subsystems as integral parts of a united information system. Also, CSAC is attempting to coordinate county activities with the corresponding edp efforts of California cities and the state of California.

Law enforcement. PIN is already tied in with the State Highway Patrol's AUTOSTATIS on a computer-to-computer basis, and in the near future will also be tied in with the FBI's new National Crime Information Center in Washington D.C. via AUTOSTATIS. This will give Bay Area law enforcement agencies the capability of searching files at the regional, state and federal level with one inquiry via PIN 1050 terminal.

SFIS. We look forward to participating in the proposed statewide federated information system, which will operate as a communication utility, allowing transmission of information between state and local government computer centers. This will be the bridge for accessing the Department of Motor Vehicles' developing automated management information system on a real-time basis; the Department of Justice's developing system at the Bureau of Criminal Identification and investigation; the Department of Social Welfare's data processing center; and many others. We are also most interested in the developing California law enforcement telecommunication system, which will serve many of the above agencies as a forerunner, a part of, or separately from SFIS—the relationship has not been fully defined as of this date.

implications for the public

As servants of the public, we know the final test of any governmental system should be "Does it truly benefit the public?" We believe our present and proposed automated systems benefit Alameda County residents in two ways:

More efficient government. Centralization allows for full equipment utilization, plus providing a staff of experienced personnel. One-time capture of data at the source, timely file update, and elimination of many hard copy reports will all contribute to more efficient government—and help reduce the paper blizzard. The paperwork problem was spelled out by the Lockheed Missiles and Space Company in their 1965 report entitled *California Statewide Information System Study.* They pointed out that most county departments regularly submit some 600 different kinds of reports to 28 different State departments, totaling about 10,000 reports a year for a typical county. And these figures do not include intra-agency reports at either the county or state level.

Increased service. Systems like PIN and AUTOSTATIS are helping to make the Bay Area a safer place to live. And as the unified information system expands, it will provide the data base for future planning; and for helping welfare, health and probation social workers spot and control potential trouble areas before—not after—the fact. ■

THE CALIFORNIA EDUCATIONAL INFORMATION SYSTEM

with regional centers

by ALVIN GROSSMAN

Next to national defense, education is the largest single enterprise in the United States. In 1964, expenditures for all levels of public education, including capital outlay, reached approximately 27 billion dollars. The nation's schools and colleges enrolled one-fourth of our population. With millions of people and billions of dollars to be accounted for, the American educational enterprise appears ripe for the tasks that computers can uniquely perform.

Information problems are woven all through the fabric of educational processes, from problems of collecting, storing, communicating, retrieving, and displaying information, to problems of receiving, learning, and using information. Student, teacher, administrator, research and guidance worker, business manager, board member—all are very directly concerned with the transmission and utilization of information.

National attention is now focused on the strategic importance of education. The past decade has witnessed pressure in our schools of a kind and intensity not experienced before. It is the nature of American schools to respond to a variety of appeals. This they do, but ever so *slowly*.

problems facing educational systems

Change takes time, particularly when it is applied to education. But time is the element that today's educators do not have. After 100 years of relatively static curriculum, educators have suddenly been faced with a very real—and perhaps quite terrifying—situations, in which change must be brought about right away. Students coming through our traditional programs have found themselves, almost overnight, unable to cope with the highly complex and technological world around them. The traditional time lapse between significant scientific, technological, and social changes and the need to accept and to adapt to them has become nonexistent.

The entire nation looks to education for the solution

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to each of these problems, or at least as the agency best suited to provide a solution. Whether this is appropriate or good should be left to the philosophers and the politicians to debate. The main point here is that life is moving too rapidly; educators can no longer do nothing in the hope that solutions will come with time. This is the moment for bold and imaginative educational innovations.

For too long educators have attached relatively little importance to developing information systems that could provide the facility to generate educational intelligence; instead, these leaders have virtually continued to do things the way they have always been done—because it is "traditional" to do so.

This type of thinking has made educators captives of the written word. Since Gutenberg, they have rosily accepted the printed page as the best medium for imparting knowledge. To be sure, other aids have been recognized—audio-visual, for example—but their use is regarded as supplemental to the instructional program rather than an integral part of it.

Probably the greatest road block to the acceptance of different ways of doing things is that educators treasure the old seasoned methods and back off from new challenges. Almost everyone in a school district knows how its operations can be improved; but, often enough, the improvements are stillborn or not born at all. A variety of reasons, of course, are seized upon. No one is available to plan changes; new proposals may offend somebody; there may not be any room in the budget; and so on.

It is now an established fact that while technological developments have fairly cascaded into the American scene, the public schools have not kept pace. Most educators have failed to employ current innovations because we have traditionally adopted the "wait and see" attitude. When a new technology becomes available to us, we want to see if someone else has determined or demonstrated its feasibility. By the time its potential benefits to the schools is widely accepted, another new development springs up on the horizon; we abandon trial of the prior one because now we must see if the newcomer will prove to be of greater value. While we wait for each new development to come along and let each one go by, our students are being deprived of educational aids that could well equip them to cope with the new and challenging space age.

In summary, the problems facing education which may be alleviated by the computer include:

1. The ever increasing number of students and the relative shortage of teachers.
2. The need for new teaching techniques.
3. The increasingly complex problems faced by school administrators—as with all other administrators.
4. The need for the student to learn about edp techniques—to equip him for our modern technological society.

the california system

The California system is a direct outgrowth of seven years of research and development cosponsored by the Cooperative Research Branch of the U. S. Office of Education and the State Department of Education. This effort has had the full support of the major educational organizations in the state, including the California Association of School Administrators, the California Association of Secondary School Administrators, and the California Teachers Association.

With the enactment of the first massive federal aid to education program in 1958, the California State Department of Education realized the urgent need for a method of accumulating valid information concerning educational programs within the state upon which decisions of statewide application could be made. When intensive consideration was given to the most practical means of gathering this information, it became apparent that the application of data-processing techniques to educational practices offered a realistic approach to the problem of developing an educational information system.

Toward meeting the nation's urgent educational needs, the department's attention was first directed to the area of pupil services—an area in which many local school districts had already gained experience. This area includes grade reporting, test scoring and reporting, pupil scheduling and attendance accounting. The vast majority of these districts treated these services on an application-by-application basis with little attention to a systems approach. The study that was made indicated that the state's educational system was faced with a broad gap in its ability to collect, relate, and process valid educational data so that it could be used reliably in such areas as facility planning, development of curriculums suitable to the pupil's needs, career decision-making information, enrollment projections, etc.

As a result of this study and with the advice of a competent advisory committee, the department embarked upon a course of action which encompassed the following:

a. Appraised the study made in 1959-60 of the information needs of education and the management needs of the State Department of Education. This was accomplished with management leadership and active participation from local school districts and county offices of education.
b. Converted the idealistic needs to statements of practicalities and priorities.
c. Developed a statewide plan to create and implement an integrated system to collect, process, display, and effectively utilize management information.
d. Implemented the concept of an information system as a "single corporate entity" regardless of organizational structure and the degree of centralization or decentralization in operations.

Data-processing systems in scattered school districts in California, as in most states, have developed haphazardly during recent years to meet the pressing needs of each local situation. Despite the hard work of the systems personnel in these districts, certain problems have been known to generate trouble—for example: inefficiencies due to inadequate equipment and/or a lack of sufficiently trained personnel, failure to integrate properly the data-processing applications with the district's educational program, and excessive involvement with needs of the moment at the expense of well-planned procedures that would take care of many needs over a reasonably long period of time.

At this point, it became obvious that many school districts, because of limited size, financial inability, or lack of personnel resources, could never utilize these procedures and that a means of making them available was necessary. Thus, the concept of regional centers serving the school districts within certain geographical areas was created.

Among the advantages of regional educational data-processing operations are the following:

1. It is less expensive to furnish and operate one central installation for a region consisting of a number of school districts.
2. The benefits derived from the learning, developments, and improvements that take place at the processing center in a regional system can be applied to a large number of schools, not just a few.
3. A higher degree of central staff competency is more

likely to be realized in a regional system than in a multitude of local district systems.

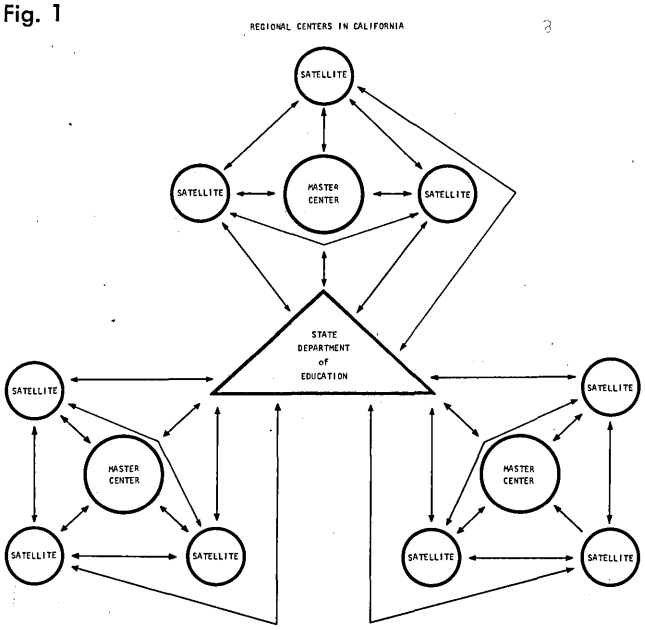
4. There is greater uniformity of procedures and products in a regional venture than can be found among separate district systems.
5. The various districts cooperating in a regional system can contribute valuable suggestions to the total effort. This is true because of the large number of schools participating and the unique differences existing among the districts in the system.

The regional organization plan became a part of a unified approach to educational data processing. The State Department of Education created a Bureau of Systems & Data Processing to coordinate this statewide effort. Their responsibility was in setting standards, defining compatibility, and coordinating the activities of the regional centers. Each regional center came into being by meeting the following criteria:

1. *Adequate Student Population.* In accordance with the code established by the Department of Education, the center must serve a single school district having an enrollment of not less than 100,000 pupils or two or more school districts, within or without the county, having a combined enrollment of not less than 100,000 pupils.
2. *Administrative Commitment.* The active rather than passive support of top administrators (Superintendent, Board of Education and Board of Supervisors) is required in order to insure full development of the potential system. This should take the form of letters of endorsement from the Boards and the County Adminstration. The facility administration housing a center must be totally committed to regional cooperation and education data processing.
3. *Adequate Financial Support and Equitable Cost Distribution.* The regional educational data processing center must be a self-supporting activity, operating on a cost-recovered basis. The users of the center must be willing to support the cost of pupil data processing, facility preparation and associated overhead expense.
4. *Geographic Location of the Center.* The regional center must be centrally located in order to be accessible for meetings, in-service training of participating school personnel, and data receipt and delivery. The selected site must be chosen with the cost of facility preparation in mind. The economics of converting existing educational structures must be considered in the decision for the location of the center.
5. *Availability of Qualified Personnel.* Each center will require a top administrator to assume the over-all responsibility for the successful operation of the center. This person must be capable of understanding educational concepts and problems as well as those related to electronic data processing. The table of organization of the center may follow the outlines presented in the California State Department of Education publication entitled "Regional Educational Data Processing Centers in the State of California."
6. *Promotion of Uniform Practices.* It is imperative that school districts served by a center be willing to accept the basic California Total Educational Information System Service package available from the Regional Educational Data Processing Centers. Local programs above and beyond the basic system will be developed by the center at the expense of its users.

In California, at the present time, there are 12 regional centers. They are considered service organizations. They are not a part of the State Department of Education, but a cooperating agency under local/regional control. They are all implementing a common basic package of services in the pupil services area. The centers are organized on an interacting master/satellite concept so that maximum computing power is not necessary at each center. Fig. 1 illustrates this network. The master centers provide the capability for student scheduling and for educational research involving complex mathematical

Fig. 1



models. At the present time eight centers are using Honeywell equipment (H-200 & 2200), three have selected the IBM 360 (Models 40 & 50), and one has an IBM 1401. All programs are written in COBOL.

The primary function of the regional centers is that of providing an integrated package of services which cannot be efficiently maintained or operated in local districts. This package is based upon the concept of a management information system and utilizes the management-by-exception approach. The outputs are categorized by the following four-level reporting system.

a. Regularly scheduled reports
b. Triggered reports
c. Probe reports
d. Planning reports

The regular reports would include a student report card, a monthly attendance roster, a list of test scores, etc. The triggered report would be generated if data exceeded a certain limitation. A copy of such a report is illustrated in Fig. 2. In this instance, a report is issued on all students whose absences exceed three for a given month. The exceeding of this criteria triggers a report which also illustrates the concept of a corporate or total file on a student. In this instance, information relating to the student's absences for the year is illuminated as is relevant information concerning the student's intellectual ability and achievement and current grade point averages. The probing type of report can allow an administrator, counselor, or teacher to dig deeper and obtain more specific information about a student or about a course or about a curriculum. The planning type of report uses historical data and makes comparisons and allows for projections.

In order for data to be especially useful to those who

cific information, it is manipulated and formatted pecifically with the area of concern and authority individual designated to receive it. The typical in the pupil area go to the following:

District Superintendent
District Curriculum Director
District Research Director
.. Building Principals
e. Departmental Chairman
f. School Counselors
g. Teachers

Fig. 3 illustrates the data in a special report prepared for the District Superintendent, while Fig. 4 illustrates the same data prepared specifically for the District Curriculum Specialist.

On the basis of practical administration, regional centers can successfully handle the processing of data originating in three major types of school districts:

1. Small school districts of less than 10,000 enrollment may wish to send original source documents directly to the regional center for processing. These districts typically do not have sufficient volume to warrant the purchase and use of their own data-processing equipment; they can obtain data-processing services for less cost and with greater speed than by manual methods. For such districts a regional center offers a tangible way of meeting their needs.
2. Medium-size school districts of from 10,000 to 30,000 enrollment typically find justification for minimal data-processing equipment. This equipment might allow for punching test scores onto cards, sorting those scores by various groupings or grades, and printing rosters of scores for teachers and counselors. Such districts submit punch-card *data* to the regional centers for specialized computation, tabulation, and distribution and for special reports and analyses.

Fig. 2

Figure 2

IRREGULAR ATTENDANCE ANALYSIS — ALTA MAURE (SCHOOL NAME) — 1212 VALLEYVIEW (SCHOOL ADDRESS) — JUAREZ (COUNSELOR)

STUDENT IDENTIFICATION	ABSENCES THIS MONTH	ABSENCES THIS YEAR	PATTERN M	T	W	T	F	AM	PM	RELATED FACTORS READ	MATH	LANG	CURRENT GPA	NOTES
BERLIN, GLORIA J.	3	14	1	2	1	1	1	4	7	8	8	7	3.15	
MOORE, THOMAS A.	5	20	2	3	4	5	5	5	3	5	3	5	1.99	
NOYES, TANIA R.	3	4	1	2	1	-	-	8	7	7	8	8	3.97	
OLSON, ROGER ---	8	8	2	1	1	1	1	8	5	5	8	5	3.13	
PIMENTAL, JESSE N.	4	12	8	-	-	-	8	4	4	4	4	4	2.80	
WASHINGTON, CARVER B.	14	19	3	3	3	3	3	6	8	8	8	8	3.35	

3. Large districts maintaining a fairly sophisticated computer system have found it desirable to utilize the regional centers for pupil scheduling, linear programming problems, and in the future, to use the complex budget simulator to prepare annual budgets and project future ones.

The planned structure of regional processing procedures and reporting methods has been developed by consensus of school districts participating in the regional system. Uniformity of processing design has resulted in economy, greater speed, and reliability. One of the major responsibilities of the regional center has been to offer coordination and leadership in effective and reliable methods of handling (1) pupil data; (2) business data; (3) payroll data; (4) personnel data, and (5) curriculum materials. Local reports for cumulative records are now being made compatible with the data-processing system utilized in the regional centers, and this is facilitating inter- and intra-district exchange of pupil information.

Further study, supported by a grant from the U. S. Office of Education and carried out by a team of R/D experts in the field of data processing at the Department

Fig. 3

Figure 3

1ST SEMESTER 1965 — ADMINISTRATIVE PLANNING SERIES — SAN MARCOS UNIFIED SCHOOL DISTRICT

CALIFORNIA ACHIEVEMENT BATTERY (TIME PERIOD) — DIAGNOSTIC REPORT: STUDENTS HANDICAPPED IN READING (TEST NAME) — PREPARED FOR: DISTRICT SUPERINTENDENT

GRADE LEVEL	STATUS INDEXES 05-09	1.0-1.9	2.0-2.9	3.0-3.9	4.0+	PERCENTAGES BY GRADE 05-09	1.0-1.9	2.0-2.9	3.0-3.9	4.0+	TOTAL ENROLLMENT BY GRADE
GRADE 1	NOT TESTED										
GRADE 2	NOT TESTED										
GRADE 3	46	23	3	1	0	9.2	4.6	.6	.2	0	500
GRADE 4	NOT TESTED										
GRADE 5	34	30	21	10	0	5.8	5.1	3.5	1.7	0	585
GRADE 6	NOT TESTED										
GRADE 7	NOT TESTED										
GRADE 8	19	17	26	12	3	3.6	4.1	5.2	2.9	.9	415
GRADE 9	NOT TESTED										
GRADE 10	NOT TESTED										
GRADE 11	10	12	6	5	0	2.7	3.3	1.6	1.3	0	365
GRADE 12											
TOTAL NO. OF HANDICAPPED STUDENTS			274			PERCENTAGE OF HANDICAPPED STUDENTS					14.6%
TOTAL BY CATEGORY	105	82	56	28	3						1865

Fig. 4

Figure 4

1ST SEMESTER 1965 — ADMINISTRATIVE PLANNING SERIES — SAN MARCOS UNIFIED SCHOOL DISTRICT

CALIFORNIA ACHIEVEMENT BATTERY (TIME PERIOD) — DIAGNOSTIC REPORT: STUDENTS HANDICAPPED IN READING (TEST NAME) — PREPARED FOR: DIRECTOR OF INSTRUCTION

SCHOOL	GRADE 05-09	STATUS INDEXES 1.0-1.9	2.0-2.9	PLACEMENT 3.0-3.9	4.0+	PERCENTAGES BY GRADE 05-09	1.0-1.9	2.0-2.9	3.0-3.9	4.0+	TOTAL ENROLLMENT BY GRADE
ABRAHAM LINCOLN											
GRADE 3	3	5	1	0	0	10.3	3.4	0	0	0	29
GRADE 5	2	2	1	0	0	6.5	6.5	3.2	0	0	31
WOODROW WILSON											
GRADE 3	2	0	1	1	0	6.5	0	3.2	3.2	0	31
[illegible]	[illegible]										
JAMES MADISON											
GRADE 3	1	2	0	0	0	2.8	5.7	0	0	0	35
[illegible]	[illegible]										
RIO BRAVO J.H.											
[illegible]	[illegible]										
[illegible]											
GRADE 11	6	7	2	2	0	2.3	2.7	.7	.7	0	260
[illegible]											
TOTAL BY CATEGORY	22	18	10	7	1						676

of Education, disclosed that data relating to pupils were only a part of the information needed for educational planning. Also important were uniform business-accounting procedures, information concerning professional personnel, and facts relating to instructional materials and equipment.

The intent of these new systems along with the pupil system is to provide audit and management reports for school districts. In addition, the system will be used to prepare all reports which the district must make to the State Department of Education or to the U. S. Office of Education. At some future date, this reporting system will be replaced with a scheduled transmission of data developed during the regular processing cycle for the school district. The data transmitted will be entered into a systems process at the Department of Education, developing information required for the internal operation of the department. In addition, data to be transmitted to the U. S. Office of Education, satisfying its reporting

requirements, will be developed with this process. To assist in the development of these new systems, the State Department of Education has contracted with Aerojet-General Corp., Sacramento, California, to furnish systems design specialists.

Again with the full cooperation and support of the U. S. Office of Education, California launched, in 1965, a three-year project which has the following objectives:

1. The design and development of a *total* educational information system incorporating as a subsystem the pupil-personnel system developed previously and also new subsystems for business services, personnel/payroll, and instructional materials and equipment.
2. The development of procedures that would facilitate wise and appropriate use of the total educational information system.
3. The demonstration of this system in operational Regional Educational Data-Processing Centers.

The design of the California Total Educational Information System, which is planned as a national system, encompasses several major edp concepts which are innovative in the educational community. An understanding of these concepts is essential to appreciate the magnitude and importance of this system.

Primary among these concepts is the design of a data control system that will determine the rationale of the data inputs, provide for file protection, and not only permit rapid processing of a variety of business and personnel data but also greatly assist in the organization of data into usable information with which district, regional, and state educators and administrators can make decisions. The data control system is the key element in the design of a compatible and integrated computer system for educational business management. It will ensure the compatibility of data irrespective of the size of the school district. It will interrelate and control the input data so that integrated sets of reports at varying levels of detail such as illustrated for the pupil area can be made for the district, county, state, or federal requirements involved in the use of the same data bank.

The primary purpose of the data control is to provide a single point of entry, audit, and control of all input submitted for processing.

Once a transaction has been accepted by data control, all required generation, assignments, controls, and distribution are automatically made. Transactions need only be submitted once for complete processing throughout the business system.

The specific functions of the data control are as follows:

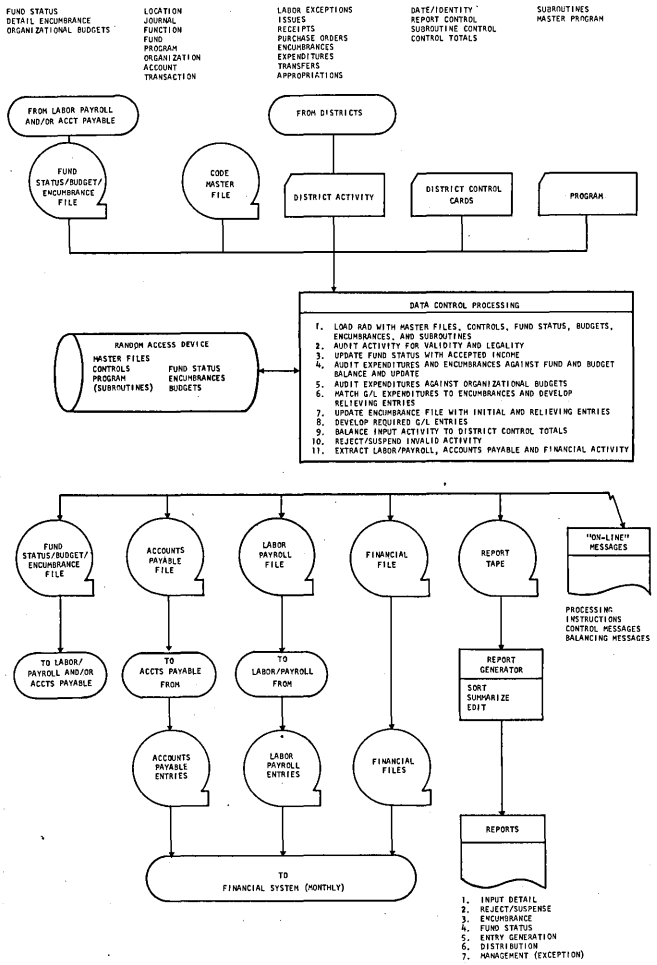
a. Audit input for validity
b. Audit input for legality
c. Audit input against fund status and budgets
d. Develop required encumbrance and general ledger entries for transactions directly entering financial subsystem
e. Update budget, fund, and encumbrance files with current financial activity
f. Balance submitted activity to submitted controls
g. Reject and/or suspend involved activity
h. Distribute required transactions to the labor/payroll, accounts payable, and financial subsystems

In order to provide the flexibility required to meet individual district requirements, various control, audit and processing routines will be developed as closed subroutines. By the submission of a control card, districts can define which of these elements are required to meet their specific needs.

Report generation will also be on a select through the submission of a report control car those reports specifically required by a district generated.

Fig. 5 is a flow chart depicting the processing seq

Fig. 5



input data, mainline logic, and output files contained within the data control subsystem.

In summary, the centralized data control processing concept allows for processing of all input through a single source system, common control routines, common audit routines, assurance that charges will not be accepted by one system and rejected by another, and internal and external control of the distribution of charges.

Another significant systems concept incorporated in the emerging total system is the development of master files of personnel and fiscal data. Rather than design several files of data relevant to a specific reporting or recording requirement, the system being developed considers all of the data concerning an individual in the school district or a financial transaction as a single record.

The key file in the whole system will be the personnel/payroll employee file. All personnel and payroll data will be carried on a single employee data record. All the employee data records for a school district will make efficient computer processing possible. All of the information about an individual will be available from one source, and the grouping of district employees together on the file will facilitate the preparation of district reports.

The social security number will be used to sequence the file, and the file will be maintained in social security number within district within county order. This use of the social security number will keep the school personnel/

payroll system in step with other systems such as the State Teachers' Retirement System, the State Employees' Retirement System, the Internal Revenue Service, and the State Teaching Credentials office. Thus, it is possible to extract automatically such information as credential expiration date, retirement date, earnings, and seniority information for a school employee—all from the same file. In the same way, the financial file will contain all indicative as well as accounting data in one record.

The program budgeting and accounting concept is another innovation of this system that must be understood in appraising the benefits of the whole project. It will permit organization of information so that school officials and the taxpayer can understand and evaluate expenditure proposals, program by program, each with a definite set of goals and objectives. The program accounting and cost reporting features of this system allow evaluation of the status of funding and of the progress in achieving the objectives for the program quite separately from the conventional budgetary controls established for functional groups in the school district.

The expenditure budget generation proposed is based on the premise that the total educational activity within a district is aimed towards the direct or indirect support of a series of educational programs, both regular and special. Therefore, the expenditure budget is primarily developed on a program-by-program basis and by the fiscal requirements necessary for each program to meet the students' educational needs rather than being controlled by expected revenue.

A comparison of estimated revenue and budget expenditures will not be made until an expenditure budget has been developed based on program requirements. Local administration must then determine the corrective action to bring the two entities, income and expenditure, into balance. Where budget expenditures exceed the estimated revenue, reductions to various expenditure items will be necessary. Conversely, where there is an income excess or it is desired to determine the effect of a proposed or expected cost increase, parameters may be submitted on a "plus" basis for the generation of an actual or memo budget.

These parameters may be by program, organization, or line item. They may be specific dollar amounts, per cent, revision to a specific cost item, or a combination of the three. In any event, based on the criteria submitted, the computer will automatically effect the specified cost items and generate a revised budget.

Although the optimum budget originally generated seldom is adopted, primarily due to financial limitations, it does provide a useful management tool. The ability to report necessary reductions within programs or organizations to local administration, school boards, legislative groups, and the taxpayer should prove a sympathetic base for possible additional funding.

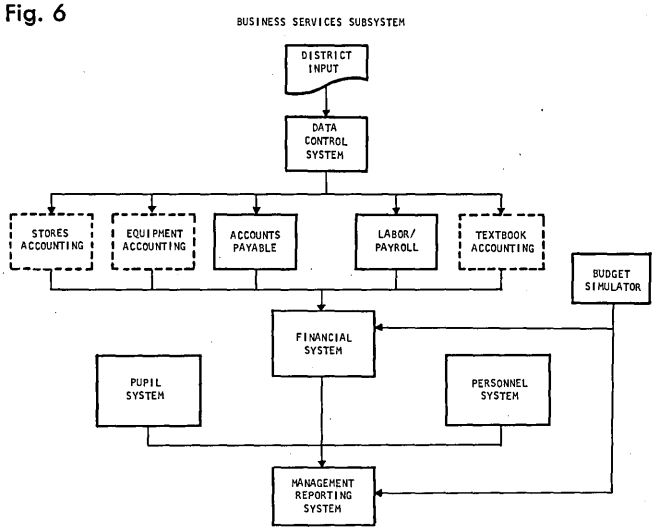
Underlying all of the concepts identified above is the same basic theory of a management information system utilizing exception reporting. Again, the educator employing this technique is not buried in reams of statistical tabulations; instead, he receives reports only of those elements of his programs that fail to meet the acceptance criteria he has established for them. The computer makes the analysis of the actual data from day-to-day operations and triggers an alert to the educator/manager when a condition exists which does not meet his criteria for acceptance.

The total Business Services processing will include the following subsystems:

1. Data Control
2. Inventory Stores Accounting
3. Accounts Payable
4. Labor/Payroll
5. Equipment Accounting
6. Textbook Accounting
7. Financial Accounting
8. Budget Simulator
9. Management Reporting

Fig. 6 shows the Business and Personnel Subsystem. Solid lines indicate those portions of the system that have been designed and the dotted lines indicate areas still to be completed.

Fig. 6



While the total system is designed primarily for use by school districts, the design will include a process to develop a by-product of information and data to be transmitted to the state Department of Education. Such a process is intended to replace the scheduled and unscheduled manual reports now made by local school districts to the department. At the department level, the information and data from each district that are transmitted from the regional centers will be processed through the system in the Department of Education to provide for meeting requirements of departmental organizations and for reporting data to be transmitted to the United States Office of Education.

The information sent on to the U. S. Office includes such data as the total dollars spent on each federally assisted program, the qualifications of teachers involved in such a program, the evaluation of the effectiveness of the program, and most important, in what ways these programs and dollars have benefited the children.

The California experience in automating educational information has already borne tangible benefits. It has immeasurably strengthened the conviction of those who have had a part in it that data-processing systems similar to the type described here can meet—*more* than half way—the urgent needs that the collecting, processing, and maintenance of educational data have posed for much too long a time.

After seven years of intensive study and experimentation, it is clearly evident that any data-processing system, whether district or regional, can run into serious difficulties (1) if the developmental phases of the processing program are not consigned to competent, well-trained personnel and (2) if quick and effective methods of communication between the center's staff and the schools are not established from the outset. It has also been found that the willingness of systems participants to work out mutual problems, to cooperate, to compromise if necessary, to consider the progress of all users rather than the gain of a few—is indispensable to the healthy functioning of a regional data-processing system. ■

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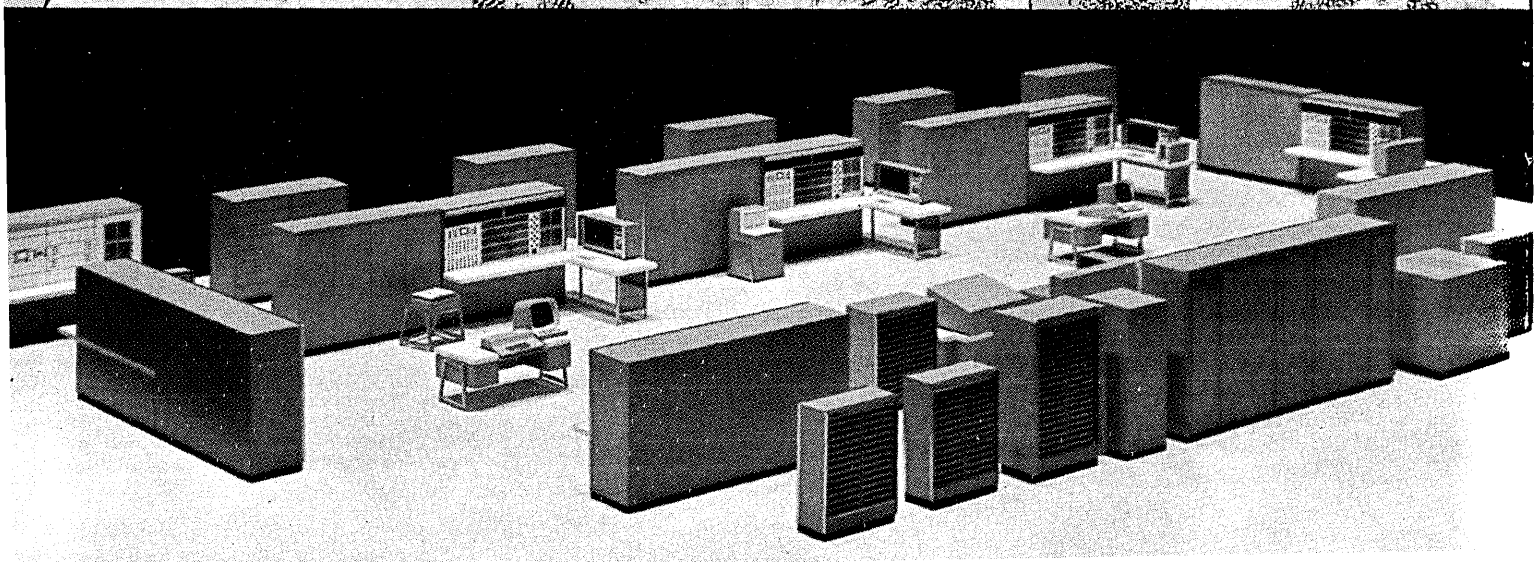

FLUIDIC COMPUTERS

by JOHN H. HUMPHRIES JR.

Fluidics, a tremendously interesting and fascinating subject, represents an entirely new concept in computer technology. For many years fluid power, under manual or electronic control, has provided the "brawn" to perform a variety of useful tasks. However, during the past decade, engineers have developed a new technology whereby fluids are capable of providing the "brains" as well as the "brawn" of a system.

Fluidics is a general term, including both gaseous and liquid substances, having the property of flow and consisting of particles that move freely among themselves so as to give way before the slightest pressure.

The basic principle of this new technology is the "Coanda Effect" and the fact that certain characteristics of fluid flow can be predetermined and thus harnessed to produce useful work. The Coanda Effect, as illustrated in Fig. 1 (*p. 40*) occurs when a jet of fluid is expelled near an inclined flat or curved plate. The jet leaving the orifice entrains (drags away) fluid from its surroundings. The entrained fluid is more easily replaced on the "open" side of the jet than on the side with the inclined plate. The results are threefold: evacuation of fluid near the plate; formation of a vortex or bubble of fluid at low pressure; and the establishment of a transverse (cross) pressure gradient along the fluid flow. The basic concept is to use a low-energy stream of fluid to direct, or control, a high-energy flow of fluid.

Fluidic circuits are highly analogous to electronic circuits. The first level of assembly for the electronic engineer is the consolidation of flip-flop, AND, OR and NOR boxes, and other logical circuitry from active and passive elements, such as resistors, diodes, transistors, cores and capacitors. Fluidic engineers have designed components that perform functions identical to those of their electronic counterparts. Let's examine some of the basic elements that have proven satisfactory in this embryonic venture:

logic elements[1]

A flip-flop is a bi-stable device with two control ports (set and reset), two output ports with predetermined values of 0 and 1, an input power signal port, and a splitter to divide or direct the fluid flow. A typical flip-flop is shown in Fig. 2 (*p. 40*). The relative position of the splitter with respect to the input signal, as well as the length and location of the boundary walls, affects the operational characteristics of the flip-flop.

The operation of a fluidic flip-flop is explained in Fig. 3 (*p. 40*). Assume that the input power signal, in Fig. 3A, has become attached to the left wall of the interaction chamber by a previous signal. As long as a signal is not received from the set input port, the device exhibits a stable 0 output. A low pressure area exists in the vortex or bubble, and ambient pressure along the opposite side of the jet provides the entrained fluid or pressure gradient to hold the jet against the wall.

An input signal at the set control port injects sufficient pressure into the vortex to destroy the low-pressure area and causes the input power flow to be deflected across the interaction chamber as shown in Fig. 3B. The low-pressure area is re-established between the right wall and the fluid flow and is caused to issue from the output port with a value of 1. The flow of fluid remains attached to the right wall by the Coanda Effect, even after the set input signal is terminated. When a signal is received at the reset control port, the flow of fluid is "switched" and caused to issue from the 0 output port as shown in Fig. 3C. Thus, the fluidic flip-flop provides us with a control device and a "memory unit"—it has two stable states and can remember

Major Humphries, of the U.S. Air Force, is engaged in the management of a multi-computer installation for a joint agency of the Defense Dept. Since entering the computer field in '56, he has participated in programming, program management, system analysis, and computer operations. He holds a BS in business administration from Miami Univ., Oxford, Ohio, and is working toward an MS from George Washington Univ.

[1] Hobbs, E. V. "Fluid Amplification Logic Elements," Harry Diamond Laboratories, Report TR-1114 (8 March 1963).

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Keyed to inventory control

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Keyed to meet delivery

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a 1 or 0 for binary logic.[2] Flip-flops can be married to produce stacked memory or storage units.

"And" Logic Element. By definition, an AND logic element must have two input signals in order to generate usable output signal. Fig. 4 is a typical AND unit. It consists of a power input port; control ports A and B representing two input signals; and three output ports, only one of which (output port C) is a usable signal. (In this discussion, the only usable signal is one that has a value of 1).

Fig. 1 Coanda Effect

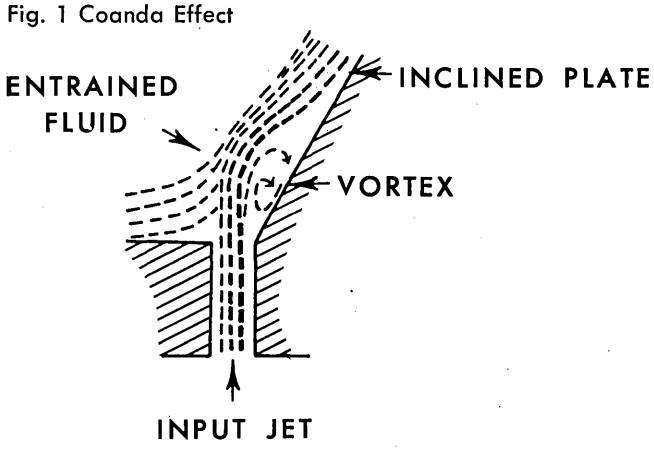


Fig. 2 Bi-Stable Flip Flop

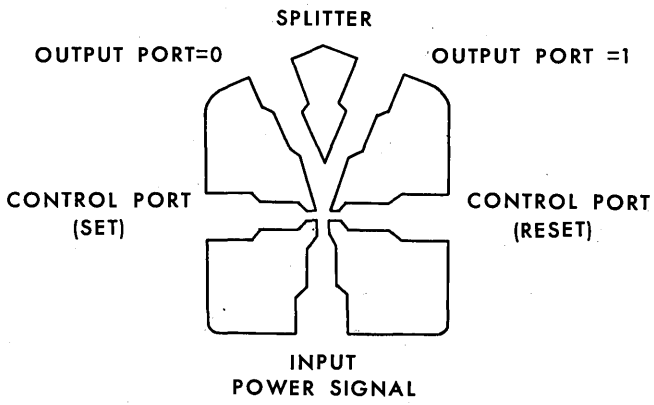
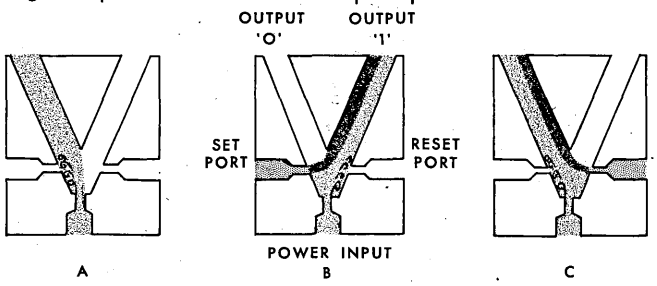


Fig. 3 Operation of a Fluidic Flip Flop



In the neutral position, Fig. 5A, the power flow would attach itself to the upper wall by the Coanda Effect, and the output signal would issue from the A output port with a value of 0. Upon receipt of an A input signal, the fluid flow is switched across the interaction chamber and attached to the opposite wall, Fig. 5B. The power flow is directed past the B input port and issues from the B output port with a value of 0. Should a signal be present at the A and B input ports, Fig. 5C, the fluid flow is deflected across both interaction chambers, attached to the lower wall by the Coanda Effect, and the signal issues from the C output port with a value of 1.

"Nor" Logic Element. The NOR element consists of a power input port; one or more input signal ports (which permits the unit to be used for multiple purposes; i.e., an OR logic element); and two output ports. Fig. 6 is an example of a NOR logic element. A NOR element is one that provides a constant signal (usually for control purposes) until a specific event (the presence of a positive signal at one or more of the input ports) disrupts the normal output signal and causes a controlled action to occur.

Notice the bias designed into this unit. As previously noted, the operational characteristics of fluidic elements are affected by the length and location of the boundary

Fig. 4 "AND" Logic Element

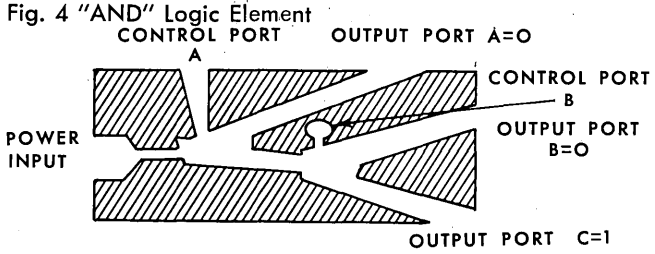


Fig. 5 Operation of the "AND" Logic Element

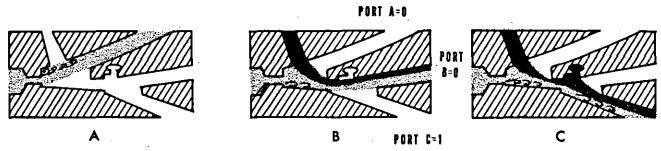
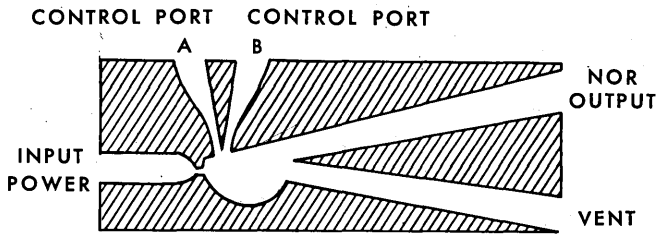


Fig. 6 "NOR" Logic Element



walls. In this case, the lower wall is purposely designed farther away from the nozzle of the input power jet than the upper wall. Consequently, the normal issue from this unit is at the NOR output port with a value of 1. Upon receipt of a signal at the A and/or B input port(s), the issue would be switched to the "vent" output port with a value of 0. However, the flow immediately returns to the NOR output port upon termination of the input signal(s). This is not a bi-stable unit. Fluidic elements have tremendous flexibility; and while designed primarily for a specific function, they can be used for multiple purposes, depending upon their relative position in the circuit. This fact will be demonstrated when a typical half-adder circuit is constructed and discussed later in this article.

Univac recently announced a new four-input, four-output NOR fluidic control device. The gate can perform logic functions or act as a detector. Each element can control up to four similar elements. By using NOR logic techniques, all types of conventional fluidic digital circuits can be assembled.

building a half-adder

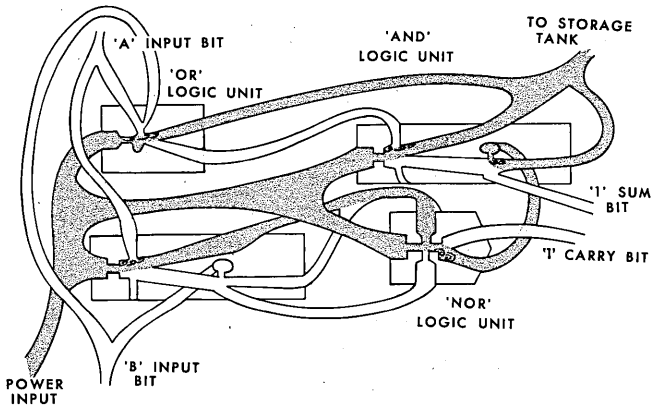
Now that we have discussed the operation of some of the most basic types of fluidic elements available, let us

[2] Wood, Lew O., "Design Guide Pure Fluid Devices," *Machine Design* (24 June 1965) Pages 154-156.

combine these into a typical fluidic half-adder circuit and discover how the arithmetic function can be performed using fluids as the working media.

Fig. 7 is an example of a fluidic half-adder circuit. Notice the flexibility of fluidic elements; a NOR unit is used

Fig. 7 Fluidic Computer, Half Adder Circuit -Neutral Position ("A" INPUT=1, "B" INPUT=0)

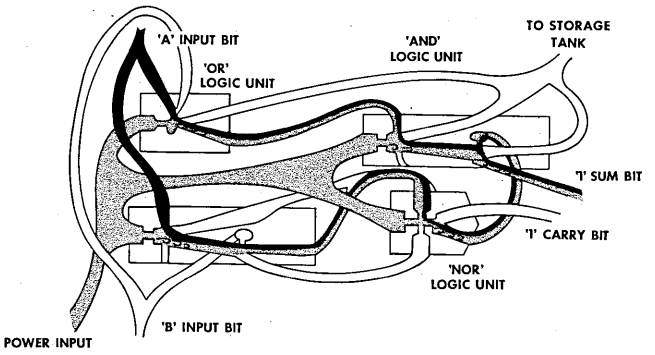


to perform OR logic (upper left unit) and a flip-flop is used to perform NOR logic (lower right unit). The shaded area indicates the primary input power flow through the circuit in the neutral state (absence of an A or B input signal).

Since there are no input signals, fluid flow conforms to the design logic of the individual units, the Coanda Effect and predetermined characteristics of fluid flow. In the neutral state there are no signals at the "sum" or "carry" output ports. This represents the condition where both the A and B input signals are negative or 0.

Fig. 8 reflects the interaction of the fluid flow when the

Fig. 8 Fluidic Compter, Half Adder Circuit ("A" INPUT=1, "B" INPUT=0)



A input signal is positive or equals 1 and the B input signal is negative.

The introduction of an A input signal simultaneously diverts the primary power flow across the interaction chambers of the OR and the AND logic units located on the left side of Fig. 8. Switching of the fluid flow in the OR unit produces an input signal at the A input port of the AND unit located at the upper right corner of Fig. 8. This input signal switches the power flow across the first interaction chamber of the AND unit and directs the flow past the B input port. It should be noted, at this point, that the A input signal has resulted in the fluid flow's being directed past the B input ports of both AND units utilized in the circuit. The absence of a B input signal to the AND unit in the lower left corner permits the flow to pass the B input port without further action, and the issue is directed to the "set" port of the NOR unit. The input signal causes the power flow to be switched across the interaction chamber of the NOR unit and subsequently provides a signal to the B input port of the AND unit located in the upper right corner of the circuit. The B input signal acts upon the fluid flow passing the port and causes the flow to switch across the second interaction chamber, resulting in the issue from the sum port. This example proves that a binary 1 (presence of an A input signal) and a binary 0 (absence of a B input signal) can be processed by a fluidic circuit to produce a 1 sum total and a 0 carry.

The arrangement and connection of the logic units in this simple half-adder circuit are such that the output signals from the AND and NOR units are basically the same when the circuit is in the neutral position, or the A or B input signal is present. One can follow the logic, so far demonstrated, and prove that the presence of both A and B input signals result in a 0 sum total and a 1 carry total.

If a fluidic element is properly designed, two signals can be introduced simultaneously and the larger will control the power flow. This element is used as a comparator. A bias is used on one of the input ports, thus providing a "preferred" output. When a pulse of higher amplitude causes the flow to switch, it only remains in that position as long as the signal is present. As soon as the higher amplitude signal is terminated, the fluid device is switched to the preferred output.

General Electric, IBM-Zurich, Bowles Engineering Corp., Univac Div. of Sperry Rand and the Harry Diamond Laboratories have built shift registers, counters, clocking and timing devices that have been integrated with half and full adders to produce analog and digital computing devices.[3]

To this point, we have discussed a simple type of memory or storage unit, the operation of an arithmetic circuit, and have mentioned that control and timing devices have been built and integrated with a variety of fluidic elements to produce analog and digital computing devices. All that remains to satisfy the definition of a computer system (i.e., input, output, memory, arithmetic/logic and control) is the development of input and output devices. General Electric has developed a coder that accepts punched card or keyboard-generated information and converts it to a pneumatic signal acceptable to fluidic circuits. The Diamond Laboratories have developed a paper tape reader that converts information from punched paper tape into signals that actuate fluidic circuits to subsequently produce typewritten hard copy.[4] They have also developed an interface unit that enables a CalComp plotter to graphically represent the results of computation performed by a fluidic analog computer designed and built in the laboratory.

materials for fabrication

Through the late 1950's the majority of effort devoted to this new technology was confined to the research laboratory. It was recognized that the transition from the laboratory was dependent upon new and inexpensive methods of fabrication. Fabrication of fluidic devices requires processes which lend themselves to complex shapes and reproducibility of close tolerances to insure disciplined fluid flow. Accommodation of a variety of environmental situations anticipated for future applications dictated that a variety of materials be considered. In the past five years, considerable research and development effort has been directed to the use of plastics, metal, glass and ceramics.[5]

DuPont developed a photosensitive plastic called Dycril

[3] NASA Contractor Report, NASA CR-101, "Fluid Amplifiers State of the Art," (October 1964).

[4] Eisenberg, Norman A., "A Pneumatic Tape Reader," Harry Diamond Laboratories Report R-RCA-65-9, (25 June 1965).

[5] Van Tilburg, R. W., "Area Experience in Modern Volume Fabrication of Pure Fluid Devices," *Proceedings of the Fluid Amplification Symposium*, Vol. III, (October 1965).

which is proving very effective. Dycril polymerizes under strong ultraviolet light, but is rather soft when not exposed. By covering the plastic with a master mold or pattern and exposing the sheet of plastic to ultraviolet light, the soft undeveloped area can be washed out with a solution of sodium hydroxide. This process lends itself to modern production methods and results in rather inexpensive elements.

Case Institute of Technology, in cooperation with the Harry Diamond Laboratories, experimented with epoxy castings. A master mold can be made from rubber or metal using high precision engraving machines. Epoxy elements covering a wide range of sizes and shapes have been fabricated. Channels as small as 0.005 inches have been cast. Precision channel casting is extremely important because the fluid flow must be disciplined in order to obtain predicted operational characteristics.

The Corning Glass Works has developed a method of producing fluid elements from Fotoform, a glass that can be made photosensitive. The process is very versatile in terms of the complexity of detail and the variety of sizes that can be fabricated. The method of fabrication involves exposing the sensitive glass to light with a standard photonegative. The exposed portions of the glass are some 20 times more soluble than the unexposed parts and can easily be washed out with a solution of hydrofluoric acid. This process yields elements of superior accuracy, and channels with tolerances as close as 0.001 inches have been obtained.

Corning has also developed a photosensitive ceramic called Fotoceram. Fotoceram is actually the Fotoform glass mentioned above, but put through an additional process to convert it to ceramic.

Injection molding promises to be the cheapest method of producing fluid elements. Just as injection molding can produce a replica of a modern aircraft for $1.50 from a $30,000 mold, replicas of fluid elements can be produced in the same manner.

At the Third Fluid Amplification Symposium, conducted by the Harry Diamond Laboratories, Washington, D. C., on 26 October, 1965, R. E. Bowles, president of Bowles Engineering Corp., discussed the second generation of fluidic systems, made possible by the development of integrated circuits. Development of the integrated circuits was dependent upon the adaptation of modern production methods to fabrication techniques as applied to fluidic circuits.

the pros and cons

In this day of electronic sophistication, one might ask why the effort is being directed into this unknown area. In the best computer room with strict temperature, humidity and dust control, electronic computers give seemingly unending problems. The fluidic computer has many advantages over its electronic counterpart in many respects; such as:

Simplicity. The elements that comprise the building blocks of fluid systems are relatively simple devices containing no moving parts. They consist of blocks of metal, ceramic, glass and various types of plastic material in which well-defined passages or channels are stamped, etched or molded.

Reliability. Fluidic devices have demonstrated an extremely high degree of reliability, far surpassing their electronic counterparts, due to the absence of moving parts. Failures to date have been the result of separation of the laminated sheets used to fabricate the unit, obstruction of the passages due to foreign material in the fluid, and complete or partial failure due to warpage or other physical deformation.

Environmental. Fluidic devices can operate reliably in adverse environments. Reliable operation in severe electromagnetic or corpuscular radiation fields can be achieved with the proper choice of material and fluids. Radiation pulses such as those produced by nuclear detonations or pulse reactors do not cause undesirable responses. The Bendix Corp. has operated fluid digital amplifiers at temperatures up to 1400°F. and observed no degradation of performance characteristics. The minimum and maximum operating temperatures are restrained only by the limitations of the fabrication material and the type of fluid utilized in the system. General Electric has subjected a flip-flop to vibration tests up to 5,000 cycles per second (cps) and acceleration tests of 50 g's with no loss in memory. Pure fluid systems appear to be immune to acceleration and vibration environments. A fluidic missile guidance and control system would be impervious to known jamming and counter-measure techniques.

Cost. Newly developed fabrication methods that lend themselves to modern production techniques promise low costs per item due to simplicity. Low production costs will increase the scope of potential applications.

the drawbacks

While the advantages of fluidic devices, circuits and systems are impressive, one must also look to the disadvantage of this new technology in order to evaluate its potential. The major disadvantages encountered to date are:

Lack of Speed. Fluidic devices are experiencing a rather low response rate compared to their electronic counterparts. Fluidic devices are operating in the range of 2,000 to 3,000 cps with anticipated response rates up to 10,000 cps. Response rates of this magnitude result in millisecond operations as opposed to nanosecond operations in electronic devices.

Design Difficulties. While fluid devices are very simple mechanically, the selection of critical shapes and tolerances is extremely complex. Tolerances of interaction chambers and the orifices are far more critical than originally anticipated. Analytical approaches are not sufficient to fully carry out a design. As a result, most designs are arrived at empirically, using analytical techniques as a guide.

Leakage. Fluid flow must conform to strict discipline, and no leakage can be tolerated in the system. Sealing of the laminated sections of the devices and the interconnections has been one of the major problems in the field to date.

Noise. Fluid transitioning through the system causes a certain amount of "noise" that affects the operational characteristics of the fluidic devices. A fluidic system will consist of an array of devices connected by tubes or pipes containing bends, turns, walls and channels which act as deflectors of noise. Experience has indicated that while response rates can be increased by using higher pressures, the increase in noise and related unpredictable operating characteristics of the devices are not acceptable trade-offs for the increased speed.

In conclusion, it appears that fluidic computers have a definite place in the ever-expanding array of data processing techniques. Industrial leaders foresee rapid expansion in the application of pure fluid systems in the next decade. Forecasts predict an annual market as high as $250 million by 1970. Granted, the low response rate could impose temporary limitations on the scope of potential applications; however, the associated advantage of this new concept dictates serious evaluation for those applications which require high reliability, capability to operate in adverse environments, and in such situations where shock and vibration result in adverse operating characteristics of their electronic counterparts. ■

THE COBOL CONCLUSION

by HOWARD BROMBERG

The COBOL experiment began in May, 1959. According to some, it has ended many times. According to others, it should have ended many times. The fact of the matter, however, is that COBOL has survived and, more important, is currently thriving. The one segment of the computing community that refused to accept reports of its demise is the business data processing user. To him, COBOL offered a singular opportunity for a meaningful and practical means of describing solutions to data processing problems. Criticism of the lack of linguistic elegance, the abundance of syntactical redundancy, semantic verbosity and the like were all subordinate to the single realistic goal of achieving and using a practical tool for the business uses of computers.

Throughout the language's seven-year history, mistakes were made by every segment of the COBOL community. The COBOL Committee was plagued by discontinuity of personnel and, more often than not, by a lack of talent. The CODASYL COBOL Executive Committee manifested, at best, only casual interest in the entire activity. Little control was exercised over the development effort and the degree of guidance normally expected from a group of top-level technical managers was not forthcoming. The computer manufacturers initially were too eager to gain a marketing advantage over the "hungry I" who, in turn, was apparently too busy in an effort to expand the market for its own language to offer the needed early support.

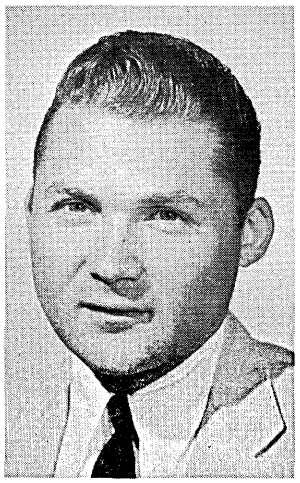
The first translators were horrors for the users. Most of them were preprocessors to an existing assembly system. The second batch of translators eliminated this problem of excessive compile time, but incorporated one of generating inefficient coding and utilizing excessive amounts of memory. Throughout this time, education of the user was totally disregarded. Fancy facts and "gee whiz" figures were foisted upon the community showing, at the same time, the significant dollar savings resulting from the use of COBOL and the huge compiling and executing costs resulting from its use. Finally, the ASA got involved in COBOL standardization. Their normal operating velocity and numerous false starts did little to further the grand COBOL experiment.

Within the last two years, a new category of user has evolved. This user is only passively affected by the third-generation hucksters, unmoved by announcements of universal, problem-oriented languages, and mildly amused by published accounts of conversion fiascoes. I call him "the quiet user." His computer may be a product of any manufacturer. It is used as the means and not the end itself. His data processing organization may be as typical or atypical as imaginable. Large or small, open or closed shop, multiprocessed or not, the quiet users share one common element; namely, the intelligent, sustained use of COBOL.

These are the people who now announce the real end of the COBOL experiment. This conclusion is based upon three necessary conditions; one, it exists; two, it works; and three, it grows. From this point on, there should be no more "why" articles about COBOL . . . now they should all be "how."

My own experiences with COBOL throughout the last seven years have been most everything—educational, rewarding, humorous, pathetic, interesting, distasteful, difficult and unbelievable. It all began with a lovely summer meeting on July 8, 1959, in Gull Lake, Mich., about 12 miles west of Battle Creek. As unlikely as the place was, the meeting notice was equally peculiar with the request to "Bring your shorts and bathing suit." Four months later, we had a first draft of COBOL. I wonder if the occupants of the new General Motors Building in New York City will ever be impressed by the fact that on that site, when it contained the Savoy Plaza Hotel, six tried and true members of the COBOL Short-Range Language Committee spent the first week of November, 1959, in an herculean, round-the-clock effort to produce the first draft COBOL manual. It is sometimes difficult to comprehend the expenditures of hundreds of thousands of man-hours and dollars that have gone into this COBOL effort since the publication of COBOL–60. When one compares the 1959 model automobiles, television sets, computing machines and the dollar volume of the computing industry with their current counterparts, one begins to get the idea. Continuing with this COBOL reverie, I remember the world's first correct, complete COBOL compilation. The date was August 17, 1960, and the machine was the RCA 501. Written across the printer sheets was the comment. "Good output—isn't it beautiful (well almost)." Shortly thereafter, the New York Herald Tribune, the New York Times and others wrote about the first COBOL compiler. The headline for the New York Times article was "Victory is Claimed in Computer Translating Race."

On Dec. 6, 1960, the first live demonstration of COBOL compatibility was held. The two existing COBOL compilers (the RCA 501 and Univac II were used to demonstrate



Mr. Bromberg is vice president, plans and programs, for Information Management Inc. and a contributing editor of DATAMATION. He has been chairman of the USA Standards Institute Working Group on COBOL Standards since its inception, is also chairman of the USASI Working Group on International Programming Languages Activities, and is chief of the U.S. delegation to the International Standards Organization's Technical Committee on Programming Languages Standardization.

the practicability of source language compatibility to the CODASYL Executive Committee. A program, written by an industrial user for the 501, was recompiled on the Univac. Similarly, a COBOL program, written by a government user for the Univac II, was also compiled on the 501. While each program required slight modifications for recompilation, the exercise demonstrated the capability for program exchange that existed within COBOL.

Of all the various happenings during these days, three were special signs of the times. The first was a Business Week article that appeared late in 1961, and recounted the superior achievement of the IBM Corporation. The headline read something like, "Six IBM Trainees Write COBOL for 1410 Computer in Six Weeks"—(and find God). The parenthetical comment is mine. The second was a three-day Army COBOL presentation at the Aberdeen proving grounds in Maryland. During this time, each manufacturer was requested to present a summary of the COBOL activity to various representatives of the Army. Driving onto the base, many interesting signs such as COBOL Building, COBOL Parking Lot, COBOL Visitors and COBOL Lounge were seen. The crowning touch, however, was being signed in by a 15-year veteran Army top sergeant with the most unlikely title of "COBOL NCO". The third event was the voice of Charlie Phillips, who was then the chairman of the

SCHEMATIC OF ASA COBOL FUNCTIONAL PROCESSING MODULES

FUNCTIONAL PROCESSING MODULES								
NUCLEUS	SEQUENTIAL ACCESS	RANDOM ACCESS	RANDOM PROCESSING	SORT	REPORT WRITER	SEGMENTATION	LIBRARY	TABLE HANDLING
HI	HI	HI	HI	HI	HI	HI	HI	HI
		LO		LO	LO	LO	LO	MID
LO	LO							LO
MINIMUM STANDARD		NULL	NULL	NULL	NULL	NULL	NULL	

CODASYL Executive Committee, when he received a white marble tombstone with the letters COBOL chiseled and gold leafed across the front. Subsequently, many other pleasant events have occurred with respect to COBOL, the most enjoyable always being reading about another corporate entity that has jumped on the COBOL bandwagon.

The main purpose of this article is to place the COBOL conclusion in its proper perspective. The conclusion is really synonymous with the achievement of a COBOL standard. I do not intend to offer a critical commentary on the standard. Rather, I will report on the various activities which have led to its development, the structure of the standard itself, and some peripheral areas that will be affected. As someone once said, "This is neither the end nor the beginning, but rather the end of the beginning."

asa activity

The American Standards Association has been involved in the pursuit of standards for various aspects of the computer and information processing industry since 1960. The task group with the specific charge of COBOL standardization is X3.4.4. Organized early in the standards game, this task group has had a surprisingly consistent membership totaling approximately 20 individuals. Initially, it appeared that its membership would be made up of those members disillusioned with the progress of the COBOL Committee and/or those persons afraid of missing out on something. At any rate, the specific goal was clear; and to realize it, four working groups were established. Unlike ALGOL, whose development and standardization were both being accomplished by various international groups, and FORTRAN, for which one ASA group became both the maintenance and standardization authority, COBOL presented a different set of circumstances. On the one hand, development and maintenance were the property of an external organization called the CODASYL COBOL committee.

While domestic standardization was properly within the province of the ASA task group, the following problems remained unsolved: (a) all computer manufacturers were not decisive about their COBOL plans; (b) the language specification itself led to a variety of interpretations; (c) international requirements were yet to be considered; (d) no one knew who the COBOL users really were. On top of these considerations, there was a general feeling among the manufacturers that premature standardization of COBOL would stifle further development of the language and would create obvious marketing problems.

At the same time, the users felt that without sufficient use experience, there was a significant risk of standardizing on incorrect elements of the language. Still another point of view represented the political and marketing implications. At one time, it was feared that the government would insist on a complete implementation of the language, much of which had never been implemented—let alone proved. So the problem was really not what to do, but how to do it.

The first ASA COBOL working group to be established under X3.4.4 had as its goal the production of a survey of all existing COBOL compilers. The idea was to determine exactly which language elements had been implemented in order to help select elements to be included in the standard. Two surveys were attempted. The first reported on the contents of all COBOL compilers prior to Jan. 1, 1965. The second, which was never completed, attempted to report on the later compilers. The initial survey was published in the COBOL Information Bulletin (CIB), and the latter survey was used as a task group internal working document. While the intent of the survey was good, its purpose was defeated by the length of time it took for completion. For some reason, it required an inordinate amount of time for each computer manufacturer to tell the world and his competitors exactly which COBOL elements he was implementing for which machine. Consequently, by the time the final review cycle and sign-off had been completed, the information was no longer of use to the task group involved in the actual selection of COBOL elements for the standard. Some interesting lessons besides the obvious ones were learned from this activity. First, it was learned that surveys are difficult to conduct. Without the proper motivation on both sides, there is little hope of success in such ventures. Second, surveys are difficult to create. Even with the proper cooperation, the language used in survey questions must be sufficiently clear and unambiguous to allow a valid, accurate response. Third, an established, proven technique must be used to evaluate the results of the survey. Too often, responses from survey questions are received and no one knows exactly what to do with them. For example, how much more (or less) weight should one give to a response to a question received from Joe Smith, private consultant, than to a response to the same question received from the manager of a huge, multi-divisional data processing organization?

The problem today is slightly different. Because the selection of language elements that will comprise the stan-

dard has already been made, this task group has turned its survey attentions from the manufacturer to the user. Its current program involves questioning the COBOL user community in an attempt to discover which elements of the language are being used, which elements are required for which applications, what needed facilities do not exist in the language and a host of other relevant considerations. The basis for such an undertaking is the belief that if a language does not change, it will not survive. Consequently this group is attempting to determine the improvements COBOL requires in order for it to maintain a responsiveness to the needs of the data processing community. It is no longer the fact that a language must continually grow as far as volume of elements is concerned. Rather, what is being attempted is to ascertain that the language is satisfactory for its intended environment. If necessary, this effort will involve the elimination of unnecessary and unused features.

The initial problem, in this area, is to locate the COBOL users. After this has been done, the task group will consult with professional survey organizations in an attempt to purchase, if necessary, a survey which will have a high degree of success built into it. At the same time, they will also develop an evaluation technique. Hopefully, the results of the activity will lead to responsible changes both for the next development cycle of COBOL and for the next COBOL standard review.

The second ASA COBOL working group has as its charge a rather controversial goal; namely, the development of techniques to determine how responsive a particular COBOL implementation is to the published standard. When this goal was first established, the group came under heavy fire from those critics who believed that ASA should not be involved in any form of "testing." It was believed that any activity of this type would be misused by certain parties in order to determine how fast a compiler runs, how efficient the object code is, and so forth. This group is, however, not producing a compiler test. What it is doing is offering an individual the opportunity to determine for himself exactly which elements of his manufacturer's COBOL compiler do, in fact, correspond to the published standard specifications. No attempt is made to measure how effectively the particular element has been implemented, how much coding is produced, or in any other way to measure "efficiency." Unlike ALGOL or FORTRAN, there is an attempt in the COBOL standardization area to produce a means whereby one can determine whether a particular implementation is indeed "standard." (Recently, the federal government let a contract to a private organization for the purpose of developing a benchmark test to determine whether particular FORTRAN implementations are indeed entitled to be called ASA Basic FORTRAN or ASA FORTRAN.) The result of this task group's effort is a program entitled "The COBOL Standard Audit Routine." It consists of a set of 18 modular routines, all of which are written in a basic subset of COBOL. The routine generates its own internal data and performs a significant sampling of all COBOL standard elements. Subsequently, it is hoped, this static routine will be augmented so that actual programs for audited elements may be compiled and executed against a set of standard data. In such a manner, we will be able to determine whether a particular implemented feature has been accurately implemented on a given compiler as well as whether there has been a consistent interpretation of the same element across different compilers. A description of the COBOL Standard Audit Routine will be attached to the proposed American COBOL Standard as an appendix.

The third ASA COBOL task group has as its responsibility the publication of the COBOL Information Bulletin. To date, eight such bulletins have been published and disseminated. Approximately 3,000 copies of each issue have been distributed. The CIB has as its purpose the dissemination of timely, accurate information concerning the activities involved in COBOL development, standardization and use. As such, it reports on activities of the various committees involved both domestically and internationally as well as offering a forum for readers concerning their comments about any aspect of COBOL.

The fourth ASA COBOL task group is the one responsible for the actual selection of the language elements which make up the standard. Inputs to this group were the implementation surveys, the activities of the COBOL Committee, and its members' own expert familiarity with the language and its intended uses. To arrive at the present set of selected language elements, the task group developed a set of criteria that were then applied to each element of COBOL, Edition 1965. These criteria enabled a determination as to which elements should not be included in the standard and, for included elements, into which particular module or level they should be placed. These criteria follow:

1. General usefulness of an element or function in terms of:
   a. the degree of implementation shown by the compiler study;
   b. acceptance by users as determined from their responses to CIB's 6 and 7, and the general experience of the committee's members;
   c. the degree to which a function is required as determined by the experience of the committee's members.
2. Functional capability of an element or function, considering redundancy.
3. Processing system capability.
4. Cost of implementation versus advantages of use.
5. Over-all consistency of a defined level.
6. Upward compatibility within a module.

While the foregoing activities were underway, extensive liaison was required both with the CODASYL COBOL Committee and the European Computer Manufacturers' Association's COBOL committee. Fortunately, because of dulication of individual and corporate memberships, this type of liaison was almost automatic. However, in order to assure proper international participation, a COBOL International Advisory Committee was established. Members of this group were recruited from those countries who participate in the COBOL activity of Subcommittee 5 (Common Programming Languages) of the International Standards Organization. Open communication channels are maintained with all liaison activities and a meeting of the International Advisory Committee was held in Geneva in May, 1966.

The result of the ASA COBOL task group's activity is a proposal for a COBOL standard which takes the form of a nucleus in combination with functional processing modules. The accompanying schematic diagram displays the form of the PUSASI COBOL standard.[1]

organization of the standard

The proposed ASA COBOL standard[2] is organized on a functional processing module (FPM) concept. There are nine modules, each concerned with a particular data processing function. Each module itself is divided into two or more levels. In some cases, the least inclusive level of a module is a null set and is excluded from the con-

[1] Recently, the ASA was reorganized into the United States of America Standards Institute. Consequently, all COBOL standards activities are prefixed with USASI. The lower case "p" indicates that this is a proposed standard.

[2] Work done under sponsorship of the National Bureau of Standards, Contract #CST-269.

sideration of a minimum standard. As a detail reference to the elements which make up each level of each module, a copy of the ASA working paper entitled "American Standards Association COBOL Processing Modules" will be part of the standard. A brief general description of the contents and function of each level follows.

nucleus

The Nucleus describes basic language concepts such as character sets, substitution characters, the rules for literal formation, name characteristics, and figurative constants. In addition, the Nucleus includes those elements of the Identification, Environment, Data and Procedure Divisions necessary to perform internal processing. The Nucleus is divided into two levels:

1. The low level Nucleus is a subset which contains elements necessary to perform basic internal processing. The facilities of the low level Nucleus include provisions for program labeling within the Identification Division. Within the Environment Division, the naming of the source and object computers and facilities for declaration of their memory sizes are provided along with the ability to select and use any hardware switches available. In the Data Division, provision is made for the definition of Working Storage items and records, and constants. These definitions include format and characteristic description, and editing requirements. The Procedure Division of the low level Nucleus, in general, provides the simpler options of the basic processing verbs. As an example, ADD, SUBTRACT, MULTIPLY and DIVIDE are provided in their simpler forms, but the COMPUTE verb is not. The low level Nucleus, then, is intended to serve as the core of those compilers which are intended for use on small machines for either peripheral processing or straightforward business data processing functions.
2. The high level Nucleus contains all elements of the low level Nucleus and, in addition, provides more sophisticated and complex facilities for internal processing. These added facilities include additional capabilities in the general language concepts area, the DATA-COMPILED option of the Identification Division, additional facilities for the specification of the object computer, extended level description capabilities in the Data Division, and the more complex options of the internal processing verbs. The high level Nucleus then is intended to form the foundation of compilers of larger scope and provides the full power for internal processing of the ASA COBOL standard.

sequential access

The Sequential Access module contains facilities for the processing of files on such sequential media as punched cards, paper tape, magnetic tape, and printers; and for the processing of sequentially ordered files on direct access devices. The Sequential Access FPM is divided into two levels:

1. The low level of Sequential Access provides facilities for basic serial file processing. These facilities include file definition in the Environment Division, file and data description capabilities in the Data Division and the Procedure Division verbs necessary for the control, reading and writing of these files. The low level of Sequential Access, then, is intended to be

used in conjunction with the low level of the Nucleus in straightforward processing of serially organized files.

2. The high level of Sequential Access includes all elements of the low level and, in addition, provides extended capabilities for the processing of serially ordered files. These capabilities include extensions in the areas of storage allocation and file assignment in the Environment Division. In the Data Division, file organization and labeling extensions are included. In the Procedure Division, the facilities for specification of user designed labels and error procedures are provided in addition to more complex options of the file processing verbs. The high level of the Sequential Access module, then, is intended for use in compilers based on the high level of the Nucleus and provides the full capabilities of the ASA standard in terms of serial file processing.

random access

This module parallels the function of the Sequential Access module except that it is intended for use with randomly ordered files on direct-access devices. In addition to the two functional levels, the Random Access module contains as its lowest level a null set, indicating that these facilities are not a requirement for the implementation of a minimum standard ASA COBOL compiler.

This module consists of a null set and one level. However, if Random Processing is implemented, one of the levels of the Random Access FPM must also be implemented.

Random Processing provides the capabilities necessary for asynchronous processing of randomly accessed records. These capabilites include in the Environment Division the ability to specify a number of asynchronous processing cycles. In the Data Division, the ability to specify Saved Areas to be associated with particular asynchronous processing cycles is provided. Procedure Division provisions include the ability to: (1) start the asynchronous processing cycle within the main flow of a program, (2) control the cycle and, (3) call a temporary halt to asynchronous processing in order to synchronize the processing cycle. Random Processing, then, is intended for use in situations where the hardware and application allow the processing of records in the order in which they are obtained from the I/O device rather than that in which they are sought. (In addition, this capability allows the user to take advantage of available hardware overlap features.)

The Sort FPM provides the user with the ability to insert one or more sorts within a COBOL program. In addition, as part of the Sort capability, the user may specify, in COBOL, first and last pass own-coding. The Sort FPM is divided into two levels and a null set.

1. The low level provides the ability to specify a single sort as a COBOL program. In addition, the programmer may include, in the form of input and output procedures, first and last pass own-coding for this sort.
2. The high level, in addition to supplying the facilities of the low level, permits specification of more than one sort per program and allows the specification of separate processing before and after each sort.

The Sort, then, is designed to provide flexible and logical integration of the sorting function into COBOL source programs.

The Report Writer provides a means, without the use of procedure statements, for the specification and formatting of output reports. This capability includes page formatting, derivation of fields, summarization, and propagation of various levels of totals. The Report Writer is divided into two levels and a null set.

1. The low level provides the facilities necessary for page formatting. These facilities include definition of over-all reports, report groups, and page limits as well as the verbs necessary to semi-automatically produce these reports.
2. The high level, in addition to the low level facilities, provides various controls for reporting. These controls comprise the difference between the page formatting function of the low level of the Report Writer and the controlling of an entire report provided by the high level. In addition, the high level provides the Declarative statement: USE BEFORE REPORTING.

The Report Writer FPM, then, is intended to satisfy user requirements in the production of output reports. Its low level represents a simple page formatter and its high level provides the more sophisticated control functions required for the production of complete printed reports. Furthermore, it removes from the user the burden of keeping track of and programming the clerical procedures associated with the production of complete reports.

Segmentation provides the ability to overlay portions of an object program at execution time. Segmentation is divided into two levels and a null set.

1. The low level of segmentation provides for the assignment of priority numbers including fixed and non-fixed memory ranges.
2. The high level of Segmentation includes the capabilities of the low level, plus the ability to assign segment limits through the OBJECT-COMPUTER paragraph of the Environment Division.

Segmentation, then, provides for the automatic overlay of portions of the Procedure Division at object time.

The COBOL Library provides for the compile time inclusion of previously described portions of the Environment, Data and Procedure Divisions. The Library is divided into two levels and a null set.

1. The low level of the Library provides the COPY statement, which allows the user to include elements in his source program at compile time.
2. The high level of the Library adds to the capabilities of the low level the REPLACING option. This option allows the user, while including portions of his program from the library, to make modifications in terms of identifiers.

The library, then, provides the capability of pre-defining procedures and data sets and of including them in COBOL programs with necessary modifications.

table handling

Table Handling provides the capabilities necessary for the definition, maintenance and use of internal tables or arrays. The Table Handling FPM is divided into three levels:

1. Low level Table Handling provides for the definition of fixed tables, the specification and use of one level of subscripting or indexing and, in the Procedure Division, the manipulation of indices.
2. The mid-level of Table Handling adds to the capabilities of the low level two more levels of subscripting and indexing as well as additional indexing options. In the Procedure Division, it expands the capabilities of the SET verb.
3. The high level of Table Handling expands the capabilities provided by the low and mid-levels to include the full facilities of COBOL. In particular, the SEARCH verb is available in the high level.

Table Handling, then, is intended to facilitate the defini-

tion, maintenance and accessing of internal tables. Two distinct means for referring to items in tables are provided in subscripting and indexing. In the high level, automatic table searching can be accomplished. The Table Handling facility is a necessary part of almost any COBOL application and, as a result, is a requirement for any ASA standard compiler.

It should be noted that, of the nine functional processing modules, three are required for the minimum ASA standard compiler. These are the low level of the Nucleus, the low level of Sequential Access, and the low level of Table Handling. It is felt that these functions represent the classic requirements of internal processing, access to sequentially ordered files, and the use of internal tables.

final approval steps

To expedite the work of the USASI COBOL Task Group, the National Bureau of Standards prepared a document based on the task group's work. This document is intended to become the proposed USASI COBOL standard. The document is divided into three major sections. The first is the Introduction, which includes a discussion on how to use the standard, the structure of the standard, and various listings showing the elements of COBOL-65 and their disposition with respect to the standard. The second section specifies the COBOL elements contained in the standard. This section includes a chapter on each functional processing module and the Nucleus showing the full specification of each language element within each module. The third section is the Appendix, which includes histories of ASA and CODASYL activity, the organization of and justification for the standard, and a description of the COBOL Standard Audit Routine. This document was completed in December of 1966. It will undergo a number of technical review cycles within the various USASI COBOL groups. It is anticipated that the reviews will be completed and the document accepted as a proposed standard sometime early in 1967. At that time, consideration will be given to the approval of the PUSASI COBOL document as an ISO Recommendation. The COBOL specifications can then be submitted to TC 97 (the international counterpart to USASI X3.4) and sent out for mail ballot for approval as an ISO standard.

Regardless of the international implications, it appears likely that the PUSASI COBOL standard will become an official U.S. standard in the very near future. The important consideration is not when the specifications become an official standard, but what they reflect.

The initial work has been carried to its proper conclusion. It is now up to the members of the data processing community to use the standard, to comment on its effectiveness, and to participate in its further evolution. Out of the uncertainty, out of the politics, out of the nit-picking and competitive position jockeying, a reasonable COBOL specification has evolved. In the next few years, as we learn from our experiences with the standard, as our use of the new equipment becomes secure, as PL/I is given the opportunity to mature, and as new facilities are necessarily added to COBOL, there will, no doubt, be the opportunity for writing the next chapter in the COBOL conclusion. ■

MULTIPROGRAMMING SOFTWARE, HARDWARE FROM HONEYWELL

An extensive line of products for its Series 200 family of computers has been announced by Honeywell EDP, Wellesley Hills, Mass. Included are an operating system, multiprogramming hardware, an audio response system, and disc files.

The extended Mod 2 operating system, for direct-access processing, is multiprogramming software that features memory protection. It allows both foreground and background jobs to run concurrently—the former, initiated by communications interrupts, getting the higher priority. The processing components of the operating system include the DOD COBOL 65 compiler and ASA FORTRAN. The full extended Mod 2 requires an 81K computer.

For the H-1200, 2200, and 4200, Honeywell has come up with hardware additions, capable of being installed in the field, to facilitate multiprogramming. It includes memory protection (memory is divided into protected and unprotected areas) with program-settable upper and lower boundaries; memory address relocation; interrupt masking, to prevent interruption of high-priority communications programs; and an instruction timeout, which halts processing of lengthy instructions when a high-priority interrupt occurs. Also included is the ability to transfer both 8-bit and 6-bit characters between the cpu and peripherals.

Operating with remote Touch-Tone telephones is an audio response system that provides 31, 63, or 189 vocabulary elements (an element can be a tone, word, or phrase).

Also announced are replaceable disc pack and fixed-disc file systems. The disc packs each have six discs, can be attached to either of two drives that vary in their recording densities. Thus, the capacities per pack are 4.6 and 9.2 million characters. In any configuration, the maximum and average access times are 165 and 82.5 msec, respectively, and the data transfer rate is 208,333 cps. Up to eight drives can be linked to one control unit, which means the maximum on-line storage is 36.7 and 73.3 million characters per control. Both controls can handle 6-bit characters, but one can also read and write an 8-bit character.

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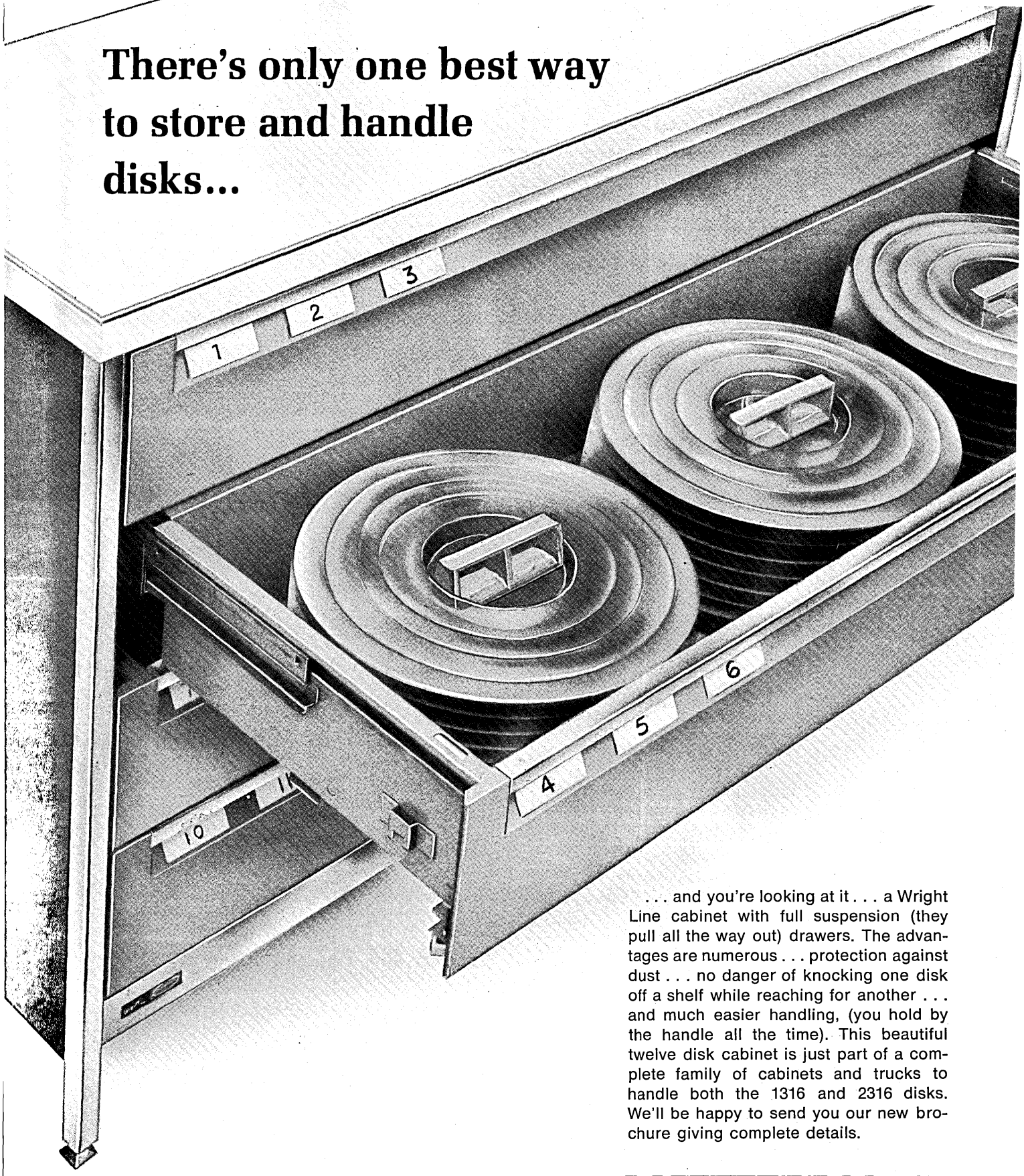

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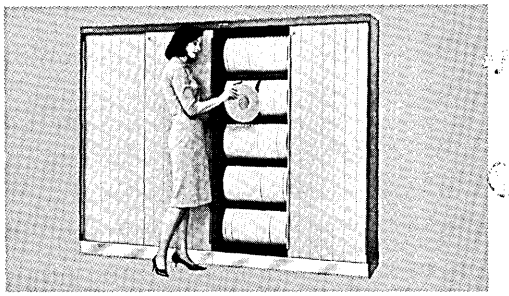

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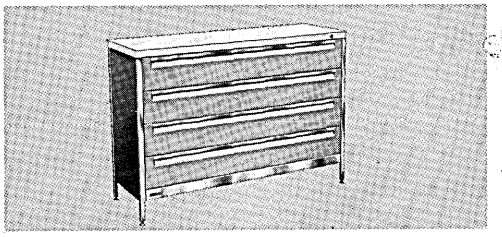

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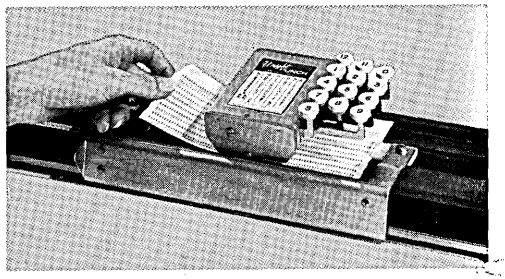

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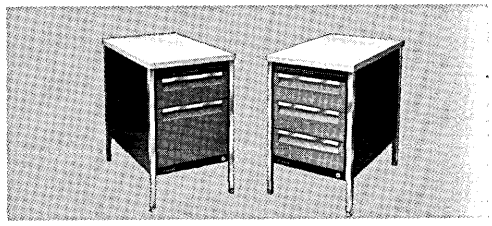

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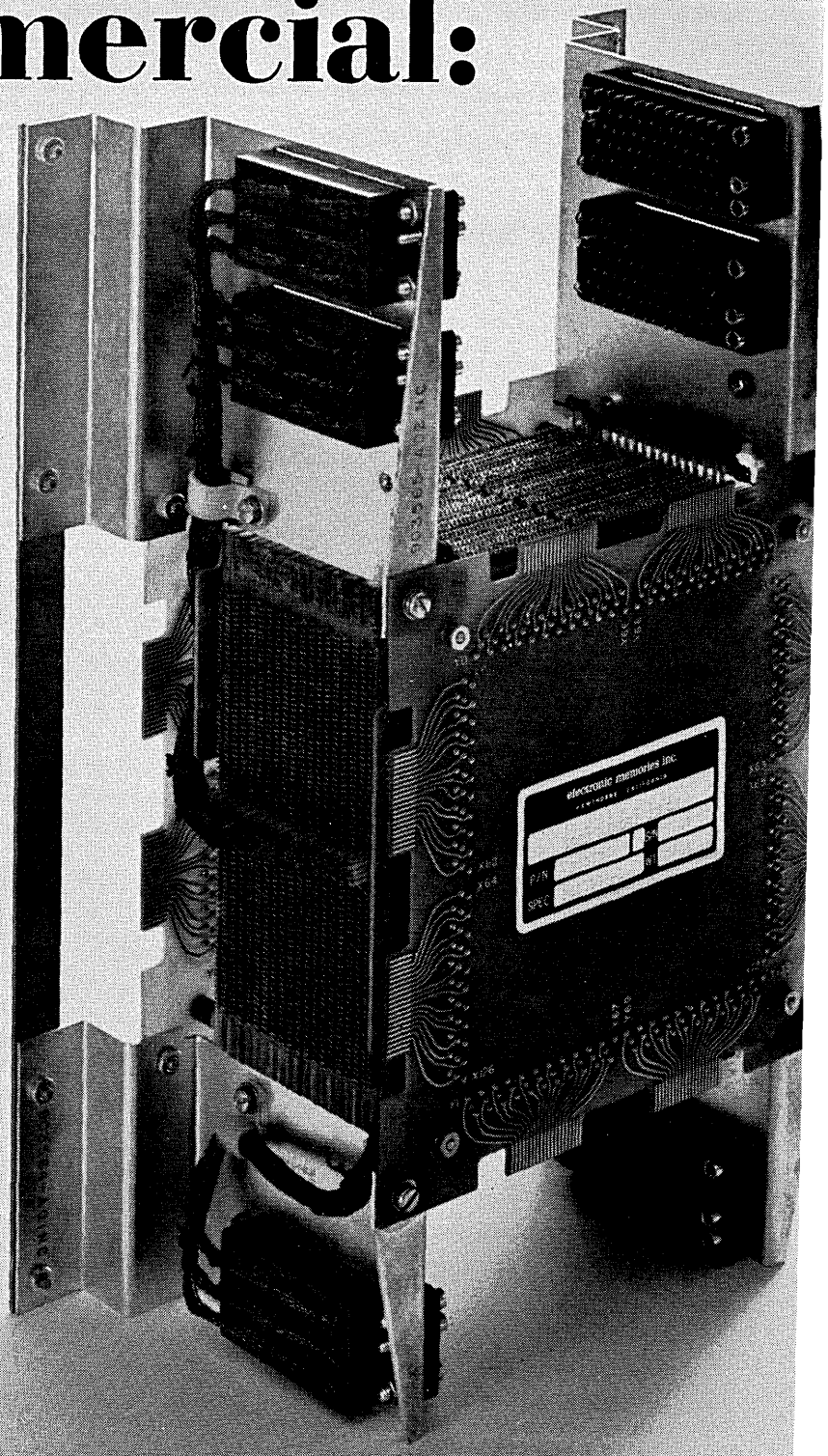

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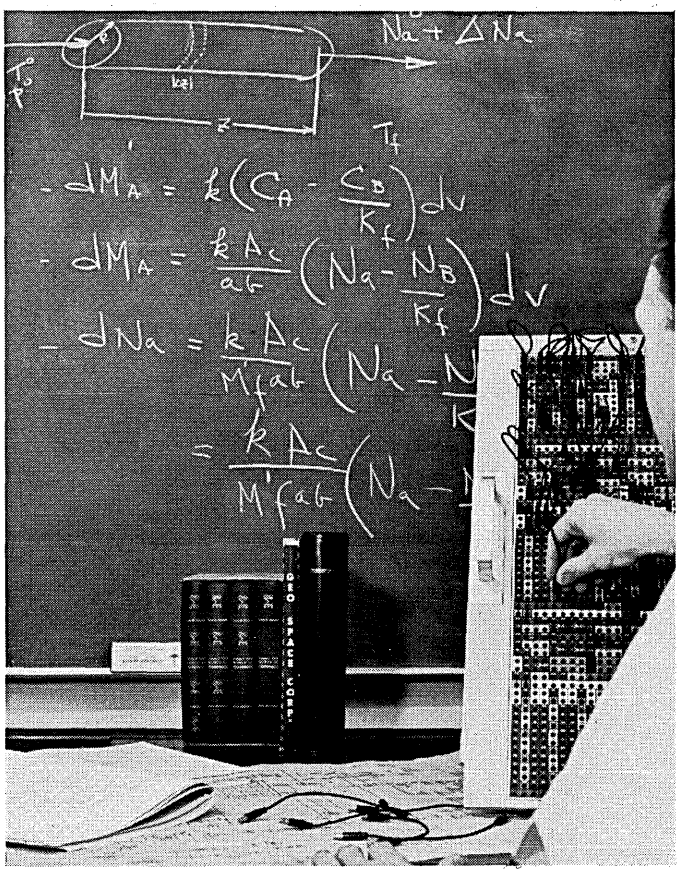

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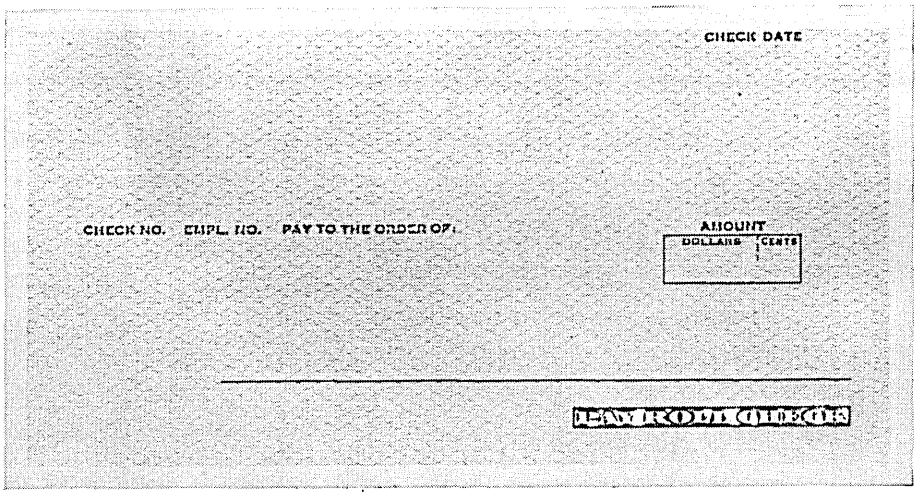

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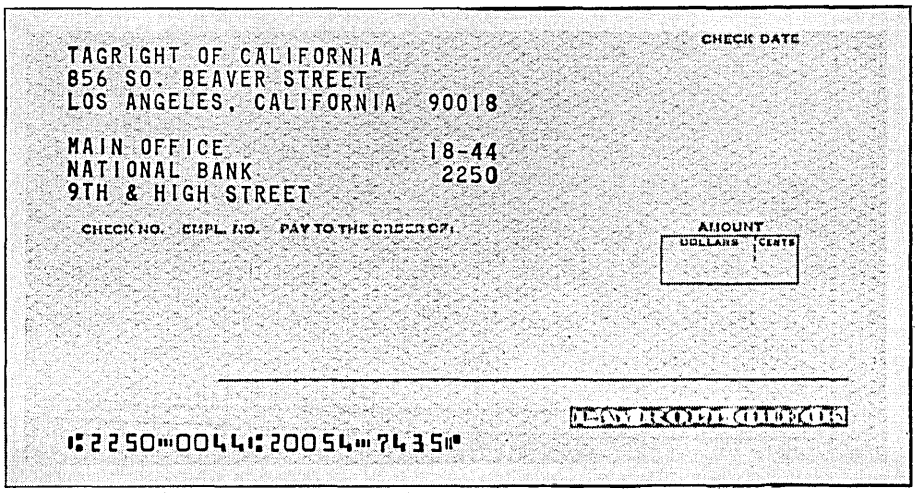

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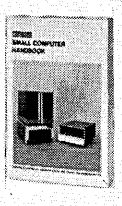

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CIRCLE 28 ON READER CARD

THE UNPREDICTABLE COMPUTER

by FRED GRUENBERGER

The use of computer systems and data banks to monitor the activities of things and people is rapidly increasing. At present, a few hospitals have computer information systems, the major airlines have computer reservation systems (combined airline-hotel-auto reservation systems are in the offing), and one city has computerized its real estate and traffic data. These large systems will soon proliferate and affect everyone. Discussions of their effects, particularly when errors occur, are increasingly frequent in the public press.

Out of the millions who are thinking or writing about the effects of computer monitoring of our affairs, perhaps a half-million or so understand stored program computing —its power, its limitations, its implications, and its mechanisms. This half-million has used computers, either casually or professionally; and even among these people, there is a wide range of understanding. The remaining millions lack the necessary computer knowledge to attack the problem adequately.

Ideally, perhaps, computer people should try to educate the others. Since that may not be feasible, at least we should insure that computer people themselves understand the implications of a complex computer program.

Two extreme opinions emerge from the large group:

1. The Overwhelmed View says, "These machines can do anything. Already they're setting type, designing clothes, cutting off electric power, and putting people out of jobs. There's no end in sight—the computers are taking over."

2. The Relaxed View—very much in the minority—says, "Computers do only what they're told. Human fingers are always poised over the HALT button. Man is in complete control."

Unfortunately, both ideas are about equally correct and incorrect, simply because they are uninformed views.

demonstration problem

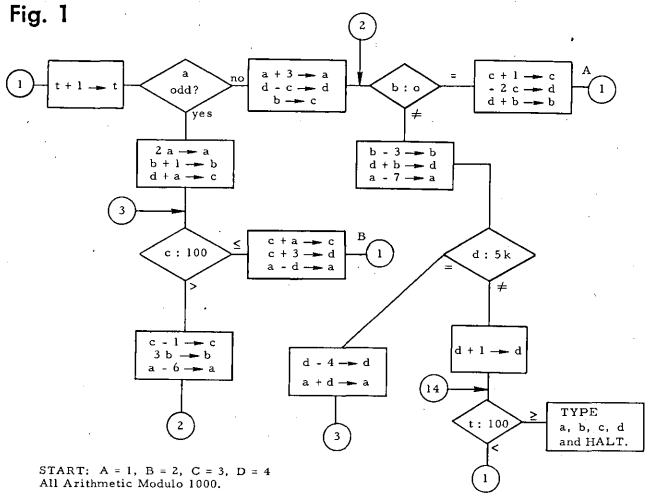
Computers *do* behave exactly as they are programmed to behave. However, such behavior is usually unpredictable. That seems like a paradox, but it is easily demonstrated in a trivial situation: take four numbers and call them *a, b, c,* and *d;* let them have initial values of 1, 2, 3, and 4, respectively. Let them vary according to the flowchart in Fig. 1.

The arrow means "replaces." Thus, the statement "$c + a = a$" means that the sum of the current values of c and a is to replace the value of a. The colon is used for comparison; i.e. "b:0" means that the value of b is compared to zero. And the notation "d:5k" asks if d is a multiple of 5. The traffic pattern is left-to-right and top-to-bottom except where directed by the small circled numbers; thus, at the right end of the top stream, one is directed to the left end. A counter, t, records each passage through reference 1. At reference 14, the counter is checked for the value 100. What will be the values of the four variables at that time?

The computer lets us play out the consequences of our plan so that the question posed above has an answer. The logic indicated in Fig. 1 is meaningless, and simply designed to be as complex as possible in a short space. *An unaided human cannot foresee the consequences of such logic.**

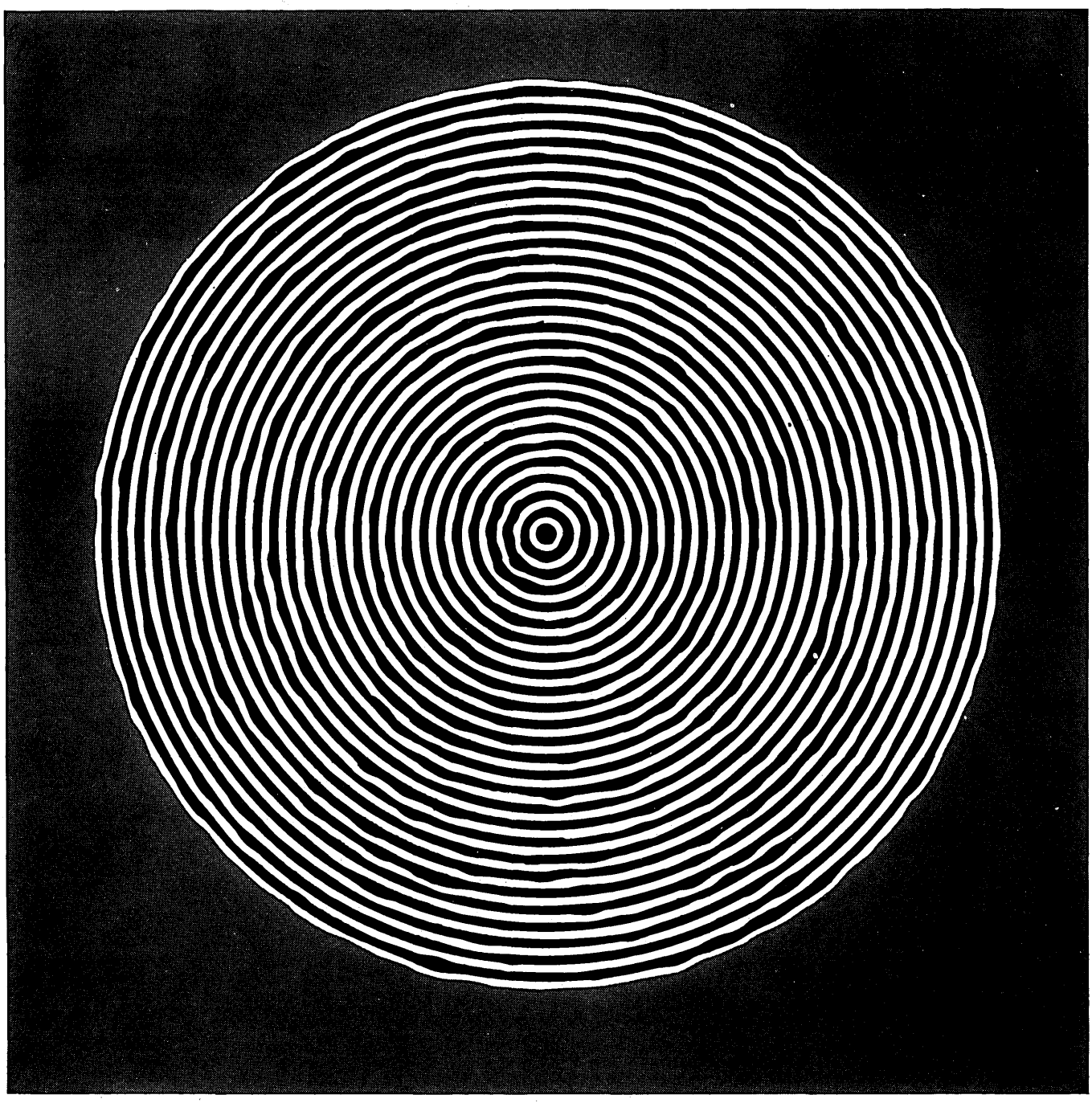
What is more pertinent yet, a human cannot even know if the logic he has programmed is fully and completely the logic of his problem, or even if it is consistent. Every professional programmer has had the experience of having an old program (which was supposedly debugged, tested, and in production for weeks or months) suddenly collapse when some unforeseen condition arose. This phenomenon could result from sloppy or careless work, of course, but it also happens to those who are not sloppy or careless. They simply cannot predict the logical decision paths that they themselves have programmed. And this point, it seems to me, is never stressed or demonstrated. (To make this point more vivid, examine Fig. 1 again. If the reference at A is changed to three and the reference at B is changed to two, how much confidence would

Fig. 1

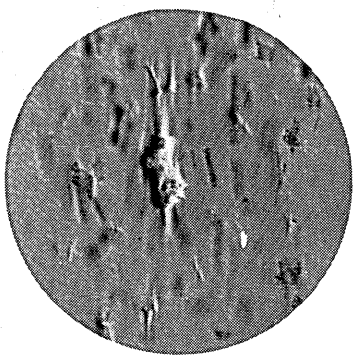


*Of course, someone with tremendous patience could, indeed, "play like a computer" and figure out the results, which are these: -388, -289, -286, -470. But the point is not thus vitiated; the 100 can be replaced by 1000; the decisions made can be doubled, and doubled again. A point is soon reached where the italicized statement must be true.

A member of the senior staff at Informatics, Inc., specializing in on-line systems, Mr. Gruenberger is a well-known writer and film producer in the computing field. He holds an M.S. in mathematics from the Univ. of Wisconsin.



Just a few micro-inches can rough-up a magnetic tape.



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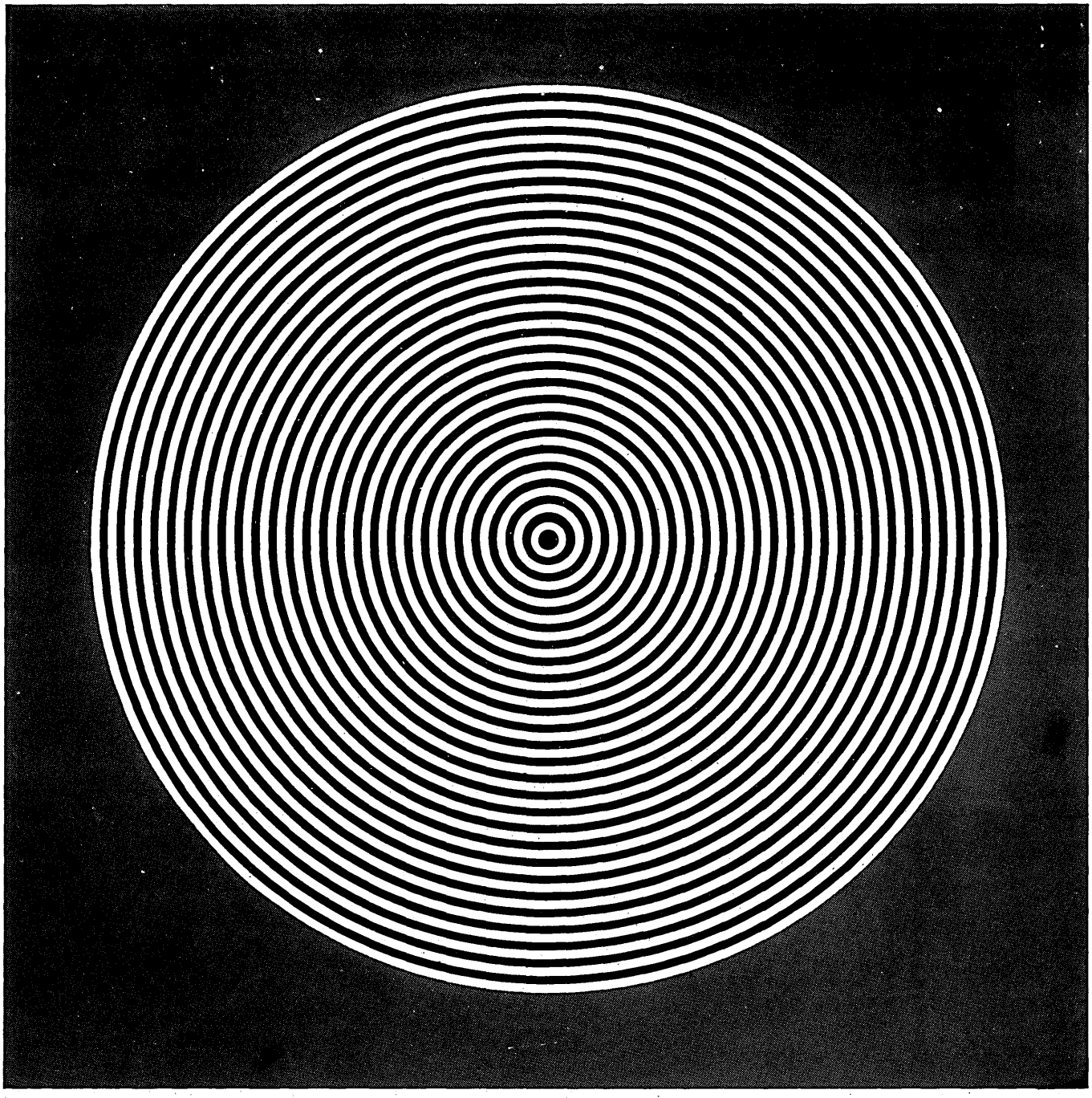

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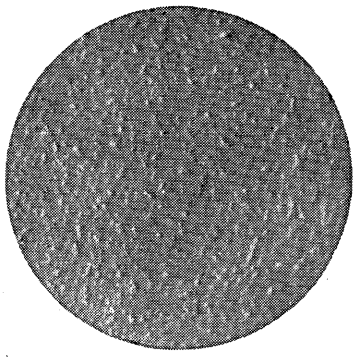

CELANAR LOW PROFILE FILM. NOTICE THE FAR GREATER SMOOTHNESS, ABSENCE OF SURFACE IRREGULARITIES. (UNRETOUCHED 400X PHOTO-MICROGRAPH.)

unusual flexibility. Durability. Tensile strength. And scratch resistance. Just about everything you could want in a tape material.

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CIRCLE 29 ON READER CARD

you have that the counter at reference 14 ever *would* get to 100?)

The programmer, then, is seldom sure of the consequences of what he has programmed. Perhaps in time, for any given program, he could increase his knowledge of the consequences, but his supervisors can't wait. The program must be committed to production. Fortunately, most computer programs work satisfactorily; i.e., they produce no undesirable results. (This discussion assumes that the data processing mechanisms are mechanically and electronically perfect; that is, they carry out faithfully the instructions given them. If machine failure can be postulated, the situation might be just so much worse.)

Suppose that each decision box (e.g., "Is *a* odd or even?") has only two alternatives (in real life, these can have many alternatives). A set of 20 such decisions involve a million possible paths. To be sure, each individual decision can be tested independently, by forcing the data both ways and observing that the correct path at that point is followed, but this would not investigate the interaction of all the decisions. In real life a computer program can contain hundreds or thousands of such decisions.

This situation is complicated by three additional factors:

1. In present-day computer use, a mathematical model is often constructed by one person or team but programmed by another. Through imperfect communication between these people, the program may model something different from the initiator's intention.

2. Particularly in the large time-sharing systems of the future, programs will frequently be used indirectly. Thus, a library program for a stock situation may call on another program, which may call on another program, and so on.

3. Computer programs may call on each other in another way: e.g., an information processing network created for police work may call on a network set-up to deal with public health information, and both may need access to a network of credit information.

checking the system

We should expect surprises, then, as the increased use of computers leads to ever more complex paths of programmed logic. Strange consequences are inevitable.

What should computer people do about all of this? First, we must be prepared to explain the mistakes. If unpredictable computer programs produce serious consequences, the reaction of the public will be at the expense of computer people and the computers. Sober voices of knowledge and experience will be needed.

But we could also do something more positive. For example, in the cryptographic business, two teams are always at work: one to create a better, tighter system, and another to break it down. We need the philosophy of that second team, to deliberately probe for the weaknesses in our information processing schemes. We could try, for example, to find conditions that would over-load the air traffic control system. We could have a team approach a hospital data processing system from the point of view of a drug addict, a murderer, or simply a petty thief. We can't assume that any network is secure, particularly if it utilizes telephone lines. It would be better if data processing experts tried to compromise such systems before the amateurs show the way. ■

COMPUTERS AND COMMUNICATIONS SYMPOSIUM

workshop report

Designers and users of computer hardware, software and communication systems gathered on Jan. 19 at the Miramar Hotel, Santa Monica, Calif., to discuss common problems and, hopefully, solutions. The IEEE Symposium on Computers and Communications attracted over 565 attendees from all over the nation for its one-day symposium. The nub of the conference was, where do we seem to be heading, how are we constrained, what impact will advances in each field have on the other, and where should we be going? It was the first large confrontation between the data processing and communication fraternities and, though sparks flew, a transfer of understandings, estimates, demands, rationales and prophecies was accomplished.

The symposium was basically a workshop conference, with morning speakers setting the stage for common language and points of reference. The afternoon workshops were followed by a reportorial session for all attendees in which the proceedings of those workshops were summarized. An evening panel discussion created an even participation between panelists and audience.

The general chairman and first morning speaker, Irving Cohen (Informatics), expressed concern that events were overtaking the loose coordination between computer and communication system designers. Harvey McMains (AT&T) underlined the lack of good requirements definition—and the problems in educating managers to the pros and cons—of on-line systems. J. C. R. Licklider (IBM/MIT) discussed an educational network involving computers, highlighting its system requirements. Paul Byrns (Univac) discussed fourth generation time-sharing systems and their necessary communications. Ken Iler (GT&E) traced the development of communications and the impact of digital communications on current plant design.

The workshops were on broadband techniques (D. Ashford, Lenkurt), trends in message and circuit switching (W. Keister, B.T.L.), commercial time-sharing systems (J. Babcock, Allen-Babcock Computing), models for time-shared processing (L. Kleinrock, UCLA), system architecture for the communications environment (G. Amdahl, IBM), economic factors for network planning (R. L. Francisco, Western Union), social effects of computer networks (M. Adelson, SDC), and console design (D. C. Engelbart, Stanford Research). The software aspects loomed important in many of the workshops. The panelists or speakers in each workshop were balanced between computer and communications types and by advocates for on-line distributed system users.

The workshop reporters presented many critical aspects of computer-communication systems which the morning speakers did not cover. Some results were inconclusive, but many good approaches were suggested. Data processing types suggested more conducive communications services and tariffs, changing by the bit and length of path, the increased freedom to use non-utility equipment on utility lines, more efficient services from public-switched services, and lower cost terminals which would facilitate user operation. Communication types expounded on the problems of using voice lines for digital transmission (better modems and interface), the economics of modification of large plant investment (soon to be inherited by the data processors), and the means for attaining high reliabilities in transmission and switching (by digital systems, the reliability of which should be the envy of the computer industry).

Unfortunately, little justice can be done here to the variety of excellent ideas and arguments presented. Of special interest for computer network development, in the architecture workshop, were two planned experiments using currently operational computers. Mel Pirtle (UC-Berkeley) discussed a network of SDS 940 users, including machines at Berkeley, SRI, and Bolt Beranek and Newman. Jim Forgie (MIT) discussed a network to operate between Washington (PDP-8), SDC (Q-32) and MIT (TX-2). Goals are to get at programs and files not locally available. The latter mixed system is attempting to build translators for programs and at this time considers the overhead worth it. The console workshop conceded that typewriter input and hard copy will be with us for a long time, but that the best bet for low cost, adaptable terminals lay in the area of the direct view storage tube. The broadband workshop's consensus seemed to favor the coaxial cable/wideband amplifier ap-

SYMPOSIUM . . .

proach until state-of-the-art advances in other areas appear. The models workshop explored theories and experiments in queue management, but, interestingly, found that sometimes the user could beat the system or defeat himself with respect to costs and priorities. The social effects workshop found that the integrity and privacy of data banks seemed less a technical feasibility matter than a quid-pro-quo between cost and accommodation to social ethics and and business needs.

Because of the rapid growth in computer systems (10X by 1975) and communications plants (2X by 1975), their marriage, as R. L. Francisco put it in the economic factors workshop, will take extensive planning and give and take. But he emphasized that a low-cost, public message switching system for the smaller system user was a necessity. R. Hill (Informatics) indicated the cost trade-offs would determine the use of special purpose versus g.p. software systems. In the switching workshop, trends toward a complete processing/communication service were seen with communicators increasingly becoming data processors, and vice-versa. The commercial time-sharing systems workshop explored economic methods of operation, worried over file security and the need for standardizing communications interface. L. Hittle (GE) discussed the economics of sharing bulk storage, a major factor in cost.

The evening panel, moderated by Dr. Licklider, consisted of the workshop leaders, aided by Dick Mills (MIT) and Paul Davies (consultant and program chairman). The topic was "The Information Network Concept"—into what it should evolve and the ways of fostering and regulating it. The FCC inquiry into computers and communications was noted favorably for its insight and intent.

The purview of the symposium was so broad that a comprehensive treatment of relevant topics was not possible. It was apparent that the diversity of system types—remote data banks, processing utilities, integrated transportation control systems, etc.—which will react with both public and private communication systems, will result in many new system requirements. These will be in the areas of more efficient switching, better interfaces between systems using different languages and file structures, and, perhaps most significantly, better software and hardware at lower cost for man-machine communications.

—IRVING COHEN

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If you write Digitek on your company letterhead requesting the name of the organizations mentioned above, we will not tell you. We will, however, send you a rather novel brochure delineating Digitek's completely unique method of building compilers. In a plain brown wrapper.

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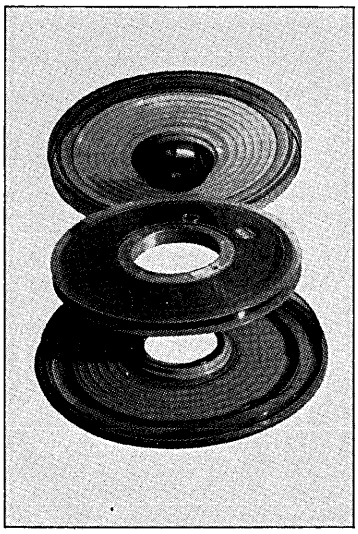
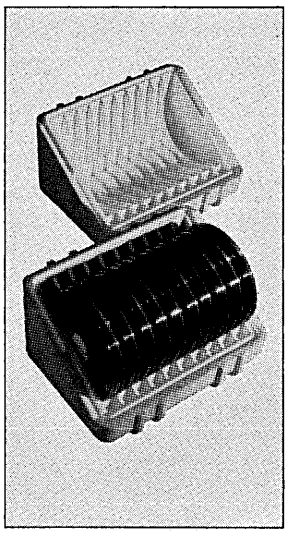
CIRCLE 41 ON READER CARD

Ampex makes computer tape

come clean and comfortable.





Ever since we started making magnetic tape, we have worked hard to make it as clean as possible. First we developed an inherently clean coating for it. Then we began giving it a super cleaning before and after certification. Now two packaging innovations will make certain you get it clean and comfortable and keep it that way.

1) **A new canister:**
Our exclusive new design eliminates all the problems you may have had with canisters before. It has an all-plastic positive locking mechanism that cannot introduce contamination.

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Probably the best idea the industry saw last year, we modestly admit, was our new TAPE-SAFE Environmental Shipper. Made of expanded-bead polystyrene, this shipping container individually supports and separates up to ten tape canisters. Guards them against shock, vibration, temperature and humidity variations. Won't contaminate your computer area. And these unique reusable boxes are standard with your minimum order of Ampex tape for IBM and IBM-compatible computers.

What it comes down to is this: *We're not simply selling you tape. We are providing you with unparalleled data reliability even after hundreds of thousands of equipment passes.*

If you would like a free copy of our new technical booklet, "The Care and Storage of Computer Tape," just write us at 401 Broadway, Redwood City, California 94063.

AMPEX

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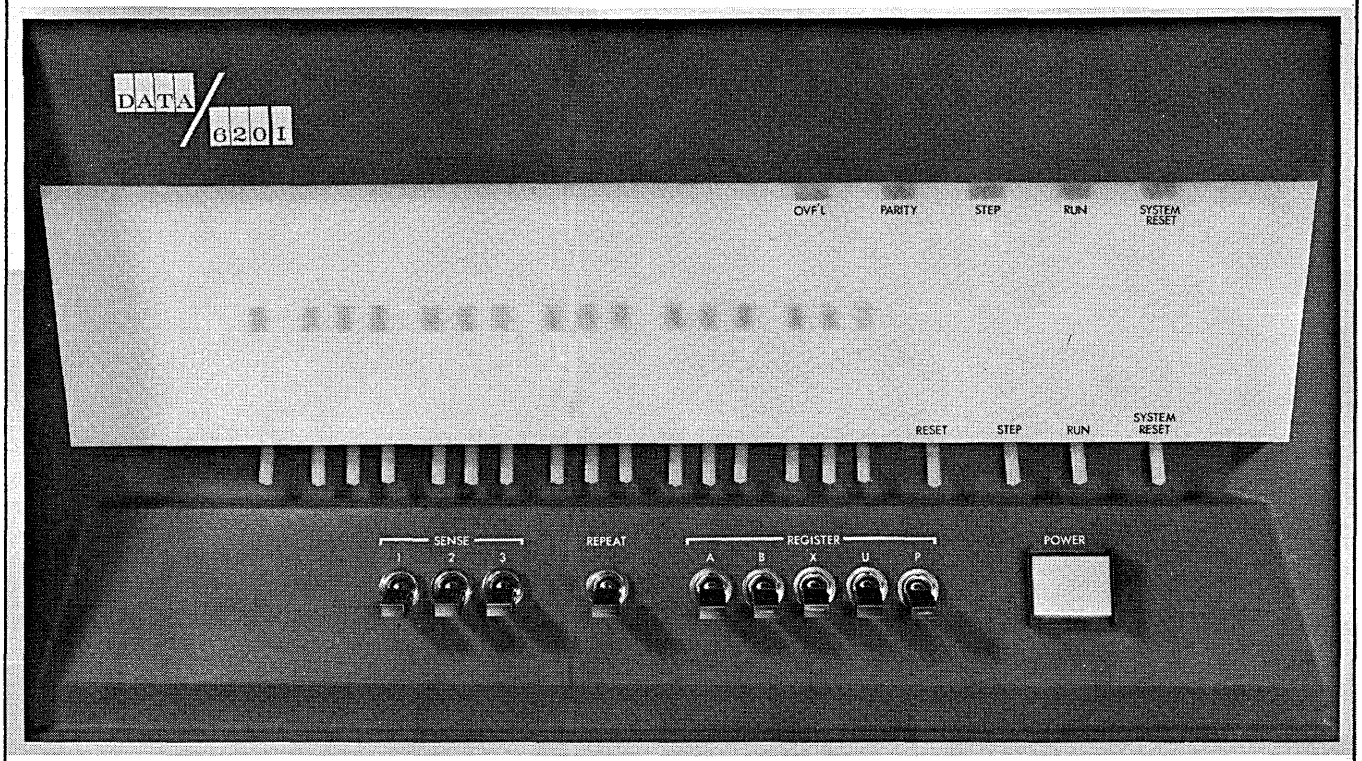
Introducing the DATA/620·I



new systems computer

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Designed for faster problem solution the DATA/620-I has a bigger instruction set, integrated circuit reliability, is smaller, has one-half the components, and costs less than any computer in its class.

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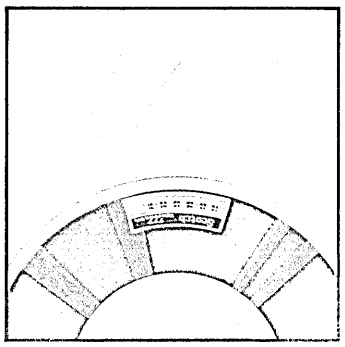
3M brings you No. 777, the world's finest computer tape, plus the ultimate in computer tape capability



NEW "SCOTCH" BRAND NO. 777 COMPUTER TAPE

An exclusive breakthrough combining long-range reliability and true economy. "Scotch" Brand No. 777 delivers extended error-free performance in continued use — maintains error-free reliability under varying environmental conditions. Provides completely compatible performance at all bit densities including 1600 bpi (3200 fci). Dramatically out-performs any other computer tape ever developed.

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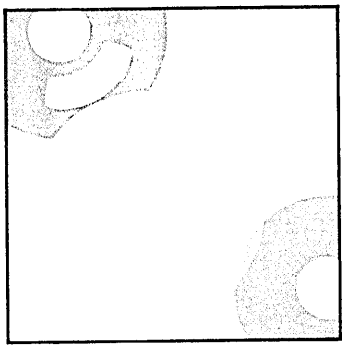
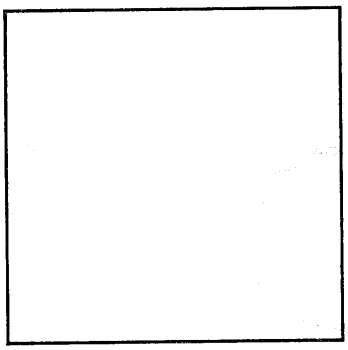


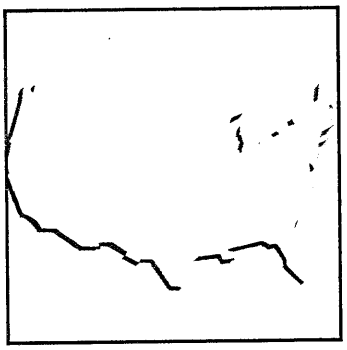
FULL LINE OF TAPES AND ACCESSORIES

3M gives you the world's most complete line of performance-proven computer tapes for your data processing needs. 3M also provides a wide selection of computer tape accessories, such as sturdy and safe, self-sealing shipping and storage containers to protect your tapes in transit or while stored in your tape library. Whatever your needs in computer tapes or computer tape accessories, 3M can supply them.



SERVICE WHEN AND WHERE YOU NEED IT

Nearly one hundred sales and service representatives are available nationwide to provide fast personalized service. They are qualified to counsel you on selecting the most efficient and economical tape suited to your specific needs. These representatives are backed by the world's largest, most experienced computer tape technical and research staffs. With 3M . . . solutions to tape problems are as near as your telephone.



NATIONWIDE DISTRIBUTION AND MANUFACTURING

Need fast delivery? Only 3M has three strategically located full capacity tape manufacturing plants in the United States. All plants are governed by the same strict quality controls to assure you of consistently uniform computer tape products. In addition, 3M maintains branch warehouses in sixteen cities throughout the nation to provide you with prompt, dependable supply of all your computer tape needs.

Whatever computer system yo employ or plan to use, find ou how 3M can cut your costs. Write Market Services Department Magnetic Products Division, 3M Company, St. Paul, Minn. 5511

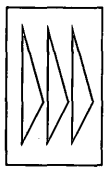
pe than the people who perfected it?

From the original painting by Neil Boyle

SATURN

Under contract to The Boeing Company, Planning Research Corporation has assisted in the planning, design, and checkout of software for the Operational Display System and Breadboard Development Facility used in the Saturn V Systems Development Facility.

Planning Research offers the nation's most complete non-hardware capability for the development of computer systems – from analysis of the total problem through system engineering, hardware system design, programming, and checkout. Applied to *any* computer system, Planning Research experience saves time or money, or both. For particulars, write to Mr. John N. Graham, Jr., Vice President for Computer Systems Design.



PLANNING RESEARCH CORPORATION

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news briefs

IBM SITUATION STILL IN STUDY STAGE AT JUSTICE

Speculation about the Justice Department's interest in IBM's activities is continuing but no action beyond the study stage had been reported by mid-February.

Subjects said to be under consideration include pricing policies, related cut-price time sales by universities, long-leadtime hardware announcements, the legal standing under the 1956 consent decree of services recently added by IBM through its information marketing group, and just plain bigness—considering the company's estimated share of over 70% of the market.

According to a government source, the Justice Department has received complaints concerning IBM from a number of service bureaus who are unhappy about what they regard as unfair competition produced by educational discounts. Allegedly, because of the discount, a university service bureau can undercut the price of a commercial service bureau.

Under the 1956 consent decree, IBM lease terms for given equipment have to be substantially equivalent to purchase terms covering the same gear. Whether they are actually equivalent at any particular time is hard to determine because of free time allowances, maintenance, training and other contract considerations, as well as frequent price changes. Complaints have been heard that recent price changes have upset the balance.

Other complaints have charged that IBM is not delivering equipment in sequential model order, another requirement under the decree.

The 1956 settlement bars IBM from processing customer's data directly, which is what led to the Service Bureau Corp. The exact language is as follows:

"IBM is hereby ordered and directed to transfer . . . all its contracts for service bureau business to . . . SBC and shall thereafter be enjoined from engaging in the service bureau business." The decree defines service bureau business as ". . . the preparation with tabulating and/or electronic data processing machines of accounting, statistical, and mathematical information and reports of others on a fee basis."

The basic question here is whether QUIKTRAN, DATATEXT, and similar services offered by IBM qualify as service bureau business. Service bureaus perform analogous functions, but IBM says it is selling machine time rather than dp service (because the user pays according to computer hours per month).

When QUIKTRAN was introduced, Justice received a lot of complaints from IBM competitors alleging violation of this part of the decree. The flak has since died down, but the government is worried that it will increase if, as seems likely, IBM data center services are multiplied and expanded. Another factor is that the information marketing group comes under the Data Processing Division, thus qualifying the service group for hardware discounts—which, of course, competitors don't get.

It is at least conceivable that, if QUIKTRAN doesn't violate the decree, IBM data centers could use the same basic approach to get into the general data processing business. The user would input his data through a remote, on-line terminal, a time-shared computer would process it and send back the results. As with the other services, IBM could base the fee on machine time used per month, rather than on the amount of data received or printed out.

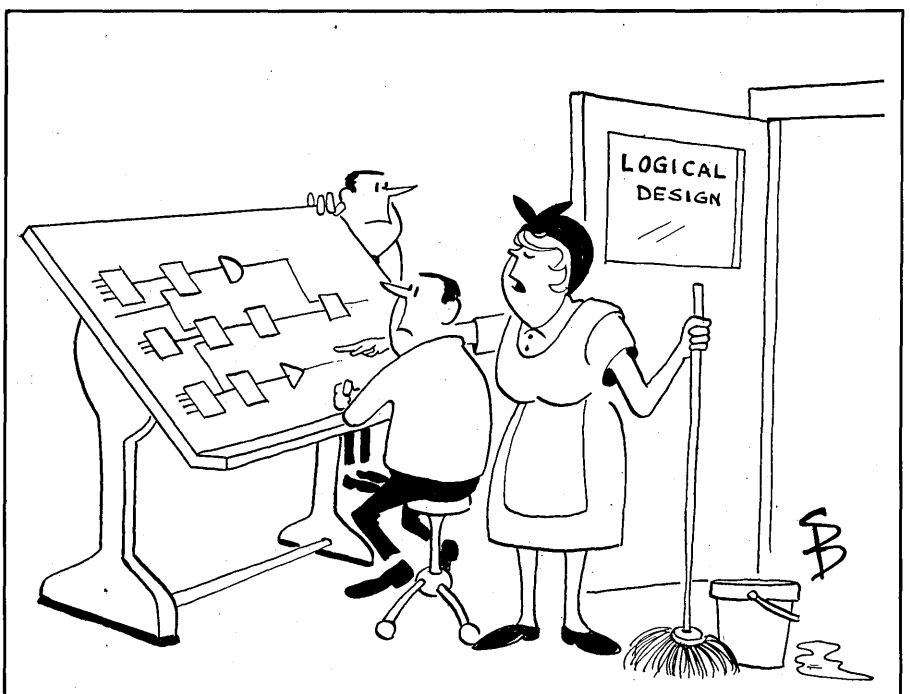
IBM has been informed by the Justice Department only that a preliminary investigation of the computer industry is underway and that, depending on the facts, a more comprehensive investigation may follow.

THE TELPAK PROBLEM: WHO WILL SAVE MONEY?

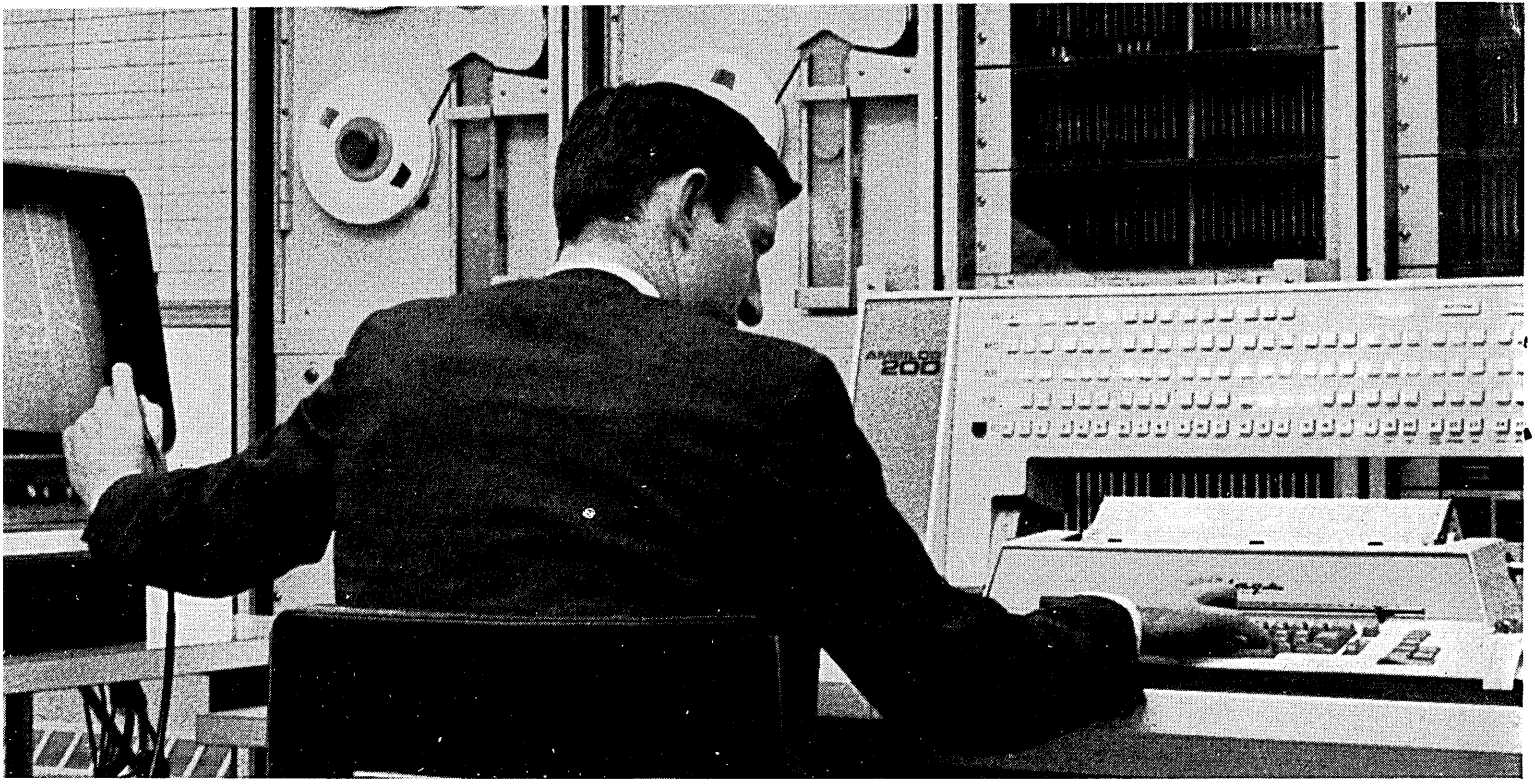
The ripples caused by the January proposals by AT&T on a new communications service for high-speed data and facsimile transmission, and for revised Telpak C & D and private line telephone tariffs have still not diminished.

In accordance with the recent FCC ruling that charges for Telpak A & B (12 and 24 voice channels, respectively) were too little compared with its private line rates, AT&T proposes an alternative service to A & B: a new 48-kilocycle bandwidth service "for a few select customers;" it is equivalent to 12 voice-grade channels and offers the same transmission rates (bps).

There are some significant differences, however. Under Telpak A, a user bought 12 voice grade channels, then paid $340/month for extra wideband (data) transmission capabilities, plus $15/month for the first terminal. Under the new service, AT&T proposes that the customer will pay



"Shouldn't that be an Exclusive—Or?"



Adage makes the best computer on the market for signal processing.

It's called Ambilog 200.

Combining the best of both analog and digital techniques, Ambilog 200 was designed right from the start for processing signals (time-related variables, often in analog form). Its unique hybrid structure and ability to handle efficiently both analog and digital information make possible at relatively low cost the extremely high computing rates required in signal processing applications.

DIGITIZING AND RECORDING

Up to several hundred inputs are routed under program control through an array of multiplexer switches, hybrid arithmetic elements, and a 14-bit, 4 microsecond analog-to-digital converter for recording or outputing. Ambilog 200 converts raw data to engineering units, including corrections for calibration error, at even faster sampling rates than conventional systems which simply "acquire" data.

WAVEFORM MEASUREMENT

Peak values, axis crossings, ratios of successive differences, and other characteristics of analog signals are measured in real time. Using complex programmed detection criteria, incoming signals are monitored for events of interest, typically with a resulting 100-to-1 reduction in the bulk of magnetic tape output records.

RANDOM SIGNAL ANALYSIS

Parallel hybrid multiplication and summing, 2 microsecond 30-bit digital storage, and a flexible instruction format providing efficient list processing combine to make Ambilog 200 an extremely powerful tool for statistical signal analysis techniques. These include Fourier transformation, auto and cross correlation, power spectrum density analysis, and generation of histograms of amplitude spectra.

GRAPHIC DISPLAY

On-line CRT displays of incoming data, or of results derived by reduction and analysis, are generated at frame rates of about 30 per second using line-drawing elements. Other visual display configurations, intended as design aids, generate isometric or true-perspective projections of objects containing more than 1000 line segments, with arbitrary translation and rotation.

FUNCTION GENERATION

In generating arbitrary functions of one or more variables, quadratic or cubic interpolation is achieved at high speed by using hybrid arithmetic elements in parallel to evaluate a polynomial function. Or, where straight-line approximations are adequate, different values of slopes and intercepts for each line segment are fetched from memory for operating on the variable.

SOFTWARE

Programming aids are tailored to the specialized needs of signal processing tasks, and include an Adage assembly system, Fortran, programs for source language editing and on-line debugging and control, and a wide range of applications programs and subroutines. Ambilog 200 signal processing systems are currently being used for seismic research, dynamic structural testing, sonar signal analysis, wind tunnel testing, speech research, simulation, and biomedical monitoring.

For further details, write M. I. Stein, Product Manager, Adage Inc., 1079 Commonwealth Ave., Boston, Mass., 02215.

CIRCLE 46 ON READER CARD

Adage INC

$425/month for the 48kc wideband service for data transmission. Voice transmission is extra: $250 for a controller at each end of the line, plus terminals, which will now cost $12.50/month.

On the surface, it appears that the new service is data-oriented, and that for long-distance tape-tape data-only transmission, the service might offer savings over Telpak A, in which data transmission was superimposed on a basic voice transmission service. But communications surfaces can be misleading, and undoubtedly individual traffic and communications requirements will dictate a wide variety of final cost answers for the new service.

In addition to the proposed service, AT&T filed for new tariffs on Telpak C & D (60 and 240 channels, respectively). "C" would increase from $25 per channel-mile/month to $30; "D" from $45 to $85. All of the new tariffs are scheduled to be effective May 1, if the FCC sanctions them. The Telpak C & D proposals are planned to take effect late this year.

While it's a bit early to assess the impact of the proposed tariffs, one automobile manufacturer has reportedly estimated that the new C & D tariffs would cost him an extra $100K/month, although most of his transmission is voice. For AT&T, the new C & D rates would add up to $238.7 million in revenue for 1968. All Telpak services currently bring in $165 million a year. There are 1300 A & B users, but no breakdown on the AT&T revenue they provide.

Another factor facing communications-oriented computer users is the AT&T proposal for a restructuring of the private line telephone transmission charges. Generally, the new tariffs would represent increases in charges for hauls under 100 miles, significant decreases in the 100-500-mile range, and marked cuts for transmissions over 500 miles. But it's important to note that the FCC sanctions, if and when they come, won't necessarily affect *intra*state charges.

The proposed rate changes, which will undoubtedly be contested by many firms and associations, including truckers, retailers and airlines, are forcing many users to take a hard look at private microwave transmission, most desirable for the short haul, which offers broader band capabilities. Another question involved in microwave considerations is to what extent the FCC will allow sharing of microwave networks. It all adds up to plenty of questions for communications-oriented information processors.

BURROUGHS GETS CONTRACT FOR GIANT ILLIAC IV

The selection of Burroughs to build the experimental parallel processing computer ILLIAC IV has been approved by the Advanced Research Projects Agency of DOD. Under a contract industry sources say will exceed $10 million, Burroughs Defense, Space, and Special Systems Division will build a system with a processing speed 500-700 times that of any existing computer and 100 times that of any computer still in development. Only software said to be included in the contract is an assembler.

The ILLIAC IV will have four control units interacting with 250 arithmetic units, each with its own thin-film memory. It will be the first system to apply large scale integrated circuits (about 100 circuits/chip) on such a big job. It is understood that Texas Instruments will supply the LSI's and Burroughs will make the thin film.

It remains for the prime contractor, the Univ. of Illinois, to negotiate the contract with Burroughs; they began the study portion of the ARPA-funded project in 1965. Early last summer, $50K design contracts were awarded Univac, RCA, and Burroughs, leading to proposals on which the final award was based. Daniel Slotnik of the university will direct the development.

BECK RESIGNS FROM SCIENTIFIC DATA SYSTEMS

Robert M. Beck, one of the founders of Scientific Data Systems, has resigned as executive vice president but will continue to serve as a director.

Beck, who worked with SDS president Max Palevsky for some 16 years at Northrop, Bendix, and Packard-Bell before helping set up SDS in 1961, was not only a key technical man but had a large part in running the company. Once asked how SDS could hope to avoid the problems that had hit Control Data, Palevsky replied "because Beck is better at running a company than Norris."

Apparently dividing Beck's former responsibilities are new senior vice presidents Dan L. McGurk and Sanford Kaplan. McGurk has been marketing vice president and Kaplan vp for finance. Now McGurk will head operations, which includes marketing, manufacturing, systems and development. He, in turn, is being replaced as marketing director by Louis B. Perillo, who was sales manager. Kaplan now adds administration to his financial responsibilities.

Beck has reportedly garnered sev-

SOFTWARE DILEMMA?

You say you're in the steel business? Or was it oil? Maybe clothing? But ever since you installed your first computer it hasn't stopped growing? Get a bigger machine? Maybe three machines? Get more programmers to run them? Your systems analyst just recommended you should have lots more COBOL to mix with your FORTRAN, JOVIAL, and ALGOL—and ten new programmers would help get the show on the road? More programmers in-house? You know, the friendly overhead group that keep multiplying with your computer system? And what you thought you needed were more practical results and less computer jazz? But you are specialists in the aerospace business? Or was it toys? Electronics? Well anyway, you agree it's not the software business? Maybe a shot of IDC would help. What's an IDC? Well, let's explain it this way...

IDC is a company whose sole effort and profit motivation is in the field of software. It is a management-oriented company that major computer manufacturers — maybe even the one who sold you your computer — rely on to provide entire software packages. IDC is a company composed exclusively of highly-talented software specialists who have solved problems like yours many times. Programmers in our organization are not overhead, but top echelon employees. They receive excellent salaries plus bonuses and incentives for ahead-of-time performance, correct solutions to your problems, and at a firm fixed price. But don't you do this for outstanding producers in your business, too? To get a superior performance for less dollars, doesn't it make sense to call on IDC to assist you in handling computer applications and software programs? For an improved perspective on your software management problems, contact IDC now. 1621 East 17th Street, Santa Ana, California. Phone: (714) 547-8861

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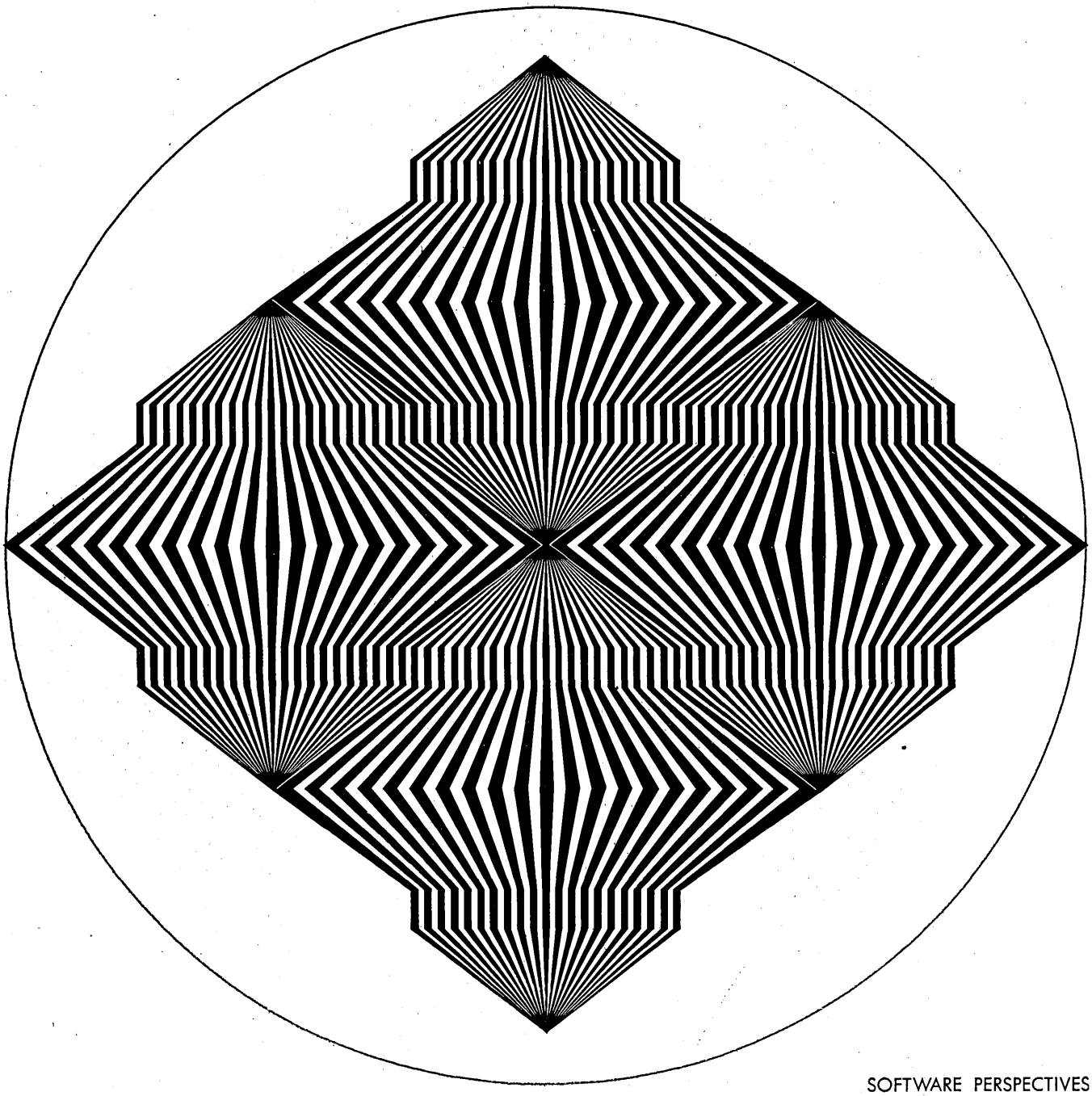


CIRCLE 48 ON READER CARD

eral million dollars from SDS stock options. When the company went public, the stock was selling for $25 a share while the first people associated with the firm got in at under one dollar. Recent price per share has been around $90.

Other SDS early birds who have flown went to such places as France, Japan, and back to school. Beck, who has purchased a 21,000-acre ranch in Colorado, evidently wants to be a rancher.

SYSTEMS APPROACH TO SOCIAL PROBLEMS LEAD SUBJECT AT WINCON

The "systems approach"—a modern cliche—was defined, examined and applied to various domestic problems at the IEEE Aerospace and Electronic Systems Group's Winter Convention in Los Angeles last month. In an overview of "The Systems Approach to Major Problems of an Expanding Society," session chairman Dr. Henry A. Rowen, new president of The RAND Corp., emphasized that the systems approach was a careful look at all elements involved in a situation, and not a method of understanding everything—or even everything important. He praised the aerospace industry for its advances in the field of systems research: for introducing the ideas of systems analysis to the public agencies through their defense and space programs, where analysis of all factors is of major importance. But he stressed, as did the other speakers, that the industry in general, and engineers in particular, are weak in the social sciences. Too often problems and facets of human behavior are ignored; a knowledge and understanding of human behavior must accompany technical knowledge to be effective in a problem area, he said. The goal of the systems approach in society is to dissect, analyze and surmount complex public problems, Dr. Rowen stated, concluding that eventually there will be a vast amount of resources devoted to finding solutions to these problems; the major dilemma facing systems analysts in the coming years will be the effective channeling of these funds.

A second speaker, Roy McCabe of System Development Corp., presented a paper on crime prevention and control by Dr. William W. Herrmann, also of SDC. McCabe discussed the background and present success of the application to police work of military command and control theories: a system dependent on effective communications, in which a director, or commander, is central to various field, or control, units. Analysis of police work falls into four overlapping areas, he explained, including sensing—the ways in which police acquire information; analysis; decision; and action. McCabe added that the police command and control system is now an ineffective open-loop system; feedback is delayed, sometimes confused, and full of loose ends. Another problem confronting police networks is their interface with other public agencies such as public health and safety organizations.

Using well-chosen statistics to capture immediate interest in the technically oriented audience, Frank W. Lehan, an independent consultant, made a plea for systems analysts to attack the problems in areas of health and medicine. He revealed that the U.S. is numero uno in the international line-up in T.V. sets, automobiles and telephones per capita, but 17th in life expectancy, 7th in number of doctors and nurses per capita, and 23rd in hospital beds per capita. Lehan credited advanced technology with many improvements in the medical field: reluced cost of analysis and tests, new practices through new equipment, and improved transportation. Mentioning a data storage and retrieval system that is in the experimental stage, he stated that a medical utility, if successful, would be extremely beneficial. Encouraging analysts to explore the field, he suggested research in programs covering prevention of disease, early warning and detection, diagnosis procedures, and storage and retrieval software.

Dr. Rudolf C. Flothow, director of education systems development at Lockheed, wound up the session with a look at "The Selective Use of System Technology for Education." The evolution of a new education system is coming, he warned, and it will include self-training, longer years of schooling, at-home classes, and schools within industry (e.g., he postulated the University of Boeing—a two-year college program of the future similar to present junior colleges, that would cover basic undergraduate studies as well as on-the-job training programs).

In demonstrating how the systems approach is necessary to the educational system, he stated that a clear definition of the operation and functions of a school does not exist; many educators do not have distinct ideas of their job functions: some teachers still feel perhaps they really *are* glorified babysitters. Two important parts of the systems approach here, then, are task analysis and enunciation of the objectives of instruction.

Flothow remarked that computer-assisted instruction is not revolutionary—it is a logical extension of the old system. "CAI programs," he quipped, "are textbooks without a spine."

Agreeing with Dr. Rowen, he listed resource allocation as a major problem in education. Specifically, he referred to the Elementary and Secondary Educational Act which, in one aspect, allocated money for inventive, experimental areas of instruction, only to discover that neither the methods of instruction nor the objectives were clearly defined. Research in the educational field, he added, consists more of intuitive explanation and demonstration than absolutes. The obstacles encountered while working in an area so closely involved with intuition and personal beliefs are offset by the quick results produced by research, he stated. Flothow concluded that when discussing alternatives of a system, technicians always state, "change the people." And in education, he added, "That's what we're doing."

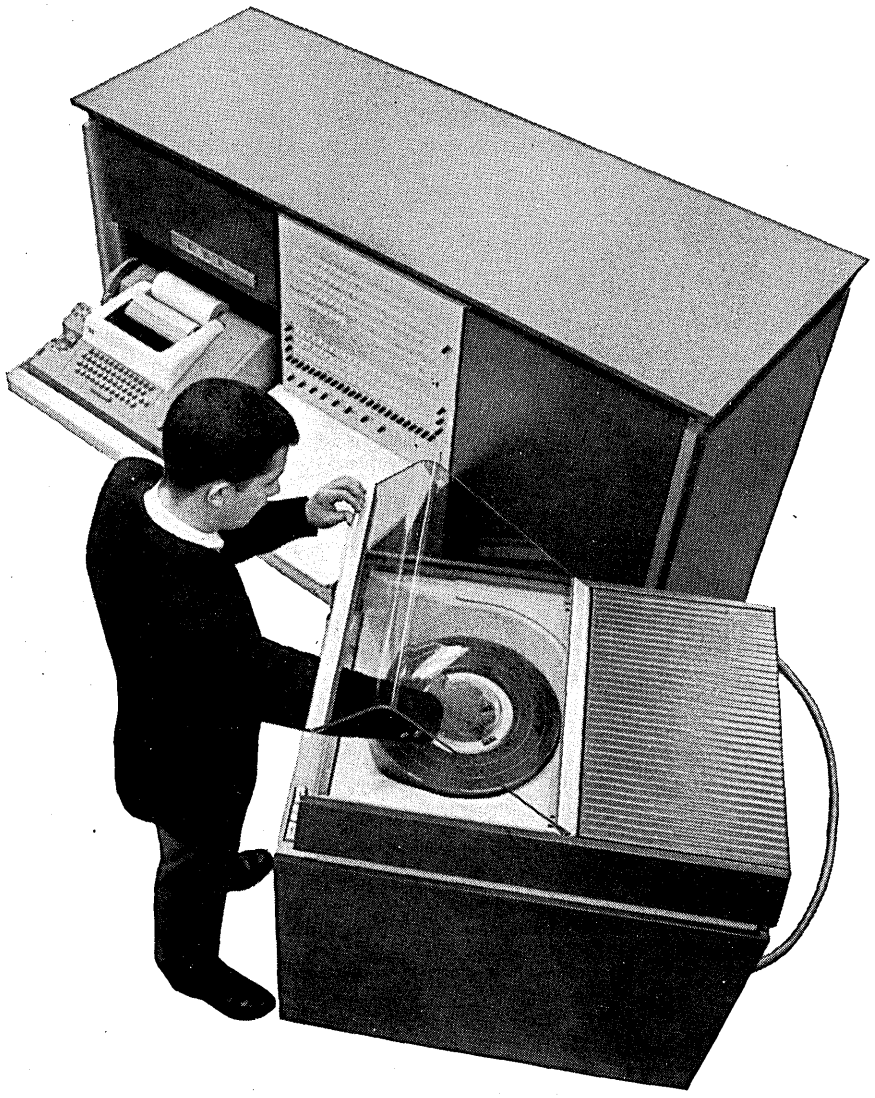
BANKERS URGED TO PLAN FAR AHEAD AT ABA MEETING

"What was not begun two years ago —in terms of services, automated operations, and management information systems—is not likely to be operational in 1970," the banking community was told at a recent American Bankers Association meeting in New Orleans. Speaking before the "MIS/Central File Workshop," Robert Stevens of Touche, Ross, Bailey & Smart warned that most banks haven't realized that coping with the increasing pace of economic and technological change requires longer and better-managed planning than a decade ago.

Banks, he said, are definitely looking at the concept of MIS for solutions and are ordering and installing third-generation equipment to get the MIS ingredients offered—central files, on-line simulation and graphic displays. But they are generally adopting the hardware without planning for its "potential, effective use."

Development of MIS in any bank will require "changes in management philosophy, invade the decision-making prerogatives of middle and top management, demand a restructuring of bank accounting," and require development of an "over-all corporate viewpoint." It cannot be done from a department level, noted Stevens; instead, there must be an "organization for the management of change" within the bank, functioning directly

The only 24-bit real-time computer with a concurrent floating point arithmetic unit.



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Twenty percent less expensive and with twice the throughput (572K words/sec.) of its nearest competitor, the SEL-840A also has the first real real-time monitor on the market today. Delivery: 60 days. Price: $54,500.

For further information, write for BULLETIN 9056A, or contact Systems Engineering Laboratories, Inc., 6901 West Sunrise Blvd., Fort Lauderdale, Fla. 33310. Area Code 305-587-2900. Offices also in Washington, D.C.; Los Angeles, California; Boston, Massachusetts; San Francisco, California; Cleveland, Ohio; Houston, Texas; Huntsville, Alabama; and Orlando, Florida.

Systems Engineering Laboratories

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under the chief executive officer.

H. Wayne Nelson, Burroughs Corp., warned against the potential evils of the central information file. As the heart of an MIS system, such a file —containing data about all departmental and functional areas—could be used to do little more than inundate management with reports, driving it back to making decisions based on "intuition, judgment and experience."

BELL DEVELOPS TELSIM CONVERSATIONAL LANGUAGE

Bell Labs has developed a conversational compiler language, Telsim, for use in simulating continuous systems. Engineers without programmer training have used the system on an IBM 7090 for such projects as simulation of the trajectory of the lunar descent of the Apollo spacecraft.

The user draws a block diagram of the system under study, then describes the diagram to the computer, box by box, giving contents and the variables to be printed during the simulation. A question-and-answer interplay with Telsim frees the user from memorizing specialized responses and programming instructions. The inputs are translated into equations, which Telsim compiles into FORTRAN.

When the problem is defined, the user requests a printout of the equation to check for accuracy. Then the simulation is run and printed out. The machine-independent Telsim requires 4K words of storage. Bell is considering means to make the system available to the public.

CIRCLE 160 ON READER CARD

L.A. ACM CHAPTER HEARS WIEDERHOLD DESCRIBE ACME MEDICAL SCHOOL SYSTEM

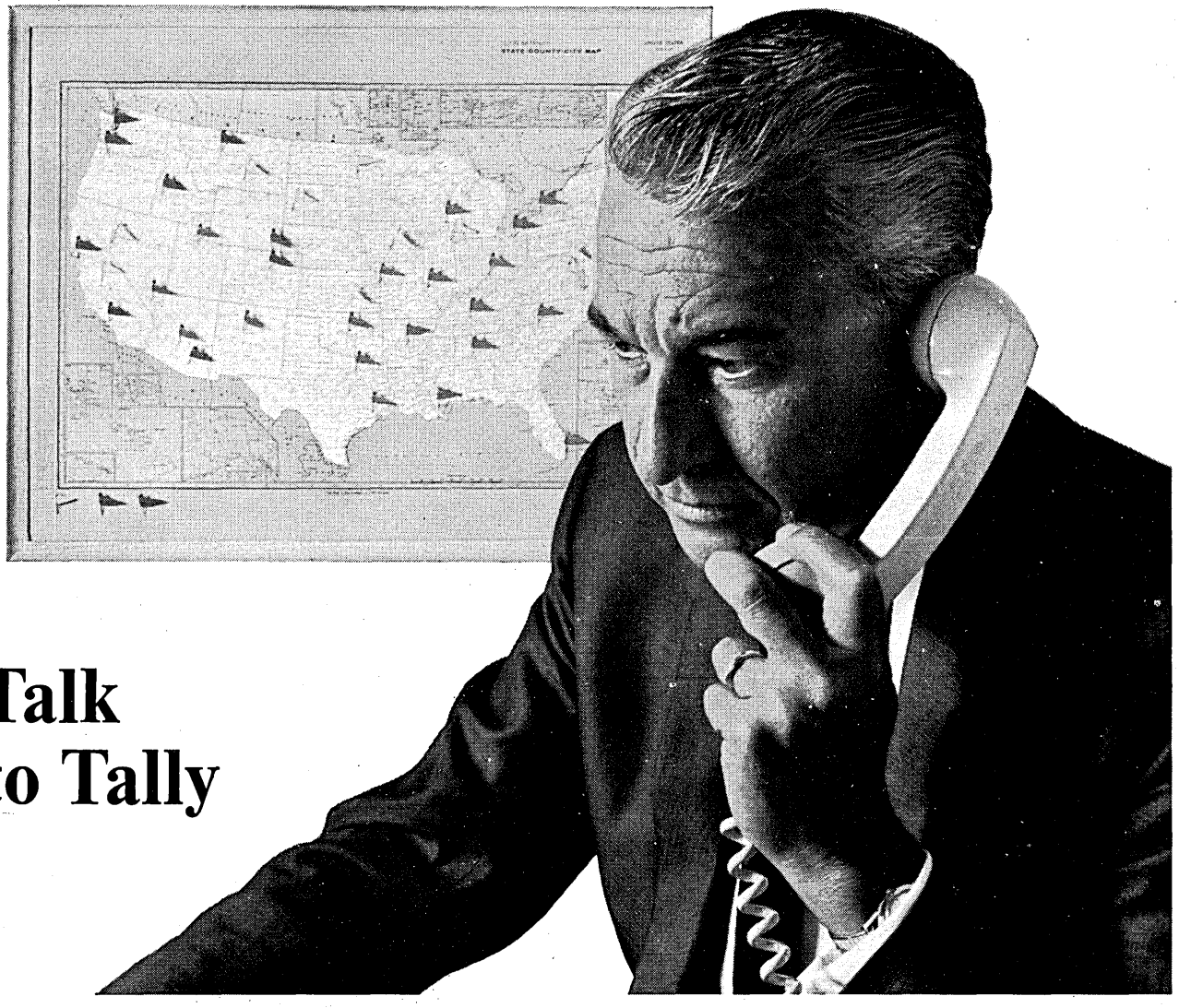
When doctors who have never used a computer before take a three-lecture course and come back a couple of weeks later to say "I used up that 16K of core you gave me," the system must be offering them something of interest. This has been one of the encouraging signs in the development of ACME, described for members of the Los Angeles chapter of ACM at the February meeting by Gio Wiederhold, associate director of the Stanford Computation Center and head of the separate medical school computer facility there.

The name ACME stands—or stood —for Advanced Computer for Medical Experimentation. The last word in the title has now been replaced by Research, because Experimentation sounds bad in the medical environment, but the acronym lingers on.

Planning for ACME got started about a year ago. The need for it stemmed from the on-line nature of the work that needed to be done—and couldn't be handled by the established computation center—and the necessity of starting on the ground floor, within the medical school, to develop a system unlike any already existing. Other medical information schemes, in the opinion of the ACME people, don't gather data from the right places and don't distribute it to the right people in a useful form. IBM, for example, offers a hospital system but it produces punched cards as output. "So the doctor says, 'Quick, give me the report,' and what's the technician supposed to do? Read the holes in the cards to him?"

To solve these problems and others, Wiederhold and a small staff ("If you don't have much money, hire just a few very expensive programmers") have gathered together an assortment of equipment, some home-built. They have a System 360 Mod 50 with 64K fast core, a 1-million-byte bulk core, 32 slightly modified 2741 terminals, a variety of converters and input-output devices, and a Datacell ("but we don't call it that because the doctors would think it's genetic and

Ever wish you could bring the whole operation under one roof?

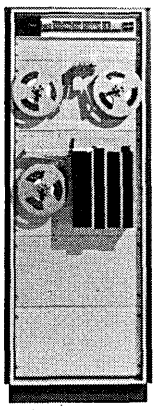


Talk to Tally

Tally data communication systems can tell you nearly as much about the daily operations of distant offices, plants and warehouses as you could learn if they were across the hall. A Tally system uses low-cost dial-up phone lines to bring in daily reports of business operations such as sale orders, shipments, inventory levels, billings, and the like. Arriving on perforated paper tape, this data is ready for immediate computer entry.

Rental is remarkably low. Tally terminals transmit and receive at 12 times the speed of the fastest TWX or Telex machine. What's more, the Tally system detects and corrects transmission-line errors automatically and that's something that no other comparably priced system can do–not even the phone company's Dataspeed.

Already many forward thinking firms are moving a step ahead of the competition by putting Tally systems to work. A Tally system could be smoothing out data flow for you too!



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You can depend on Tally equipment to serve you well, because it's made by the world's leading supplier of perforated tape equipment for data communications. So when you're ready to enhance the efficiency of your business with data communications, be sure to talk to Tally.

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want one for themselves.") An 1800 is being added now.

The machinery arrived before the building was done, and it's housed in a jerry-built structure of 2 × 4's, beaverboard, and plastic sheeting. There is no air conditioning—just a big fan and a lot of opening and closing of doors depending on the relative temperature and humidity between inside and outdoors. To everyone's surprise, the equipment "works most of the time under these conditions."

The system includes both real-time data acquisition, through custom-built analog/digital converters, and time-sharing. A subset of PL/I is used, generating straight binary code so that recompilation is done every time but is fast enough not to create problems. Everything is done from core, without swapping. The system also serves as a fast processor and data bank for a few PDP-8's and LINC's in the medical school.

For accounting purposes, Wiederhold has found that charging only for core space and time is the most practical approach. So far, only about a dozen users are operating at a time.

Special efforts have been made to give the inexperienced users familiar forms of guidance. Thus the computer doesn't demand special codes from the doctors; when one of them signs on, the terminal prints "name?" Adding the polite question marks to all messages, however, has led to some odd side effects: the diagnostics end up being suggestions. If all else fails, the user may get the plaintive message "log off?"

Wiederhold sees some important applications in the future, if some special equipment can be built. One is finding the location of scars in brain tissue without cutting in and taking a look around. Another is the administering of anesthetics and monitoring the patient's reactions to them. As operations get more complicated, they take longer and longer. The result is that several different kinds of anesthetics may be necessary, alternating with drugs that bring the patient back towards consciousness. Without the precision of machine monitoring—and perhaps later computing the doses—several anesthesiologists may be involved, all doing some informed guessing about how the patient is getting along. Still another area is accumulation of accurate data that doesn't now exist, such as recording of spontaneous heart failure. If such data could be saved for just a few cases, doctors would have more information than they do now for study.

In answering questions from the floor, Wiederhold emphasized that ACME is still in the experimental stage; after about three years, they will see what has been learned. On the necessity of custom-built equipment: most analog-to-digital converters were designed for the military, the cost reflects this, and "we don't plan to drop them from 20,000 feet."

"Why don't you use the data transmission equipment developed by AT&T?"

"We'd have to deal with the telephone company." (Applause.)

TIME-SHARING TENTACLES STRETCH TOWARD TRUCKING

Tiny Information Utility Corp. of Los Angeles is planning a time-sharing service for the trucking industry. Begun as a carbon copy of Keydata, the company got the inspiration for a special angle from a trucking executive who, as an ex-rater, said that rating could never be computerized; it was too complex.

To vp Allen Fiffer, that was proof enough that *here* was the key problem. Basing his system on two general PUC and one Western States Motor Bureau tariffs, Fiffer is building a generalized rating system for the state of California which will later be modified to incorporate special tariffs for produce, sugar, lumber, etc. Incorporating such factors as classes of commodities, weights, distances, full or partial truckloads and split shipments, Fiffer's system hopes to solve the rating problem, often done intuitively or by false memory, leading to overcharges and the wrath of the PUC. Shippers themselves hire whole rating crews whose job it is to discover overcharges. Their reward: half of what the company collects.

An on-line terminal at the trucker's office will compute the rates and prepare bills, additional terminals at dock will prepare the documents required to load the truck, select its route. Eventually the system will expand to include other accounting and management functions. Terminals located at the premises of the truckers will offer additional advice on routing and loading as well as wiping out the need for counter-raters.

Originally designed to be implemented on Univac gear, the system is now scheduled for checkout in April on Allen-Babcock Computing's 360/50; operations should begin in July. The market? Well, there are 2000 trucking firms in California, with 1000-4000 bills a night representing a typical billing load. Right now, it

news briefs

takes two raters and four billers to produce 1000 bills, and Fiffer figures that with his system, one man can do the work of four. But accurately. Include as prospects the shippers, the additional services which can be developed for truckers *and* shippers, and it begins to add up to what Fiffer & crew hope will be a AAA credit rating for his two-year-old company.

CIRCLE 161 ON READER CARD

AUTODIN PILOT PRODUCTION MODEL SHOWN IN OPERATION

Philco-Ford has shown an operating prototype of the AUTODIN switching centers to be installed at locations around the world under a $46-million contract from the U.S. Army Electronics Command.

The Defense Communications Agency (DCA) is the manager of the National Communications System (covering all government owned and leased communications), and AUTODIN is a part of it. The U.S. Army Electronics Command (ECOM) is responsible for the procurement of AUTODIN, while the Strategic Communications Command (STRATCOM) is responsible for its installation and operation.

During the next 18 months, a total of 12 overseas AUTODIN switches will be installed, and a 13th facility will be established for training purposes at Fort Monmouth, N.J.

The overseas AUTODIN centers will be installed in the Philippines, Germany, England, Okinawa, Japan, Guam, Alaska, and at five additional sites (of which three will be in the Far East) that have not yet been divulged. The Philippines center (100-line size) is scheduled to go into operation in the spring of 1967. The centers scheduled for Germany, England, and Fort Monmouth are also under construction.

Eight of the overseas AUTODIN centers will each service 200 duplex communications lines. The other four will service 100 duplex communications lines. The larger centers will use six Philco Model 102 computers and the smaller centers four.

The over-all overseas AUTODIN procurement will run to $120 million. The switch procurement, which is being supplied by Philco-Ford, will run to $46 million.

Each center will consist of 4 subsystems: communications, store-and-forward switch, power, and software.

The communications subsystem provides the interface functions required to connect the center to the outside world. In a large center, it can handle up to 250 I/O channels simultaneously, or a volume of 262,500 words/minute (at 4 eight-bit characters/word). Control of the communications-subsystem equipment is semi-automatic. Circuits are manually monitored at a console to spot signs of degraded performance; lines that go down completely are automatically signalled. Switching to a new line in the case of degraded performance or total malfunction is done manually. Reliability is maintained by means of triple circuit redundancy.

The message switch controls all line traffic and performs all message processing, storing, and forwarding. It also exercises supervisory control over the switch equipment and automatically creates new configurations to maintain operational effectiveness in the event of equipment failure. The process of identifying a failure, isolating the malfunctioning component, and changing the configuration to maintain performance without losing or garbling a message is accomplished in from 2 to 20 seconds, depending on the nature of the failure and the equipment involved.

In a 200-line center, four processors are used to handle line-traffic control, one to process messages and exercise supervisory control, and one for back-up. In the smaller, 100-line center, two processors are used for line traffic, one for message processing and supervisory control, and one for backup.

The switch configuration consists of the processors, 18 tape stations, 2 magnetic drums, and 10 modules of 512K bit core memory with a 1.5 microsecond word cycle time. All the processors are functionally interchangeable.

In addition, there is a supervisory console to monitor line and subsystem status and a maintenance console to monitor subsystem, processor, and drum status.

The drums have a capacity of 7 million characters/drum and a transfer rate of 130K words/second (at 4 eight-bit characters/word). They are used for in-transit storage of all messages with routine priority. Core is dumped onto the drums once a second.

The tape files are used for reference (copy of every message), journal (summary of message traffic), and intercept storage (line queues). How long messages remain on the drum before being transferred to a queue on tape is a manual decision.

Each 200-line center can handle approximately 1800 messages per hour at an average message length of 2000 characters.

The programming subsystem contains all the software necessary to perform the message processing, monitoring, signalling, and control and fallback functions. Switchovers in the event of primary-supply or subsystem failures are handled automatically.

The installation, operation, and maintenance of the centers, which will service a total of 4000 terminals, will be handled by Philco-Ford's TechRep Division. The division will also be responsible for the training center at Fort Monmouth and the training of all operating personnel.

FJCC PROGRAM COMMITTEE ISSUES CALL FOR PAPERS

Papers are requested for the 1967 Fall Joint Computer Conference, to be held at the Convention Center, Anaheim, California, Nov. 14-16. The deadline is April 14.

The technical program committee is offering assistance to those whose papers are selected in preparing for oral presentation. One-day sessions will be scheduled for this purpose at locations convenient for the authors.

Complete drafts of papers are requested, as well as abstracts of 100-150 words. Five copies should be sent to Harry T. Larson, Technical Program Committee Chairman, 1967 FJCC, P.O. Box 457, Costa Mesa, Calif. 92627.

UNIVERSITIES ANNOUNCE COURSES, RESEARCH PLANS

Harvard and the Universities of Oklahoma and Illinois have each announced new activities in computer sciences.

Harvard is offering two extension courses on computer mapping, with 30 scholarships available. One is a short introduction to the subject, to be given by correspondence. The other is a two-week intermediate and advanced training conference and will be held at Harvard May 8-19, 1967. Information and application forms are available from Mrs. Helen Mansfield, Director, Program of Extension Studies, Laboratory for Computer Graphics, Memorial Hall 121, Harvard Univ., Cambridge, Mass. 02138.

The Univ. of Oklahoma has arranged two summer programs in mathematics and computer sciences for college teachers. A ten-week research/participation session for full-time faculty members has been announced, with participants contributing two lectures. The seminars are from June 7 to Aug. 16. A four-week conference is also planned, from July 24 to Aug. 19. Participants must be college teachers with at least three years' teaching experience, able to program in two computer languages, and with a background of courses in abstract algebra and advanced calculus. Both summer sessions offer fees and certain expenses to the applicants selected. Information: Dr. Richard V. Andree, Mathematics Service Committee, Univ. of Oklahoma, Norman, Okla. 73069.

The Department of Computer Science at the Univ. of Illinois has begun a graduate program, leading to masters and doctors degrees. Some assistantships and fellowships are available. Information: Prof. John R. Pasta, Head, Department of Computer Science, Univ. of Illinois, Urbana, Ill. 61801.

PRIVACY LEAD TOPIC AT SPRING JOINT CONFERENCE

Since the increasing proposals and plans for national computer utilities and data banks have created great concern over the "privacy problem," the 1967 Spring Joint Computer Conference will devote several sessions to the legal, technical and social aspects of the issue.

U.S. Congressman Cornelius Gallagher, chairman of the government's Special Subcommittee on the Invasion of Privacy, will keynote the Atlantic City, N.J., meeting with a talk on "National Data Banks and Privacy." In the same opening session, Columbia Univ. political science professor Dr. Alan Westin will speak on legal safeguards, and AFIPS representative Stanley Rothman will cover "The Meaning of Privacy."

The SJCC, which will be held at Convention Hall April 18-20, will feature 34 technical sessions and over 100 exhibitors. Brian Pollard of RCA EDP is chairing this year's meeting, while M. P. Chinitz of Univac heads the technical program. The sessions (7 panel discussions, 5 paper/panel combinations, and 22 paper sessions) treat four major areas: hardware devices, logic and computer organization, programming and applications, and analog/hybrid systems. A special 35th session will deal with "Management Conditions for Management Information Systems." At the banquet Wednesday evening, Maj. Gen. John W. O'Neill, chief of the Air Force Electronic Systems Division, will be the featured speaker.

Advance registration will take place at the Chalfonte- Haddon Hall on Monday, April 17, 4-11 p.m., and each day thereafter at Convention Hall, 8:30-5:00. Fee for members of the AFIPS sponsoring societies is $20; for

news briefs

non-members, $30; for students, $3. For further information on SJCC 67, contact Howard Babcock, RCA EDP, Cherry Hill, N.J.

IEEE COMPUTER GROUP SETS FIRST ANNUAL CONFERENCE

Papers are requested for the First Annual IEEE Computer Conference, to be held Sept. 6-8 at the Edgewater Beach Hotel, Chicago, Ill. The conference is sponsored by the IEEE Computer Group, with the cooperation of Northwestern Univ. and the IEEE Chicago Section.

Papers are invited that describe original research in the following areas: design automation, new computer elements and new computer system organizations, reliability, pattern recognition, on-line computer systems and their applications.

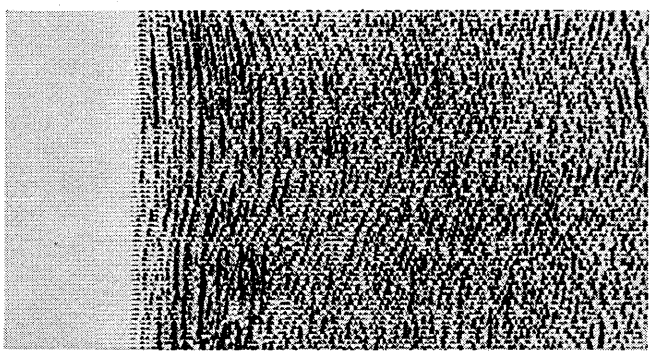
Authors are asked to submit seven copies of a 75-word abstract and a synopsis of about 2000 words with a list of references and any important illustrations by April 10. Decisions will be made by May 31 and complete manuscripts are due Sept. 6.

Entries should be sent to Professor S. S. Yau, Dept. of Electrical Engineering, The Technological Institute, Northwestern Univ., Evanston, Ill. 60201.

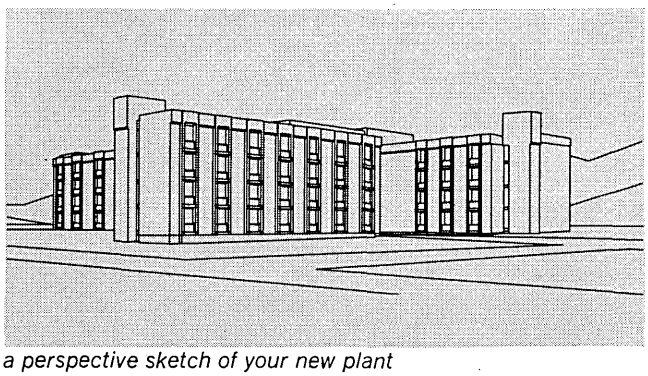
● At least IBM's share of the market has decreased somewhere. The Association of American Railroads has prepared a summary of computer installations in their industry showing that IBM's domination has slumped by .8% to 86.5% while second-place Univac has zoomed from 7.7% to 8.9% during the past year. In the last five months, the number of railroads using computers has increased from 52 to 59 and the number of computers they use from 181 to 192. Twenty 360's were installed during the second half of 1966.

● RCA has decided to go after a larger share of the market for magnetic tape, setting up a separate Magnetic Products Division to be headed by Joseph Stefan. The company estimates that demand will double within five years. Magnetic cards will also be produced by the new division. First expansion move is doubling the size of the Indianapolis plant to 120,000 square feet, scheduled for completion by the end of this year. The product line will include audio, video, and instrumentation tape as well.

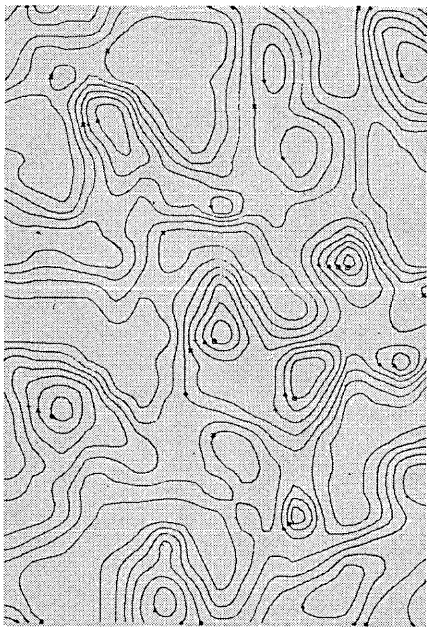
Would you believe a CalComp plotter and any computer can draw pictures like these in seconds?



"wiggle trace" seismic sections



a perspective sketch of your new plant



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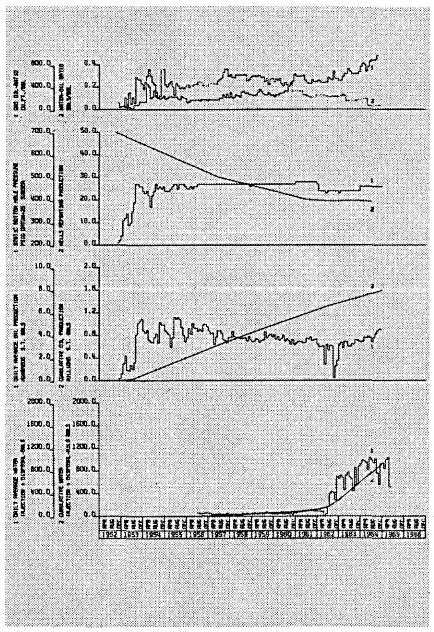

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Ferroxcube Corporation of America is the nation's leading independent manufacturer of ferrite recording devices and memory systems for data processing equipment.

On Jan. 3, 1966, less than three weeks after the decision to make its first expansion outside New York State, Ferroxcube was in operation in a 26,000 square foot plant in Denver Technological Center.

Because its overall experience was so favorable, Ferroxcube made the Denver plant a full division on Oct. 1, 1966, with autonomous operations for production, product development, applications engineering, sales, and customer service.

Payroll stood at 260 at the end of 1966 and is expected to reach 600 by 1968.

Here's what Ferroxcube found in Denver:

C. J. Kunz, Jr., Vice President and General Manager: "People are the most important thing in our business. We didn't want location to be a detriment to finding them, so we looked for an ideal place to live. Denver impressed us as one of the better places in the country. Our history to date has verified this."

Robert C. Derschang, Marketing Manager: "Communications and transportation that are fast, convenient and economical are sales essentials. Denver transportation is quick to every part of the country, and we're central and accessible to customers in any direction."

Hugh DeVries, Project Engineer: "Denver has first-rank universities and a great deal of science-based industry. Consequently, there is a broad scientific community which results in excellent vendor service. It also means a good pipe-line for ideas, and a considerable reservoir to draw on for either trained manpower or consulting talent."

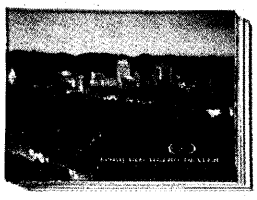
Lowell H. Mau, Personnel Director: "Our success in transferring 20 key personnel was 100%. We provided a pre-transfer trip for the families, and the community won them over."

This is Ferroxcube's experience in Denver.

It's part of the experience of other industry leaders who have moved here, too: IBM, Honeywell, Ampex, Amphenol, Litton, Dahlstrom, Martin, Beech Aircraft, Ball Brothers Research, Bendix.

It's the reason why firms that began here have become industry leaders: Gates Rubber, Samsonite, Coors, C. A. Norgren, Ideal Cement.

SEND TODAY—For this handsome new 60-page brochure which gives you a broad review of Metro Denver and Colorado's Front Range of Science and Technology. All inquiries absolutely confidential. Forward Metro Denver, Department 179, 1301 Welton Street, Denver, Colorado 80204. Phone (303) 534-3211.



FORWARD METRO DENVER

washington report

NEW PROTESTS READIED ON AT&T LINE TARIFFS

GSA and Aeronautical Radio, Inc., are preparing formal protests to the new AT&T private line tariff; the objections probably will be filed about the end of this month. According to a neutral, expert source, there is "a good chance" FCC can be persuaded to suspend the new rates for 90 days because "AT&T has jumped the gun." If he's right, present individual private line rates, as well as Telpak A and B, would be extended 90 days beyond May 1st. The new tariff is predicated on an 8% rate of return, approximately, says our source, but the FCC hasn't yet decided what the return should be. So, if the new rates go into effect on May 1st, as scheduled, Ma Bell will start collecting revenue it may not be entitled to.

Suspending the tariff for 90 days could sidestep this problem because the commission would then have until the end of July to issue a verdict on rate of return. This is the chief issue in the general telephone investigation currently underway. A decision is expected in June.

After this question is settled, users can be expected to argue that the return from private line service should be lower than the over-all rate. They will also contend that AT&T has loaded its rate base with extraneous costs. The higher terminal rates in the new tariff are another thorn. AT&T says they're justified, at least implicitly, by the commission's order of several months ago, which ordered Ma Bell to "unify" private line and Telpak rates. Opponents say the order was restricted to line charges.

LAW ENFORCEMENT AGENCIES MAY BE BIGGER COMPUTER MARKET

Spurred by a recent Presidential message, proposed legislation, and a massive report, law enforcement agencies are likely to become a much bigger dp market. The legislation (S 917) authorizes $50 million in grants to state and local governments for equipment and personnel. Better deployment of police and court forces is among the goals. Title III of S 917 authorizes research contracts, designed to improve methodology, between the federal government and public or private organizations.

The report, issued last month by the President's Commission on Law Enforcement, devotes most of Chapter II to promoting a computerized command and control system. It presents a cost-effectiveness analysis showing that such a system is the optimum way, among several alternatives, of nabbing more crooks. A Commission study of Los Angeles arrest records suggests that the police solve only about 25% of all reported crimes. The report recommends "an experimental program to develop a computer-assisted command and control system ... established with federal support."

ARMY ADP CHIEF RETIRES: FORMAL ORGANIZATION CHANGES

Col. Morris Dantzker, chief of the army's dp management activity, is retiring the end of this month and the operation is being shifted on the organization chart.

Dantzker reported directly to the Vice Chief of Staff. An Assistant Vice Chief will be appointed shortly. Army Information and Data Systems (AIDS) is to be put in his office, under the immediate supervision of a Director of Management Information Systems; AIDS will then become MIS. A likely candidate for director is Col. Jay P. Thomas.

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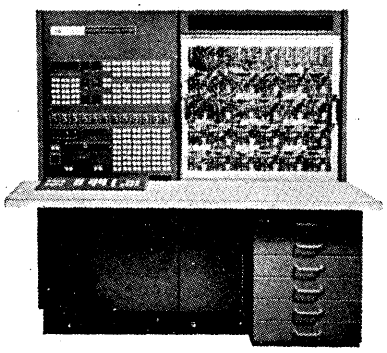

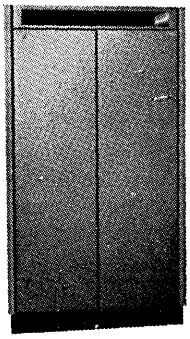

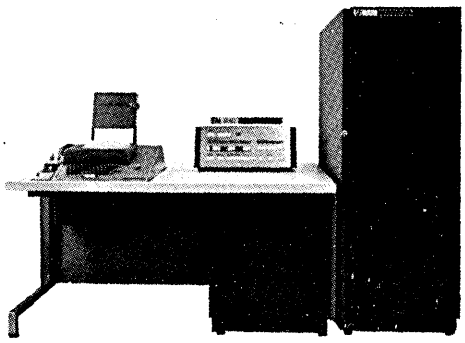

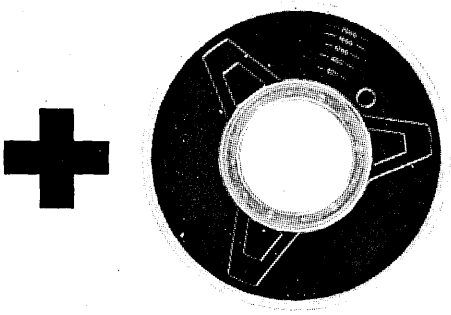

How to use simple addition

to solve complex problems

Introducing the 690, the new EAI hybrid computing system. Now you can get a working hybrid computing system by adding two EAI computers and an interface together and loading the software into memory.

The new EAI hybrid has an analog computer ready and waiting for a digital that was designed for the hybrid hookup... where the interface was designed to take maximum advantage of both computers' features... where the software is standard, already written and tested and ready to load. In short, a working hybrid computing system that's still more than the sum of its parts, but is created by straightforward interconnection.

This simple addition means a single responsibility for the system. It also means reliable software maintenance and updating, as well as the advantages of other laboratories using the standard 690 systems.

It means you can start toward a hybrid system from either an analog or digital computer and expand in orderly fashion without running the risk of "experimentation" in your system.

The four parts of the EAI 690 that you add together were designed together to deliver more computational return on your invested dollar.

First in the addition is the EAI 680 analog computer, embodying over a decade of EAI experience. It's a sophisticated 156-amplifier machine, which even in its basic form includes a healthy complement of digital logic and control.

Then there's the EAI 640 digital computer. It was designed from the start with an extremely flexible input-output structure so that it is integrated easily into a hybrid configuration.

Between them is the EAI 693 which functions as both a data converter and comprehensive monitor and control interface unit for the system.

Finally, there's the 690 software which solves problems rather than creates them. It includes hybrid FORTRAN, HYTRAN℠ Operations Interpreter, Hybrid Debug, Hardware Diagnostics and a Hybrid Subroutine Library.

All this adds up to a superior capability for scientific problem-solving. You get high-speed analog capability for the simulation of system dynamics combined with the memory, logic and high-precision numerical capability of the digital computer. The engineer, the scientist, the designer is still "part of the loop", still capable of direct interaction with the program to add his own creative input.

We'll be happy to send a complete technical description of the EAI 680 analog computer or the EAI 640 digital computer, as well as the EAI 690 hybrid computing system. That way we can also get across what we mean by the EAI backup services, such as training, maintenance and five computation centers with standard systems, as well as total system responsibility, software maintenance and the users library. Write today.

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690

EAI® ELECTRONIC ASSOCIATES, INC.
West Long Branch, New Jersey

world report

360/67 SOFTWARE SNAGS AFFECT EUROPEAN PLANS

The delivery setbacks on time-sharing software for the 360/67 have created a furor among many European industrial and scientific groups. One estimate is that at least half the 67s ordered will be affected by this software nose-dive. In the U.K., CEIR Ltd. has based a $9 million expansion on the big 360. They are known to be reconsidering Control Data as an alternative. Britain's Atomic Energy Authority, Shell Petroleum in The Netherlands, and the giant BASF industrial group in Germany are other big customers very dependent on time-sharing ability for their planned systems. In spite of the difficulties with the 67, the Universities of Newcastle and Durham have joined forces to share a $2.25 million installation due for delivery by the end of this year. But at three other universities with large re-equipment schedules -- Imperial College, London; Manchester University; and Bristol University -- the IBM 67 doesn't even rate a starting price at the moment. All three of these installations will be over the $2.5 million mark. Bristol is expected to drop first. A CDC 6400, with 1700s linked on as remote consoles, is tipped as the favorite. Decision date is scheduled for June. Contracts for Manchester and Imperial College have become a much more protracted affair for political reasons. But CDC is again odds-on favorite.

GERMANY STRENGTHENS COMPUTER FACILITIES

The German computer industry has taken another step further in a process for consolidating the industry that started last November. The giant Siemens company (Germany's biggest electrical engineering combine, with manufacturing licences with RCA for Spectra 70) has bought a majority holding in Zuse. Owned by Dr. P. Zuse until 1964, this tiny company was first sold to another industrial giant, Brown Boveri, of Switzerland, who was intent on exploiting Zuse machines for process control for power stations and industrial plants. Now the Zuse company has passed back to German control and will fill part of Siemens' urgent need to expand production. Brown Boveri still maintains a 30% stake in Zuse, but the repurchase by Germany is indicative of the Bonn Government's attitude for putting Germany into the rank of a Western European computer power. There are strong signs that Germany may be prepared to enter into collaboration with France on special large machine projects, thus taking over a budding partnership that faltered when French and British companies tried to get together more than 18 months ago.

ICT FACING FURTHER MANAGEMENT CHANGES

Forever in top management turmoil, ICT is faced with another change in the higher regions. Chairman and chief executive Mr. Cecil Mead has retired. Temporary executive is Colonel T. Maxwell, Mead's deputy and nominee of the Vickers industrial group which holds a 23% stake. This situation is expected to last out the year. After 10 years of mergers and

(Continued on page 93)

Why not?

—because The Kelly-Springfield Tire Company gets the right tire to the right place at the right time, with a modern communications and data processing system, that's why not. And they sell over 2600 different sizes and types of tires in the U.S., Canada and 66 other countries.

Here's how the system works: at each warehouse Bell System Teletype® machines use master tapes to enter standard information on customers and their purchases, while the variable sale information is typed in manually. The machines make printed orders and by-product tapes containing this information.

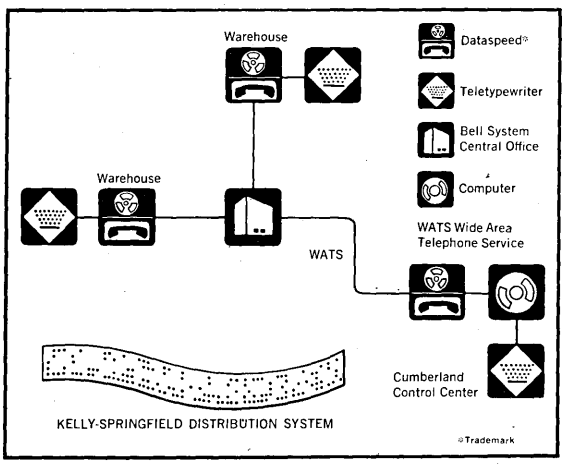
The Cumberland, Maryland, Control Center uses Wide Area Telephone Service to make scheduled calls to the warehouse Dataspeed senders. The punched paper tapes are then transmitted over Dataspeed at 1050 words a minute. Full daily information from the company's giant warehouses, strategically located throughout the country, is transmitted in 16 minutes.

Weekly reports at Cumberland give a complete picture of inventory, sales and orders for every warehouse in the country. A summary of data from each of the 26 warehouses is prepared for factory production scheduling.

The result: Information flow is faster, more accurate. Customers get the best possible service, everywhere in the Kelly-Springfield marketing world.

For more information, call your Bell Telephone Business Office and ask for a talk with one of our Communications Consultants. And don't hesitate to call us early—because that way we can serve you best.

When you work with data communications, work with the Bell System.



BELL SYSTEM AT&T and Associated Companies

(Continued from page 91)

management shuffle, cut and deal, ICT is destined to get an outsider to take over the reins. The company's advisers are looking for a hardened industrialist to inject new blood. This may be quite a job seeing how much has been spilt in past years. Salary is believed to be no object: the $200 million ICT group will probably end up as one of the dozen or so British outfits paying over $100,000 a year for their man.

AIR TRAFFIC CONTROL PLANS IN MODEL STAGE

Airspace modelling is rapidly coming in vogue this side of the Atlantic. The Eurocontrol Experimental Centre, Bretigny, has contracted General Precision Systems of London to model European airspace for use with the agency's new Telefunken TR4 Computer. And in Britain, Elliott Automation is constructing a model of airspace and air traffic over the U.K. under a contract from the Ministry of Technology. It will be used to test the operational rules for the national air traffic control scheme. The specification has been set for a Coral '66 as a programming language for this type of real-time control system. Original Coral was a sub-set of Jovial. It has since been through the mill (there are at least three manufacturers and two defence establishment versions) and is about to emerge as a unified language called Acol (Algol-Coral).

CAI MARKET IN U.K. SHOWS SIGNS OF LIFE

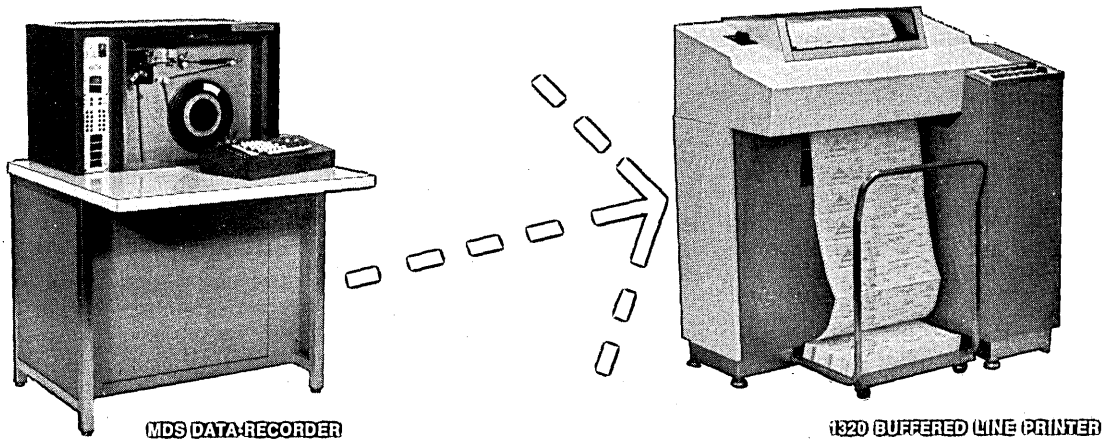
Proposals have been put to the British Department of Education and Science and the Ministry of Technology that could open the estimated $30 million market for computer-aided teaching systems. The College of Education, Bolton, Lancashire, has asked for a $150,000 grant for a research teaching system. It is based on an Elliott Automation 903 16K machine and an Educational Systems Ltd. teaching machine. Bolton's proposal is aimed at breaking a bottleneck in training staff to write programmed instruction material and in validating available teaching programmes. In the U.K. alone there are more than 5,000 of the electro-mechanical teaching machines that are programmed with material held on film. A library list of some 1,500 programmes has been established. But there is no central organisation for checking the validity of this material. The idea at Bolton is to establish a centre which will sort out the programmes in good or bad categories. To do this, up to 30 teaching machines will be linked to a 903 computer. The machine will automatically check and analyse how a complete class gets on with the same material. At present this type of job (all too rarely carried out) is done with a teacher monitoring pupils with a pencil and pad to see how they fare with a new programme.

BITS & PIECES

The Bayerische Hypotheken and Weshel Bank have plumped for a Univac 491 to link 50 branches around Munich to a head office dp centre. It will handle current and deposit accounting, would probably be the first on-line banking system to come on-stream in Germany ... One of the biggest makers of automatic control gear in Denmark, Danfoss, has ordered a batch of GE-115s from Bull-General Electric ... Britain's Department of Education and Science has completed a manpower report called Computer Education. It emphasises a growing shortage of personnel and calculates that manpower needs will rise by 11,000 systems analysts, 19,000 programmers and 16,000 operators by 1970.

This Low-Cost MDS Data-Recorder/Line Printer Team . . .

Depending on the Data-Recorder model, other EDP functions are provided in addition to the Line Print-Out . . . *



MDS DATA-RECORDER

1320 BUFFERED LINE PRINTER

. . . unbinds your printer-bound computer installation . . . eliminates the need for a remote line print-out computer

Here's line print-out, from magnetic tape, with no computer involvement. This MDS combination also can take the place of a remote computer for line print-out. And when linked to an MDS 1103 Data-Recorder, it can handle line print-out of data received, over standard transmission facilities, from remote locations.

This new MDS combination links a 1320 Buffered Line Printer with *any* MDS 1100 or 6400 Series Data-Recorder (The 1100 Series records data at 200 BPI on 7-channel magnetic tape . . . the 6400 Series at 800 BPI on 9 channels). Data Recorder memory may contain 80, 90, 100, 120 or 140 characters.

The 1320 will print a maximum of 132 characters per line, at a maximum of 300 lines per minute. Maximum paper width is 20 inches. Paper slewing rate is 25 inches per second.

Rental for the 1320 unit is unusually low . . . $420 monthly plus $70 monthly maintenance. Data-Recorder rental and maintenance depend on the model used.

When not in use with the Buffered Line Printer, Data-Recorders may be used for routine transcribing and verifying of data on magnetic tape, for computer input.

Tell us your application . . . we'll supply more details.

1101
Routine transcribing of data from source documents direct to computer magnetic tape.

1102
Pooling short batches of data into a single magnetic tape.

1103
Long-Distance transmission of data.

1104
Adding/Listing machine function.

1105
Transfer of coded data from punched paper tape to magnetic tape.

1106
Conversion of data from punched cards to magnetic tape.

1109
Combination of punched card data conversion and long distance data transmission.

MDS

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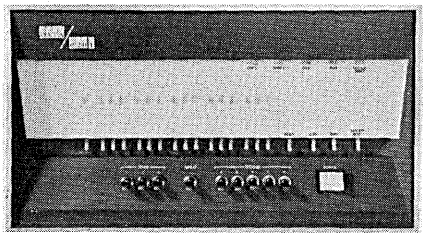
CIRCLE 58 ON READER CARD

new products

systems computer

DATA/620 I is a system-oriented digital computer designed for system and automation tasks previously considered too expensive for computer solution. Easily interfaced with special-purpose system components through its Party Line I/O system, the i.c. computer also has the Micro-EXEC facility, a proprietary hardware technique for micro-step sequencing which permits subroutine processing at



nanosecond speeds. System includes over 100 machine commands and register change commands, and six addressing modes. Offers modular software, up to 32K (16 or 18-bit) words of storage, and a memory cycle time of 1.8 usec. Typical system with 4K memory and teletype costs less than $15K. DATA MACHINES, INC., Newport Beach, Calif. For information:

CIRCLE 100 ON READER CARD

card reader

CRU-DS5 card reader is designed for card input to the telephone company's type 5 data set, which transmits at 650 wpm. The hopper-feed unit reads punched cards at a 65 cps effective rate, and converts data to any 5, 6, 7, or 8-level parallel code for transmission. One model, DS5-N, is available now; DS5-S will be available in second quarter '67. DIGITAL ELECTRONIC MACHINES, INC., Kansas City, Mo. For information:

CIRCLE 101 ON READER CARD

typesetting software

Computerized typesetting system that virtually eliminates the hyphen combines a Spectra 70/25 65K computer system with a Photon 560 typesetter. The process, AUTOSCRIPT, requires a minimum configuration of six tapes, paper tape reader-punch and a printer. Able to vary spacing not only between words, but also between letters, the phototypesetter can justify lines on the two-column pages without resorting to hyphenation except in very unusual circumstances. Software is free to Spectra buyers. RCA EDP, Cherry Hill, N.J. For information:

CIRCLE 102 ON READER CARD

hybrid computer system

EAI has combined a 693 linkage system with its already announced 640 digital computer and 680 analog-hybrid computer to form an integrated medium-scale hybrid, the 690. The system has the same control, set-up, output, display and software philosophies as the large-scale 8900 hybrid system. A major feature is modularity, permitting addition of digital or analog capabilities. The digital system offers a 16-bit instruction and data-word plus protect bit, a protected core memory with 32K word storage capacity, a 1.65 usec cycle time, a repertoire of 62 instructions, multi-level interrupt capabilities and a capacity to communicate with up to 64 peripheral devices. Maximum I/O rate is 1.2-million 8-bit bytes per second. In the analog portion of the system, the user is provided high dynamic and static accuracy, 500 kc bandwidth operational amplifiers, a system pre-wired for expansion to 156 analog amplifiers, extensive parallel logic capability, servo-set pots, low (10-volt) power requirements. Primary areas of use, for which applications packages are designed, include aerospace, bio-medical, process control and education. The software library, used on the 8900, includes hybrid FORTRAN symbolic assembler with linkage routines, Hytran Operations Interpreter, hardware diagnostics, Hybrid Debug, and other hybrid routines. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J. For information:

CIRCLE 103 ON READER CARD

disc files

Three categories of head-per-track disc files include Systems Memory, small but fast storage, provided as an extension of main memory for permanent storage of control programs, operating software and program libraries. These units, designed for the B2500/3500, have capacity ranges of 1-2 million bytes, average access time of 17 msec, transfer rate

PRODUCT OF THE MONTH

An advanced communications technique, Binary Synchronous Communications (BSC), which can double the speed at which computers communicate, has been designed for the System/360 Tele-processing networks. BSC more effectively regulates the flow of data characters into transmission lines, increasing the speed of transmission from 25-100% by generating control characters. Control characters are derived from elements of logic circuitry, the utility program and characters present in the customer's input media. The control characters generated by BSC are flexible, permitting multipoint operation on synchronous lines.

Also announced is a new terminal, the 2780, which allows users to send information in its original data format (without conversion or editing of machine language input) between the terminal and System 360 mod 30, 40, 50, 65, and 75's equipped with BSC versions of the 2701 data adapter and the 2703 transmission control unit.

The 2780 is available in four models offering various combinations of printing, card reading, and card punching. Without special features, the unit allows data transmission speeds up to 400 cps, printing of 300 lines/minute, card reading at 400 cpm, and card punching at up to 270 cpm. Buffering of I/O transmission data, as well as BSC capability, are built in. Terminal has an 80 print position printer and choice of four character sets: 39, 47, 52, 63; transmission codes available are ASCII, EBCDIC, and Transcode.

First deliveries of the terminal are scheduled for fourth quarter '67. BSC on the 2701 and 2703 will be available in second and fourth quarter '67, respectively. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 104 ON READER CARD

new products

of 292 KB, and are available now. Modular Random Storage discs are designed to handle medium-size activity files. Range of capacity for these units is from 10 million-19.2 billion bytes, access time is 20-30 msec, 218-1000 KB transfer rate; most models are currently available. Data Memory Banks are an organization of head-per-track files into banks of modules for high-volume storage with the ability to add in small increments. Units have capacity from 100 million-1.25 billion bytes, 40-60 msec access time, and 377-395 KB transfer rate. Two models are currently available; others will be produced in February '68 and January '69. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 105 ON READER CARD

voice-band data set

Three new data sets are designed to connect directly to leased telephone facilities or privately-owned communication lines. Units are AE2024, a non-synchronous frequency-shift-keying (FSK)—i.e., directed by incoming data from one frequency to the other—operating at up to 1600 bits per second; AE2025, a synchronous FSK unit, operating at fixed rates of 600 or 1200 bps; and AE2026, synchronous FSK, operating at a fixed rate of 2400 bps. All three can be used with 2- or 4-wire facilities. AUTOMATIC ELECTRIC DIV., GENERAL TELEPHONE & ELECTRONICS, Northlake, Ill. For information:

CIRCLE 106 ON READER CARD

gp system

Disc-oriented version of the CDC 3000 series is the 3150, which offers simultaneous foreground and background processing under Mass Storage Operating System. Features include 24-bit (binary) word, 1.75 usec cycle time. BCD and floating point hardware are optional, with both available in one package. Price of the basic configuration—cpu/console, 16K memory, two 12-bit channels, one 24-bit channel, peripheral control electronics, 1200 cpm reader, two 854 (8.2 million characters) discs, two disc packs, and 300 lpm printer—is $325K, or $8300/month. An extra 16K of core and optional peripherals are also available. Software includes MSOS, CDC FORTRAN and COBOL, assembly system, ALGOL, PERT cost and time, simultaneous peripheral processing package, and ADAPT, for numerical control. Compatible with the 3300,

You ask what it costs to get started on a total information system?

This new concept in computer systems packaging lets you substantially lower the cost of implementing your total information system.

Look what you get: Not some "same as you had before except cheaper" computer — but the CONTROL DATA® 3150 — a complete, self-contained, mass-storage-oriented computing system.

The standard 3150 "starter-set" package includes central processor with desk console, I/O typewriter, 16K memory (1.75 usec. cycle), three high speed data channels, card reader, two disk storage drives with two disk packs, plus a 300 LPM line printer — or optionally, our 1000 LPM printer.

That's only half of it. With the 3150 you get field proven software so you can start-up immediately. Mass Storage Operating System (MSOS) library includes COMPASS, FORTRAN, COBOL, SORT, just to mention examples; provides the capability for simultaneous foreground stacked-job activity, and a background I/O or real-time activity.

Delivery? As soon as you're ready. The 3150 is also fully compatible with larger 3000 Series Control Data systems.

Ask any Control Data representative to tell you more about the 3150, or write for information to our Minneapolis office, Dept. H-37.

...$325,000 outright
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CONTROL DATA CORPORATION

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CIRCLE 59 ON READER CARD

3-67

new products

the 3150 can be delivered four months after receipt of order. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 107 ON READER CARD

display tube

Type 24M18P31M is a 24-inch all-glass flat-face cathode ray tube for large console displays, particularly those used in air traffic, military and computer-driven systems. The flat face provides wide-angle viewing; all-glass makeup gives high strength and simplified mounting; low deflection angle (57 degrees) increases precision. Specifications include magnetic focusing and deflection, 57° deflection angle, 136" spherical plate radius, P31 phosphor, 25 kv accelerator voltage, and 5 mil center line width. Price $1200 in sample quantities, delivery time 30 to 45 days. THOMAS ELECTRONICS, INC., Clifton, N.J. For information:

CIRCLE 108 ON READER CARD

line printers

Four line printers, for use with the EELM System 4 computer series, include the Mod 4554, which operates at 2700 lines/minute with 160 print columns. Other models are the 4555: 1350 lines/minute, 132 print columns; Mod 4560: 750 lines/minute, 160 print columns; and Mod 4561: 750 lines/minute, 132 print columns. For each model, 64 characters are available in ECMA type font B, with 6 and 8 lines per inch spacing. Transfer to print buffer can be made at a rate of 200K bytes/sec. Company is developing OEM activities in the U.S. ENGLISH ELECTRIC-LEO-MARCONI COMPUTERS, LTD., London, England. For information:

CIRCLE 109 ON READER CARD

storage and retrieval software

ACCUFILE is an information storage and retrieval software system designed to handle data involved in computer programming and applications. Programs, flowcharts, etc., punched on cards, are stored on tapes and duplicates, eliminating the need for the cards. A separate and continuously updated index is automatically maintained, being printed out after each update, on the identification, location and modification of all data on the tape file. A compression technique allows one-half-million cards to be

recorded on ½" tape with a packing density of 1600 bpi in 9-parallel bit characters, allowing a 24-bit word to be represented in 3 characters. Block lengths range from five 24-bit words to 4,096 24-bit words. In configurations using the larger cpu, reverse reading of a single block is possible. INTERNATIONAL COMPUTERS AND TABULATORS, LTD., London, England. For information:

CIRCLE 117 ON READER CARD

incremental recorder test unit

Model 1400 test unit is capable of exercising incremental recorders by supplying all external command functions including Step and Record and

IRG signals, and monitoring all recorder outputs. Programming capabilities include a wide variation in recording rates, a choice of record lengths, odd or even parity, and the type of repetitive pattern recorded on tape. Price is $350. DIGI-DATA CORP., Bladensburg, Md. For information:

CIRCLE 118 ON READER CARD

output recorder

The 280 microfilm recorder and display system can generate 126 different alphanumeric characters and special symbols, both upper and lower case letters; unit can rotate, italicize or intensify any symbol, can plot points or draw vectors in continuous lines rather than short strokes. Five-inch CRT produces image for the microfilm recording camera, and a 7" dia. CRT produces the image for the hardcopy output. A 19" CRT is optional for visual monitoring. Data may be displayed a line at a time, page at a time, or in any random sequence—in four standard selectable character/symbol sizes of 128, 85, 64 or 43 characters per line. System can display computer output at rate of 110K cps, or 128-character lines at a throughput rate of 38,400 lines per minute. Vectors and points are displayed and recorded at rates up to 200K per second; vector generator can go from smallest size to full-screen diagonal in one command. DATA DISPLAY DIV., CONTROL DATA CORP., St. Paul, Minn. For information:

CIRCLE 119 ON READER CARD

drum subsystem

The FH-1782 drum (two-million-word capacity) and FH-432 drum (262K words) have been tied together in a subsystem for use with the 1108 and 494 computers. Up to eight drums—either model, any combination—can be in the subsystem, handled by one control unit. Two control units may be used, however, each with access to any drum (wired for dual channel operation), to provide for execution of two operations simultaneously and to provide for the backup necessary in multiprocessing. ATI drums and control units in the subsystem are logically and electrically independent so that a failure in any one unit will not affect the others. UNIVAC DIV., SPERRY RAND, Philadelphia, Pa. For information:

CIRCLE 120 ON READER CARD

telemetry and remote control

Tone telemetering and remote control system employs tone echoing which enables it to handle up to 1000 separate channels of data over a single voice grade telephone circuit, compared to a maximum of 30 with conventional techniques. Basic to the system is Twintron, and electromechanical resonator with an extremely high Q; unit is not affected by shock, vibration, humidity, altitude or proximity to other resonators. Tone is transmitted from control points at one frequency and the answer-back signal is transmitted through the same circuit in the reverse direction as an "echo"—therefore requiring only one tone frequency. Applications include water works and pipe line telemetering, actuation and verification of railroad signal indications, remote control telemetering of radio transmitters. H B ENGINEERING CORP., Silver Spring, Md. For information:

CIRCLE 121 ON READER CARD

conversion system

Designed specifically for a Univac 1108 installation, a-d interfacing conversion system consists of control logic, interface electronics and two 32-channel 50KC a-d multiplexors and converters. After each conversion, the data is stored in a buffer register and an input data request is sent to the computer. Upon acceptance, the computer sends an input acknowledge signal to the interface system. DATAMETRICS CORP., North Hollywood, Calif. For information:

CIRCLE 122 ON READER CARD

let yourself GROW

at NCR's expanding electronics division in los angeles

Take Southern California's largest commercial computer facility, multiply by two, and you have a quick picture of today's expansion at NCR Electronics Division. You can accelerate your own future by joining this dynamic organization now. At NCR, you will share new challenges with men who have already placed some of the world's most advanced digital systems hardware on the market. And you will help create systems to bring business automation to more than 120 countries. The Southern California skies are clear and the track is fast. On your mark, get set, grow.

stored on a tape.

The basic system has 13 major commands and is modular according to function. It will delete a deck from the tape, build a new deck from new data and routines already stored, move a file from one tape to another, print a file, generate a tape for subsequent punching of a card deck, build a tape from stored decks and parts of decks for a computer run, and generate a flow chart stored in the file.

New capabilities can be added to the open-ended ACCUFILE, which is written in machine language for the 7090/7094, and is being converted for the 360/50 and other models. ANAGRAM CORP., Springfield, Va. For information:

CIRCLE 110 ON READER CARD

data reduction software

The MAC/RAN data reduction system is a software package for analysis of random data in a range of engineering applications. System consists of an Executive and a series of computational processors, all designed to operate on most systems incorporating ASA FORTRAN IV compilers or equivalents. Executive is modifiable to increase or decrease the number of intermediate storage devices required to operate the system. All communications between processor and environment are through Executive routines. Data preparation operations include calibration, units conversion, digital filtering, decimation and trend removal. MEASUREMENT ANALYSIS CORP., Los Angeles, Calif. For information:

CIRCLE 111 ON READER CARD

hospital terminal

Designed for use in nursing stations, the Medset on-line hospital terminal can also be used in laboratories, pharmacies and administrative offices. Terminal is connected to an NCR 315 or 315 RMC computer with minimum memory of 20K. The RMC can also handle more than one job simultaneously. Medset has a 10-column keyboard, slip and journal printer, and display light panel. Entries on the console are directed by a system of eleven logic-controlled response lights. First deliveries are scheduled for mid-'67. THE NATIONAL CASH REGISTER CO., Dayton, Ohio. For information:

CIRCLE 112 ON READER CARD

document reader

Series 220 electronic readers feed and read documents that have been gang punched with the firm's Original Document Processing (ODP) perforated figures which are both human and machine-readable. Models are available wired for connection to card punches, paper tape punches or mag tape recorders. Data conversion speed ranges from 25 transactions per minute with a one-transaction punched card to 60 transactions/minute with mag tape. The unit can process items ranging from 4″ to 7¼″ in width and 2¼″ to 3⅜″ in height. CUMMINS-CHICAGO CORP., Chicago, Ill. For information:

CIRCLE 113 ON READER CARD

optical card scanner

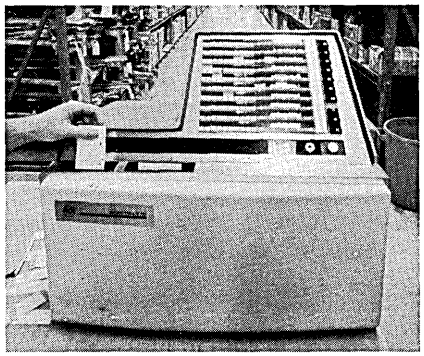
The MRC 1501 optical card scanner is designed for use in such educational and hospital dp applications as billing, tests, surveys and grade reporting. It reads position-coded, pencil-marked, printed and imprinted data from both sides of an 80-column card in a single pass, simultaneously reading punched-hole data. The computer-controlled unit can read up to 1500 cards/minute into the cpu or onto

mag tape; hardware interfaces and software editing, communications and formatting for the 1501 are available for use with the IBM 360 and Honeywell 200 systems. The system uses discrimination circuitry which permits selection of the darkest mark in a column, ignoring erasures and smudges. MEASUREMENT RESEARCH CENTER, Iowa City, Iowa. For information:

CIRCLE 114 ON READER CARD

data collection system

Replacing the EDGE system in the RCA product line, the 70/630 Data Gathering System is designed for use with the Spectra 70/35, 45 and 55 computers. The DGS input station, with a full range of controls and accuracy checks, can be located as far



as 30 miles from the computer, and can transmit information at a rate of 120 cps. Up to 384 terminals can be connected to each Communications Control Multichannel on the computer. Deliveries of the system and software will begin in first quarter '68. RCA EDP, Cherry Hill, N.J. For information:

CIRCLE 115 ON READER CARD

card sets

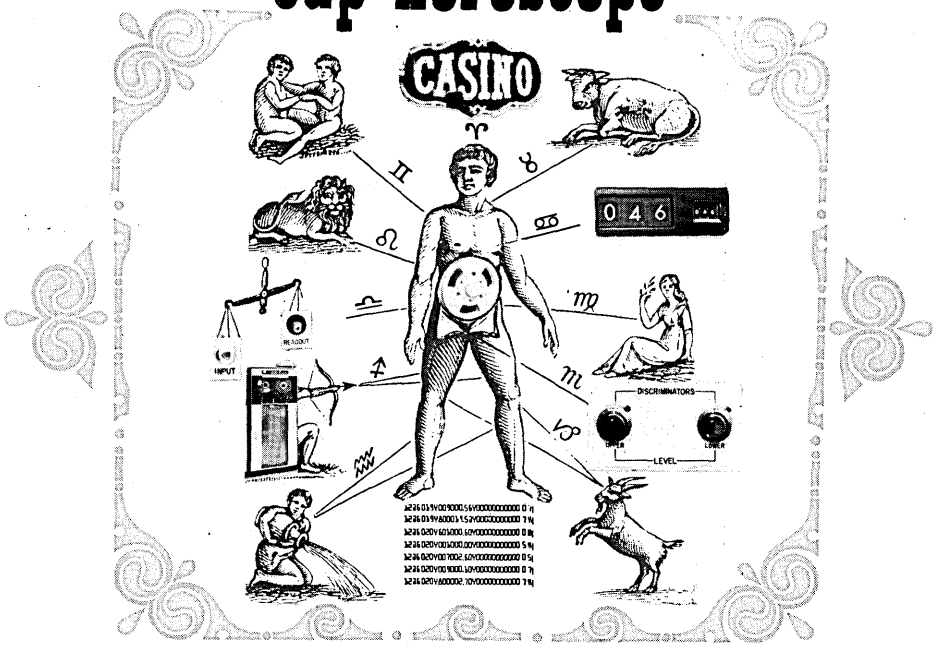
Data processing card sets for retail, wholesale and industrial control systems are available in perforated, mark-sensing and optical scanning designs. Special set includes two to five part sets with two tab cards, single- or double-sided carbons with thumb-notch carbon extraction, and choice of colored stock or two-color printing on one or both sides of the form. SHELBY BUSINESS FORMS, INC., Shelby, Ohio. For information:

CIRCLE 116 ON READER CARD

mag tape system

Types 2504 and 2505 9-track mag tape systems for the 1900 Series computers have respective data transfer rates of 80K and 160K cps. Data is

edp horoscope



by T. D. C. KUCH

AQUARIUS *(January 21-February 19)*
You will discover a glitch in your new, super-duper GLUT compiler which was patented yesterday. Patent the glitch.

PISCES *(February 20-March 20)*
You will write a brilliant parody. DATAMATION will publish it. Everyone will laugh and laugh. Except your boss. Dust off your resume.

ARIES *(March 21-April 19)*
You will find a program bug today. It will be in a program that has been running for months, and has gone through *n* cycles. Surprise—you have irretrievably lost *n -1* master records. Dust off your resume.

TAURUS *(April 20-May 20)*
You will send a discreet job feeler in reply to a blind ad run by your own company. You won't be hired.

GEMINI *(May 21-June 21)*
Announce a new whizbang computer. If enough letters of intent come in, start designing it.

MOON CHILDREN *(June 22-July 21)*
Your company will spend two years developing a faster, cheaper version of rival's Computer X. A month after you announce Computer X^2, Computer X will be obsoleted by rival's Computer Y. Go back to thermostats.

LEO *(July 22-August 21)*
At the next JCC you will visit a hospitality suite and become disgustingly drunk. After it is too late you will discover that it was your own company's hospitality suite. Dust off your resume.

VIRGO *(August 22-September 22)*
This week is a good time to invent another ultimate programming language. Call it GLUT. Tell clients this stands for Greatest Language; Un-Toppable. In reality, it is an acronym for Generate Lots of Undocumented Trivia. Take out a patent.

LIBRA *(September 23-October 22)*
Release an untested system to your customers this week. Resist all complaints. Carefully collect customers' corrections. Publish them as your improvements.

SCORPIO *(October 23-November 21)*
Place a full-page ad in a computer magazine this month: advertise hell out of what you're weakest in. If your hardware divide won't work, praise your library routines; if your COBOL compiler is only half-written, call it COMPACT COBOL; if, on the other hand, it generates garbage as well as what it should, call it EXTENDED COBOL.

SAGITTARIUS
(November 22-December 21)
You will assemble your program today, and find no errors indicated. Correct source deck and try again.

CAPRICORN
(December 22-January 20)
The day after you exercise your stock option, your company's stock will drop 16 points. Don't bother delaying purchase of the stock; the market will wait for you.

NEW! THIN CONTAINERS FROM AMERLINE

Storage space is an expensive proposition for business today, and we at Amerline recognize this fact. It took a lot of engineering time to retain all the fine features of our standard container; a positive dust and moisture barrier, strong rigid construction, distortion free support for the reel, and above all our "trouble free" lock that you get only from Amerline.

You just do not have trouble with our lock. It does not wear. Positive action, yes! Wear particles, no! Easy to operate, but still, after thousands of openings and closings you will have the same smooth, trouble free, operation that you originally bought. There is no need to worry about contamination when you choose the new Amerline thin container.

Amerline thin containers and tape reels are available from your favorite tape supplier. Ask them for a sample.

Just to let you know we didn't overlook anything, our new thin line is the only one that will stack the same as the standard container.

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new literature

DISPLAY UNIT: 15-inch CRT display system that provides visual presentation of several computer variables simultaneously is described in four-page data sheet. Unit can accept up to 18 analog variables as inputs and simultaneously display any four as distinctly coded traces. General-purpose computer applications are optimization of a physical system's performance characteristics; investigation of the sensitivity of a system to parameter variations; determination of parameter boundary limits; definition of a control system's ability region, and fitting of theoretical curves to experimental data. Described are features, specifications, and external configurations. ELECTRONIC ASSOCIATES INC., West Long Branch, N.J. For copy:

CIRCLE 140 ON READER CARD

LOGIC IMPLEMENTATION: Primer is designed to help new and experienced engineers learn the design philosophy of the 13-Series line of microcircuit digital logic cards. Part one describes symbology and covers basic logic rules, and part two deals with the implementation of the logical rules using the 13-Series ADC line, covers the application of logic to flip-flops, "0"-level trigger control, NAND-ganging, positive load gating and special applications. CANOGA ELECTRONICS CORP., Chatsworth, Calif. For copy:

CIRCLE 141 ON READER CARD

RECORDING VERIFICATION: Four-page bulletin describes Flux Check, which is a means of reading each character in incremental recording to verify that it appears on the tape in its intended form. Timing diagrams and systems applications are shown, and interface specifications include function, description and signal. KENNEDY CO., Pasadena, Calif. For copy:

CIRCLE 142 ON READER CARD

DOCUMENT PROCESSING TECHNIQUES: Guide to processing storage and retrieval of bibliographic information at the NASA scientific and technical information facility are described in 149-page book. Report is designed as instruction manual for analysts, librarians, and information specialists. Cost: $3; microfiche $.65. NASA-CR-62033. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

REFERENCE TABLE: Covering the IBM 1300 and 2300 drum and disc storage units, the table is divided into two sections—Table A, which is an organization and pricing summary, and Table B, which lists the maximum record sizes and record transmission times for these devices. Transmission times and record sizes were calculated on a 1401. COMPUTER METHODS CORP., White Plains, N.Y. For Copy:

CIRCLE 143 ON READER CARD

COLLATOR-JOGGER: Brochure describes collator which in one pass assembles a 12-sheet set, handling flat or folded paper and forms varying from 3″ x 6″ to 24″ x 12″—intermixing paper sizes, grades and finishes. Assembly of doubles, blanks and bad pages can be prevented by visual control. CUMMINS-CHICAGO CORP., Chicago, Ill. For copy:

CIRCLE 144 ON READER CARD

MATHEMATICAL PROGRAMS: Catalog of 22 programs developed by NASA for its own use is now available to industry. Outlined are mathematical programs and digital-computer programming techniques that are available at nominal charge to private firms, educational institutions, and others in non-aerospace fields. Each program is briefly described, and a source for additional information with address is given. Cost: $1. NASA SP-5069, CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION, Springfield, Va. 22151.

BILLING AND INVOICING MACHINE: EBS/1210 desk-sized system is described in brochure. Individual data

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Challenges at all levels for: PROGRAMMING ANALYSTS

PROBLEM: To explore and develop promising possibilities in simulation, optimization, modeling and information storage and retrieval systems. Examples—a management financial model that will simulate and forecast company activities fully and accurately five years ahead. Systems for selected dissemination of information and remote access to large data bases.

PROBLEM: To contribute significantly to the solution of technical problems confronting an organization that devotes approximately 10% of its revenue to research and development...an organization that already has: a remote computing capability designed to serve some 2000 scientists and engineers; plus, real time control systems for prototype automatic-data-acquisition; plus, numerical control systems.

PROBLEM: To develop information systems enabling people to really communicate, make decisions and plan for the future. As of now, second generation equipment (represented in part by almost two billion characters of disc storage shared by three IBM 7010's) has been pushed to the limit. Many of the problems of communicating information from field locations to the corporate data bank still remain to be solved.

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Challenges for: PLANNERS, SYSTEMS DEVELOPERS & COMPUTING EDUCATORS

PROBLEM: How can third-generation computing and information technologies be applied to provide timely access on a nationwide basis to a centralized data bank of 8 billion characters. What configuration of computer and communication hardware should be used, and what software must be designed and implemented to make this goal successful.

PROBLEM: How can Programming Systems be adapted to solve the problems of integrated file organization, specific and generalized communications routines for data acquisition, on-line inquiry and updating capabilities, administrative message switching, remote computing concepts, problem-oriented languages and optimized utilization of computer facilities.

PROBLEM: To make certain, through the use of the best educational techniques, that top management and all functional areas fully realize and utilize the computer's real potential.

PROBLEM: Again through education, but without disturbing work in progress, to raise the capability level of all programmers and to prepare the company as a whole for the new environment.

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sheets cover I/O, operator control, processor, and stored program. System uses punched tape and stored program input and has a standard alphanumeric keyboard. LITTON ELECTRONIC BUSINESS SYSTEMS, Orange, N.J. For copy:

CIRCLE 145 ON READER CARD

MONOLITHIC DIODE MATRICES: Applications to dp systems are described in 60-page manual. Prepared as an aid to systems designers, the manual explains the dielectric isolation principle and metalized fuse link interconnection technique as applied to integration of custom-patterned diode matrices. Detailed information is provided on matrix configurations, electrical characteristics and applications. RADIATION INC., MICROELECTRONICS DIV., Melbourne, Fla. For copy:

CIRCLE 146 ON READER CARD

GENERAL HEURISTICS INVESTMENT MODEL: Designed for nonprofit research organizations, the model provides a formula for selecting research projects from many alternatives. This report describes a model that supplies information to aid decision-makers, and includes rate of return on investment; qualitative attributes per dollar investment; initial costs of projects; continuing investment requirements; alternative levels of investment time necessary to complete the project. After the critical factors have been evaluated, the projects are tested through the qualitative model. Cost: $3; microfiche, $.65. AD-640 651. CLEARINGHOUSE, U.S. DEPARTMENT OF COMMERCE, Springfield, Va. 22151.

MULTIPLEXER: Bulletin gives general description of model 501 which has a full-scale output of ±5.0 volts, lists standard features and specifications and explains theory of operation. SYSTEMS ENGINEERING LABORATORIES, INC., Ft. Lauderdale, Fla. For copy:

CIRCLE 147 ON READER CARD

CUSTOMER ACCOUNTING: Easy posting procedures for handling standard methods of accounts receivable are outlined in folder. MONROE INTERNATIONAL, INC., Orange, N.J. For copy

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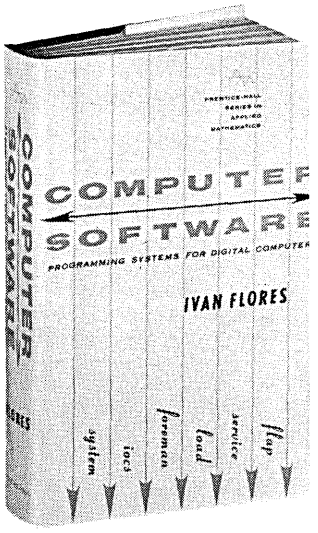

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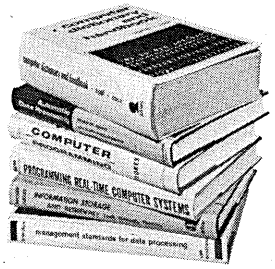

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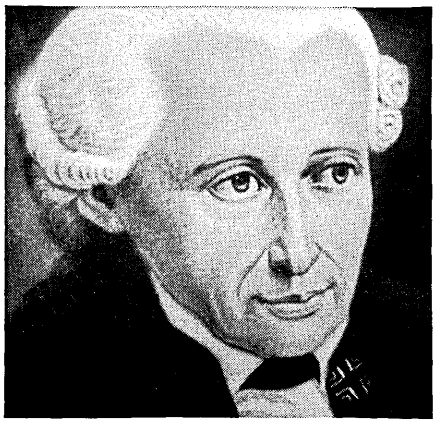
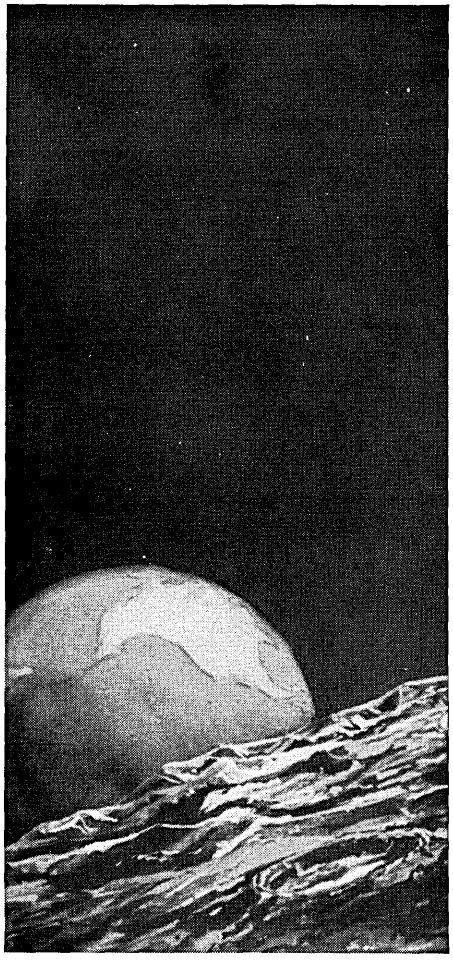
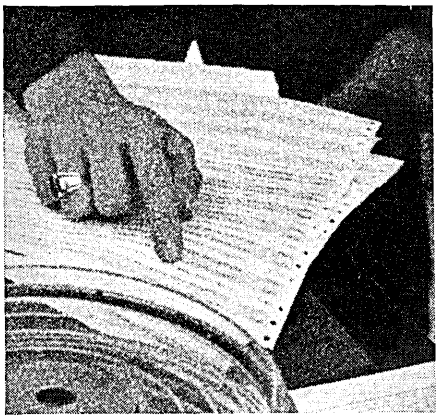


If you're the kind of systems programmer who has a mind that's deep enough for Kant,



broad enough for science fiction,



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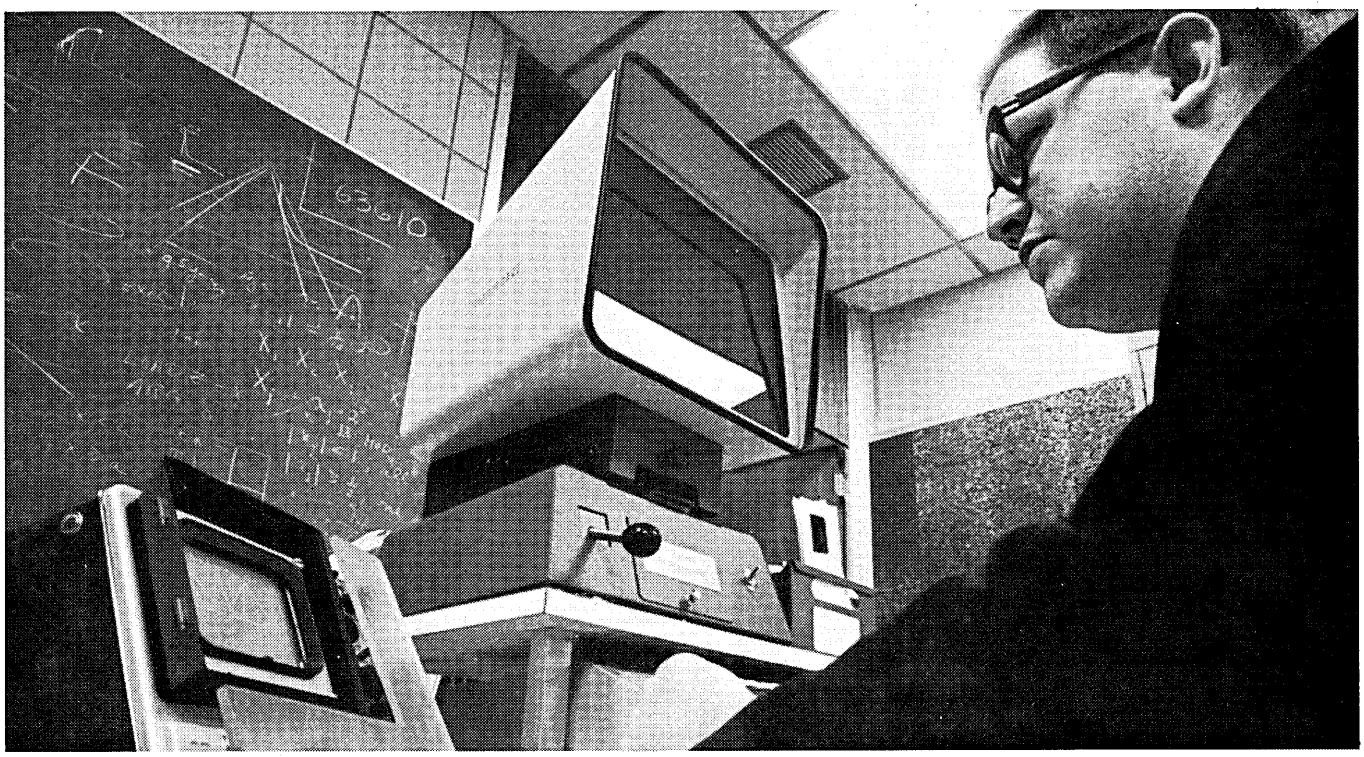

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* Built for Dynatech, Cambridge, Mass.

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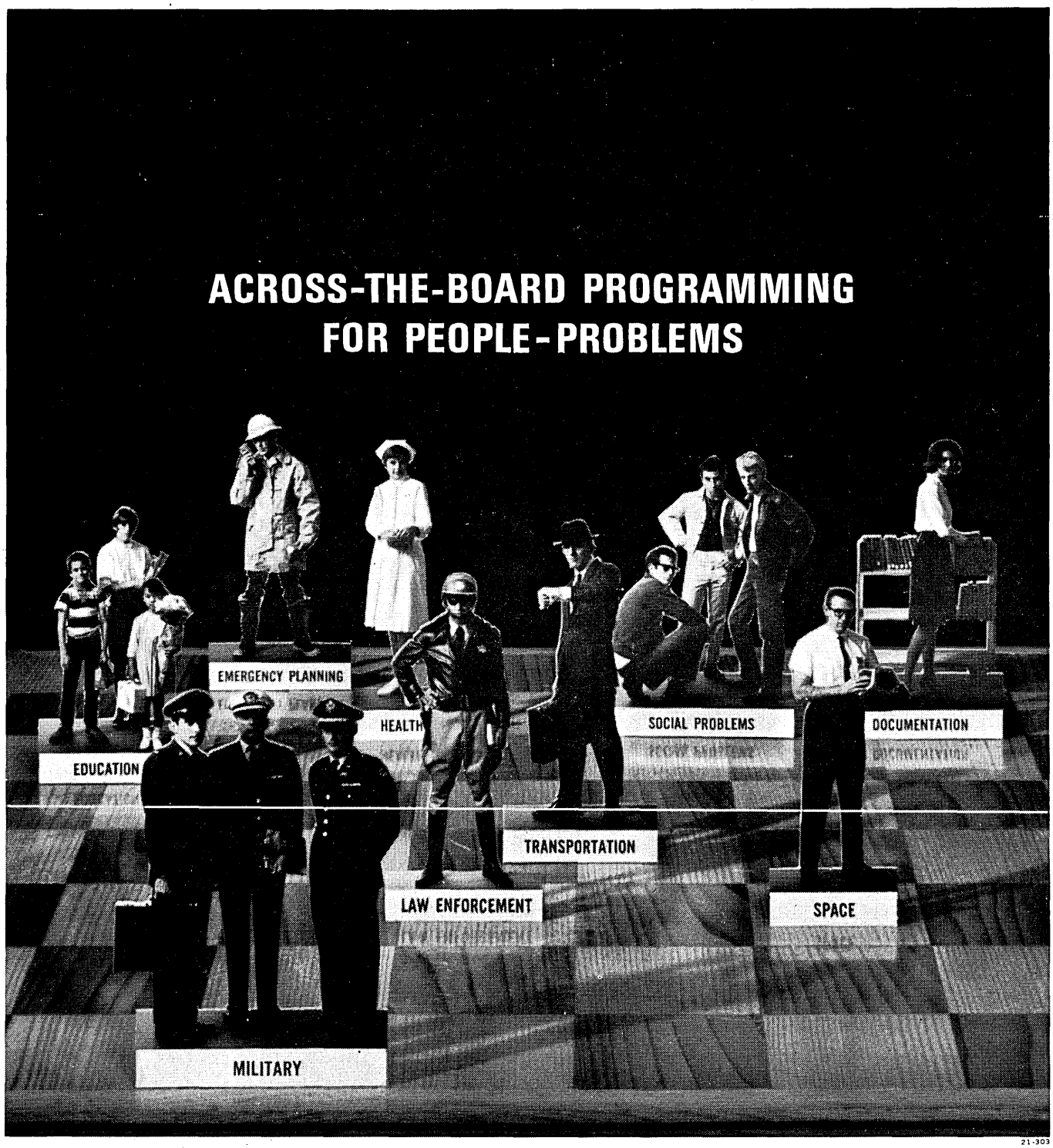

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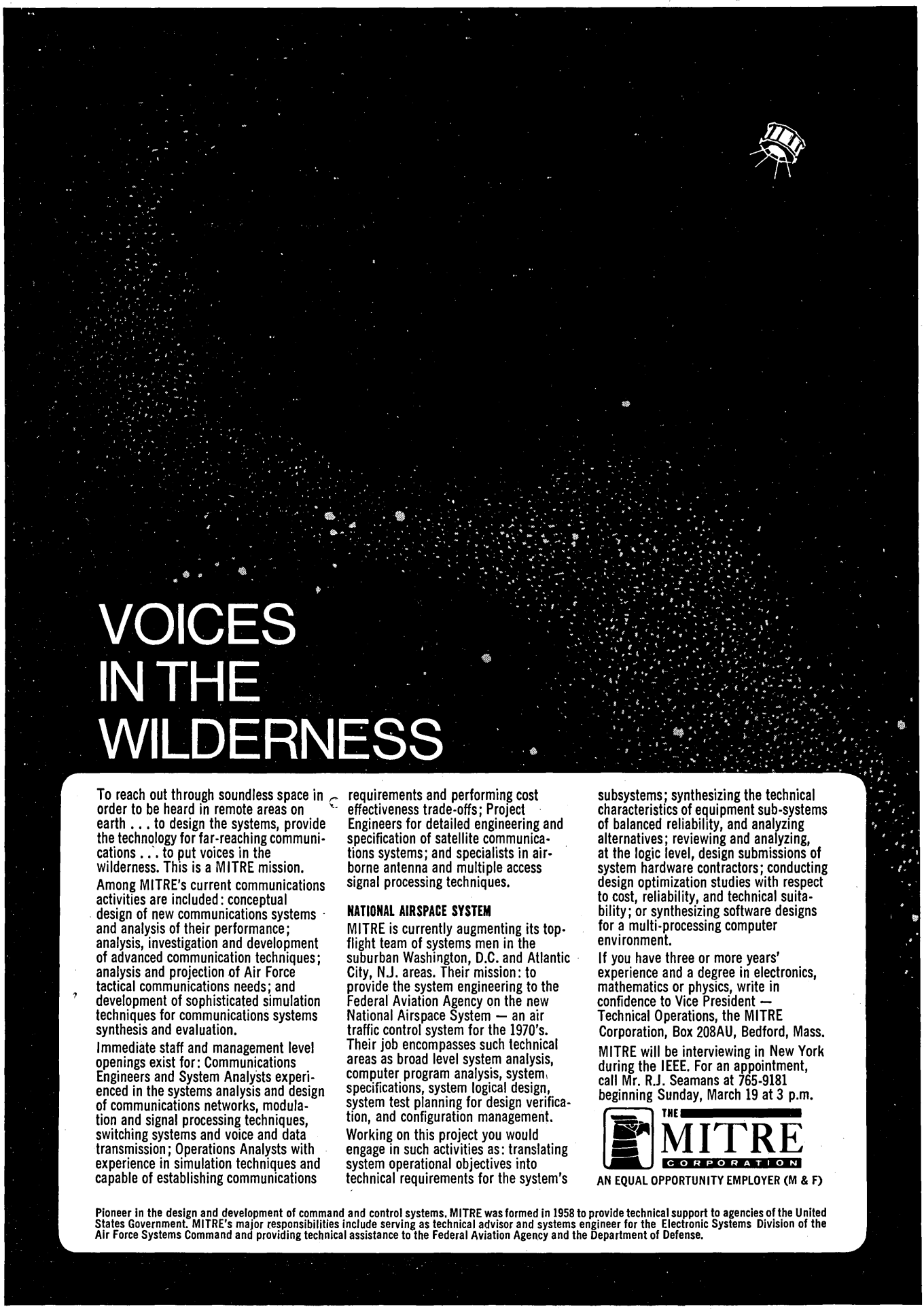

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MITRE is currently augmenting its top-flight team of systems men in the suburban Washington, D.C. and Atlantic City, N.J. areas. Their mission: to provide the system engineering to the Federal Aviation Agency on the new National Airspace System — an air traffic control system for the 1970's. Their job encompasses such technical areas as broad level system analysis, computer program analysis, system specifications, system logical design, system test planning for design verification, and configuration management.

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If you have three or more years' experience and a degree in electronics, mathematics or physics, write in confidence to Vice President — Technical Operations, the MITRE Corporation, Box 208AU, Bedford, Mass.

MITRE will be interviewing in New York during the IEEE. For an appointment, call Mr. R.J. Seamans at 765-9181 beginning Sunday, March 19 at 3 p.m.

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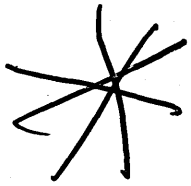
CIRCLE 324 ON READER CARD

look ahead

(Continued from page 19)

a profile questionnaire for their members, hope to distribute and process it with the help of ARPA dollars. Results could be available this summer. A second-stage study would attempt to identify the uses and users of a broader industry data base, then establish its elements. Without worrying about the practical difficulties involved in acquiring such information (e.g., how to get IBM to divulge its data), the study would ultimately result in a recommendation to ARPA on how to get the missing information. (See Editor's Readout, Feb. & March '66.)

MAKING MONEY WITH AN OFF-LINE PRINTER



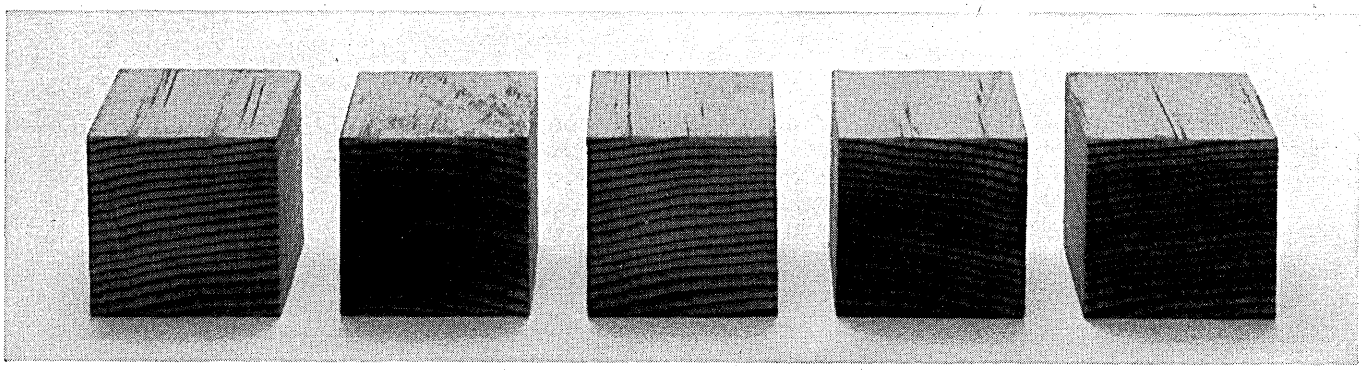
There's a firm called Alphanumeric Inc., Hicksville, N.Y., whose stock has skyrocketed from $7.50 to the $170-195 range in the last year. The reasons are: 1) The development of extremely high speed photocomposition techniques now incorporated in a yet-to-be-marketed off-line system, APS-2 (now in prototype), and 2) IBM's firm interest in the techniques patented last month. At time of writing, Alphanumeric announced discussions with IBM on a possible 2-year, $3-million contract under which AI would supply various systems, not yet announced.

LEAR SIEGLER: OUT THOUGH NEVER IN

Lear Siegler's Data and Controls Division, never officially announcing its entry into the commercial computer business although its LSI 8800 was announced to the general public in the spring of '66, now states firmly the unit is not for commercial consumption. Primarily a military supplier, LS will provide the 8800 as part of digital systems in defense-oriented contracts. Five stand-alone units have been sold to the White Sands Missile Range. The 8800 (8-bit, 2-65K bytes) is intended for data conversion, message switching, process control.

RUMORS AND RAW RANDOM DATA

Look for Teletype to announce a new terminal, the Mod 37, which will offer 150 wpm plus backspace and tabs. Also in the works: a new 1050 wpm electrostatic printer ... One GE source says the company's software problems are solved. The slack has been taken out of the 600 series operating system, and throughput doubled. ... Word is around that Computer Sciences is being bought up. ... We hear that IBM's current monthly production of the 360/65 is eight times that of the 7094 at the same stage in its history. .. Look for RCA to hit some of the gaps in the IBM product line. The Spectra 70/45G (265K bytes) may be announced this spring as the 70/46 time-sharing machine. Further down the line: a large-scale scientific beast. ... Verne Walker, president of Mesa Scientific when it was bought by Planning Research Corp., has left PRC to become a management consultant in Newport Beach, Calif. Still a consultant to PRC, he reportedly can't get back into the software biz till June '68. ... Digital Development, San Diego disc maker, has been acquired by Xebec, diversified Kansas City firm which makes, among other things, automatic circuit testers. Xebec has pumped around $600K into DDI, which should log $2 million this FY, hopes for $3 million next. Bill O'Sullivan will continue to head up DDI. ... Art Speckhard, formerly CSC's northwest regional manager has been chosen to head up Computer Sciences International, with HQ in Brussels.



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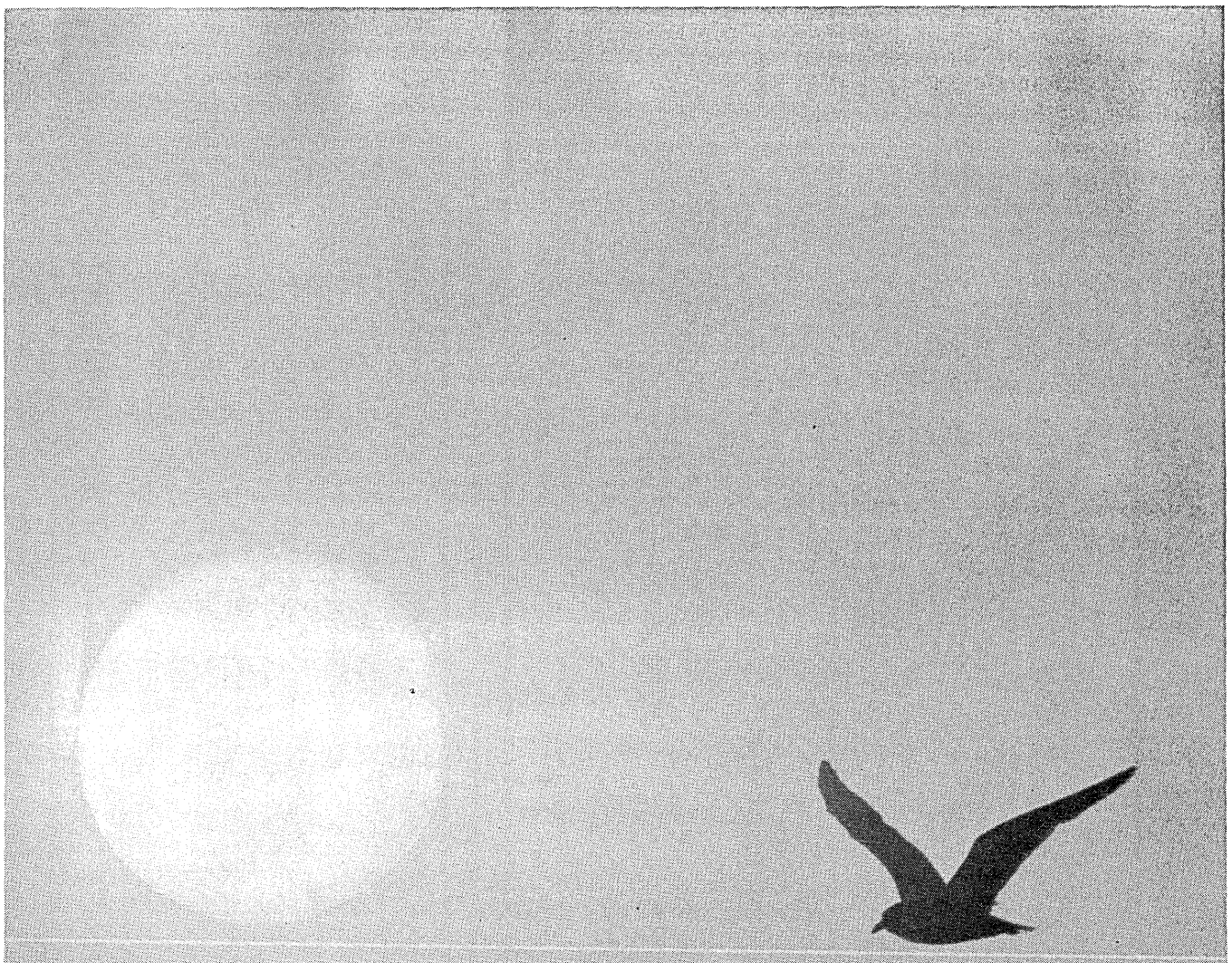

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books

***The Programmer's FORTRAN II and IV*, by Charles P. Lecht, McGraw-Hill Book Co., 1966, $7.95.**

The purpose of this book is to provide a complete reference guide on the FORTRAN II and FORTRAN IV programming languages. In the foreword, it states: "The intent is to show clearly and concisely the full extent, meaning and limitations of each type of statement in the FORTRAN language. . . ." In the introduction, the author notes that this book "reflects more of what the language is than what it may have been intended to be" and elsewhere, it states that this book "makes all this information readily and constantly accessible."

The book includes a foreword by Robert Bemer, a preface and note by the author, and major sections titled: I. Introduction, II. FORTRAN Statements, III. FORTRAN IV Statements, IV. Related Topics, and V. Appendices. The five-page foreword contains in addition to other introductory remarks, a brief and informal history of FORTRAN. The introduction consists of a definition of FORTRAN, information on FORTRAN symbols and types of statements, and other very general rules and remarks related to writing a FORTRAN program.

The second section is a description of each of the FORTRAN statements arranged in alphabetical order and according to a fixed format for presentation. Differences between FORTRAN II and IV for each statement are shown clearly. Section III is a description of new features in FORTRAN IV. Section IV consists of general rules and specifications for preparation of function and subroutine subprograms. The appendices consist of a glossary (48 items), a table of FORTRAN built-in functions and library functions, and a table of FORTRAN symbols and their equivalent punched card Hollerith codes.

The entire volume has been prepared with offset printing. As a result, it contains very generous margins and blank space throughout which the reader could use to record his own personal notes, reminders, remarks or additional information.

The author states that strict formatting rules were used for "presentation of the material with great precision and completeness of information content." In this regard, the principal merit of this book is the organization of the material into a clear easy-to-read format for each FORTRAN statement type. Unfortunately, this feature alone has not enabled the author to succeed in accomplishing the primary intent and objective. The author is to be commended on the clarity with which he has shown the differences between FORTRAN II and IV, but the book is not rich in new or additional information of a reference nature. The material is essentially that which appears elsewhere in earlier publications and does not provide the much-sought-after additional information so essential to improved and efficient programming.

If the user has had difficulty with earlier reference material, he will soon discover that this book does not overcome certain chronic difficulties characteristic of other publications. If the reader does not know the material before reading it, he will not in all probability truly comprehend the impact and implications of the material until he has committed certain errors and only then will he be able to interpret ". . . the full extent, meaning, and limitations . . ." of certain material. This reference book, as many others, does not give the "whole truth". In many instances, it omits information which would provide considerable extension, flexibility, and programming liberty to the programmer.

In certain cases, enlightening information is either absent or is presented in such a manner as to be overly restrictive—sometimes so strongly that it is actually in error or so severely limited that it inhibits efficient and good programming practices. Specific examples are: 1) In the statement DO n $i = m_1, m_2, m_3$, the value of m_2 does not necessarily have to be greater than or equal to m_1. 2) In FORTRAN II, if the index value, i, of the DO has been used as a variable within the range of the DO, its current value is available upon exit and is equal to $i+1$ when passing to the next statement after a "satisfied" DO. 3) In subprograms, if an argument is an array name, it must appear in a DIMENSION statement in the subprogram but it is not essential that it have the same maximum size as the actual argument in the calling program.

The author states: "This book is to be used for reference purposes. It is not a 'self-teaching' device." The first assertion is good and the second is certainly true. If it is assumed that this reference was designed for the needs of the practicing programmer who is already familiar with FORTRAN, then it becomes difficult to determine for whom it is actually intended. Specifically, it appears that its most practical uses are for 1) program-

books

mers who write a program only occasionally, 2) programmers making the transition between FORTRAN II and IV, 3) small computing groups who have access only to packaged or manufacturer's publications, or 4) relatively inexperienced programmers of junior level. In any event, the ever present problem remains: the explanatory information is insufficient and inadequate for a new or junior-level programmer's use; if used by the professional or seasoned programmer, he will not find the kind of advanced information for which he is searching. Moreover, the professional programmer very quickly graduates to a level that requires information more advanced than just the basic rules and statement form definitions.

This book is not without typographical errors and unfortunate omissions. In the latter category, the lack of an index is a serious omission for the professional programmer and the failure to include a bibliography is unfortunate for the "uninformed" reader.

It is difficult to determine what criteria was used to select the words which appear in the glossary. Used in the text but conspicuously missing are such words as "compiler", "memory record", "overflow/underflow" and "object time", while other lower-level words do appear in the glossary. In this regard, the possibility of confusion between the use of the asterisk for glossary reference and as a multiplication symbol may have been avoided by using some other symbol to indicate glossary reference.

In FORTRAN II, the omission of information on the restriction for the magnitude of integer data (i.e., I-type) is an unfortunate oversight; likewise, the lack of similar information for this improved feature in FORTRAN IV could seriously restrict certain programming flexibility.

It was not until pp. 63 and 119 that naming conventions for FORTRAN variables are given where they appeared under the presentation for FUNCTION, FORTRAN IV. In that presentation, a cross reference to Section IV, where the rules for naming FUNCTION and SUBROUTINE subprograms are given, would be helpful. Without this essential knowledge, the user would certainly fail to enjoy much success in producing subprograms.

When discussing overflow, underflow, and divide check conditions, information is missing to indicate whether the light is left on or turned off after testing. A statement of the operations hierarchy is also missing. When the order of operations in an expression is not explicitly specified by the use of parentheses, it would be

helpful for the reader to know the order of operation for exponentiation, multiplication, division, etc., of innermost to outermost operations.

It is disturbing that a different type setting is used in Section III. Because of this, it is difficult to distinguish except by context between the alphabetic character "O" and zero. Other miscellaneous omissions occur as a result of default or overly strong statements where important exceptions are not specifically stated.

Valuable additions to the book which would substantially improve its use for advanced programmers would be more notes and/or remarks for programming techniques (suggested only once in the rules for the CONTINUE statement), programming "traps" (e.g., what happens if a subscript is allowed to exceed its dimension specification?), first-level debugging information, a brief discussion of the possibility of incorporating machine language programming routines, and examples which add further clarity.

It should be noted that one tends to forget certain infrequently used rules and/or details. Reading a volume such as this provides a valuable review and enables the reader to recall certain programming techniques, nuances, and various levels of detail which he may have at least temporarily forgotten. To wit, while reading this book, the reviewer learned that the name of the FUNCTION can be given a value with an input statement and that the range of a FORTRAN IV DO loop may be ended with a logical IF statement.

M. G. SINGLETON

book briefs

(Beginning this month, DATAMATION *will list current books available in the data processing field. For further information on the books listed below, please write directly to the publishing company.)*

***Computer Programming and Related Mathematics*, Richard V. Andree. John Wiley & Sons, Inc., New York, N.Y. 1967. 284 pages.**

Introduction to computer programming emphasizing the mathematical techniques and using the GOTRAN language on an IBM 1620 as an example.

***Introduction to Digital Electronics*, Arthur W. Lo. Addison-Wesley Publishing Co., Inc., Reading, Mass. 1967. 223 pages. $10.75.**

A senior-graduate level study of the digital operation of solid-state electronic devices and circuits as used in computers.

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people

■ Dr. Richard W. Hamming, director of the computing science research department, Bell Labs, has been elected to the board of directors of Scientific Data Systems, Santa Monica, Calif.

■ F. Gordon Smith has accepted the position of president of Data Processing Supplies Corp., a New York-based firm with sales offices in North America and Europe. He was formerly vp and special assistant to the president at Univac in Philadelphia, Pa.

■ Robert K. Stanton, former dp systems manager for the Bonus Gifts program at Rexall Drugs and Chemical Co., Beverly Hills, Calif., has joined the Pacific Coast Stock Exchange as dp manager, Los Angeles office.

■ Dr. M. T. Tayyabkhan has been named vp of computer sciences, Real-time Systems, Inc., New York, N.Y. He was previously director of corporate management sciences at Union Carbide Corp.

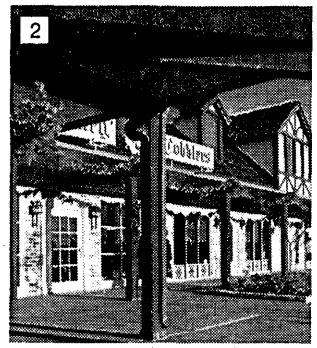
■ Dr. Melvin E. Salveson has been elected vp and director of the CEIR, Inc. applied research and management sciences div. He was formerly president of Management Sciences Corp. in Los Angeles.

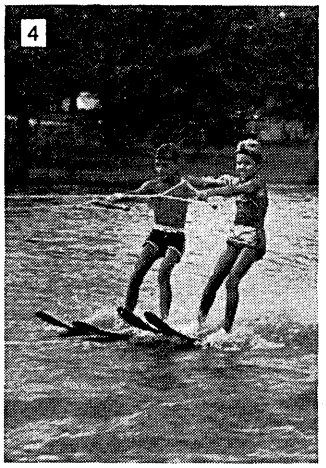
■ Ralph E. Weindling has been elected president of John Diebold Inc., New York City. He has long been associated with the company's consulting firm, The Diebold Group, Inc., and most recently was general manager of Diebold Europe, S.A.

■ Calvin D. Thimsen has joined Computer Sciences Corp. as director of Northwest Operations. He will be located at the Richland, Wash. facilities which support work done by the Atomic Energy Commission.

■ Norbert D. LaVally has been elected president of Universal Data Systems, Los Angeles. Prior to joining UDS, he was special assistant to the commander of the USAF Satellite Control Facility.

■ Robert L. Hamilton, project leader for management information systems at MITRE Corp. Bedford, Mass., has been chosen to head the company's new management system department.





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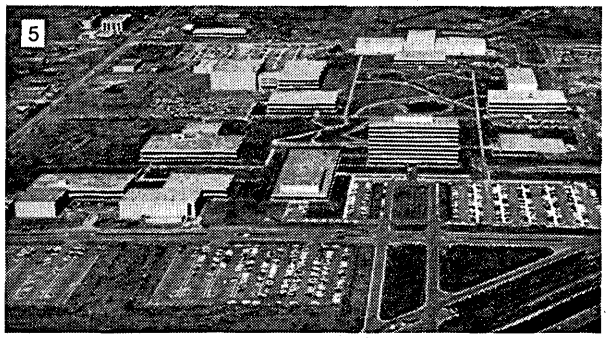

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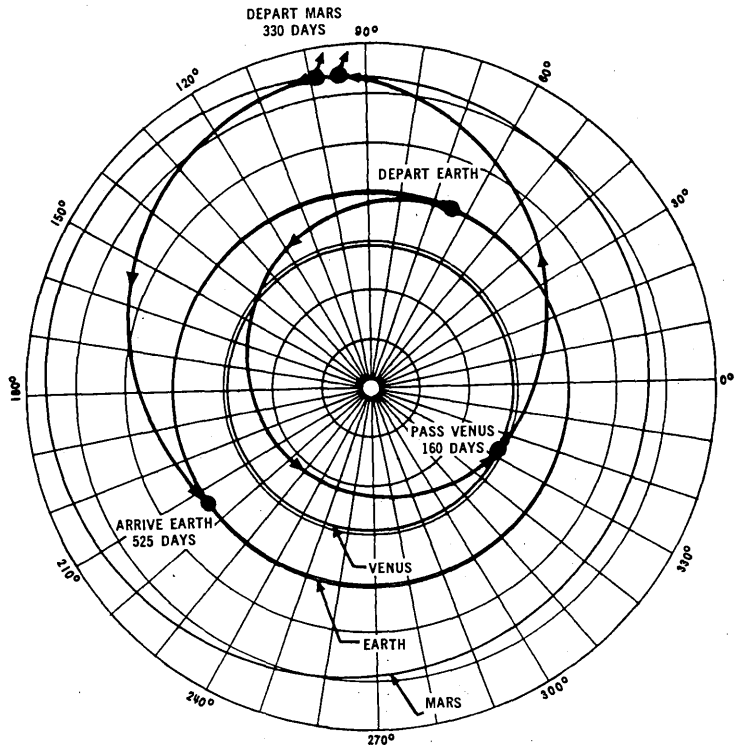
We have a courtesy suite in The City Squire Motor Inn during The Show March 20th-22nd . . . *drop in and see us!*



Why not Venus en route to Mars?

Is there a penalty we must pay in total trip time to get a look at Venus en route to Mars?

Or can fuel savings be realized by this mission mode?

Among the advanced interplanetary missions being investigated at Bellcomm is a Venus swingby mission to Mars. Many more interplanetary as well as lunar and earth orbital missions will be studied as part of our assignment for NASA's Office of Manned Space Flight.

And many more specialists are needed in all technical disciplines bearing on analysis of planetary missions—flight mechanics, guidance and navigation, communications, bioastronautics, propulsion and power systems. Bellcomm also needs aeronautical and mechanical engineers broadly experienced in vehicle systems or mission planning.

If you are interested and qualified, Bellcomm offers rewarding opportunities. Send your résumé in confidence to Mr. N. W. Smusyn, Personnel Director, Bellcomm, Inc., Room 1504-E, 1100 17th St., N.W., Washington, D.C. 20036. Bellcomm is an equal opportunity employer.

Bellcomm, Inc.
A Bell System Company

CIRCLE 339 ON READER CARD

datamart

Address all replies to box number advertisements as follows:

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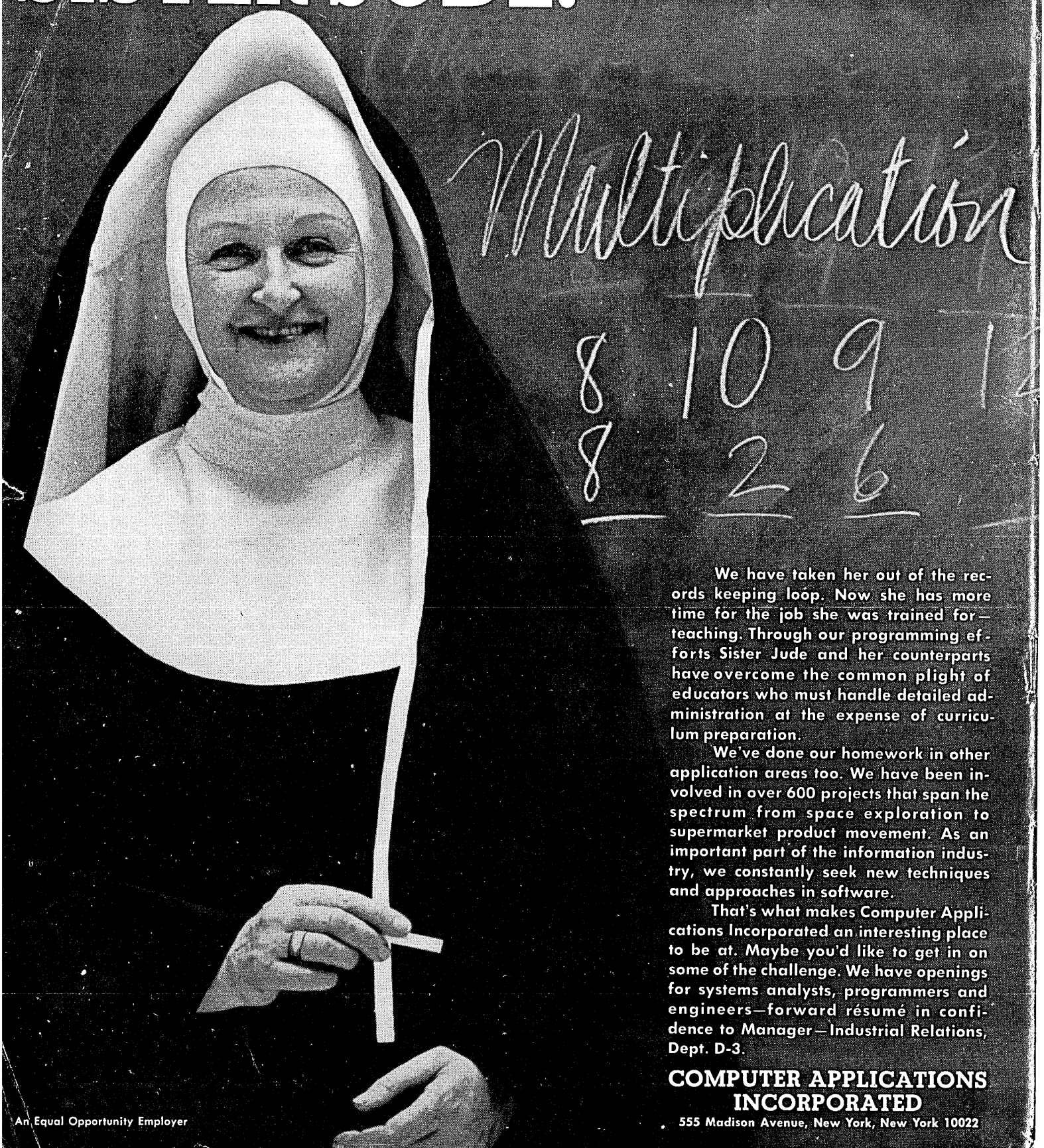
PROFESSIONAL SERVICES

HELP WANTED—Educational Institution

USED EQUIPMENT

advertisers' index

WE JUST CREATED A LITTLE MIRACLE FOR SISTER JUDE.



We have taken her out of the records keeping loop. Now she has more time for the job she was trained for—teaching. Through our programming efforts Sister Jude and her counterparts have overcome the common plight of educators who must handle detailed administration at the expense of curriculum preparation.

We've done our homework in other application areas too. We have been involved in over 600 projects that span the spectrum from space exploration to supermarket product movement. As an important part of the information industry, we constantly seek new techniques and approaches in software.

That's what makes Computer Applications Incorporated an interesting place to be at. Maybe you'd like to get in on some of the challenge. We have openings for systems analysts, programmers and engineers—forward résumé in confidence to Manager—Industrial Relations, Dept. D-3.

COMPUTER APPLICATIONS INCORPORATED

555 Madison Avenue, New York, New York 10022

An Equal Opportunity Employer

if MAC tape is as good as the best, how come it doesn't cost as much?

Fair question, but first, let's get this straight. "As good as the best" means, given the present state of the art, perfect. Error-free, drop-out free. And we have some of the most expensive testing machines in existence to guarantee that we can use the superlative without having you throw it in our faces.

Now, about price. We make MAC Tape with a gravure coating process that costs more than any competitive method. But it results in a more uniform coating, which is why we chose it. And we use extra steps in formulating the coating (sorry, but they're secret) that nobody else uses; and nobody else is quite as careful about washing the finished tape to remove everything that can cause errors. We figured out how much it costs to make tape this expensive way, added the costs of selling and a small but fair profit, and that's the price.

If others are charging more, that's their problem. If you've been paying more, you may save as much as 40% with MAC Tape. A recent order resulted in a documented saving of $93,000—enough to qualify the purchaser as an honest-to-goodness Hero. Whatever your tape budget, it could go 40% farther or permit a 40% cut when you specify MAC Tape. Get the whole story on our painstaking methods of tape manufacture; amaze your associates with your knowledge in this fascinating field of computer expertise; send for our free booklet. If you're ready to start saving money even before you're an expert, a salesman equipped with order blanks will deliver your copy. Ready? Write: "Dear MAC Panel Company, Box 5027, High Point, N. C. 27261. Please send me..."

CIRCLE 2 ON READER CARD

We'll stop at nothing to help you select the right memory system

...we'll even lend you one (with or without the applications engineer) for a free trial

We can help if you have no experience with core memories, but are designing industrial control systems that must handle and store data. To see how they can profit by the use of a low cost core memory, give us a call. We'll send an applications engineer around with the system best suited to your needs. He'll help you get it on line for evaluation.

We can help if you're familiar with core memories, but don't see how a standard off-the-shelf design could satisfy your requirements. Send us your block diagram. We'll study it and send you back a complete blueprint showing you how a general purpose core memory can be used as a versatile data-manipulating system capable of many more logic functions than storage. (We may even be able to eliminate some redundant functions required by less versatile storage techniques.)

We can help even if you're already using core storage, but aren't convinced that a mass produced memory can provide many of the control, access and operating mode functions formerly associated (usually one at a time) with custom design. Drop us a line. We'll lend you a small system for a 10-day free trial. See for yourself what it can do. If at the end of the trial period you can't bear to part with it, we'll work something out.

Our point—to prove that our line of catalog standards is broad enough to satisfy most data storage requirements and that we'll do almost anything to help you apply them to your system. Our FX-12 and FX-14 Series Systems are available in some 200 types. Sizes range from 128 words x 8 bits to 4K x 32, with cycle times from 4 to 8 microseconds. Prices start at $1,190. If you'd like to check details and specifications before we talk, write for Bulletins M6612 and M6614.

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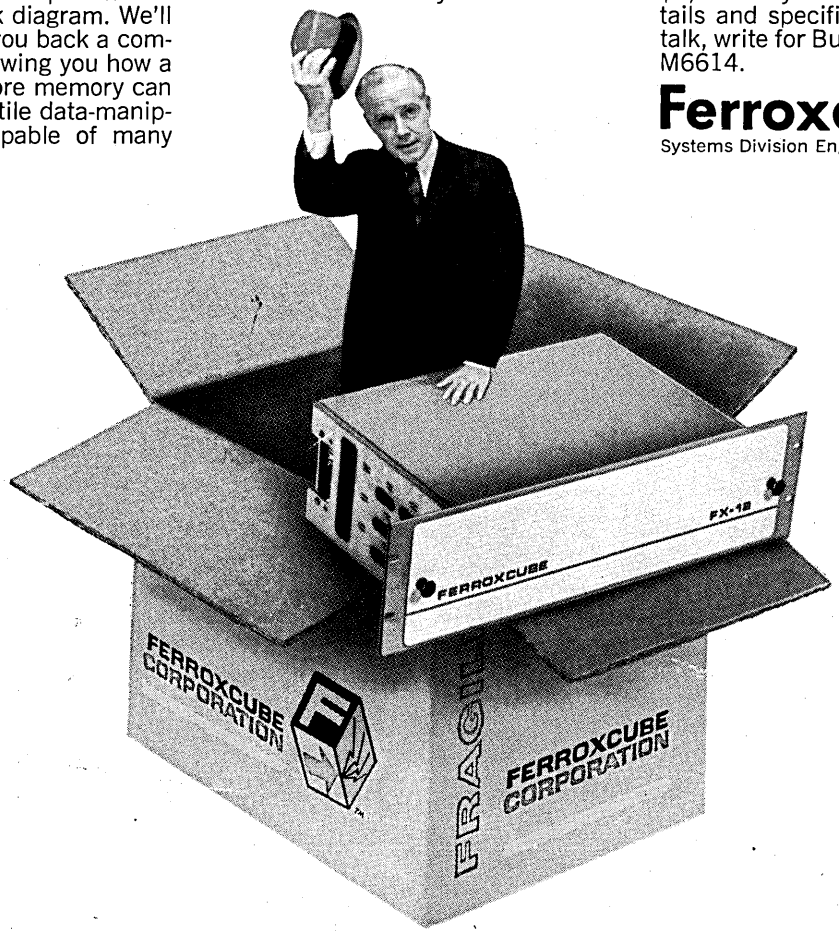

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