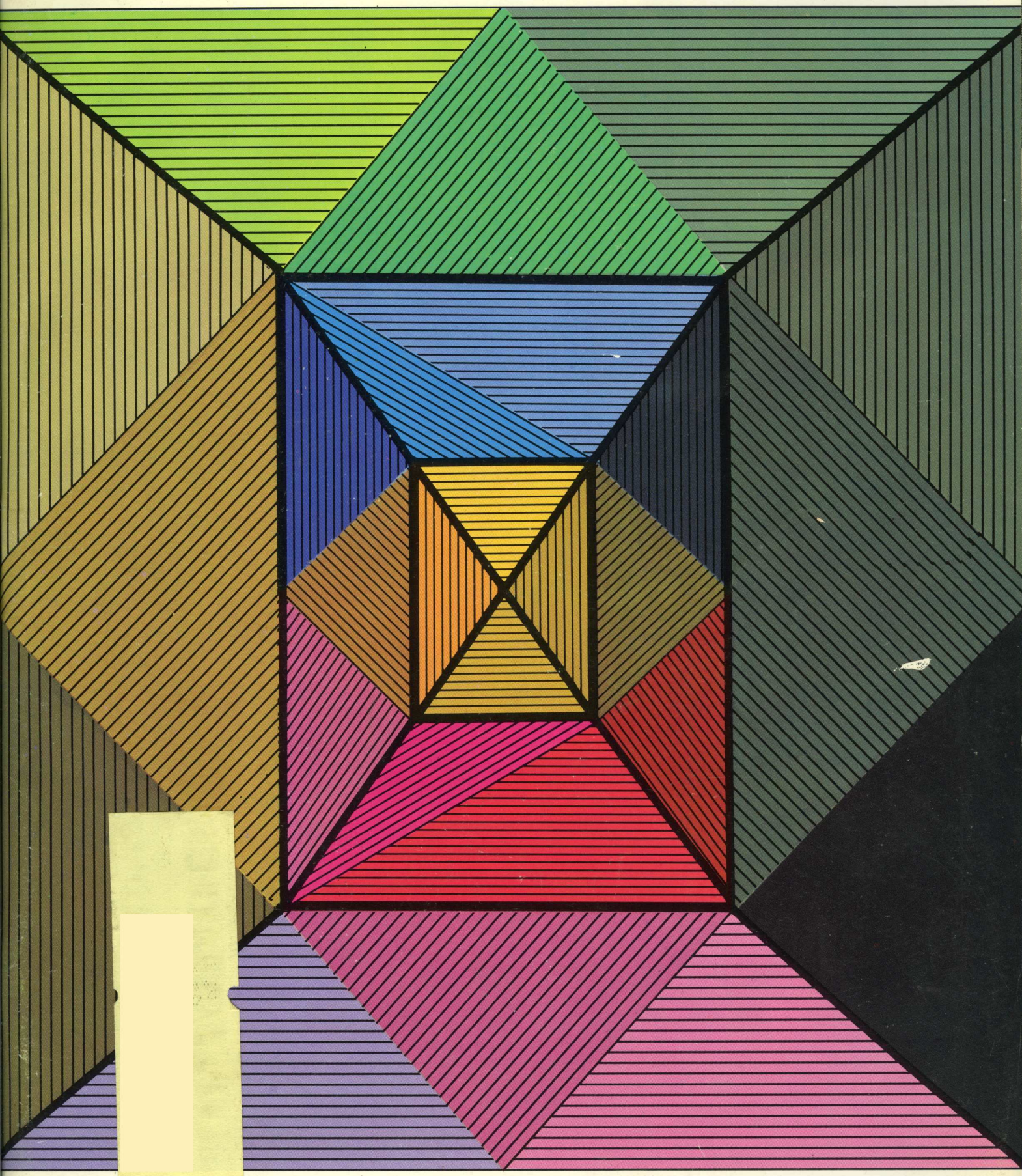
DATAMATION®

67

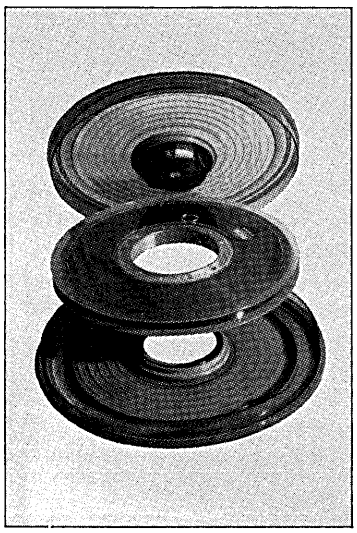
May

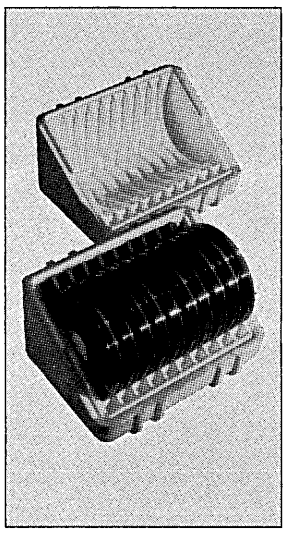


management information systems

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.

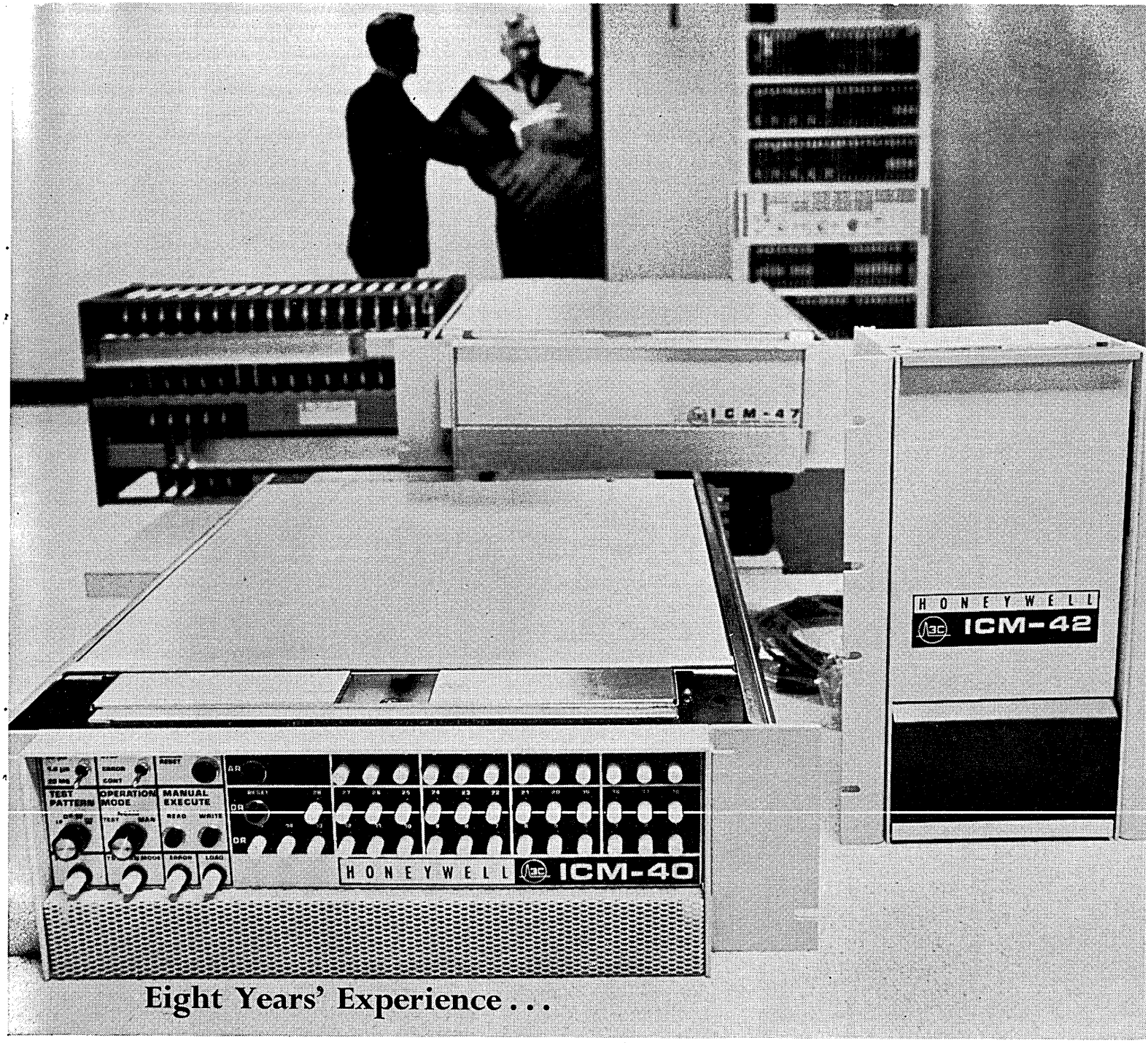
2) **A new shipper:**
Probably the best idea the industry saw last year, we modestly admit, was our new TAPE-SAFE Environmental Shipper. Made of expanded-bead polystyrene, this shipping container individually supports and separates up to ten tape canisters. Guards them against shock, vibration, temperature 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

CIRCLE 1 ON READER CARD



Eight Years' Experience . . .

. . . make our I/C μ-STORE memory systems a sound solution to your digital design problems

In eight years we've delivered hundreds of core memory systems — over 1,100 still operational. We've also delivered over a hundred I/C *μ-STORE* core memories, like the ICM-40 and ICM-47. (These sub-microsecond memories are the result of more than three years' research and development in I/C technology.)

If you've drawn a block marked "core memory" recently, let us show you *μ-STORE* speeds, capacities, and capabilities . . . you'll find our eight years' experience has helped produce a series of standard products designed to meet your memory needs. Write for our new brochure. It sums up all the facts. Honeywell, Computer Control Division, Old Connecticut Path, Framingham, Massachusetts 01701.

Honeywell

COMPUTER CONTROL DIVISION

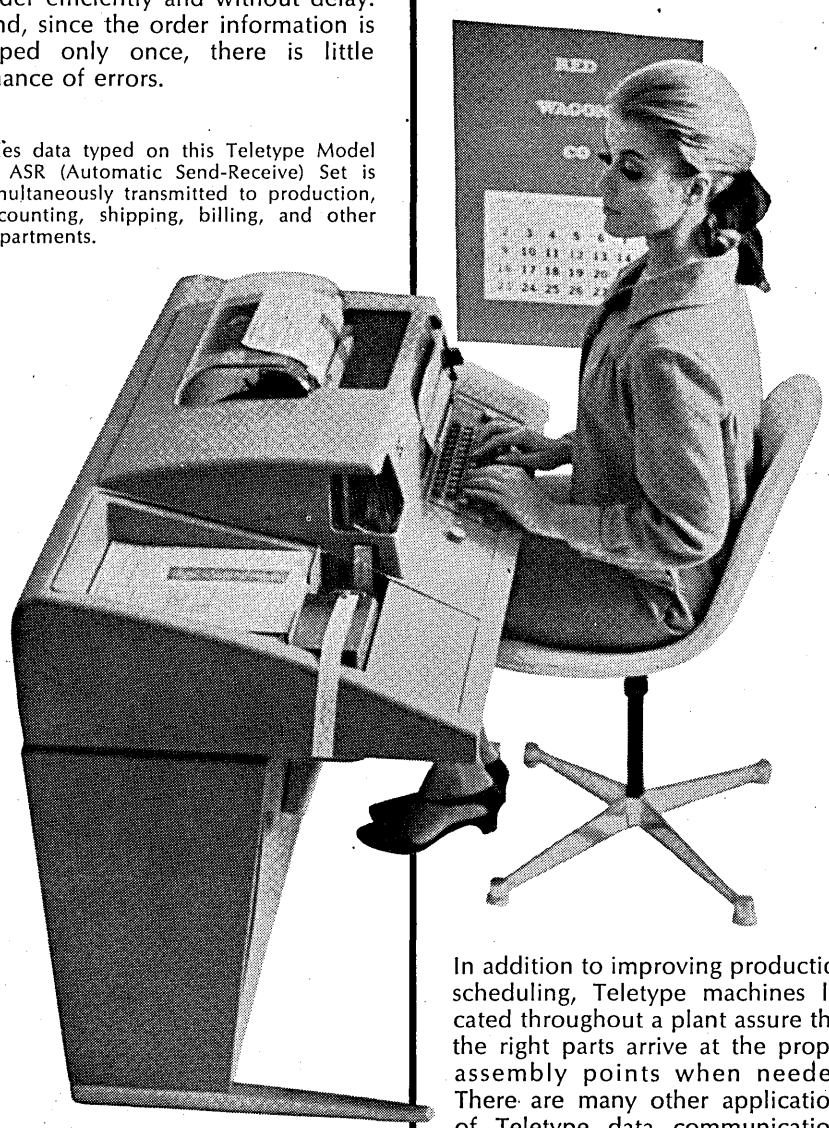
CIRCLE 4 ON READER CARD

KEYED TO KEEP PRODUCTION ON SCHEDULE

A major cause of production problems in expanding companies is outdated communications. By the time an order is entered in the books, retyped onto manufacturing forms, and delivered to production, many valuable days are lost. Too often the order then must be squeezed into an already overworked production schedule.

The answer is instant communications Many companies have solved their production problems by using Teletype data communications equipment to speed the flow of data. For example, at the same time a Teletype Model 35 ASR (automatic send-receive) set is preparing a sales processing form, it is sending all necessary information to a Model 33 KSR (keyboard send-receive) set in the production department.

As a result, accurate data is available immediately to enable the production department to schedule the order efficiently and without delay. And, since the order information is typed only once, there is little chance of errors.



Sales data typed on this Teletype Model 35 ASR (Automatic Send-Receive) Set is simultaneously transmitted to production, accounting, shipping, billing, and other departments.

In addition to improving production scheduling, Teletype machines located throughout a plant assure that the right parts arrive at the proper assembly points when needed. There are many other applications of Teletype data communications equipment in various phases of production as the following examples point out.

Provides management control The manufacturing of airplanes is primarily on a job shop basis. This is why a major aircraft company had difficulty keeping control over raw material needs, inventory levels, and work schedules which often vary between shifts.

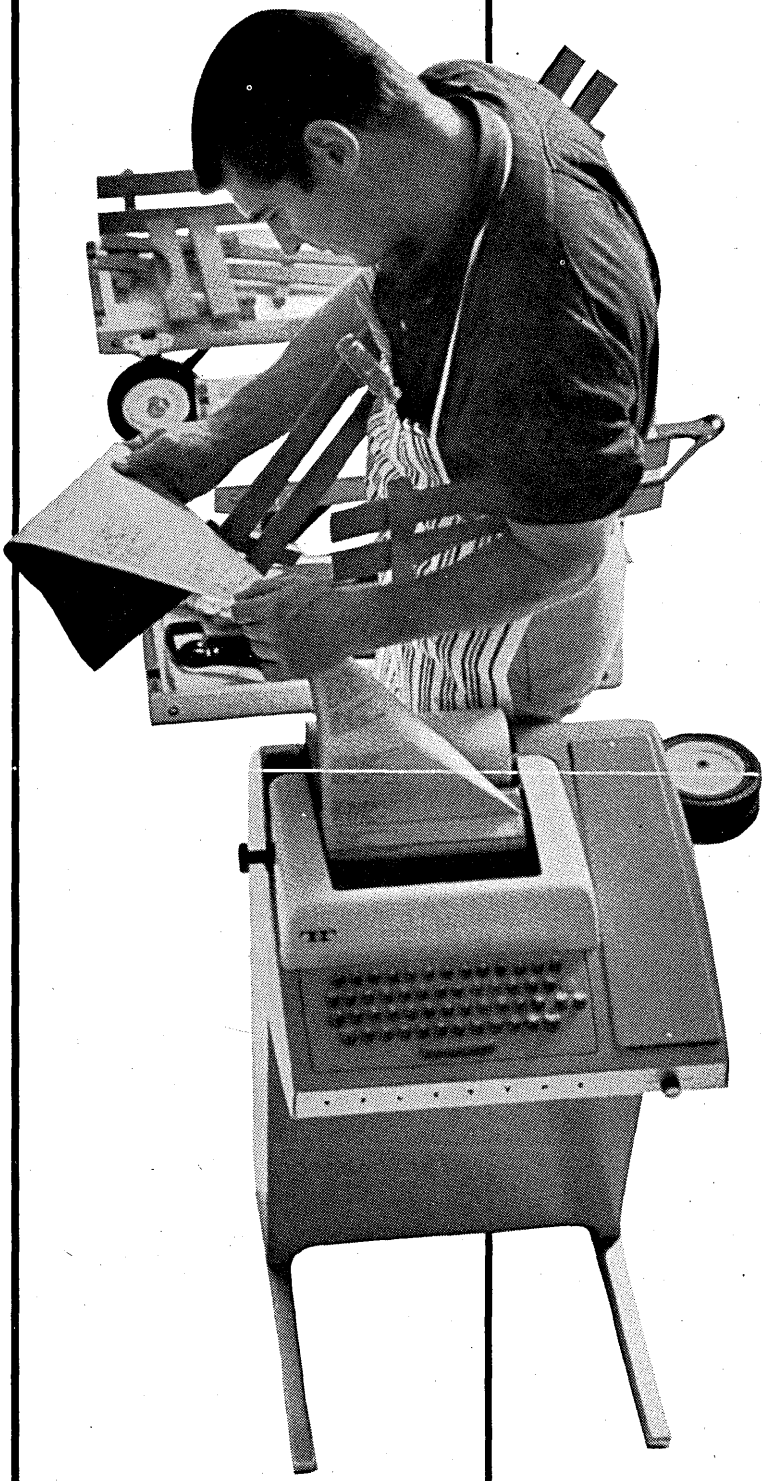
The company solved the problem by using Teletype machines at various plant locations to instantly feed production data to two real-time computers. As a result, management has regained control over production, shortened lead time, and cut overall manufacturing costs.

A leading oil refinery has a digital data control system in its Texas facilities that includes Teletype equipment. Because of this system, the demand logging of the current plant status is available and up-to-date at all times.

Assures machines function properly A unique process-control system has been developed to assure the proper functioning of machines used in producing automobile parts. Within seconds of a machine failure, the computer system provides the cause and location of the breakdown. It also keeps track of the total cycle run on every tool in the machine and notes hourly tool change needs. A Teletype Model 35 ASR set is used by the programer console to make alterations in the operating functions of the stored program in the logic-control memory.

A midwest steel producer uses a network of Teletype equipment to increase the efficiency of their quality control. The data communications network speeds information to a quality control center from over 500 employees, keeping watch over steel quality at field laboratories, offices and testing stations throughout the mill. With this system, test results of production run samples are available in minutes.

More about data communications Teletype applications engineers can assist companies, like yours, in planning a more efficient and economical data system. To obtain their help on your communications problem or a copy of our new brochure, "HOW TELETYPE EQUIPMENT MOVES DATA FOR YOUR BUSINESS OR INDUSTRY," contact: Teletype Corporation, Dept. 81E, 5555 Touhy Avenue, Skokie, Illinois 60076.

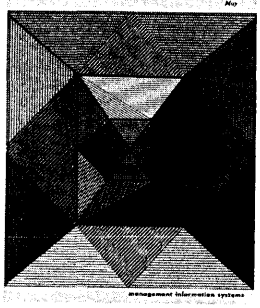


The information needed for timely production scheduling is received on this Teletype Model 33 KSR (Keyboard Send-Receive) Set.

TELETYPE®

machines that make data move

DATAMATION



may
1967

volume 13 number 5

4800 bps has grown up!

Introducing MODEM 4400/48

Now, **dependable** 4800 bps data transmission is here! We've eliminated the constant pampering, monitoring and the expense of conditioned transmission lines required for 4800 bps. How? Our MODEM 4400/48 just by-passes the troublesome bandwidth on your line. This data set, based on the same unique* narrow-band concept as our 2400 bps MODEM 4400, transmits over the same Type 3002 unequalized lines — the lowest cost lines available.

Let us show you how 4800 bps has grown up. We're conducting demonstrations now. Send for information.

milgo

Milgo Electronic Corporation
7620 N. W. 36th Avenue, Miami, Florida 33147
*patent applied for

CIRCLE 8 ON READER CARD

DATAMATION 67®

may
1967

volume 13 number 5

automatic
information
processing
for business
industry & science

datamation departments

Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't come back late from a noon-hour shopping spree loaded down with goodies. Or take time to show the girls its bargains. Or try them on. But it *can* read. And gobble data at the rate of 2400 typewritten characters a second. It can read hand printing, too. 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 can handle 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.

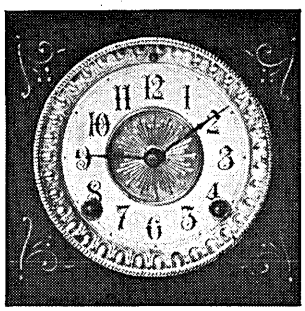
RECOGNITION EQUIPMENT Incorporated

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

calendar

DATE	TITLE	LOCATION	SPONSOR/ CONTACT
May 18	Technical Symposium	Century Plaza Hotel Los Angeles, Calif.	L.A. Chapter ACM
May 19	New England Systems Seminar	Statler-Hilton Boston, Mass.	Systems & Procedures Assn.
May 19	Workshop: Computer and Today's Manager	Rackham Educational Bldg. Univ. of Michigan Detroit, Michigan	U. of Michigan Institute of Science & Technology
May 23-26	Users meeting	Americana Hotel New York, N.Y.	GUIDE Intl. (IBM users)
May 24-26	National Symposium & Exhibit	Jack Tar Hotel San Francisco, Calif.	Society for Information Display
May 24-26	Annual Northwest Business Machine & Equipment Show	Exhibition Hall Seattle Center Seattle, Wash.	M. Beckmeyer P.O. Box 854 Seattle, Wash.
May 24-26	Northwest DPMA Conference	Palliser Hotel Calgary, Alberta Canada	Data Processing Management Assn.
May 26	One-Day Technical Symposium	Community Concourse San Diego, Calif.	Assn. for Computing Machinery
May 31- June 2	Meeting: Operations Research Society	New York Hilton New York, N.Y.	ORSA
June 1-2	Colloquium: Computers in the Earth Sciences	Univ. of Kansas Lawrence, Kansas	Kansas Geological Survey
June 9	Conference: Advances in Computing	State U. of N.Y. Stony Brook Long Island, N.Y.	State U. of N.Y. & Long Island ACM
June 12-15	SIAM National Meeting	Shoreham Hotel Washington, D.C.	Society for Industrial & Applied Math
June 14-17	Meeting: Social Science Data Bases	U. of Calif. Los Angeles, Calif.	Council of Social Science Data Archives
June 15-16	Southeastern Regional Meeting	U. of North Carolina Chapel Hill, N.C.	ACM & SICBIO
June 15-16	ADAPSO Conference	Doral Hotel Miami, Florida	Assn. of Data Processing Service Orgztns.
June 19-21	Conference: ADP in Local Government	Barbizon-Plaza New York, N.Y.	N.Y.U. Grad School of Public Admin.
June 20-23	International Conference & Business Exposition	War Memorial Auditorium Boston, Mass.	Data Processing Management Assn.

It's about time



and how C-E-I-R can help you cut it, save it, and use it more efficiently.

When you vote in favor of computers, the single most critical task you'll face is making every minute count. Time is money, and lost or wasted time means a drain on profits.

C-E-I-R offers every service necessary to help you optimize your computer facilities or your computer service requirements . . . consulting in the purchase, sale or lease of computers, professional manpower assistance, specialized management science seminars, economic and statistical studies, computer systems design and programming, experienced data processing specialists, new talent trained in one of our 45 Automation Institutes, service bureau assistance.

No matter the size of your organization, if you are charged with the responsibility for optimum operations, save yourself time. Investigate the full services of C-E-I-R, the world's most experienced applied research and computer services organization. C-E-I-R INC.

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CIRCLE 11 ON READER CARD

letters

computer selection

Sir:

Your February lead article and editorial on computer selection recall the *Literary Digest*, a national news magazine of a few decades back. For readers too young to remember, in 1936 that magazine used its subscription list for sample polling, producing a straw vote on the presidential election of that year. *Literary Digest* confidently predicted a Landon landslide, but the electorate did otherwise. Shortly thereafter the magazine was defunct.

When Dr. Schneidewind ("The Practice of Computer Selection," Feb., p. 22) analyzed 69 responses received from questionnaires directed to "a random sample of DATAMATION readership," one wonders if this represents the same sort of bias encountered in the *Literary Digest*. For example, simple interpolation of figures quoted yields the result that the average monthly rental of installations surveyed was about $52,000! Hardly a random sample of today's computer population.

Perhaps the most misleading results are shown in reporting on the use of consultants: apparently two of the 69 respondents reported that accounting firm consultants were used, and this is duly tabulated as 2.9%. The figure is probably low by an order of magnitude, or so. Articles appearing in *Forbes, Business Week* and elsewhere within the past year paint quite a different picture. May I suggest that DATAMATION remedy this disservice to its readers with a more accurate, in-depth study in an early issue?

OWEN M. RYE
Waban, Massachusetts

Dr. Schneidewind replies: I don't think DATAMATION is in danger of going out of business as the result of my article. The *Literary Digest's* mailing list was heavily weighted with high-income subscribers. I don't think there are biases of this type in the DATAMATION mailing list, i.e., there should not be a correlation between computer selection practices and presence on DATAMATION's mailing list. Computer rentals were reported by *organization*. Many organizations in the survey have several computers. We wanted to know the behavior of organizations in selecting computers, not individual installations. An average rental of $55,000 per *organization* does not seem unusual.

The data presented in the article are sample results. *Inferences* are made about the characteristics of the population of computer users from sample results, at a pre-determined confidence level. Nowhere was it stated that the sample results are the actual population values. Although 2.9% of the users in the sample employ accountant firms as consultants, the actual *population* value is estimated not to exceed 9%, at a confidence level of 99.73%. Secondly, it is the *relative* magnitudes of the sample results which are important in the analysis, not absolute magnitudes, since almost all hypothesis tests were made with respect to *differences* among selection practices.

The difference between the use of management consultants and accountants, based on the sample results, is not statistically significant. However, the difference between the use of independent consultants and management consultants, considered as another group, is statistically significant (hypothesis accepted at 95% confidence level).

Sir:

Re: Editor's Readout (Feb., p. 21): it is only too true that many companies are falling prey to the "snow job" of computer salesmen; and in this, IBM has an unquestionable lead.

I speak from experience, as I was instrumental in our company's selection of a Burroughs B300 system. Being present at the "last ditch stand" sales meeting with IBM, I can testify to the fact that they tried desperately to snow us into accepting their 1400 Series computer with a seven-pocket MICR sorter, knowing full well it would not satisfy our needs. This was done after unsuccessfully running through a sales pitch on the 360/30, 1460, 1440, etc.

Our Burroughs system was ordered in mid-March 1966, was installed and operational by July 1, well ahead of promised delivery dates. We have had 100% support from Burroughs Corp., both in software and maintenance, leaving nothing to be desired.

Yes sir! I am glad to say there are companies that can outperform IBM.

SYDNEY J. RANGER
San Francisco, California

Sir:

The Editor's Readout (Feb., p. 21) reports that one of the respondents to your computer selection survey stated he would be interested to know if Honeywell plans to compete with any of IBM's applications packages.

Honeywell has designed several packages specifically for the insurance company market. FACILE (Fire and Casualty Insurance Library Editions) is an integrated management and control system now being delivered as each area is completed and, by utilizing Honeywell's "building-block" concept, may be phased into a user's operation as needed.

In addition to FACILE, Honeywell has also made TIP (Total Insurance Processing) and LIMIS (Life Insurance Management Information System) available for general life insurance companies.

JAMES L. DONNELLAN
St. James, L.I., New York

the mapmakers

Sir:

Steve Cordell's article, "Digitizing Contour Maps," (Feb., p. 41) failed to cover a common problem: how do you obtain a digitized map when no map exists at all? A method was suggested by Gordon J. F. MacDonald (UCLA), which—when programmed—proved quite useful when applied on a global scale.

Basically, the method involves starting with data given with geographical (spherical) coordinates (θ,λ). Using independent harmonic functions, a polynomial P (θ,λ) can be derived which fits the data in the least-squares sense. (Generally, such computations are done with Legendre polynomials, but that method is impractical when data is measured at arbitrary points rather than on a regular grid.) If care is taken to avoid "overfitting" by having an insufficient number of data points for the number of terms in P (θ,λ), and if the points are well distributed, (θ,λ) will represent a smoothed value of the data at any point $(\theta_i\ \lambda_i)$. This is true even at points distinct from the original data points, because the sphere is closed, and there are no boundary effects. With due regard for round-off, detail can be increased by increasing the number of data points and polynomial terms.

This technique has been used to map climatological means (e.g., rainfall, pressure), heat-flow through the earth's crust, gravity anomalies, and geomagnetic variations. The technique is applicable to any closed surface which can be projected onto a sphere.

DAVID ROSS
Glendale, California

orchids

Sir:

Louis Fein's article on the IEEE Pattern Recognition Workshop (Feb., p. 84) is an excellent review of a technical meeting, combining concise statements of topics covered with an evaluation of its accomplishments and direction.

At a time when our computing

letters

field is flooded with press releases, product announcements, and official pronouncements, and when the professional societies have not seemed to find a way to be evaluative of technical progress, social implications, or even subjective leadership in this field, it is noticeable when a colleague applies sound judgment with lucid reporting.

WINSTON RILEY III
Bethesda, Maryland.

time-sharing systems

Sir:

In the Look Ahead section (Feb., p. 19) is presented an interesting capsuled comparison of several commercially available time-sharing systems. I would like to add several comments pertaining to the BBN system.

Bolt Beranek & Newman is currently running its TELCOMP service on PDP-7, PDP-8 hardware, allows the user *either* full or half-duplex lines, charges only for terminal hookup time, and provides the most rapid and equitable I/O *execution* time of any time-shared system, commercial or otherwise. Mr. O'Sullivan's reference to "slow I/O" should be clarified since it refers to the admittedly relative slowness of loading and dumping one's program via paper tape (a situation currently being rectified by the addition of bulk central storage).

PAUL V. MCISAAC
Cambridge, Massachusetts

out of the woods

Sir:

The second paragraph of the News Brief on UC Berkeley's CDC 6400 system (Feb., p. 70) implies that the new system will provide a greatly decreased turnaround time when compared to the present IBM 7094/7040 direct coupled system. Apparently this implication is based on comparing the proposed terminal to be linked to the CDC 6400 with the present batch processing system in operation on the DCS.

We happen to be the "forestry station" mentioned in the story. We are operating as a terminal to the DCS through an IBM 7740 communications control system. Our "high speed" terminal is an IBM 1974-2 data transmission processor and we are experiencing a turnaround time varying from 1-30 minutes. Although the present system is not ideal, it is a great deal better than that implied in your News Brief.

ROBERT M. MILLER
U.S. Dept. of Agriculture
Forest Service
Berkeley, California

vultures indeed

Sir:

Re Frank Daniele's letter in the March issue (p. 13), and your comments, I believe that the term "body snatchers and other recruiting vultures" is a valid description of the activities of a majority of the "management consultants," "career consultants," and "executive search" firms active in the computer personnel field today. The unfortunate thing about it all is that we, the computer professionals, are partly responsible. Vultures and body snatchers won't stay in business for long without firms paying their fees and computer people allowing their names to be listed.

Incidentally, please don't quit being "impudent, indiscreet and sarcastic" when you feel the situation warrants such an approach. I, for one, would be glad to pay for a subscription to take up the slack in your budget if candor drives away some of the "people and organizations that support your printing of DATAMATION . . ."

JOHN L. FIKE
Richardson, Texas

fortran to . . .

Sir:

Re M. G. Singleton's review of my book, "The Programmer's FORTRAN II and IV," (Mar., p. 131): neither he nor I—struggling to understand a field in which there is so wide an abyss between theory and practice—can have as much certainty about the accuracy or inaccuracy of our observations as we would like. For example, it is an illusion that there is, except on paper, a standard computer-industry FORTRAN II. Thus, Mr. Singleton's observation "In FORTRAN II, the omission of information on the restriction of magnitude of integer data (i.e., I-type) is an unfortunate oversight," is an unfortunate undersight. It was purposely omitted. Presenting this item as though it were similarly restricted for all existing compilers would be fallacious.

To write a book on FORTRAN to cover all implementation contingencies would be a silly exercise in organizational stamina, because its conditional complexity would defeat its

meaningful usage at the programmer's desk (e.g., integer data is restricted to two decimal digits for core size A, machine B, etc.) To write a book on one specific FORTRAN and pretend others don't exist is scurrilous. Then, one might write a book which has meat common to most working compilers and which leaves blank space so that the experiences of each person using it within his own working environment may be recorded.

As a reference source, my book is intended to avoid presenting industry-wide answers where there are none, and at the same time provide space so that the experience peculiar to a particular programmer within a particular computer facility using a particular version of FORTRAN can be recorded.

CHARLES P. LECHT
New York, New York

Mr. Singleton replies: The review is based in part on experience gained from use of the reference by programmers who are knowledgeable in several higher level programming languages. For the potential user, the review provides a practical evaluation for comparison; for the "buying public," it serves as a realistic guide for selecting a programming reference book from among the many which are currently available. Mr. Lecht's additional comments do indeed supplement the admonishment to the eager shopper looking for a complete FORTRAN reference.

. . . and fore

Sir:

The review demonstrates implicitly (and unwittingly) the purpose and usefulness of that work, despite Mr. Singleton's explicit profession of unawareness in this regard.

R. W. BEMER
Phoenix, Arizona

cobol inclusions

Sir:

Howard Bromberg's recounting ("The COBOL Conclusion," March, p. 45) of the committee-assisted birth and nurturing of COBOL is an excellent historical summary.

Unfortunately, the article faithfully repeats two bits of dogma that are poorly justified. One is that the hallowed table handling facility is "a necessary part of almost any COBOL application and, as a result, is a requirement for any ASA standard compiler." The other is an obsolescent artifice called segmentation, which ignores conventional operating system capability by imposing overlay design on both the COBOL user *and* the compiler.

System/360 COBOL seems to have found a simple, satisfactory solution to the overlay requirement, facilitated by its linkage section and CALL ENTRY, and RETURN procedural statements.

The redundancy, awkwardness, and futility of the table handling facility should be cause for a re-examination. Subscripting is more natural, particularly with regard to cleanness of notation; related object code can be generated in just as efficient a manner as for table handling statements. If a table is small, any special "searching" feature is superfluous; if a table is large (and cpu time is a critical factor), then probably a type of binary search is the better programming approach.

It behooves the COBOL community to re-evaluate the inclusion of these two features in a standard, when that standard is likely to be wielded in a coercive fashion against both large and small computer manufacturers.

KENNETH P. SEIDEL
Northridge, California

The author replies: I feel that I am the wrong addressee. The justification for and creation of the "dogma" are really in the province of the CODASYL COBOL Committee, not USASI. Nevertheless, I offer the following:

The OCCURS clause and, hence, subscripting are both part of the table handling module in addition to indexing and the SET and SEARCH verbs. Because the majority of commercial programs seem to use subscripting, it seems reasonable for the pUSASI Standard to require at least one level of subscripting.

By "conventional operating system," Mr. Seidel evidently means OS/360. The COBOL Committee is not in a position to dictate how control systems are to be designed. The specifications for segmentation are far less restrictive in this area than are those of a linkage method such as CALL. Furthermore, the use of S/360's linkage feature requires a good deal of knowledge on the part of the programmer concerning how OS and linkage editor work. COBOL tries to avoid this level of detail.

Direct indexing (without ± integer) uses exactly the same notation as subscripting.

The COBOL table handling subcommittee felt that the explicit association of an index-name with a table element would enable compiler designers to develop better object code. The chairman (who was also the designer of the specification) represented a large COBOL implementor, as did other members of the committee, and they agreed with this premise. As to the actual object code that is generated when indexing is implemented—that is strictly up to the implementor.

The SEARCH verb is independent of table size. If it enables the compiler to access a hardware table hook-up, then it may be superior to a hand-coded COBOL search. If it doesn't (or isn't), the programmer is free to ignore it.

The purpose of the ALL option of SEARCH allows the implementor to generate a binary search.

communications & cable cars

Sir:

Several references in the March issue to the dialogue between the informa-

letters

tion processing industry and the communications industry bring a possible future problem to light. With multiprocessing and time-sharing, it is very possible that the dp industry is asking communications to lay the rails for a "street car" or electric trolley system. It seems highly likely that the small computer, like the car, will make that business rapidly uneconomic. We in the information processing community should take great care not to push the communications people into an uneconomic area—for we will all have to pay the costs of the deficits.

JOHN A. KEENAN
Madison, Wisconsin

data reduction software

Sir:

We would like to clarify the description of the MAC/RAN software system for random time series data analysis (March, p. 101).

Besides the data preparation operations of detrending, filtering and calibration, the system has several additional subprocessors. The computation of spectral density and correlation functions via either standard methods or a fast Fourier transform algorithm is provided. Probability density functions can be computed along with a chi square goodness-of-fit test for normality. A processor for the analysis of multi-input, single-output linear systems is included to allow the estimation of frequency response and coherence functions from measured data. Plotting capability is provided in the system via an Executive Processor. A Print and Plot Processor is supplied so that previously computed results can be reprinted or replotted in the same or different manner.

LOREN D. ENOCHSON
Measurement Analysis Corp.
Los Angeles, California

h2os

Sir:

Inspired by Maj. Humphries' ("Fluidic Computers," March, p. 39) implication of the takeover by fluidic computers, we have taken swift action. Our MIS predicts a smoother-flowing operation with the replacement of our Klackety-Klack Corp. Mod 2 System (Electron-flow" main-frame with 64K "moving-magnetism" memory and "pulsating" peripherals) with a new third-generation Flood Corp. Mod 4/5 Fluidic System ("no moving parts" main-spring with 64L "no-flow" reservoir and three input tanks and four output "troughs"). Also, by eliminating the time now spent oiling our flip-flops, we should effect an enormous cost reduction.

Our first action to prepare for this event is the procurement of appropriate maintenance kits. Perhaps others can profit from the tremendous systems study behind this selection:

Quantity	Unit	Item
1	each	Mop, large
1	"	Binary Hydrometer (calibrated in ONES and ZEROS)
1100	pieces	Hose, assorted sizes
11000	each	Hose clamps
11	"	Plumber's-snake
1	"	Plumber's-snake-extractor
101	"	Corks
1	"	Module-extender, 43-pipe
111	"	Sponges
10	"	Modules, spare, FLOOD-Gate type
101	liters	Bit-Juice
1	each	Bit-Bucket
1	"	Adapter, Overflow-nozzle type

LARRY HUDSON
Pasadena, California

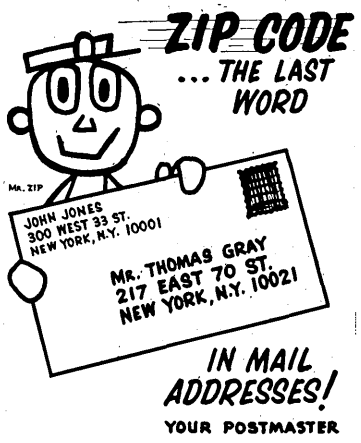
Reminds us of the day the floating decimal point sank.

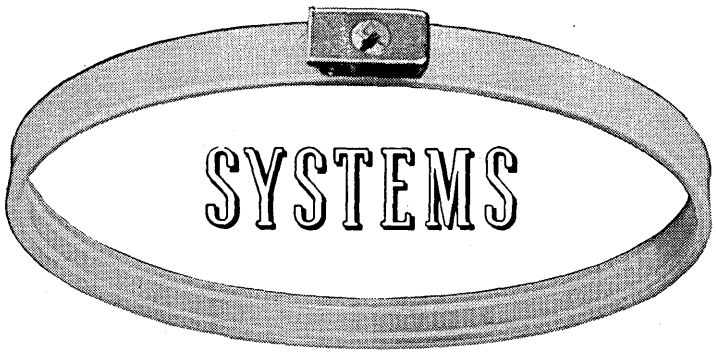
tape trouble?

Sir:

We have been experiencing more than a reasonable amount of difficulty utilizing IBM Dynacel tape on 7330 tape drives. Not having similar difficulty with competitive tape brands, we are inclined to fault the Dynacel tape. We would like to hear from others' experiences with this tape on the 7330.

GEORGE E. SULLIVAN
Director
Administrative Data Systems
Univ. of Rhode Island
Kingston, Rhode Island





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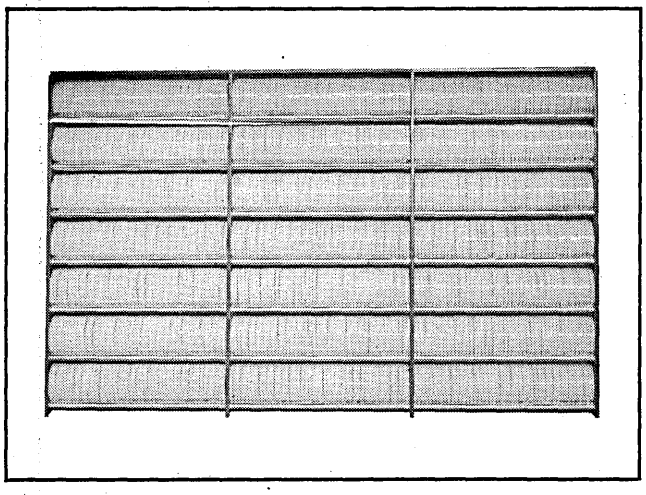

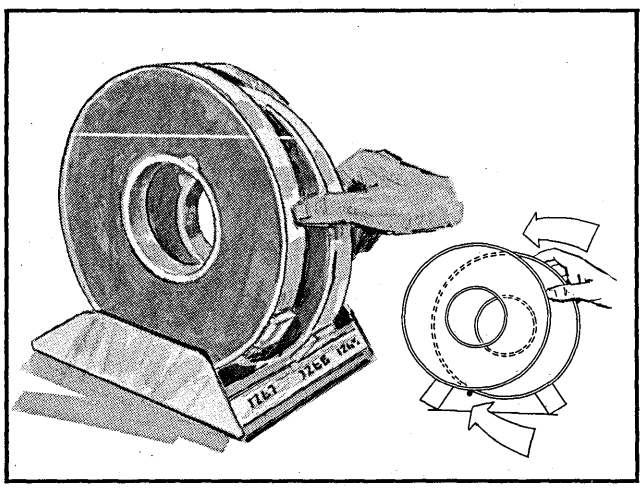

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At Gulf, oil is where you find it– with an EMR Computer

Among the new tools in oil exploration is the digital computer, and a pacesetter is Gulf Oil. Gulf uses EMR *ADVANCE* Series Computers to process seismic records to get a better picture of subsurface structure. Problems associated with seismic records are two-fold; first to determine the "true" signal by eliminating extraneous signals caused by false reflections-unwanted "noise"; and second, to correlate signals based on area geology and topographical conditions. Compounding the problems are the large number of such records which must be reviewed daily.

To solve these problems, Gulf Oil selected an EMR Computer System. Using an *ADVANCE* 6050 Computer with seismic interface hardware and a system of seismic software specially developed by the EMR Computer Division, Gulf now processes seismic records in real-time. More accurate information is available faster to help Gulf make decisions which result in more productive and profitable drilling.

Other oil companies and geophysical contractors are using EMR systems also. We think this total approach to a systems problem can help you– even if you're not looking for oil.

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look ahead

LOSERS CLAIM
TAXPAYERS LOSE $50 MILLION
IN AF AWARD TO IBM

Outraged howls are emanating from competitors who lost out to IBM on the big Air Force Phase II contract awarded last month. Informed sources estimate that IBM's bid on a purchase basis for 20 360/40's and 115 30's came in around $115 million, some $50 million over losers Burroughs, Honeywell and RCA. And that figure doesn't include maintenance and other costs. Calling the AF's evaluation as "nitpicking," one shocked loser feels that a lot of adjustments could be made for 50 megabucks. All three losers are believed to be giving careful study to the possibility of taking their cause to a higher court—Congress or the Justice Dept.

GE FUMBLES WITH
SUCCESSFUL T-S SERVICE

GE's commercial time-sharing operation under the Missiles and Space Div. at Valley Forge, Pa., is said to have been the most profitable in the business ($2 million, 400 customers in 18 months). But after one of its well known charter battles, GE has wiped out that unique organization in favor of putting the whole shebang under Information Systems Div., led by non-computerite Paul Ludley. Most of the 25 MSD employees running commercial t-s, including boss Lou Cimino, are moving on to greener pastures, and the seven 265 systems at Valley Forge, we hear, will be shipped to other locations. "GE has killed the golden goose in favor of chicken soup because charters carry more weight than success," one employee said.

COLLINS ALUMNI PREPARING
COMMUNICATIONS PROCESSOR

A communications system with its own stored-program computer, capable of handling a number of dissimilar terminal devices and transmitting at up to 9600 bps, is being developed by Marshall Communications, Santa Ana, Calif. The M1000, as it's called, provides full duplex service over voice-grade lines. Transmission speeds run from 1200 to 9600 bauds, automatically varied according to line conditions. Message switching capacity is 1-4,000 (200-character) messages/hour. The computer is an IC, parallel unit with 4-64K (24-bit) words of core. Cycle time is two usec.

The 7-month-old firm, a subsidiary of Marshall Industries, was founded by three ex-members of Collins Radio. The president is Melvin L. Doelz, who was a vp and director at Collins, where he developed the Kineplex data transmission method.

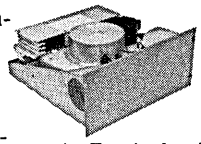
A fully-implemented M1000 system with software, able to handle 16-32 lines, will sell for $125-150K.

CHEAPIE ON-LINE
SYSTEM FOR HOSPITALS

While other hospitals have on-line clinical lab testing in the planning or experimental stages, Yale-New Haven Hospital is on the air — using the $1K/month IBM 1130

What's so remarkable about "in-contact" disc memories?

"In-contact" memories use heads that actually *touch* the disc—gently and continuously. That leads to several unique advantages:



An F-series head-per-track system.

Records at twice the density

We have recorded 6600 bpi with "in-contact" heads. Our standard memories operate at a conservative 3300 bpi—more than *twice* the storage density of the best "floating head" memories.

Stores 50% more per dollar

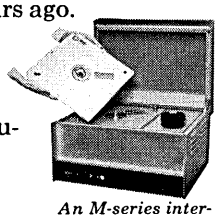
A single track holds 100,000 bits—enough to fill the core memory of many small computers. The higher storage density gives you 50% more storage capacity for every dollar invested in equipment.

Takes only 8¾" rack space

Our fixed-disc, head-per-track system stores up to 6,400,000 bits in 8¾" of rack space. Our interchangeable disc system—also rack mountable—stores 13,000,000 bits per disc cartridge.

Unusual reliability

We've been spinning one disc beneath "in-contact" heads for over 20,000 hours. The disc is not so much worn as polished. And it still reads out the data we recorded nearly three years ago.



An M-series interchangeable-disc system.

In another test, 512 tracks with a head on each operated continuously for 2,160 hours without a single failure of any kind. That's 1,105,920 track hours without failure.

How do we keep the disc and heads from wearing out?

Much of this is a trade secret, but we can tell you this much: we plate the disc with a thin rhodium armor to protect the magnetic storage medium, then polish the surface to a near optical finish that deviates from perfect smoothness less than 0.4 microinches A.A.

For more details write Data Disc, Incorporated, 1275 California Ave., Palo Alto, California 94304. Phone (415) 326-7602.

DATA DISC

CIRCLE 17 ON READER CARD

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If you're going to have a new business address, please fill out the form at the right now and return it to us. We'll make sure that DATAMATION keeps up with you. To save time, we need your old address, just as it's printed on the mailing label, (or the whole label is better yet) as well as your new address.

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Title____
Company____

Address____
City____

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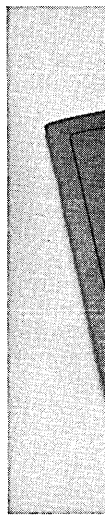

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and a time-sharing software system developed under a $3K NIH research grant. The software, created by Dr. John Donovan (now of MIT), and a Dymex multiplexer are what permits the 1130 to handle 50 test instruments, three inquiry terminals, and other peripherals virtually simultaneously.

Up to 50,000 tests are now processed daily, although twice that can be handled. Through keyboard terminals, the doctor and technician can obtain in real-time any test records and can readjust the parameters on any instrument. The system also prints out total patient and ward reports and stores blood bank inventories.

The machine-independent exec system, written in Fortran II, is modular, containing an interrupt and executive routine and a common data segment. The exec can dictate the configuration used and handle priority interrupts. If the cpu fails, the multiplexer switches to printing out on a keypunch unit; all cpu procedures are also on the system's one-megacharacter disc.

REMOTE USERS EYE NEW COMPUTER TERMINAL

A custom-made remote terminal, consisting of a PDP-8/S with 600-lpm printer, 400-cpm card reader, and a plotter if you want, will be tested soon by the Santa Barbara Computer Center. Operating over a full duplex line, the terminal in Los Angeles will be linked to a CDC 3600 some 70 miles distant. Watching the test will be many other L.A. users who'd like to go on-line as the 3600 is replaced by a 6400 early next year.

The terminals, 25 on order, are being made by Digital Logic Corp., Orange, Calif., headed by ex-DEC salesman Dick Musson. The 8/S, says Musson, who's made money designing interfaces for DEC computers, could be replaced by DMI's 620-I. SBCC, meanwhile, has plans for a keyboard/CRT terminal.

SOFTWARE PATENTABILITY TRIGGERS TALK, ACTION AT SJCC

Representatives of seven software houses met during the recent SJCC to discuss possibilities of forming a software association (see April Readout), and decided to try to get software firms to sign a petition requesting that section 106 of the current proposed patent legislation be deleted. The section says "A plan of action or set of operating instructions, in whatever form presented, to cause a controlled data processor or computer to perform selected operations shall not be patentable." The group will also work toward the establishment of an association of software firms.

Underlining the significance of section 106 is the fact that so far atomic weapons are the only major exclusion in U.S. patent law. And according to several SJCC panelists on the topic, the section's ambiguous wording may bar not only software but hardware doing an equivalent job. Late last month presidential science adviser Dr. Donald Hornig advised the House patent subcommittee to study the section further...advice interpreted by some as an Executive invitation to the computer industry to explain all consequences of 106 to Congress.

TAKING UP WHERE IBM LEFT OFF

A San Francisco software house is finding happiness by doctoring 360 operating systems to fit the needs of individual customers.

Headed by Alan Hochschild, Western Operations was formed about a year and a half ago, and now claims to be the largest independent software house in the Bay

(Continued on page 123)

editor's read✳ut

NOT QUITE ALL ABOUT MIS

Every once in awhile, we get tired of editing from our balsam tower and we wander out into the real world and talk to people about what they're doing. It seemed an especially good idea to do so in preparation for this month's issue, partly because we weren't quite sure what an MIS was, partly because the little knowledge we *did* have about it made us feel the way one man described his attitude toward a similarly amorphous topic: "It's like trying to love a dirigible."

So, notebook and pencil in hand, armed with a few fuzzy questions and our most patient smile, we lurched off to talk (listen) to some peope we had heard had Management Information Systems. We talked to a bank and a railroad, a petroleum firm, a diversified manufacturer, an aerospace firm, a consultant who specializes in this sort of thing, and one computer manufacturer who has—wonder of wonders—installed its own MIS. We've omitted their names to protect the guilty. Our informal survey hardly qualifies for rigorous analysis and interpretation, but we did come away with some general impressions perhaps worth sharing . . . although for *real* meat we suggest you turn to the articles in this issue dealing with MIS.

The first thing we found out is that there is no general agreement on a definition of MIS. As a matter of fact, nearly all of our interviews started with the interviewee asking us what *we* meant by MIS. We turned that one around in a hurry, and found that by and large, most of our friends do *not* equate MIS with on-line, and certainly not with real-time. One company which has pioneered in MIS doesn't even believe in random access; their system is tape-oriented. Just about everybody we talked to thinks that the idea of a CRT in the president's office is a fad, not likely to achieve reality for another umpteen years. One man described his planned systems as "almost real-time."

In most cases, indeed, the MIS is a long-range plan with most of the people far enough along to have that gleam in their eye dimmed just a bit by a look at the problems between here and the magic mañana when management will know All, and plan his company's long range future by diddling with a computerized model of the corporation, aided by data describing the external world as well. For the two who have working systems, one claimed that it required 40 man-years to develop, with another 20-30 going so far into extending its capabilities. The other says it took five programmers not very long to develop his company's MIS, but we suspect it's limited to sales information.

The problems and hurdles mentioned as handicapping the development of MIS won't surprise you. Most frequently mentioned: the shortage of good, experienced systems people. Another: lack of manufacturer-provided software. Other obvious problems include safeguarding the security of data, controlling accuracy of input from many remote terminals, defining management's information requirements, lack of stature for the edp group.

There was general agreement on the need for the active support and involvement of management in the MIS development. While everybody would like to have the systems planning group report to a key top executive, there's no single title or organizational box which represents a must. One of the companies which has a working MIS has seen its group report to five different titles. Conclusion: it's the man, not the title, that counts.

The effectiveness of this man in selling MIS is again the key factor in determining just how far and fast MIS will grow. Justification for an MIS is tough otherwise; there seems to be no neat, quantitative measures by which to evaluate MIS.

Our conclusions? Yes, Virginia, there is an MIS. For large, well-organized companies with experienced, sophisticated systems staffs and active high-level support, MIS is a distinct short-range possibility. But as with most of other panaceas pushed by manufacturers and other idealists—whatever happened to Integrated Data Processing?—MIS is another of those concepts which takes probably more talent, drive and work than you are able to devote to it right now. Still, if you aren't working toward MIS, you may be in trouble. Good luck.

a problem, a challenge

MANAGEMENT INFORMATION SYSTEMS: A CRITICAL APPRAISAL

by ROBERT V. HEAD

The subject of "management information systems" has been much discussed, and much maligned, by both systems professionals and management people over the past few years. Both groups agree, though, that there has been a good deal of significant progress over the last two years or so, and it is the purpose of this paper to comment on these recent developments.

It seems appropriate to begin with a discussion of some of the basic concepts and design objectives of management information systems. This will be followed by comments on the approaches being taken by large organizations that seem to best characterize contemporary information systems development. Finally, there will be a brief discussion of some of the current problems in this volatile field. For although we have found solutions to many of the technical problems in management information systems, there remain others, largely non-technical, that threaten to inhibit the dramatic progress that might otherwise be achieved.

the concept

Let us begin by describing what a "management information system" really is. To do so, it may be useful to look back over the past ten years at the ways in which companies have been utilizing their data processing equipment. The bottom portion of Fig. 1 indicates some of the data processing applications that the typical large company has successfully developed. All these application areas have been attacked, one by one, and converted to automatic data processing equipment. As a class, these applications have provided the capability of processing the massive volume of accounting transactions of an organization, and producing, as a result of this processing, reports scheduled according to some pre-determined cycle.

This is by and large what companies have been doing up to now. The concept that has been arousing increased

Mr. Head is manager of information technology at Computer Sciences Corp., El Segundo, Calif. A contributing editor of DATAMATION, and a former manager of advanced business systems at Touche, Ross, Bailey & Smart, he has worked on the SABRE system for IBM, and the ERMA project with GE.

interest in recent years has to do not only with the processing of information by computers for accounting purposes but with using this same information in different, and more imaginative, ways. This involves, for one thing, the use of information for management *control* purposes. Here the emphasis is not on historical record-keeping but on the processing of information requests and the providing of reports "as-required" on a demand basis. The upward-pointing arrows in Fig. 1 are meant to suggest that the same data obtained for routine accounting purposes can be selected and transformed for such management control purposes.

At a higher level of management usage, there is the opportunity, and attendant design objective, in an information system to use the same data not only for middle management control but to aid policy-level decision-makers. The apex of the Fig. 1 diagram suggests that special requests can be directed to the information system by executive management, with the system providing support for decision-making at this level.[1] This can be defined as a *planning* type of usage of the information system.

Thus we are evolving from conventional or traditional applications to the use of the same information at the middle management level for control purposes and at the general management or executive level for planning purposes.[2]

Many practitioners refer to the information identified at the bottom of Fig. 1 as the organization's data base. Another way of looking at this data base is to think not in terms of separate or discrete applications but instead to view the data base as consisting of *elements* of information as shown in Fig. 2. The bottom of this

Fig. 1. Management Information System

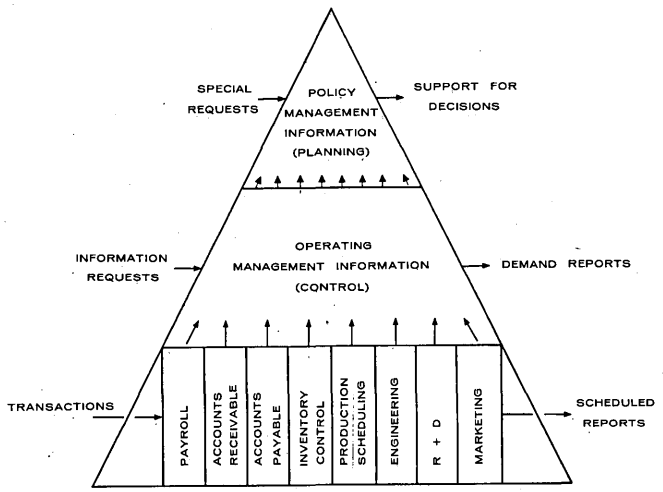
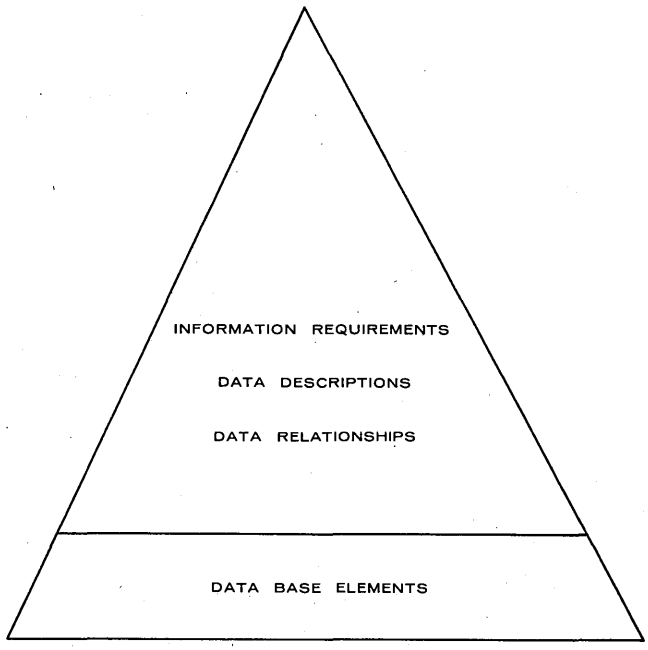


figure can be likened to a "soup" in which numerous data elements are floating around, not well-structured or well-organized but all present. In a large system, there may be hundreds or thousands of different kinds of data elements floating around in this data base soup.

In order to accomplish anything useful with these elements, it is necessary to give the data base an organization and structure. This structuring requires at least three things to be done: one is that the *information requirements* of management have to be identified. We need to know which of the elements potentially available are actually required. We need then to define them by providing a *data description,* in technical terms, of the data elements: how large they are, what their meaning is, where they are stored, how one can get at them. Then finally, it is of great importance to identify *data relationships* among the data base elements. An employee skill number might, for example, be a data element. This data element would be referenced in payroll compilation, in maintaining personnel records, in industrial relations. Thus the same data element could be related to many different files or, putting it another way, to many different management usages of information.

Not only is the organization of information changing significantly from what it has been in the past, but the utilization of this information is also changing. Companies

Fig. 2 Management Information System Data Base



engaged in developing management information systems are going beyond the use of computers simply to maintain records; they are exploring much more imaginative and ambitious applications. A few of these new uses are identified in Fig. 3. They include graphics capability to display the elements retrieved from the data base, as well as modeling and simulation. They extend to linking the information system to other systems dedicated to on-line process control, and involve the application of specialized

[1]Note the phrase "support for decision-making." This is employed deliberately to avoid the implication that the computer itself is a decision-maker in any important respect. While it is true that many lower order decisions have been programmed for the computer (e.g., inventory replenishment), the computer's primary role in a management information system is to provide data adequate to abet the decision-making function. For a general discussion of programmed and nonprogrammed decision-making, see Herbert A. Simon's *The New Science of Management Decision,* (Harper & Brothers, 1960).

[2]Although the terminology differs, the usages of information discussed in this paper generally correspond to the levels of planning and control identified by Robert N. Anthony in his authoritative work, *Planning and Control Systems: A Framework for Analysis* (Harvard, 1965). Anthony's three levels are defined as follows:
Strategic Planning: the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.
Management Control: the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.
Operational Control: the process of assuring that specific tasks are carried out effectively and efficiently.
From the point of view of this paper, business data processing has heretofore concentrated on accomplishing the specific day-to-day tasks of the company, i.e., operational control.

retrieval techniques to pull information from the data base. Most of these innovations in information systems encourage, and in some instances require, a close interaction between manager and machine.

considerations in systems design

A fundamental question confronting the system designer when he begins to think about the data base aspect of management information systems is: how many levels of data base are there going to be in the organization? There exists, of course, a management hierarchy with different information needs at its various levels, and so the question arises whether the information system can serve all these levels in an organization with but a single data base.

The bottom section of Fig. 4 reflects the continuing need to maintain the details of each business transaction, facts having to do with individual customer accounts and kindred information. All these details of transactions still have to be maintained much as they have been in the past, and information about them will typically constitute a fundamental part of the data base. Operating management obviously does not need all this detail, but it does

Fig. 3. Information System Utilization

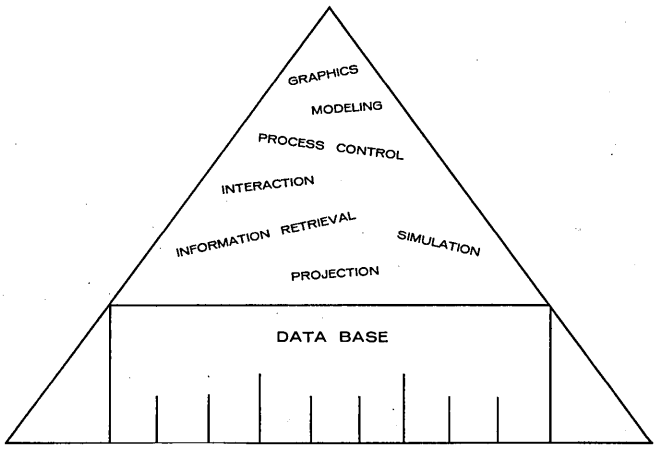
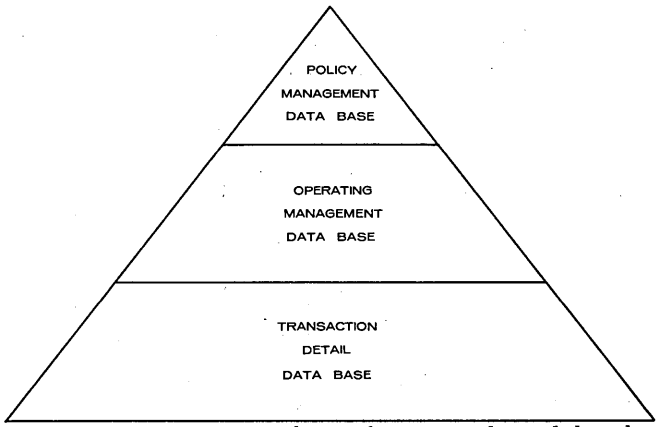


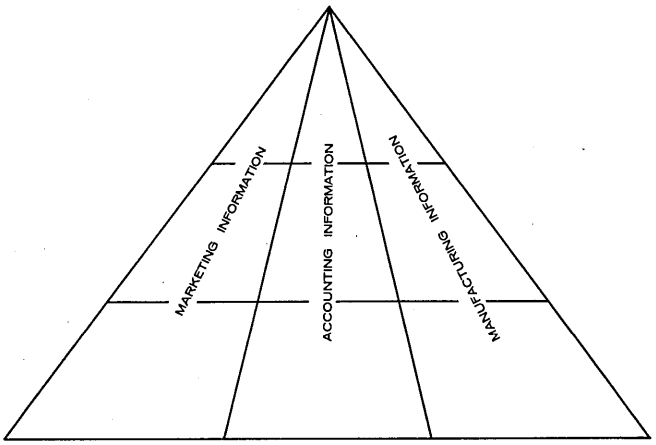
Fig. 4. How Many Levels of Data Base?



need some portion or subset of it, as indicated by the center section of Fig. 4. And at the top, policy management needs yet another subset of the overall data base. So the question must be answered: can these varying needs be served by a single data base, or will the system designer be forced to structure three different data bases? If he has to fragment the information system by level, then there is necessarily going to be some redundancy in the data elements maintained. Consider a specific example. In a commercial banking system it is necessary for the teller to have access to the details pertaining to each account—i.e., the current balance, the amounts of the checks drawn against the account, and so on. But this is really not of interest at the operating management level. This level is interested in cumulative information about groups of accounts, say all those under a branch manager's supervision. And at the policy-management level, the information needs are even broader, having to do with loan-to-deposit ratios, and deposit growth expectancy. Thus the designer is confronted with the problem of structuring the data base to accommodate these varying levels of information seekers.

A similar problem, but one having a "vertical" rather than a "horizontal" nature, is suggested by Fig. 5. For

Fig. 5. How Many Specialized Data Bases?



not only does the system designer have to structure horizontally, but he has also to determine whether different functional portions of the company can share a common data base—i.e., whether he must chop the data base into vertical as well as horizontal segments. Can the marketing department use the same data base as the production or accounting people, or is each intent on having one of its own? There seems to be some tendency in the latter direction, as there exist today systems dedicated, for example, to marketing information and serving the marketing part of the organization only. A major challenge to the information system designer lies in trying to integrate the company data base so that it can be useful to all major organizational levels and components.[3]

Another difficulty confronting the system designer concerns management's "information threshold." This has to do with the level to which a given executive may want to descend into the data base for information. The top horizontal line in Fig. 6 indicates what the system designer may regard as the "appropriate" information threshold for policy-level management. Executive "A", however, does not want to be confronted with the degree of detail

[3]Anthony takes a pessimistic view with respect to the satisfaction of top management's information needs. After asserting, rightfully, in this author's opinion, that "the data needed for strategic planning depend on the nature of the problem being studied" and that "not all these problems can be foreseen," he concludes:
It is because of the varied and unpredictable nature of the data required for strategic planning that an attempt to design an all-purpose, internal information system is probably hopeless. For the same reason, the dream of some computer specialists of a gigantic data bank, from which planners can obtain all the information they wish by pressing some buttons, is probably no more than a dream.
The author of this paper is more optimistic, holding the view that contemporary data base design concepts, which facilitate the retrieval of data elements in response to unstructured and non-predetermined management requests, can contribute significantly to the realization of such a dream.

envisaged in such a system design. An example that comes to mind is that of General Eisenhower. When he was President, his preference was said to lie in having all problems brought to him summarized very succinctly. Thus, he might be representative of the kind of chief executive who does not want to delve very far down into the data base, but instead desires summary presentations of information.

But if the system is developed to accommodate such an executive's information threshold, the system designer must determine what should be done when his chief is succeeded by another executive who has an entirely different information threshold. Consider executive "B" in Fig. 6, who frequently wishes to examine information that has to do with day-to-day control of the business—i.e., operating data. Secretary of Defense McNamara is regarded as this type of executive in that he has a very low information threshold and demands many detailed facts before making a decision.

Now, the systems analyst does not want to have to restructure, and more importantly, reimplement, the system each time there is a transition from one chief executive to another. He wishes instead to have, as a design objective, a system that is sufficiently *adaptable* to accommodate the information needs of different types of executives. This is certainly another of the challenges in information systems design.

Fig. 6. The Information Threshold Problem—I

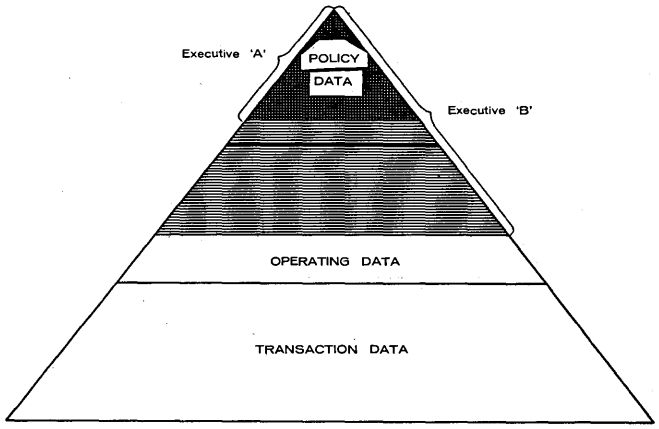
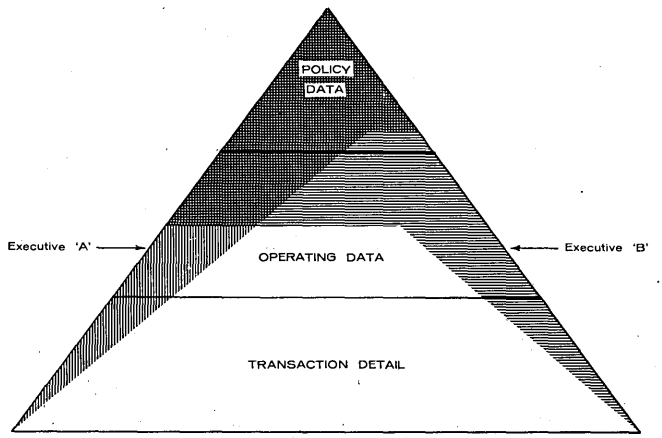


Fig. 7. The Information Threshold Problem—II



An additional aspect of this information threshold problem, or perhaps another way of looking at it, becomes evident when executive "A" has, let us say, a marketing background, so that when marketing transactions are involved he wants to go all the way down to the bottom of the data base as evidenced by the shaded left hand portion of Fig. 7. Such an executive may call for all the details of a particular customer order, asking "How long was this order delayed?" "What was the amount of the order?" Management experts may assert that this executive is violating sound organizational principles by doing so, but the systems man must recognize that in a real life situation this is the way executives do operate and, consequently, he must design systems to accommodate these needs. Otherwise, management simply will not make use of the system.

And, of course, systems can be tailored in this manner. The designer can allow hypothetical executive "A" to satisfy his personal need to know, but it must be remembered that this executive is not going to be in charge forever and may be succeeded by someone from, say, the engineering sector. This could turn out to be executive "B", as represented by the shaded right hand side of Fig. 7, who in general wishes much more detail, but will want to go down to the very lowest level in the data base only when engineering or R & D problems are involved. It is essential to design a system that does not have to be re-worked completely when such changes in management information thresholds occur.

These are some of the considerations that systems people must be concerned with, whether they work for an equipment manufacturer interested in seeing his equipment used in an information systems context, or for a user seeking to install an up-to-date management information system.

trends

Now that we have established a conceptual framework, let us examine some current industry developments. What are companies actually doing today? Some of the concepts just presented have been in the public domain for some time, but do not necessarily or entirely reflect what is actually happening in terms of the things companies are spending good money on in the information systems field.

Applications Re-working. Commercial applications programmed in the past are today being re-worked by many companies in a very drastic and far-reaching way. Existing applications are being redone, not so much because of a conscious decision by management to develop an integrated information system but simply because third-generation computers are being widely installed. Most companies that had in the past a tape-oriented, second-generation computer are now installing larger, third-generation gear. This third-generation equipment offers features not readily available to system designers in the past, including mass direct access storage, a variety of on-line terminal devices, and substantial remote processing capability.

Though it is usually possible for a company to retain existing applications by using emulation or simulation, most companies recognize that they can best exploit the more powerful new computers by rethinking their applications from the bottom up. And in the course of such rethinking, there is an unprecedented opportunity to provide more effectively for the information needs of management. Thus, the fact that new equipment is forcing applications to be redone is giving impetus to the development of management information systems.

Formalized Systems Planning. Accompanying, and related to, the phenomenon of applications re-working is the growth of a formalized approach to systems planning. This is largely a reflection of the experience gained in the recent past, when a computer was installed in the company initially for one purpose—to automate the major accounting routines. Thus, public utilities first automated revenue accounting and insurance companies, premium

accounting. But now that they have committed themselves to the expensive and time-consuming task of re-working their key applications, companies have become interested in devising some sort of "road-map" of the future in order to avoid yet another wave of re-work a few years hence. A five-year planning period is typical, although some go out longer. All seek to anticipate the systems capability that should exist in the organization over the planning period.

These plans are truly formalized, documented and presented to management for endorsement and reviewed and updated periodically. And they have many subtle and far-reaching implications. If, for example, a company has no *corporate* planning staff, the information systems group trying to develop a long-range systems plan lacks the necessary guidance to establish its plan. For the systems plan depends importantly on the firm's overall strategy concerning such matters as new products, mergers and acquisitions, and geographic expansion. When management's own insight into these future possibilities is not clear, the systems group can only build its long-term plan on *assumptions* about company growth. And by so proceeding, the systems people tend to become, by default, the corporate planning staff.

Management Science Emphasis. As the focus of technological interest in many companies comes to bear on management information systems, there is heightened emphasis on the employment of management science techniques—i.e., usage of the computer in a scientific approach to business problem solving. Looking at this development in historical perspective, it is evident that, with the repetitive accounting tasks already automated, further exploitation of the computer must draw heavily upon statistical and mathematical techniques to assist management decision-making. It is not by accident that some of the major computer manufacturers have moved to unify their product line, bridging the traditional distinction between so-called "scientific" data processing, using binary machines, and "commercial" data processing, using decimal machines. These manufacturers are striving to supply equipment that can be applied to whatever purposes are appropriate for business usage at this point in time.

Regional Information Processing. The design philosophy associated with the development of a broadly applicable company data base would appear to provide a strong motivation towards centralizing the company's information processing systems. In practice, though, there is a tendency to regionalize data processing capability, with a number of large companies proceeding actively along these lines. One diversified manufacturing company presently has data processing capability located in more than 25 decentralized operating departments. These departments, each of which has profit and loss responsibility, in the past had pretty much of a free hand to determine their data processing equipment needs. This company now plans to centralize its computing equipment, though not to the extent of pooling it in one headquarters location. There will be instead four regional centers, serving groups of these decentralized departments.

Another example is that of a large bank that presently operates several centers for processing checks, handling hundreds of thousands of items per day. They are now in the process of closing these centers, but will not pull everything into the bank's headquarters. Instead, this bank will convert to two regional centers.

Why take a regional approach? Perhaps management is reluctant at this time to make the ultimate commitment of concentrating all its data processing capability in one place. Possibly what is now happening represents an intermediate step, and another generation of systems technology will see further centralization.

Information Management Systems. Concentration on management information systems has encouraged an important collateral effort to develop "information management systems." Some practitioners call these "file management systems," others call them "management inquiry systems," or "data base systems." Basically, an information management system is a software tool useful in organizing, processing, and presenting information. Companies engaged in developing management information systems are showing increasing interest in these programs which help organize and manage information more effectively. Recalling the notion of the data base as a "soup," with data elements floating around in it, the role of an information management system is to coalesce these data elements into records and files suitable for processing and inquiry purposes. The concept of an information management system is of sufficient importance to warrant a brief discussion of the functions performed by such systems.

system functions

•File Creation—Perhaps the most basic thing they can do is establish files. This involves the identification of the data elements that must appear in a given file. These elements are described to the information management system, which then creates files in accordance with stated requirements for data element and file usage. Storage allocation is controllable by the system, and a file can be set up in whatever physical storage medium is appropriate to the use of the information in the file.

•File Maintenance—Another of the classical tasks in data processing now being assumed by information management software is file maintenance. Here, transaction processing requirements set forth by the systems analyst are transformed by the information management system into routines to accomplish the updating of master files.

•Report Generation—The idea of using software to assist in generating management reports is not new. Report generators have been around for a long time, but today's information management systems incorporate them as a function within an integrated and internally consistent software package. Thus, having set up a file and introduced transactions to update that file, the analyst can now direct the system to generate reports tailored to management specifications.

•On-Line Inquiry—The three information management functions just mentioned would be adequate for conventional, off-line, sequential processing. Many information management systems go beyond this, however, to permit operation in an on-line mode. The files established and maintained by the system thus are made available for direct management inquiry. Such inquiry capability requires the design of an inquiry language and the development of interpretive programs to analyze the inquiries and set up the file search logic required to obtain the data elements needed to satisfy the inquiry.

•Information Retrieval—The final major function of information management software has to do with information retrieval. If a system is to accept real-time queries against the data base, it is necessary to structure the files in such a way that the system can be immediately responsive to requests for information. Information management systems are thus beginning to borrow from the field of information retrieval. As a consequence, information retrieval techniques have begun moving out of the field of library science and into business organizations as an important part of information management software.

Consider the difference between the rigidly structured and carefully prescheduled computer reports that man-

agement is now accustomed to receiving, and the capability of asking the system to retrieve and display, in real-time, answers to such queries as the following: "Which branches in our banking system have more than 2,000 loan accounts *and* a loan-to-deposit ratio of 1:2 *or* have more than 10% of their deposit accounts with an average balance of over $10,000?" Advanced information management software can help the designer provide this kind of inquiry and information retrieval capability.

problems in systems planning

Thus far we have discussed some key notions in information systems design and looked briefly at major developments taking place in leading companies. While these provide signs of substantial progress, many serious problems remain. The list of problems is perhaps not quite so long as it was before the advent of third-generation computers, with their mass direct access storage and inquiry devices. Similarly, the type of software technology epitomized by the new information management systems has helped markedly. The problems remaining are less technical in nature than before. They have to do with introducing the technology that has become available into the company environment.

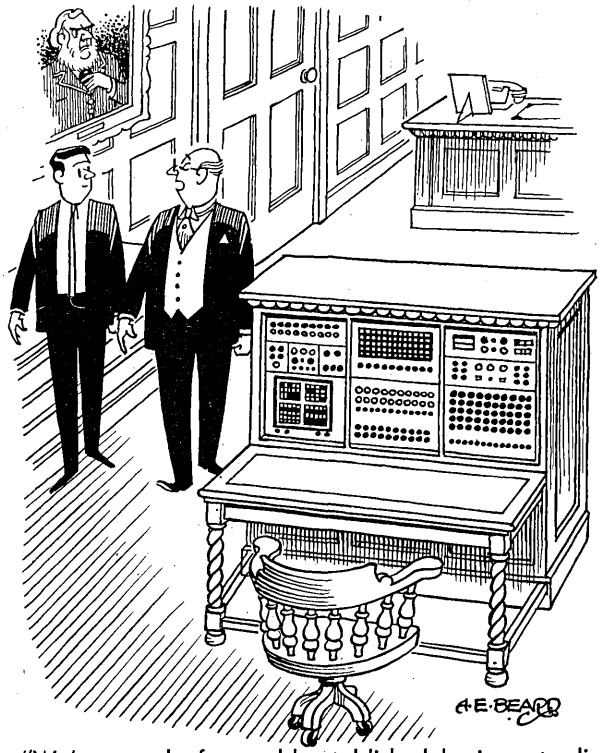
The most immediate problem of this kind centers around the fact that management information systems cost more than predecessor systems. If a company president studies his system costs, he will soon discover that the equipment and software necessary to support a management information system cost a lot more than the company had to invest in the past in more conventional applications. It is undeniable that there is a higher price tag associated with management information systems than the already considerable cost burden that companies have been carrying for data processing technology. Despite the fact that unit costs have been declining, e.g., cost per bit stored, cost per item processed, hardware and software costs are both rising in an absolute sense, reflecting the more ambitious objectives of today's information systems design. As a result, management is taking a closer look at new equipment proposals and challenging each new systems project more vigorously.

Associated with the problem of rising developmental and operating costs is that of system justification. Even though a proposed system may be very costly, an enlightened company management may be willing to support it if the proponents of the system can demonstrate what the benefits are going to be. In the past, when a computer was installed for repetitive accounting tasks, there were almost invariably demonstrable savings resulting from clerical worker displacement. This was usually a very tangible cost-justification, and most companies are proud of the fact that they have been very objective and have never installed a computer without the off-setting cost benefits. But this approach is no longer appropriate for companies that have *already* obtained these tangible cost benefits by means of systems presently installed. Today, the question is not what it may be worth, for instance, to an investment company to update its portfolios and otherwise process the paperwork, but rather what it is worth to provide an investment manager with a cathode-ray tube display device and the underlying mathematical techniques to aid in security analysis and portfolio selection. These are benefits that in the past were referred to, a trifle cavalierly, as "intangible." But *most* of the benefits of a management information system are of this intangible nature. Clearly, what is needed are new methods of justifying information system costs by quantifying somehow these heretofore "intangible" benefits. Until this can be done, it is difficult to see how management can be persuaded to commit substantial company resources to truly effective information systems development.

In seeking to chart a course of action, management men sometimes become understandably confused about just what their systems people are trying to do in the field of information technology. All too frequently management is caught in the crosstalk between two schools of thought: on the one extreme there are the enthusiasts, who point to the very powerful and sophisticated results that can be obtained with computers. It is easy, they assert, to develop a management information system. If only a particular piece of hardware is purchased or software applied, you are well on the way to achieving tremendous progress. There has unquestionably been a great deal of overzealousness and overselling, but at the other extreme lies undue disillusion. There are people who say: "This is all baloney. There really is no such thing as a management information system, it is a sort of chimera. We must be more practical and abandon these grandiose concepts." And management has been caught in the middle.

Also contributing to management's difficulty in trying to understand information systems technology is the communications gap that frequently exists between the systems professionals in the company and the management people responsible for determining where the company is going in information systems. This communications gap has always existed, but has become more evident now that it concerns systems that have an immediate impact on management decision-making.

These are foremost among the problems associated with the introduction of management information systems. While much has been accomplished in the technological sphere and in the refinement of important concepts, much remains to be done before these systems become operational on a broad scale. The challenges to be faced are many, and the exploitation of the technical tools now available will require the best efforts of systems professionals, coupled with an unprecedented level of management support. ■



"We're proud of our old established business traditions here but you'll find we still move with the times."
© DATAMATION

WEYERHAEUSER'S MANAGEMENT INFORMATION SYSTEM

by R. A. KRONENBERG

Decision-making requires information. To make the best decision, accurate information is required. It is no longer a question of *quantity* of information, it is *quality* and *timeliness* of information.

In a one-plant, one-product setup the decision maker and the information source is usually the same person. As manufacturing facilities expand, product lines increase, and marketing staffs multiply, the information problems increase. It then becomes an impossibility for one person to be the sole source of information and decision-making. At the same time, the information upon which any decision is based is altered unconsciously by every hand it passes through and thus any decision based on that information is probably not the best possible decision.

Weyerhaeuser Company, a completely integrated forest products company "from trees to customer", today faces the information decision-making problem. With products made and sold in every state and every continent, our information problems and decision-making problems have become almost overpowering. And Weyerhaeuser is not alone, for every company with many products, many manufacturing facilities, and many marketing groups faces the same problems.

objectives

How Weyerhaeuser planned to solve these problems, what the company has started to do and is now doing partially, and what we plan to do in the future is the subject of this article. Weyerhaeuser has many problems singular to its operation, as do all companies. Because of this, our solutions will not fit everyone but we figure they are the best solutions for us.

Before describing our management information system, it is probably well to define what we mean by these terms. We define a management information system as one in which the requirements at each level of management are carefully determined in advance of need and are then produced from an integrated system at predetermined times and in a form suitable for the following purposes:

1. For setting objectives
2. For shaping and evaluating alternative strategies
3. For making decisions
4. For measuring results

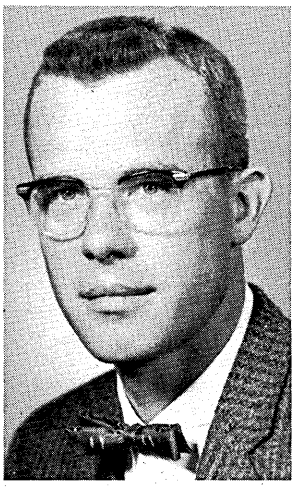
Such a system should provide the information that management needs to understand, plan, operate, and control the business. In other words, we are organizing management information systems primarily to help us to manage better, not just to save clerical costs. This is an important point in our philosophy. Our main emphasis is on improving the decision-making capabilities of the organization; we also expect to undertake whatever organizational restructuring is necessary to put each manager in a position to effectively implement these other decisions.

the additional resource

Why do we place so much emphasis on systems as a means of improving our decision-making capabilities? Many companies must manage only resources of money, people, facilities, and time. Weyerhaeuser has an additional resource to be managed—timber. This is an extremely variable resource. Our trees come in all shapes, sizes, and ages and in nine different commercial species. Literally thousands of different products can be made from this resource or raw material. Our profit performance is largely determined by the mix of products we decide to make from this timber. The question is not just one of whether we make lumber or plywood or pulp or linerboard. Within each of these product classifications are thousands of specific product possibilities. Our management job is to decide what mix of specific products to make and then organize ourselves to effectively make and sell this mix when the market opportunity is the best.

To accomplish this means our managers must understand:

1. What the market opportunities are for the various products that can be produced, including the prices that can be realized.



Currently manager of management systems operations, Mr. Kronenberg has been with the Weyerhaeuser Company since 1949. He has a CPA from the state of Oregon, and holds a BA from Reed College.

2. What products can be produced and in what quantities from our logs.

3. The costs of making and selling each of these products.

In order to produce understanding of these three factors we must have specific information on costs, yields, and prices. This means not only setting up systems to produce this information, but also handling vast quantities of data. (Our timber inventory alone takes 200 reels of tape now, and is expected to expand to 10 times this figure in five years.)

What are the essential elements of the information needed for decision-making and how does this affect the manager? In the first place, it should be tailored for the areas of the manager's responsibilities. This assumes the manager will know those areas for which he is responsible. We must find out what he needs to manage effectively. We are talking about his needs, not his wants.

So that the manager can manage and not just be a clerk, he should get the right amount of information. It should be in the right form and be the correct information for him. It is probably better to be approximate and concise, rather than exact and voluminous.

It should be understandable to him. He should know how it relates to his business. He should understand the purpose for which the information is given to him.

It should be considered in the proper time frame. Information that is late is a complete waste of money. On the other hand, since time is money in information systems, a very careful, honest look has to be given to time. There is no use paying for three-second turnaround where one hour would be more than adequate. The plant which schedules by the week has a much less critical time requirement than the plant which schedules shift by shift or hour by hour.

And lastly, we have to be careful that the cost of the information does not exceed the value of the action it is affecting. We shouldn't be spending $500 per year keeping the inventory on an item whose total usage in the year is $50.

Our objectives are to build compatible management information systems to serve the needs of the various businesses within Weyerhauser, as well as the needs of the company as a whole.

It should be pointed out that Weyerhaeuser has four primary groups for management purposes. Wood Products consists of softwood lumber, softwood plywood, particleboard, hardboard, hardwood plywood, and doors. Paperboard and Packaging includes shipping containers, folding cartons, milk cartons, and sales of bleached and unbleached board. Pulp and Paper consists of sulphate and sulphite market pulp and paper. Timberlands not only supplies raw material to the product lines above, but also sells timber, logs, and wood chips outside the company. Each of the first three of these major product categories accounts for approximately one-third of our total sales of $830 million.

history

Prior to 1963, Weyerhaeuser had the usual amount of card oriented data processing equipment located in corporate headquarters, and major division headquarters. Small computers were gradually replacing some of this equipment in the normal course of upgrading. All of the operations were batch oriented and heavily accounting oriented. Some sales and production statistical work was done.

In 1963, after some of our top management had been exposed to the capabilities of computers, a study team was formed to determine the feasibility of establishing an integrated management information system within the Wood Products Group. The study team was made up of operating people from marketing and manufacturing rather than systems people. Our technical experts were available to help the operating people in areas where they lacked knowledge.

After seventeen weeks of study the team recommended that a management information system be instituted. They felt that it was not only economically feasible but mandatory if Weyerhaeuser was to maintain a position of leadership in the forest products industry. This recommendation was accepted by management and the decision was made to go ahead in the Wood Products Group. After that effort proved its worth, similar systems were to be started in the other company operating groups.

In building our system we have departed somewhat from the accepted methods. These should be explained before the system is outlined.

1. Our objective was to build a system to fit our business, not to make the business fit the system. We took line managers out of the business and placed them in charge of planning, development, and implementation of the system. Adequate technical help is available to them; the responsibility for the system is theirs.

2. The implementation team was given the responsibility for not only building the system, but also for making a thorough evaluation of the business, including organization, function, and people. It was felt that any deficiencies in these areas should be corrected at the time the information system was being built.

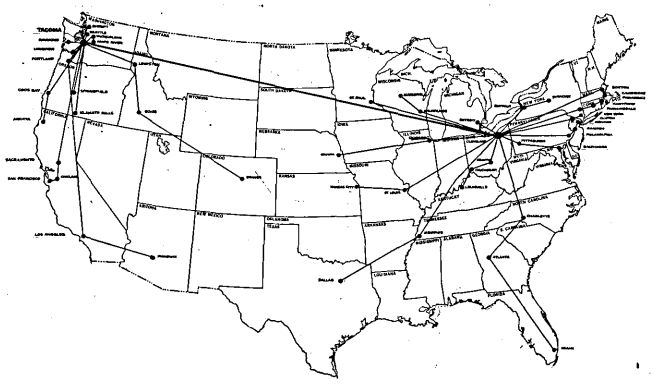
3. We took the responsibility ourselves for system design, including hardware configuration, and then asked the computer vendors to bid on this package.

4. While each business within Weyerhaeuser will develop its own system, computing capability will be provided from a central computer center located in Tacoma, Washington. Mills and offices will be connected to this computer center by high-speed communication lines.

system operation

Our first effort in the Wood Products Group management information system was to capture the information at the source and get it in the system early. It must be correct and must be understandable to the central processor. Fig. 1 shows our leased-line teletype system connecting all major manufacturing and sales locations with the central computer. Datanet 30's are located at Tacoma and Cleveland. All order and production data now flows from the field directly into the computer at the Tacoma location. It enables us to have rapid communication between all large locations for transmission of order and production data plus administration messages.

Fig. 1 Weyerhaeuser Company Management Information System Communications Network



Master files had to be created for all common data elements so that all transactions could access them. One

of the first files set up was for the items of the Wood Products Group. This meant we had to establish a list of all the products we sold and manufactured and all of the details about each item. Because we have so many variations of the 8,800 basic items, further breakdowns had to be provided. Our item file at present has an eight-digit reference code for each item.

Similar work had to be done on the master customer file. After determining who was a customer, the same detail work had to go into establishing the data base for each customer. We at present have about 40,000 customers in the file. Information on each includes such things as shipping point, mailing address, credit limit, credit rating, marketing classification code and even ZIP code. An eight-digit reference code was also used for the customer file.

Operating reports from this data base are the primary product of the system. This is and should be the payoff from the substantial sums spent in acquiring the information. How this information is presented, in what quantity, the timeliness, how understandable it is are all questions to which we are presently addressing ourselves. Using the principles already described, basic order-inventory and forecasted availability reports for manufacturing have been developed. For our distribution centers inventory reports and forecasted sales reports are in use. We are making slow but steady progress on the more sophisticated management reports.

At present, almost all of our orders are being entered from the field directly into the system. They are stored on disc files until they are shipped. At that time, the order is removed and the transaction is stored on magnetic tape.

At the same time, production information is being entered at the mills along with shipment information to update the inventories maintained on the disc files. Daily printouts of the inventory position by item, showing stock on hand and orders against it, are made for each of our mills. These are available at the mills and central order placement at 8:00 a.m. and show position as of yesterday. Production history is kept on magnetic tape.

Our present configuration of equipment to handle the Wood Products Group plus some corporate applications is shown in Fig. 2. We have General Electric 635 equipment scheduled for arrival during the summer of 1967, so this will be changing.

As the efforts in the Wood Products Group advance, similar systems are underway in the other three major groups in the company. The same basic principles will be followed. Wherever possible, common files such as customer, personnel, and vendor, will be used. Each management system will be designed so that it will not only provide the needs for its own group, but will be compatible with other groups to form a company management information system.

future plans

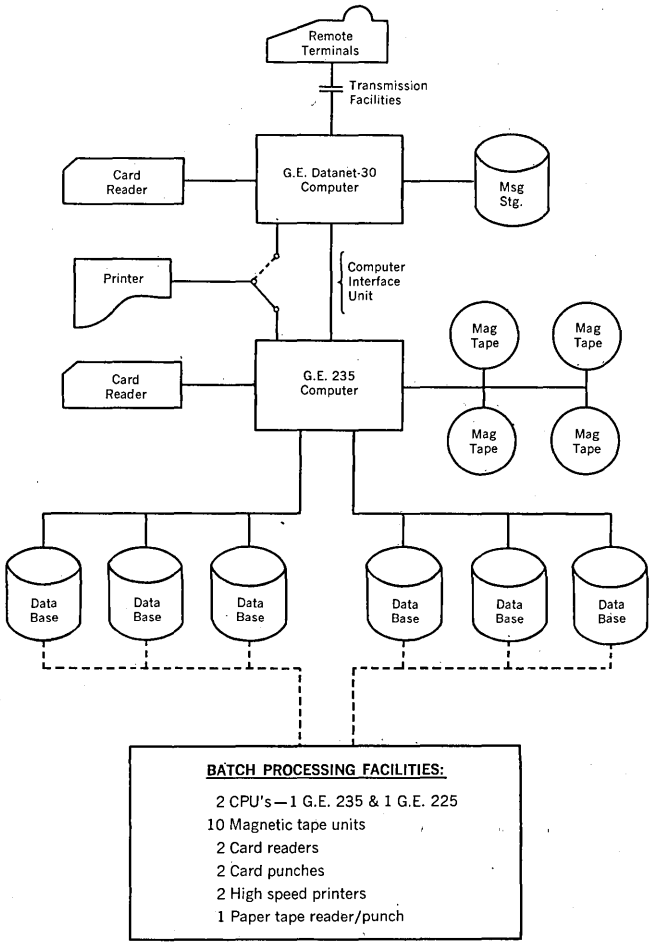
As was stated before, computing capacity will be provided for all the systems in Tacoma, Washington, the corporate headquarters. Additional low-speed and high-speed voice quality lines will be used to send the information to the central processor. At our large input stations, high-speed terminals will be used; while at the small input centers, we will probably rely on teletypes or similar equipment.

In looking at the very recent past and present, three facts stand out as major reasons for making the decision now to centralize our data processing. One is that computer capacity is increasing but unit costs are going down. You may pay more for a computer in 1967 than in 1962, but the '67 model has greater speed and more capacity. On the basis of units of work handled, the '67 model is much cheaper; one large processor is cheaper than four smaller ones.

The same trend is showing up in communications costs. Capacity is increasing, yet the unit costs of the large capacity, high-speed systems are decreasing. The state-of-the-art is such that reliable performance can be expected and received.

The third reason is system design. If we can define what a central system requires so that individual systems can be designed to fit from the beginning, our system development and programming efforts will be minimized.

Fig. 2



If we allow the separate efforts to proceed on their own, we will ultimately face the problems of interface and it will be costly.

Based on those points, we feel now is the time to centralize, rather than later—after the separate systems are created.

Embarking on this effort is a costly venture for our company or any company. We feel that rather than take a hit-or-miss attitude on data processing, we should make a strong concerted effort to get the value from better decisions by use of a management information system. Our thinking is not so much a question of *whether* you can spend the money but *when*, and when is now. The computer can be a tool to help us manage more effectively, and decisions based on a combination of sound logic and accurate information can make our investment pay off. ■

CALIFORNIA DMV GOES ON-LINE

in one giant step

by R. E. MONTIJO, JR.

In 1965, registrations for more than 10 million drivers and 11 million vehicles were on file in the California Department of Motor Vehicles (DMV).

Surveys showed that by 1975 the state could expect three million new drivers and six million additional vehicles.

Meanwhile, every day, over 200,000 queries and data entries were being funneled through the department.

To cope with this situation, California decided to build a computer-communications network capable of supporting a thoroughly automated real-time system—moving the Department of Motor Vehicles from manual and key punch operations to video data entry/display techniques and a massive automated data bank in just five years.

On October 20, 1966, the production phase of the Automated Management Information System (AMIS) got underway in Sacramento with the demonstration of conversion of driver license records. When AMIS is completed in 1970, hundreds of remote terminals and other devices will be tied into the department's state-wide electronic network.

The history, objectives, techniques and accomplishments of California's unique data processing system—one of the most extensive and ambitious programs ever undertaken—are the subject of this article.

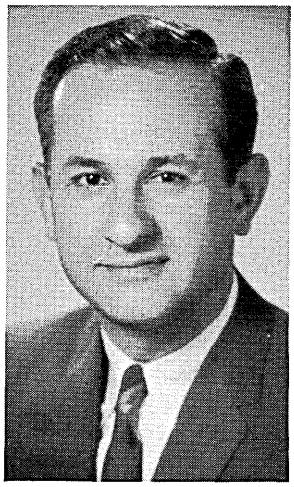
the need for AMIS

Growth, more than anything, led to AMIS—growth in workload, growth in the cost of non-automated record-keeping, growth in the time required to do this work.

California DMV's workload involves driver licensing, vehicle registration, and other related activities.

A driver record and a legal file are maintained for each licensed driver. These contain a complete history of moving violations, accidents, and court convictions. Driver record abstracts are always available to the courts. Similar data are provided to drivers and insurance companies for a nominal fee. Administration of California's financial responsibility law and driver improvement program also requires maintenance of data elements within the driver files and analysis on a continuing basis.

Also, records must be maintained for each motor vehicle. These records are organized by vehicle identification



As manager of special programs at RCA's EDP division in Cherry Hill, N.J., Mr. Montijo was responsible for the design of the RCA system at the California Dept. of Motor Vehicles. He has recently joined Planning Research Corp. as director of advanced systems planning. He has a BSEE degree from the Univ. of Arizona.

number (engine number). New vehicle registration, transfers, and annual re-registration, including issuance of plates or stickers and collection of fees, represent an equally major portion of DMV's workload. Each year, on the day after Christmas, over 10 million registration forms are mailed to Californians. For the following three months, the processing of these forms—including fee accounting and updating of the entire file—is a major project.

The importance of accurate, up-to-the-minute records within DMV is underscored by a continuous flood of inquiries from law enforcement agencies, the public, the courts, and insurance companies. These inquiries must be handled in parallel with the department's regular duties.

Today, all of these pressure points are application areas for AMIS.

Surveys by the Department of Motor Vehicles, incorporated in its report to the Legislature, indicated it would be hard pressed to keep pace with information processing using manual methods. For example:

From July, 1965, through July, 1975, California's population is expected to climb 32%—from 18.8 million to 24.8 million. In terms of vehicle registrations, this means a 50% increase—from 11 million to 16.6 million. During the decade, driver licenses will jump 48%—from 9.6 to 14.2 million.

When these figures are related to DMV's projected workload, the number of driver licenses issued annually will increase 71.5%—from 2.8 million to 4.8 million. And annual court convictions entered in DMV records will zoom 100%—from 3.6 million to 7.2 million.

Even more dramatic will be the surge of requests for information in DMV files. Inquires will climb from 15 million to 39.2 million for a net annual increase of 160.8%.

Even with AMIS in operation, DMV's total work force will expand over the decade by 2,575 positions from 5,265 positions in 1965. But this workforce expansion expected is 590 less than without AMIS. Other important economic benefits include: recovery of all conversion costs; ownership of $13.6 million of electronic data processing equipment; net cumulative savings of $1.7 million; and recurring annual savings of $5.3 million for the fiscal year 1974-75 and thereafter. While costs and savings include personnel, equipment, land, buildings, and capital outlay, no dollar value has been placed on highly improved public service and other intangible but valuable benefits—such as the number of lives saved and reduced property damage through better service to the law enforcement community.

AMIS—organization and aims

Organizing AMIS began in late 1964 when DMV outlined broad departmental goals and selected COMRESS, Inc., as consultant to develop a real-time system. A model was constructed, simulated and costed, using various manufacturers' equipment.* Goals of the system were:

1. Economical operation paced to rapid population growth.
2. Fast, one-stop, over-the-counter service.
3. Timely information for DMV, related state and local agencies, and private business.
4. Instantly available information for management decisions.

*Herman, Donald J.; *Scert: a Computer Evaluation Tool;* DATAMATION, February, 1967, pp. 26-28.

Simulations run on the model by two DMV task force teams indicated the system's feasibility. Thereafter, invitations to bid were sent to some 15 U. S. edp vendors. A letter of intent was issued to RCA on August 16, 1965, for first phase equipment. Less than a year later, the AMIS Spectra 70's were on the air.

Systems requirements included:

1. A total management information system designed to be fully operational by 1970, with phased implementation starting in 1965.
2. A system for real-time processing of input data and inquiries received on-line from remote locations, intermixed with locally entered batch-type input data—and for the directing of real-time output to remote locations simultaneously with local, high-volume, batch-type output.
3. A system capable of evolving from a manual or partially automated system with a minimum of problems.
4. An automated data bank—located in Sacramento—with storage capacity for over 15 billion characters.
5. An on-line system linking DMV field offices, law enforcement agencies, and courts with as many as 1,400 remote terminals.
6. A system capable of handling 16,000 transactions per peak hour and over 225,000 transactions per day.
7. Alternate path equipment connectivity and reserve fall-back capacity for high level reliability.
8. Programming modularity, segmentation and standardization for an orderly conversion and system buildup without re-programming, consonant with the most effective use of a multiprogrammed, multiprocessing operating system.

training at DMV

Imposing a third-generation "total" electronic system on any organization creates problems. Suddenly gone are the baskets and casual pace of a paper system. Gone also are the familiar and protective time buffers of inter-office and inter-city mail. Electronic speeds can be disturbing. People-acceptance is clearly basic to success in such ventures and DMV's AMIS was no different.

A plan of attack was devised to overcome real and imagined technical problems and the barriers arising from people's reluctance to change, while at the same time satisfying the AMIS schedule. Headway was made through seminars directed to management and supervisory personnel. The department, in turn, conducted seminars for office workers on the new system.

Training assumed critical importance. Normally, users grow in edp sophistication gradually, as they add more sophisticated hardware to their systems. But at DMV, on-line conversion to random access processing had to begin a year later—and in the completely manual drivers' license operation. There wasn't time for a phased build-up in equipment or training.

The first step was concentrated classroom training for 60 DMV programmers and supervisors. Equally important was the cross-training given to RCA's on-site systems team in driver license and vehicle registration procedures, and in the requirements of the Motor Vehicle Code.

A major objective was to acquaint the three working groups (driver license, vehicle registration and RCA systems representatives) with a working knowledge of the processing requirements of each division, as well as the characteristics of the hardware, software and programming languages.

To achieve this, two levels of month-long six-hour/day classroom training began in September, 1965. One class for 20 DMV programmers involved general systems, Spectra 70 assembly language, and COBOL. A special

course for 20 DMV edp supervisors and RCA systems men centered on systems programming design and specification. Several other classes were scheduled, too. Altogether, RCA conducted about 500 man-weeks of on-site training for programmers, supervisor/analysts, and management in general systems, programming languages, operating systems, and operations.

the programming system

An automation program of AMIS' scope requires vast sums of money and manpower. Applications programming costs are a large percentage of the total system costs. Any inefficiencies due to false starts, delays caused by poor scheduling or reprogramming downstream can easily absorb potential savings.

These factors became major considerations in all program planning decisions. Ultimately, they dictated the approach used in the design, specification, and execution of the first phase of implementation—to do a two-year job in nine months. The approach was based upon the completion of detailed system design specifications prior to programming, and a high degree of concurrency in all aspects of the effort.

RCA proposed the design and specification of a programming system super-structure. It set a four-month time limit for specifying the framework, with programming beginning late in 1966. This effort was analogous to:

1. Building the superstructure (or "overhead" programs) over a six to twelve-month period.
2. Then filling in the superstructure with the applications logic programs in a carefully planned order over a 5-year period.

This approach was called the AMIS programming system segmentation model.

This model includes the concept of an automatic file control to store and retrieve records from the largest random access file in the world within a half-second. It responds primarily to "get" and "put" commands, and is oblivious to all else in the system.

File control operates upon transactions entered from the input/output domain, which includes local and remote keyboard-printers and other conventional peripherals. These I/O devices talk to the communications channel and to the peripheral channel I/O packages, which are sub-elements of the model's I/O control section.

The transaction processing section is where most of the action is. General control for the model resides within the real-time transaction and task control element. Calculating program elements are in the transaction logic processing area. The transaction logic programs are the primary application building blocks which will be produced, added, and modified as the superstructure is given substance.

The model introduced several nuances that required re-definition of older concepts. Terms such as *thread* programs, *run* programs, *overhead* programs, and *transaction logic* programs are part of the programming system.

The video-to-tape thread represented the first conversion application. This thread begins at one of 88 video terminals and moves through communications control, real-time control, transaction logic, and peripheral I/O elements before the input message is recorded on magnetic tape. After a tape-to-printer run, each input transaction batch is proof-read and verified in hard-copy form prior to the next operation. The input document images are then sorted, merged, and the mass storage file record image is created on magnetic tape for loading into direct access storage.

The tape-to-mass-file thread enters through peripheral I/O and travels through real-time control and transaction logic before entering the file control section. Here, an index is created and the new mass storage record is deposited in the mass store.

An inquiry thread travels through communications, real-time, transaction logic, and file control, then back through the transaction logic and communications, and finally to the requestor's output device.

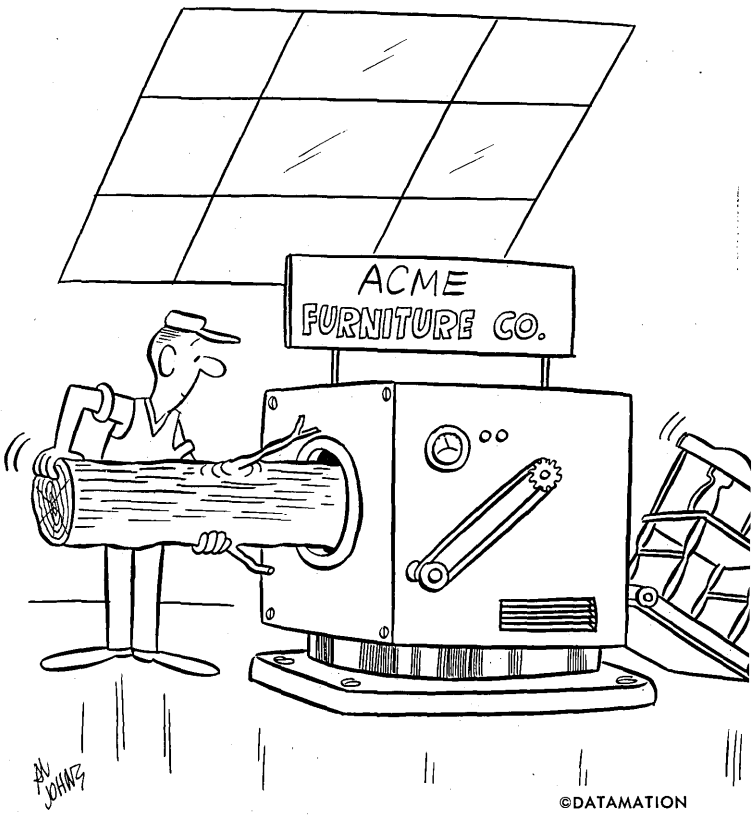
Approximately 100 similar threads and 1,000 transaction logic program segments will be included in the completed DMV system.

The thread programming organization concept has some interesting characteristics. The three threads just described reveal more programming elements in common than differences. The only differences exist in the transaction logic and in the I/O formats. All the other program elements are common to most transactions. These common elements were named *overhead programs,* because they are common to most DL (driver license) and VR (vehicle registration) transaction processing—and are to be programmed once.

Once DMV's superstructure of overhead programs is completed, transaction logic program elements may be added over the life of the open-ended system without redoing the data handling and housekeeping portions that often represent up to 50% of typical batch-type programs.

What is the relationship of overhead structure to the operating system? Thread and overhead programs are run in the user environment of the Spectra 70 operating systems. The real-time control package—a multi-processor in itself—controls and schedules overlapping of up to six transaction logic programs, including the scheduling of overlapped access to various mass storage units and maintenance of system restart and recovery points.

The Spectra 70 primary operating system-extended (POS-E), which has been in use since last July, will be replaced by the multi-programmed tape-disc operating system (TDOS) this summer. POS-E will remain in use in



the Spectra 70/45E communications processor. TDOS will be run in the Spectra 70/55G processor.

choosing a language

Selection of a programming language, naturally, was an important step. An initial objective was to use COBOL for all programs. However, COBOL's limitations in communications and random access programming, together with the innovation of the overhead programming concept, caused a re-evaluation.

Studies indicated that using COBOL to operate on a highly variable, packed record would significantly raise program core storage requirements. Even more important was COBOL's inability to handle efficiently the 6,000-byte-maximum and 200-byte-average mass storage records. Use of COBOL rather than assembly language would have meant raising the mass storage file capacity requirements four to seven times. Multiplying the latter factor by the 15 billion byte storage requirement showed the price to be prohibitive.

The AMIS' overhead programs are core-resident when the transaction processors are operating in real-time. They need be written only once. High flexibility and efficiency in bit manipulation also were desirable for programs directly interfacing communications and mass storage. Hence, assembly language was selected. All overhead programs and those which manipulate the highly compressed mass storage record directly have been written in assembly language.

Since the overhead program structure brings all transaction data, programs and records in exploded form into any of six standard overlay areas in core, COBOL and FORTRAN may be used for transaction logic programs at the customer's option. COBOL will be used on many batch runs due to its efficiency in magnetic tape record handling. FORTRAN becomes attractive for statistical and quasi-scientific models to which the automated file will be exposed in support of planning by DMV and other state agencies. The Spectra 70 report program generator is also being used in certain I/O operations.

input via video display

DMV's original bid specifications did not include equipment for converting the huge driver record files to machine-readable form. Immediately after the selection of RCA as the supplier for AMIS, DMV conducted a new study to determine processes and equipment for the initial conversion.

Use of EAM keypunch-verifiers, as originally envisioned, would have required approximately 190 keypunchers or verifiers and 350 keypunch-verifier operators, working in two shifts for a period of two years.

This technique would have produced the 50-million-paper-document driver record file, which averages some four to five documents per driver, in punched card form for a card-to-tape input process. The sorting, merging, and master record building that is necessary prior to the mass storage file load process would follow.

DMV's study of input conversion methods and costs was conducted independently by its own personnel. Direct keyboard-to-magnetic-tape and on-line keyboard-video-device techniques offered by several edp manufacturers also were evaluated. All cost factors were considered. This evaluation showed a clear advantage for the video-keyboard technique by performing the input document conversion in the same time with 50% less operators, less document control costs, 100% less floor space, and no EAM card costs to offset a slightly higher equipment cost. RCA was also selected as the direct-entry sub-system supplier.

The use of video terminals as DMV's primary input device is an exciting innovation. The Division of Drivers' Licenses has 88 Video Data Interrogators installed in a room adjacent to the central processor in Sacramento. Each of the 11 Video Controllers stores up to 16 different formats on a magnetic disc. The pre-stored formats may be the same or different within each controller, depending on the operation. Stored formats are instantly callable by each video operator by pressing a button on her keyboard.

The availability of 16 different formats to each operator makes a large dent in the problem of controlling the various documents that constitute a driver record. There's no need to fan out the component documents to various operators and input devices with single format capability. Each driver record is handled as an input batch by one operator without further subdivision. Each input transaction message is composed on the video screen for easy sight verification and correction of any keyboard errors prior to transmission to the communications processor.

When the input transaction data message is received, the video-to-tape program performs edit and validation checks prior to writing it out to magnetic tape. If any data errors are detected by program, the input message is returned to the operator's screen with a notation of the type of error found. The operator then makes a suitable correction and re-enters the message. If the input message is accepted by the processor, the operator receives a program-initiated acknowledgement message after the message has been written to magnetic tape and the read-after-write checks are satisfied. Only then is the operator allowed to proceed to the next input message. Each input message so generated is tagged with the system transaction code number, driver record number, the data, and the operator code. These input document messages are then sorted and merged for proof-listing and subsequent creation of the master record image for the mass file loading process.

The video terminals, with their respective controllers, may be locally or remotely located, using private or common carrier communication channels or data sets.

The latter technique will be used by the Division of Vehicle Registration in the replacement of the current Los Angeles-based punch card tub-files which are used to service vehicle registration inquiries for Southern California. When these remote Video Data Terminals are installed by the division in 1968, all inquiries originating in the Los Angeles area will be directed to the mass storage data banks in Sacramento for immediate response and display on a cathode ray tube face or in hard copy form.

Response times from the moment of the inquiring operator's message release until the response appears on the CRT screen run from one to five seconds, with a weighted average response time of approximately two seconds. If hard copy print-out is required, additional print time will vary as a function of the type of printer used and the length of the response message.

AMIS program progress and status

The driver license equipment complex, which includes Spectra 70/45E and 70/45G processors, was delivered on schedule with software last July. Also included were the first 32 video units and two Model 70/568 mass storage units. Each mass storage unit stores 536 million bytes of data on magnetic cards 4″ high by 16½″ long. Eight removable magazines, each containing 256 cards, store approximately 70 million bytes of data. Average access to any card is 475 milliseconds and the read-write data

The Ins and Outs...

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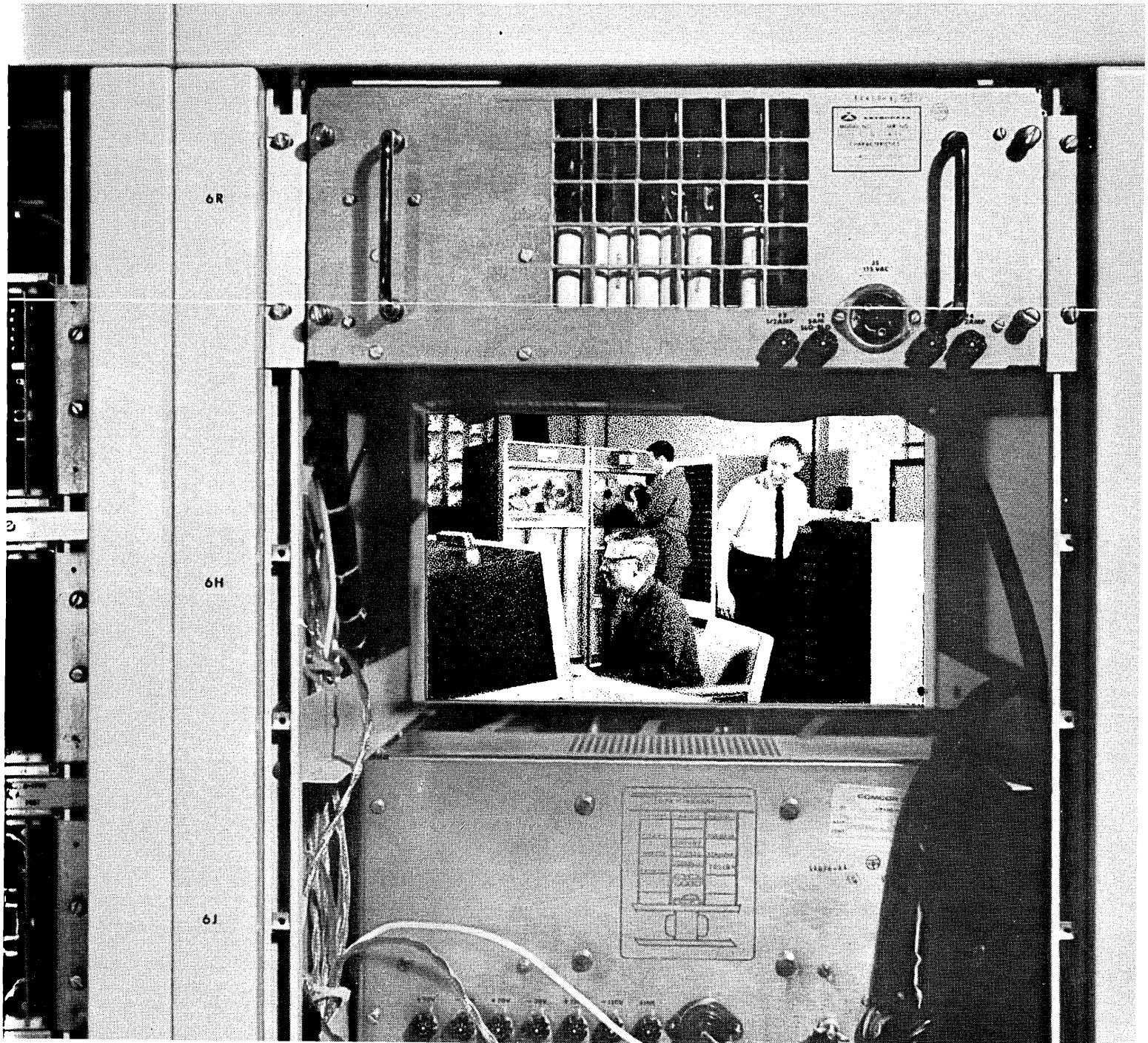


transfer rate is 70KB/second.

Last October, all 88 video data units and a third mass storage unit were delivered and became operational. The 70/45G processor was replaced by a 70/55G in February. Next month, six additional mass storage units will be installed in the driver license complex.

In July, Vehicle Registration will receive its 70/45E and 70/55G processors, along with peripherals and a large group of video data units. Later, a 70/35 processor and peripheral equipment will be delivered as temporary equipment to process the 10 million vehicle registration forms mailed out at year's end.

From August through October, 1966, the production communications programs were used to train the newly hired staff of supervisors and operators on the video data units for the start of driver record file conversion.

Also, transaction logic programs were tested preparatory to the start of conversion in October, 1966. At that time, input from 54 million paper documents began, followed by mass storage file loading for 12 million driver records.

Today, vehicle registration programming and testing are well underway in preparation for the delivery of processors this summer.

project management and control

The entire AMIS program was placed on a rigid and complete project control system in late 1965. The project control system is comprised of a PERT diagram, a weekly PERT computer run which produces the weekly project status report, a manually prepared weekly exception report, and careful surveillance of the critical path.

The PERT program includes all elements which relate directly or indirectly to the AMIS schedule, such as all program threads and program segments for the overhead and transaction programs, equipment and general purpose software, site preparation, operator hiring and training, and manual procedure design which is related to the revised flow of documents to and from the automated system.

The project status report lists all activities and events with minimum, maximum, and expected dates and slack time computations. Such schedule dates are provided for the following milestones for each overhead and transaction logic program segment in AMIS:

1. Analysis and programming started.
2. Specifications completed and approved.
3. Detailed flow chart and coding completed.
4. Program testing completed.
5. System testing completed.
6. Documentation completed.

The weekly exception report lists all scheduled activities which are either ahead or behind schedule and require corrective measures by the appropriate supervisors and edp management. These reports are reviewed regularly at DMV's edp steering committee meetings.

The project control system has been an invaluable aid in pinpointing potential problems for immediate management attention. As a direct result of the concurrent approach to the program implementation and the close control provided by the project control system, the total drivers' license complex of equipment that was delivered in July went on single-shift operation starting July 18, 1966. One week later, both machine sub-systems within the driver license complex went to a 17-hour-per-day, two-shift schedule and have operated at least five, and sometimes six, days per week.

During the 30-day acceptance period following the July delivery, DMV received 94% productive time for the composite system. System availability to the customer during the same period was 96%. Since then, both the percent productive time and percent system availability have risen into the 96 to 98% range, respectively.

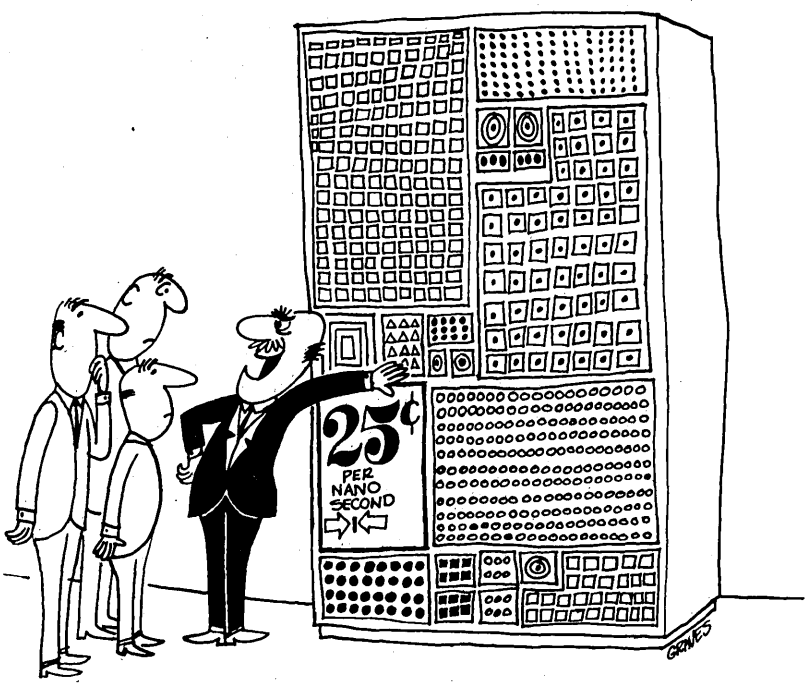
in conclusion

When we look at one of these "total" systems, we should be concerned with the *whole* system by which work is done within the customer environment. Within this context the whole system is composed of the six "M's", man, machines, money, methods, materials, and management. The computer is only one element.

Success depends equally upon the computer and peripheral equipment selected, and the assimilation of the machine sub-system by its immediate users such as programmers and equipment operators, and those users who are once-or-twice removed, such as clerks and management.

In designing any large edp system, we concentrate on maximizing throughput and minimizing costs. Throughput is often only measured in transactions or operations per unit of time—whereas within the context of the whole system, it is a measure of the productivity of the composite system that is comprised of the six M's.

Perhaps the most important characteristic of third-generation implementation is that it portends the end of hardware- or software-limited systems. The power of the hardware and the software which is available today is well beyond most of us to apply and use most effectively. Actually, we have entered a new era in edp . . . an era characterized by its almost total dependency on an inadequate supply of experienced and competent systems analysts, systems programmers, and systems engineers, together with sophisticated edp-oriented management . . . an era whose end is not in sight within this human generation. ■



"The Accounting Department helped us design our new time-sharing system." ©DATAMATION

A MANAGEMENT INFORMATION SYSTEM DESIGNED BY MANAGERS

by WALTER M. CARLSON

The Department of Defense, in coordination with the National Aeronautics and Space Administration, has installed a technical management information system that has been and continues to be designed by the management users of the system. The system provides current status data on research and exploratory development program expenditures of more than $1.5 billion annually. Successful and satisfactory experience with the system within DoD and NASA during the first year of operation has led toward adoption by other federal agencies and, possibly, by some allied defense organizations.

In addition to the direct and continuing involvement of research and development management at all echelons in the evolving design, the system has major features that are both unique and contrary to previous practices in information systems. A large measure of management's acceptance of the system can be credited to use of a computer to serve individual requests; no printouts are prepared from a data bank containing more than 50 million digits of information until and unless a specific request is made.

This paper provides a description of the system, its unusual development history, and an analysis of the features that permitted it to be in full operation 18 months after a study team was assembled with only broad guidance on the nature of the problem to be tackled.

the work unit management information system

The purpose of the system is to provide prompt DoD management access to the current status of research and technology efforts being performed in-house and under contract or grant. The goal of the system is to have the information on significant changes in status available in a central data bank within 15 days after the change occurs. A "significant change" may range from an important technical result or assignment of new people all the way to termination of the work.

The scope provides complete coverage of the DoD program in the Research and Exploratory Development categories and selected activities in the other program categories of the R&D budget. For each "work unit," a total of 35 data elements are recorded near or at their point of generation, if possible, and entered into the system in carefully standardized formats. More than 20,000 separate work units have been reported on, and updating of the reports is continuous, as changes occur, rather than periodic.

The basic record, the work unit, needs explanation. It has no specified size in terms of dollars expended, manpower used, or technical level. The work unit *is* defined by two key parameters that are qualitative and depend heavily on the judgment of the local technical management. First, the work unit is a logical element of effort chosen by local management (i.e. laboratory division head or project manager) to keep track of technical progress rather than to satisfy administrative or fiscal management needs. Second, the work unit must be technically distinguishable from other effort within the same administrative or fiscal program at the local level. To round out the logic, DoD also requires that each grant or contract be reported as at least one work unit; this rule merely guards against aggregation of two or more closely related grants or contracts into a single record.

Each laboratory and each project office responsible for technical work in one of the required program categories is obligated to define the work units within its program and to submit the required data. In DoD, the required data elements are summarized on the DD Form 1498, shown in Fig. 1. In NASA, the form is designated No. 1122, and in the Federal Aviation Agency, the form is No. 1750. (Provision is made for about 10 data elements that are unique to each of the different government

Mr. Carlson was director of technical information for the Department of Defense from 1963 to 1967, when he joined IBM on the staff of the chief scientist. His computer experience began in 1954 with DuPont and he holds BS and MS degrees in chemical engineering. He has been a director of AFIPS and was finance chairman of the IFIP Congress 65 and he is also a member of the ASA sectional committee X.3 on computer and information processing.

DESIGNED BY MANAGERS . . .

agencies; otherwise, all data elements have a common set of definitions.)

In addition to the usual statistical data and resource estimates for the previous and current years, the data contains technical descriptors (or keywords) and prose write-ups on the technical status of the work unit. These write-ups, which do not exceed 300 words, and all other data elements are reduced to machine-readable form, if they are not captured directly in machine-readable format from a source document. The data may then be stored for local reference or sent to a data bank operated by the military department involved, and the data must be sent to the DoD data bank currently operated at the Defense Documentation Center (DDC).

At DDC, the records are checked for completeness and for editorial accuracy, additional descriptors are added from a controlled vocabulary to enhance technical retrieval, and any special codes needed for data processing are applied. New entries or updating changes are being

Fig. 1

RESEARCH AND TECHNOLOGY RESUME

1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL		
4. DATE OF RESUME	5. KIND OF RESUME: 4	6. SECURITY: RPT / BRK	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
10a. CURRENT NUMBER/CODE: 18,300		10b. PRIOR NUMBER/CODE: 1,500			
11. TITLE:					
12. SCIENTIFIC OR TECH. AREA: 186		13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY: 10 / 3	
16. PROCURE. METHOD: 4	17. CONTRACT/GRANT: a. DATE: b. NUMBER: 11,100 c. TYPE: 8 d. AMOUNT:	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)	
		PRIOR FY			
		CURRENT FY			
19. GOV'T LAB/INSTALLATION/ACTIVITY: NAME: 200; ADDRESS: 40; RESP. INDIV.: 5,700; TEL:		20. PERFORMING ORGANIZATION: NAME: 2,800; ADDRESS: 100; INVESTIGATORS PRINCIPAL: 15,400; ASSOCIATE: 4,600; TEL: TYPE: 40			
21. TECHNOLOGY UTILIZATION: 4,300		22. COORDINATION: 130			
23. KEYWORDS: 36,900	11,000 identifiers	7,100 descriptors			
24.					
25.					
26.					
27. COMMUNICATIONS SECURITY: a. ☐ COMSEC OR COMSEC RELATED b. ☐ NOT RELATED	28.	29. OSD CODE: 4	30. BUDGET CODE: 8		
31. MISSION OBJECTIVE		32. PARTICIPATION: 40			
33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT				
35. EST. FUNDS (In thousands) CY+1	36.				

DD FORM 1498 (Items 1 to 26 identical to NASA Form 1122) OVER

received at an average rate of 150 per working day. About 33% of these need some degree of corrective action before entry into the data bank.

The work unit data bank is operated on a Univac 1107 with both tapes and Fastrand drum storage. The file is stored both as a direct listing of all data elements in the work unit and as an "indirect" or "inverted" listing of all work units having common reference to a particular data item within each of 30 data elements. Thus, it is possible to search by concept coordination on any logical combination of specific items chosen from among these 30 data elements. The numbers inserted in the data blocks in Fig. 1 indicate how many data items exist in the file for that data element. Searches may be conducted for any combination of data items in any of the indicated data elements.

The output from the work unit data bank is obtained only on request. A programming staff is maintained to handle each request as it arrives. While the search programs are standardized and require only the insertion of the data items and their Boolean relationships, the output format is programmed individually to the specifications of the requester. Fig. 2 provides a page from a report on "who is doing what, where?" and is a typical example of responses to managers' requests for information. For those customers who refuse to believe that the system is there to serve them and who have become addicted to the tradition that people must take what the computer gives them, DDC can also print out a complete DD Form 1498 (as shown in Fig. 1) on the high-speed printer. A report generator has been written and is being tested. It has a broad spectrum of formatting options derived from the requests received to date.

Requests are currently averaging 10 per day and are expected to average 20-30 per day within a year. About one-half of the requests are for special formats, and this type of request is increasing steadily as the users learn the system's capacity to serve them. At present, a request for a formatted report requires about 15 working days for delivery after the specifications are agreed upon—an agreement usually reached in a single phone call. The service time on formatted requests is expected to be less than five days when the report generator becomes fully operational.

development background

Since World War II, the Department of Defense has developed an extensive technical report system for completed R&D work. During the mid-1950's, DoD began developing systems for planning future R&D work, culminating in a variety of reporting requirements which are closely tied to the procedures associated with budget preparation. Only sporadic and fragmented attention had been given to reporting on-going R&D work until 1963. During that year, several efforts were initiated in the military departments to improve management's visibility of the current technical program. In February, 1964, it became evident that a DoD-wide system would provide advantages in better technical coordination, reduced duplication of system development expense, and more rapid response to inquiries from Congress and other external agencies.

From the outset, a policy group was established to include the generals, admirals, and top civilian administrators of the R&D programs in the military departments. This group decided that the first effort should be directed to the Research and Exploratory Development categories, leaving the "hardware-oriented" systems development categories for later consideration. In March, 1964, a steering group was set up within the Office of the Director of Defense Research and Engineering under Dr. Chalmers W. Sherwin, whose administrative responsibility as a deputy director covered most of the DoD program in Research and Exploratory Development. Thus, a major management commitment was made to supervise the system development before any study work was started.

In April, 1964, a working group of five management systems people from the military departments and defense agencies was assembled to decide how to proceed and to recommend a system design. A few weeks later, a NASA representative was added. The formal direction to the working group was minimal. The direct supervision of the working group by a deputy director of DDR&E took care of this. A major consequence of this close management supervision was a decision in the early stages to develop separate information systems for the planning of

the work and for reporting decisions and progress related to on-going work.

Another consequence of the top level direction was that several primary ground rules were observed. A priority consideration was that any new system should use data already being prepared at the working levels and thereby minimize extra work for DoD's scientists and engineers. Also, the system was required to have the capability of supplanting the many and varied reporting systems being imposed on local managements by the several command levels above them. A feature of policy guidance that was to have a profound impact on later events was a requirement that the system be able to handle machine-readable data at any point after source generation; the need for rigorous standardization of data element definitions and data recording procedures was ingrained from the outset. Finally, the data were to be retrievable both

Fig. 2

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PAGE 5

DDC REPORT 617 JUL 9, 1966

RECENT WORK ON IMPREGNATION ABLATIVE RESINS (MATC)

TITLE: (U) HIGH TEMPERATURE EVALUATION OF REFRACTORY COMPOSITES

CURRENT NUMBER CODE

62405514738106007

CONTRACT NUMBER:

AF33 615-1312

GOVERNMENT INSTALLATION:

AF MATERIALS LABORATORY AFMLAF
MATERIALS LABORATORY AFML (MAAE)
WRIGHT-PATTERSON AFB, WRIGHT
PATTERSON AFB, OHIO 45433 0

PERFORMING ORGANIZATION:

UNIVERSITY OF DAYTON
DAYTON, OHIO

RESPONSIBLE INDIVIDUAL:

JAMES LT D R

INVESTIGATOR:

WURST J

OBJECTIVE: (U) TO EVALUATE REFRACTORY COMPOSITES FOR HIGH TEMPERATURE APPLICATION TO CRITICAL AREAS OF RE-ENTRY VEHICLES, ROCKET MOTOR COMPONENTS, GAS TURBINE ENGINES, ETC., INCLUDING THE DETERMINATION OF HIGH TEMPERATURE MECHANICAL PROPERTIES AND MATERIALS REACTIONS TO ARC PLASMA JET SIMULATED THERMAL AND CHEMICAL ENVIRONMENTS.

APPROACH: (U) THE CONTRACTOR EVALUATES MATERIALS COVERING A WIDE SPECTRUM, I.E., COATED REFRACTORY METALS, SUPERALLOYS, ABLATIVE PLASTICS, GRAPHITES, REFRACTORY CERAMICS AND VARIOUS COMPOSITE COMBINATIONS AND EVALUATES THESE MATERIALS UNDER A VARIETY OF SIMULATED CONDITIONS TO SCREEN MATERIALS FOR THESE APPLICATIONS.

PROGRESS: (U) THROUGH THE USE OF THESE SCREENING AND EVALUATION TASKS, COMPETING MATERIALS FOR THE ABOVE APPLICATIONS WERE CHACTERIZED AS TO THEIR BEHAVIOR IN THE SIMULATED ENVIRONMENTS, AREAS WHICH ARE BEING COMPLETED OR ARE NOW ACTIVE INCLUDE STATISTICAL EVALUATION OF COATED COLUMBIUM AND MOLYBDENUM ALLOYS, POST-FLIGHT ANALYSIS OF SELECT HARDWARE FROM THE ASV-3 ASSEP VEHICLE, ROUTINE PLASMA JET SCREENING OF ABLATIVES FOR START AND X-15 A-2, PROPERTY MEASUREMENTS OF CERAMICS AND GRAPHITES OVER 4000 DEG F, ROCKET NOZZLE MATERIALS TESTING, AND EVALUATION OF SUPERALLOYS BARE AND COATED FOR AN ADVANCED LAUNCH VEHICLE APPLICATION.

ACCESSION NUMBER: DF500453

UNCLASSIFIED

in digital, machine-readable form for remote transmission (if needed) and in the usual variety of analog, human-readable forms.

Two ground rules have had a major influence on the way the system has evolved.

From the outset, the emphasis has been on the technical content of the work actually going on rather than on the kind of language that is used for planning and budget review purposes. This insures that the system serves to expedite management's ability to survey current efforts within a technically oriented framework. It also insures that the system can be used effectively by local supervision and technical personnel to locate others currently working in specialized disciplines or on projects with specific components and specific objectives. This technical reference capability has become an outstanding by-product of the system.

The handling of data on resources was set up on the basis of estimates rather than on the basis of accounting records or official contractual documentation. This decision was crucial. Experience has shown that, in any large organization, an effort to obtain an accurate picture of resource expenditures, obligations, or commitments for research and development work may result in "sharp dollars but fuzzy technology." Similarly, efforts to obtain accurate technical pictures of work in progress nearly always result in "sharp technology but fuzzy dollars." The choice was for a sharp technology picture and only estimates of the associated resources used. Provision is made for cross-reference to budget and project accounts so that special financial data can be obtained from these accounting systems as needed.

A critical policy trade-off was also adopted from the beginning. Efforts to delegate decision authority on work programs downward in the R&D organization had been thwarted continuously by lack of data on what was currently going on. Accordingly, the local management tended to expect a large amount of "second-guessing" on their work program decisions by higher headquarters. The trade-off planned for the system from the beginning can be summarized in this imaginary quotation from the highest management in DoD's program for R&D,

> "Mr. Laboratory Manager (Project Director), you say you want more autonomy. Fine. You can make your own decisions on work program and resource allocation. But there is a price you must pay. You will have to record these decisions so that anyone interested can become aware of your decisions within 15 days after you make them. If you accept this trade-off, we'll work to see that you get the decision authority."

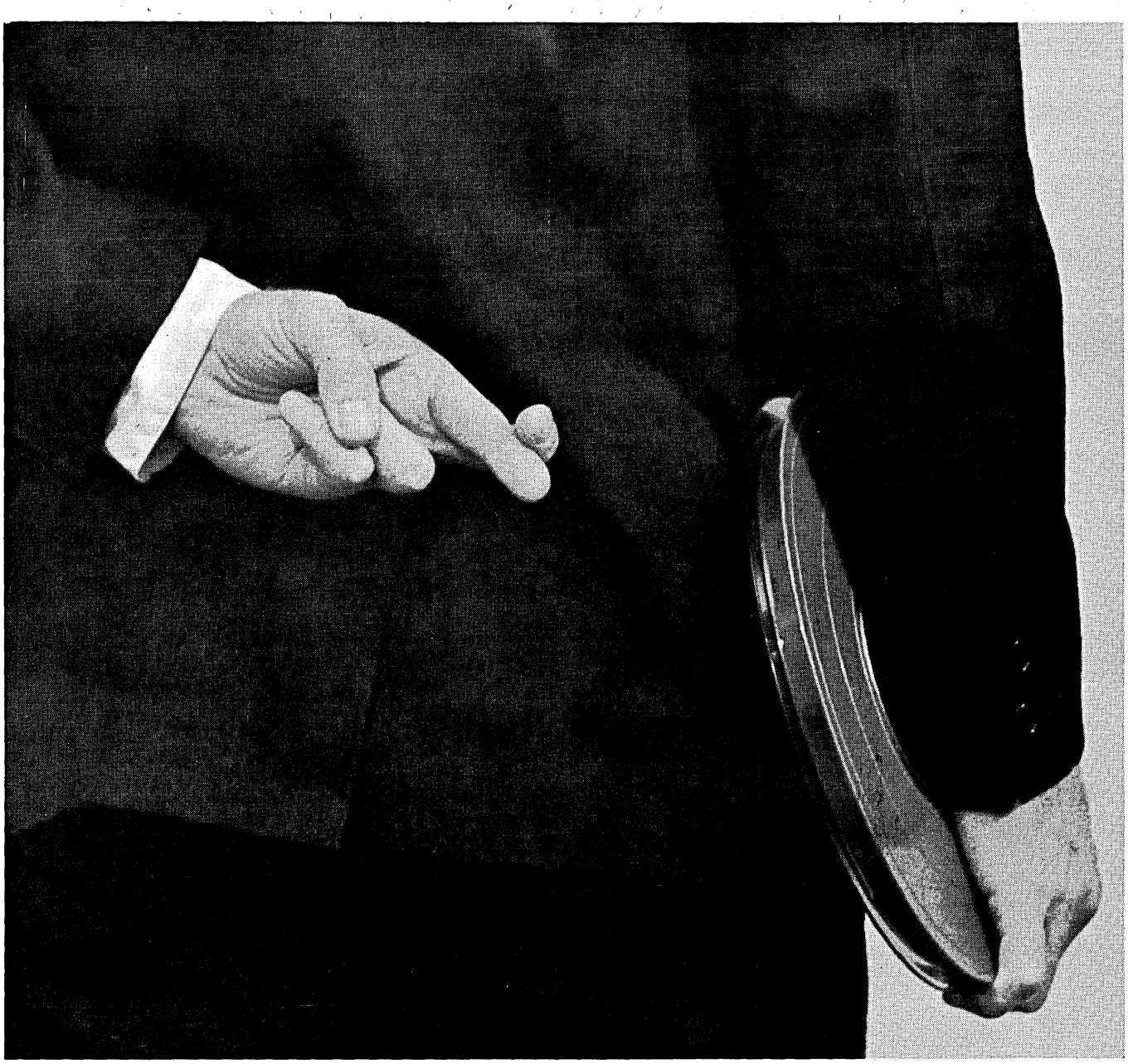
This policy trade-off has far-reaching implications to middle management. Top management will continue to evaluate the performance of the organizations assigned to carry out specified missions. Middle management, however, has to get out of its traditional "project engineering" mode of operation and to start appraising the local manager's performance. This requires that the new system be a demonstrable improvement over existing management information systems.

An intensive examination of the major reporting procedures and procurement authorization systems in DoD disclosed that a limited number of data elements occurred in the existing systems and procedures. These data elements existed in a rich mixture of names, with some data elements which were technically identical having five or ten different designations. Systematic negotiation within the working group whittled down the list of data elements, provided a generally accepted common name for each, and formatted the selected data elements onto a single input form as shown in Fig. 1. This work was accomplished in about 80 calendar days elapsed time.

The next major task was implementation of the system. Once again, top management took the lead. An agreement was signed between DoD and NASA in August, 1964, to adopt a common reporting system and to exchange management information as required to maintain effective coordination of the research and technology programs of the two agencies.

In September, DDC was requested to set up a central bank for DoD data and to arrange for receiving input from all components of the Department. No formal advice was given DDC on output requirements or procedures. This decision ultimately paved the way to success of the system, since it became possible to build the output capabilities on the basis of actual requests made by management personnel.

In October, all R&D components of DoD were directed to begin preparing work unit data and to submit the data to the central bank. By April, 1965—only one year after formation of the working group to study the



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problem—the data began to flow into the system, which now included data banks in the three military departments.

Formal promulgation of the system was accomplished with the issuance of DoD Instruction 7720.13, "Reporting of Current Research and Exploratory Development Effort at the Work Unit Level" in January, 1965. Both the October letter of direction and the January instruction contained a detailed punched-card layout for all data elements. One negative effect of the high-level composition of the working group became apparent at this point; the punched-card instructions were geared to the college graduate level, and very few keypunch operators have this level of education. Refinement of keypunch instructions is still in progress.

Data banks in each of the military departments became operational in midsummer of 1965, and the DDC central data bank began searches and elementary printouts in October, only 13 months after direction was given to start work at DDC. Programming resources required at DDC since September, 1964, were 35 man-years during the first two years of effort.

During the winter of 1964-65, it became increasingly evident that the potential for providing management information from the new system was exceeded only by our lack of understanding on what management would want from it. Nothing like it had even existed before in DoD. We therefore blessed our luck in having remained silent on output requirements and undertook the unusual and unprecedented approach of letting the users design the system as they use it.

The key decision in this approach is that each user must specify how he wants the answer to his question printed. The philosophy behind the decision is simple, but the execution has been a long struggle toward re-education of data processing personnel and managers alike.

The basis for the decision to serve each user separately is that he will thus avoid the time he spends, at strictly clerical-level work, reading large amounts of computer printout and extracting the few pieces of data he wants or performing elementary arithmetic operations to get totals, averages, ranges, and the like. The theory, now being borne out in practice, is that the pay-off of a management information system is in the quality of decisions and their recognizable impact on the economics of running the organization. Viewed from this vantage point, the extra cost for programming special-service formats and a few extra minutes of computer time is a minor matter. Our experience, however, leads us to wonder how many management information systems are being judged solely on the basis of their ability to get by with negligible programming maintenance cost or their use of minimum computer time.

Certain administrative safeguards were also necessary. A system containing as much up-to-date information as the central data bank at DDC has enormous potential for misuse, and the policy group agreed to a careful monitoring of requests during the early stages of system operation. For about one year, all requests were screened and validated by a single office in the Pentagon. The screening served the dual purpose of guarding against use for creation of personnel recruiting lists and similar malpractice and of providing a running picture of the kinds of questions being asked, the repeat business from satisfied users, and the impact of various publicity and educational efforts on management response.

However the steps taken may have been judged by the thousands of people who participated in developing the system and supplying data for it, the top management response was prompt and emphatic. Six months after the central data bank became operational, the Director of Defense Research and Engineering established the work unit data bank as first priority for personnel skills and facility scheduling at DDC. Meanwhile, the potential of the new system had already attracted the attention of other government agencies and of defense R&D units in other countries.

what it all means

The traditional approach to creating a new management information system requires an elapsed time between feasibility study and start of service of three or four years. The bulk of the time is devoted to finding what data management uses (or says it uses) and programming computers to rearrange input to supply the data in a series of standardized "reports" for management.

All too often, though not universally, the manager is confronted with report formats that he may have agreed to, reluctantly, two or three years earlier. He has changed his requirements in evolutionary patterns and will continue to change as his grasp of the job improves or as the area he controls undergoes change. He cannot use what the computer now spews out in great quantity at frequent intervals, and his requests for different reports are met by shocked references to reprogramming costs or by promises that the changes can surely be made within the next year if all goes well.

Generally, this form of unsatisfactory outcome is the result of one or more of the following factors:

1. Use of analysts having no proven managerial qualifications.
2. No supervision of the project by anyone who will have to run some part of the operation with the system that results.
3. Use of outside "consultants" with no stake in the operating benefits to be achieved.
4. Criteria for system design based upon computer room efficiencies.
5. Lack of data element standardization, especially in the face of reluctance to agree that existing subsystems have to be changed.
6. Requirements for extensive use of codes at the data sources rather than at data processing centers.
7. Use of codes rather than English titles in output reports.

The work unit management information system is an endeavor to avoid these relatively obvious pitfalls. At least, a concerted effort has been made to insure that the new system reflects the lessons learned from past difficulties.

More importantly, however, the work unit management information system has concentrated on obtaining as input the data which tend to show up in various management reports, regardless of the avowed purpose of such reports. By choosing this approach, the system was placed in operation in less than half the time normally needed for such endeavors. Thus, DoD has time to let the system evolve through actual use and still be ahead of the game. By the time the normal preparation and installation cycle would have been completed, DoD will have had two years of evolutionary and highly educational operating experience.

The administrative approach to the project had several features worth mentioning. First of all, the normally accepted practice in government circles of hiring a systems contractor was not employed; the job was done in-house except for minor service contracts. Second, the chairman of the steering group devoted up to one-fourth of his time to following the working group's activities during the

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critical phase of selecting the data elements for input. Third, the system and the philosophy of its operation were evolved together in a continuing dialogue between the designers and the management users. And finally, the system designers were not given pre-established costs or performance goals, either for the study itself or for the resulting system; the steering group followed the progress closely enough to have looked twice at the prospects for continuing in the early study phases and decided to continue on the basis of progress to date and the potentials being uncovered.

The readily visible costs for system development were about $1.6 million. The one-time data preparation costs were at least that much more. Current operating costs for the central data bank and the data banks in the military departments are in the range of $2.5 million annually, less than 2/10 of 1% of the cost of the work being reported.

The pay-off comes from the way the system is used as an aid to management decisions at all levels, from the local project office to the very top of the Executive Branch on even to Congress. The system is used because it provides these managers with a means of finding out and measuring what is going on, in terms that are directly meaningful to the manager. Some policy decisions have been made on the basis of a comprehensive picture of on-going work, and at least one of these decisions will eliminate support of unnecessary work in amounts substantially greater than the annual cost of the entire system.

No amount of systems analysis, operations research, methods studies, or direct interrogation would have ever detected the need for some of the questions that have been asked in the first year of operation.

The quality of input data is, as usual, one of the never-ending problems to be reckoned with. The work unit system has a built-in, self-correcting aspect. Some local managers treated the requirement as just one more chore imposed by systems enthusiasts on a gullible management who had no real grasp of or interest in the data being collected. They usually find out that they are wrong when higher management starts asking for more background on selected topics or asked why certain data were missing. This has the effect of swiftly mobilizing a local effort to see that the data are complete and accurate accompanied by such expressions as "Those guys are actually using it!"

working with human nature

The discussion so far has tended to emphasize the procedural and mechanical aspects of the system. Our concluding comments are addressed to the human elements of the program, primarily the management-user of the data.

The person charged with supervisory, management, or staff responsibility in an R&D organization is simply not describable in terms of pre-programmed computer routines. Furthermore, he is not going to use any mechanical system beyond the telephone or inter-office "squawk-box" when he is really in a hurry for information. Thus, his more formal data needs are recognized at random intervals, with random specifications, and with high uncertainty as to precision required.

The average human male seems to accept, without question, that he has to adjust himself to the computer. The background on this phenomenon is worth intensive study by competent sociologists. This attitude was suspected but the degree to which it was encountered is one of the major results of the effort on the work unit information system. Programmers and computer operators having a fetish for serving the computer are explainable. Skilled technical managers are not. Fortunately, all but a handful of the persons using the system finally came to understand they could, indeed, ask for the data they wanted in a format they wanted. It takes an hour or more of persuasion in most instances, however.

The reorientation of the computer programming and operating staffs to a full understanding of the work unit management information system has been, and continues to be, one on the most difficult human relations aspects of the program. The middle management criteria for successful computer applications have gravitated toward high productivity from the machines. These criteria have led to preparation of rigid, highly efficient programs in most organizations with a large production load on the computer. DDC processes more than 6,000 requests per day for documents (including all security checks) and nearly 100 requests per day for bibliographic searches through the computer. It took more than one year to convince the DDC management and the computer organization that the criteria for this new system are based on efficient use of R&D management's time rather than the machine's time.

the future

Some experiments have been underway for about a year with a small segment of the work unit file on a shared-time computer, with a cross-country hook-up between the user station in the Pentagon and the SDC computer in Santa Monica. Such a system is mechanically feasible, but we are learning that the rich diversity of management questions far exceeds the restricted capabilities of existing query languages that are used for access to the files on a shared-time computer. Ultimately, management will develop a need for rapid entry into a file of data concerning on-going R&D work. Even though this need cannot be defined now, DoD is taking the same approach that was taken in the effort to date. A capability will be developed on the basis of the latest and soundest data processing technology. From that point on, management will design the system in terms of actual need and actual use.

The DoD version of the system will grow to cover program areas not now being reported, and the system will gradually replace a whole series of reporting procedures which are now tied to the calendar rather than accomplishments or significant changes in status. As the various echelons of management learn that the data on current R&D work is available on call, they will gradually turn off the requirements for time-phased progress reporting.

Perhaps the most significant aspect of the future will be the change in management methodology. Top management has already found, to its great satisfaction, that it can find out directly what is happening now by going to the data bank rather than through a complex organization. To the extent that top management continues to design the system by reacting to organization and middle-management performance rather than to technical detail on individual work unit decisions, the system will grow and prosper. If management's design is to do "project engineering" at all levels, the cover-up reactions at lower levels will try to thwart the necessary visibility, and the system will fail.

Here, then, is a management information system that management has designed, and it is a system that will continue to be designed by the actions that management takes. ■

THE RELAY COMPUTERS AT BELL LABS

part two
those were the machines

by GEORGE R. STIBITZ as told to MRS. EVELYN LOVEDAY

As I said in the first half of this article, once we had the Complex Calculator going well at Bell Laboratories in 1940 and 1941, it was deemed economically unwise by the Powers Upstairs to build any more.

I had made several proposals in 1939 and 1940 to improve the relay computer. One of these was that in order to save the user the exasperation of having numbers overflow the computer I suggested a floating decimal point scheme (which was, in fact, finally used in a later computer about 1945).

Further, I had thought that the difficulty of troubleshooting a computer and timing its relays might be solved by a self-checking or error-detecting code. I called this the bi-quinary code, which was, in fact, more severe than the parity check used later, but was similar in concept.

In this code, each decimal digit was represented by two groups of binary (off-on) elements in each of which one and only one was ON when a digit was correctly represented. In use, a number of such paired groups would control check circuits. Before a number was stored or added, all of the elements were OFF and a check circuit determined this fact. Then, when one and only one element in the group turned ON, a check circuit verified the fact and permitted the next computational step to occur.

And so I fiddled on with these and other ideas, itching to try them out. The very ill wind of World War II blew me some good in this area, for I was loaned by Bell Laboratories to the National Defense Research Committee, (NDRC), which had the stimulating and brilliant Dr. Warren Weaver as its chairman.

I had designed a dynamic tester for anti-aircraft controls which was actuated by a punched-paper tape with digital information and which provided outputs simulating arbitrary motions of a target.

It was agreed by NDRC that a computer to produce the tape would be worthwhile and I designed a small "Interpolator" with taped program, teletype or punched tape output, and punched tape input. This computer needed only to add, though it could multiply by a constant in the program. Now I had a chance to use the bi-quinary self-checking code, and the control unit recognized 31 instructions, which included the addresses of the registers.

model ii

The detailed design of the Relay Interpolator (or Model II as it was soon to be called) was put into the hands of E. G. Andrews and his group at Bell Laboratories. Andy, like Sam Williams, was later a leading figure in the Association for Computing Machinery, and was always most competent in his work.

Model II was built on two relay racks. It contained some six registers for storing numbers and performed a linear iterative operation on data provided by punched tape. A few problems in harmonic analysis, calculation of roots of polynomials, and solution of differential equations were run, but Model II was too busy with routine data interpolation and smoothing to spend much time on fancy problems.

The program tapes were punched in machine language which included five-hole codes for "transfer from register B to adder," "read data," "punch," and so on. The tape was then looped with the ends glued together, and added to the program library.

Model II was installed in the West Street Laboratory in September, 1943.

It was exciting and a bit weird to watch this interpolator go about its work *sans* human boss: days, nights, Sundays and holidays. This was a year before Mark I was formally demonstrated, and the use of teletype tapes and readers, under the control of an impersonal bank of relays, was new. At that time it seemed to us we had a highly intelligent machine—this first programmable computer. It could call for the next program step from one tape and the next data from another at exactly the right instant, and detect any extra holes worn in the tape by repeated runs. Those

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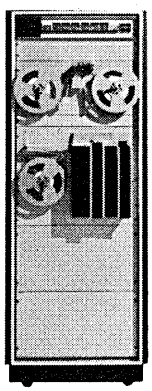

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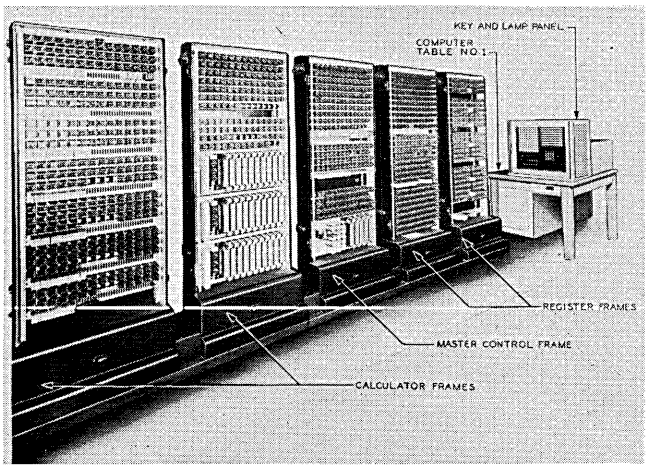
tapes took a pounding, and things were not perfect in this imperfect world. Sometimes we would come in on a Monday morning expecting to find hundreds of feet of tape ready for the dynamic tester, only to find that sometime during the weekend a tape had worn or torn through, leaving the computer without instructions.

But our room was well decorated in somewhat *avant garde* style. We kept spare tapes, glued into loops, hanging on pegs near the computer. Somewhere along the line we had failed to instruct the computer to reach out and take a new one off the peg when needed.

An occasional visitor saw the machine (as did the revered John von Neumann), and a favorite show for company was to start a computation, then allow the visitor to stick a toothpick in any relay. When that inhibited relay was needed the computer would stop, only to proceed correctly as if nothing had happened when the toothpick was removed.

The Relay Interpolator, soon dubbed Model II, was used at Bell Labs, later at the Naval Research Labs. Model III, the Ballistic Computer (shown), was developed at the National Defense Research Committee in the early 1940's, had a 10-msec high-speed storage.



Model II was useful for a long while, and late in the war was moved to the Naval Research Laboratories. It was not retired from service until 1961.

hunting circuits and the next machine

The testing of anti-aircraft equipment demanded enormous amounts of computation and qualified people were scarce. Before Model II was set up and working, I proposed in 1942 to NDRC a relay computer along the lines of my earlier suggestion for an automatic computer. Luckily Warren Weaver was with me all the way. The scope of this Ballistic Computer (Model III) was discussed and it was decided to go all out to make it a large and versatile machine. That it was, for 1942.

We decided to have nearly a dozen registers, with program tapes, a couple of subroutines, two or three "tables" on punched tape, several teletype outputs and input punches, 100% self-checking circuits in the bi-quinary code, and many other features. Also, we modified the standard teletype reader to move tape in either direction. Table data were entered in blocks, and each block was assigned an address.

Andrews' group designed "hunting" circuits that directed the forward or backward motion of the tape and searched for any address demanded by the main computer. This search could proceed independently of the computations going on the main computer and these hunting circuits performed with extreme reliability. E. L. Vibbard designed the calculator which was a true multiplication table—a rare item—as both earlier and later computers used repeated-addition multiplication.

The table-hunting circuits would read addresses specified for calculating a second or third higher order interpolated value.

Storage space was expensive and slow. In this model, the high-speed random access storage (10 milliseconds) had a capacity of one or two dozen words as I recall. Low-speed storage was almost unlimited, but was read sequentially at about 15 characters per second.

It was necessary, or at least customary, to prepare the table tapes beforehand. This scheme was useful, but provided still another *avant garde* room decoration. Yards upon yards of punched tape, waiting to be used, were strewn about the floor. Screams of anguish could be heard from the programmers when any visitor unwittingly stepped on any of the tapes, and it made for some rather lively conversation.

To be crass about it, the Model III Ballistic Computer was a real show piece, though it did its work well. Table-hunting in a computer would not appear elsewhere for several years and it was fascinating to watch. The tape reader would run through the table tape in one direction, stop to read an address, click its relays in annoyance and rush off in the opposite direction, reading addresses as it went, until the proper one was found.

This computer operated seven days and nights a week, and did the work of an estimated 25-40 girls. Nights were not always fun for Sgt. Stoddard, who was learning the ropes on the machine, for he had an alarm bell by his bed which rang when the baby wanted attention.

In all, Model III was possibly the most interesting of the Bell Computers from the point of view of its design logic and of the ease of understanding its operations. In 1944 it was moved to Fort Bliss, Texas, and was in use until 1958.

Model IV looked like Model III and did the same kind of computing. However, some changes were included, enabling Model IV to handle trigonometric functions from $-90°$ to $+360°$. Built for Naval Ordnance, its basic development was completed in 1945. In Naval circles it was known as Error Detector Mark 22, and it was in service until early 1961.

Models I through IV can be regarded as belonging to an era of the past, I think, and it was Models V and VI which bridged the gap between the beginnings of the art and the modern era of electronic computers.

model v: the floating decimal point

In size and flexibility, Model V was our most ambitious project in computer development up to that time. Two units were built. One was delivered in 1946 to the National Advisory Committee on Aeronautics (NACA) Laboratory at Langley Field, Virginia, and the other was delivered in 1947 (after months of activity at Bell Labs) to the Ballistics Research Laboratory at Aberdeen, Maryland.

This model was a system of six arithmetic units and 10 problem positions, an arrangement permitting the arithmetic units to function continuously. Problems were loaded into idle positions, and a computer on completion of one problem automatically picked up another.

Each problem position had one tape reader for input

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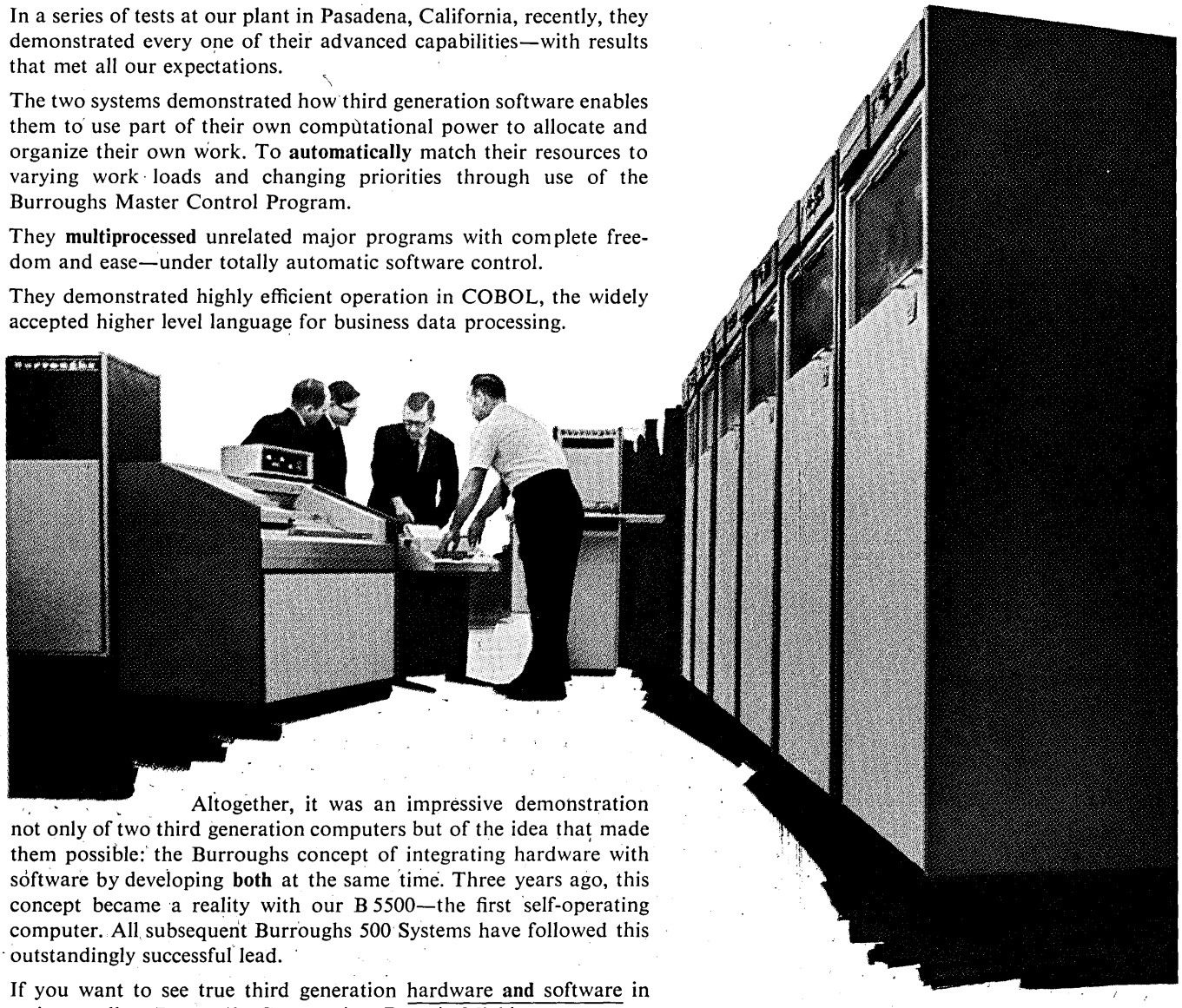

Altogether, it was an impressive demonstration not only of two third generation computers but of the idea that made them possible: the Burroughs concept of integrating hardware with software by developing **both** at the same time. Three years ago, this concept became a reality with our B 5500—the first self-operating computer. All subsequent Burroughs 500 Systems have followed this outstandingly successful lead.

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data, up to five readers for the instruction programs which allowed us flexibility in introducing subroutines, and up to six readers for tabular data. Tables of logarithms, antilogarithms, sines, cosines and antitangents were permanently wired into the machine.

Now at last, we had a chance to use my idea of the floating decimal point proposed in 1939. The concepts of zero and infinity gave us many headaches. I think we decided on 10^{-64} as zero, and 10^{64} as infinity, but I am not sure of these figures now. All the aspirin I took for those headaches did not improve my memory.

Besides the floating decimal point, the calculator of Model V included multiplication by "short cut" addition, automatic roundoff (but subject to cancellation), the ability to recognize most indeterminate arithmetic operations, special facilities for trigonometric and logarithmic calculations, and special auxiliary equipment for processing of various paper tapes. There were also some rather elaborate discriminatory controls, which are now referred to as conditional transfers.

Model V could do the work of about 225 girls with desk calculators and even after electronics were available, these computers did a lot of work. This model worked around the clock and had an excellent record for low out-of-service time. I know that one week the computer worked 167 hours out of a possible 168, and most of the time was unattended.

In recent years the two Model V computers have had a rather interesting history. The unit at Aberdeen was transferred to Fort Bliss and later was given to the University of Arizona for educational and research programs. The unit built for the National Advisory Committee on Aeronautics was given to the Texas Technological College in early 1958. Unfortunately, however, it was severely damaged in transit—the truck tipped over—and the computer was of no further use except for spare parts for the University of Arizona machine.

the last of the line

About the time that the designs for Model V were completed I resigned from Bell Labs to go into independent consulting work. However, I kept in touch with my old colleagues at Bell, and knew something about Model VI, the last relay computer built there. It was built for the Laboratories' own use in solving a wide variety of research and developmental problems, and was placed in regular service there in 1950.

In essence, it was a simplified version of Model V, having only one computer, less elaborate discriminatory controls and fewer problem positions. I knew that this model had an "end of numbers" check signal, which eased such problems as determining the end of a line of coefficients in a matrix-type problem. Also, it had an automatic "second trial" feature that functioned during unattended operation, thus improving reliability in the presence of a trouble condition.

After several years of service at Bell Labs, Model VI was given to the Polytechnic Institute in Brooklyn, N.Y. In 1960, Brooklyn Poly retired this computer and gave it to the Bihar Institute of Technology in Bihar, India.

And so, with Model VI, an era was ended. By 1950 the excitement of electronic potentialities was sweeping the country, and our blessedly reliable old relays were slow by comparison.

Now we live in a true computer age, when for even the smallest business to admit it is not using a computer is as unlikely as for a teenage girl not to have a Beatles record.

But—as I said at the beginning—I can remember when!

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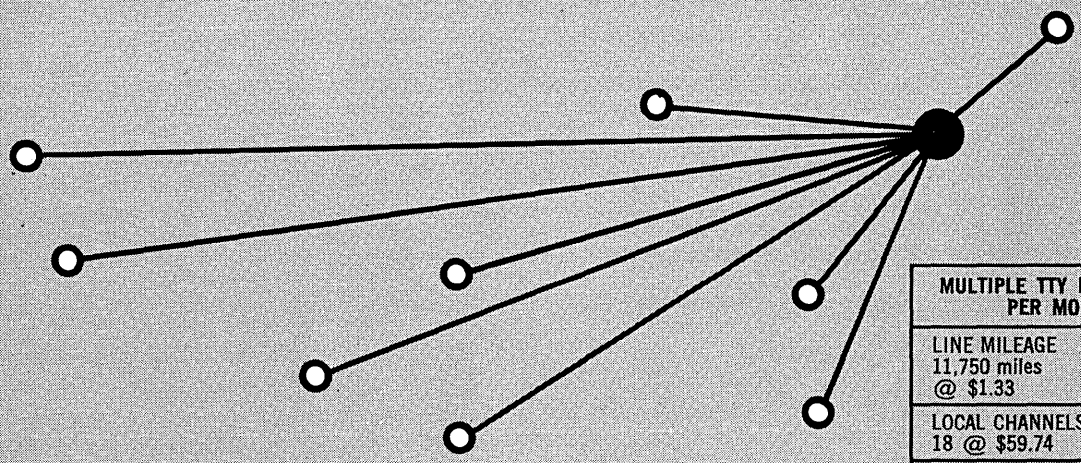

MULTIPLE TTY LINE COSTS PER MONTH	
LINE MILEAGE 11,750 miles @ $1.33	$15,628.
LOCAL CHANNELS 18 @ $59.74	1,075.
TOTAL	$16,703.

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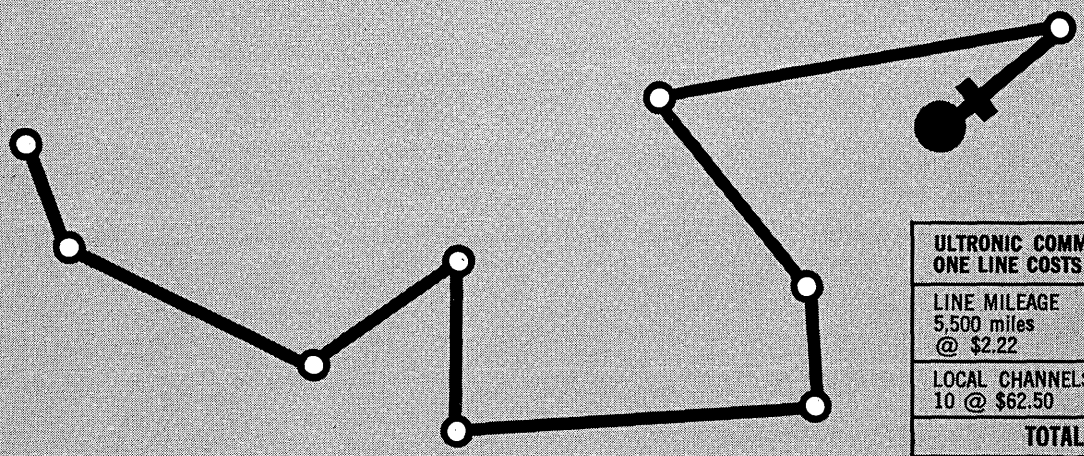

ULTRONIC COMMUNICATIONS ONE LINE COSTS PER MONTH	
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LOCAL CHANNELS 10 @ $62.50	625.
TOTAL	$12,835.

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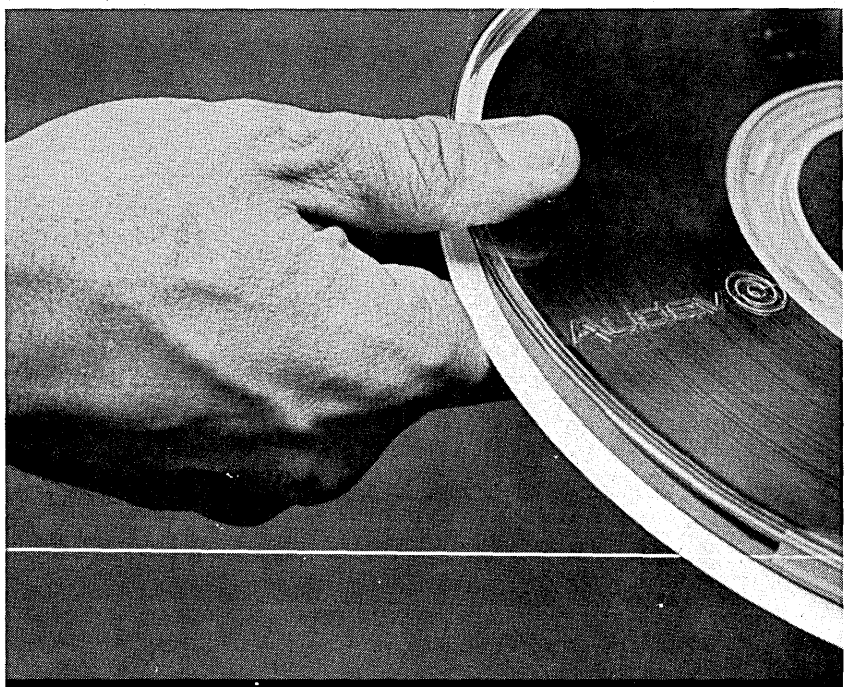
CIRCLE 27 ON READER CARD

CIRCLE 28 ON READER CARD

The $20,000 squeeze.



When programming doesn't allow for back-spacing or rewrite, a few permanent errors can wash out a computer tape on which several men labored for months. All it takes to crush the tape edges is a pinch of the reel flanges.

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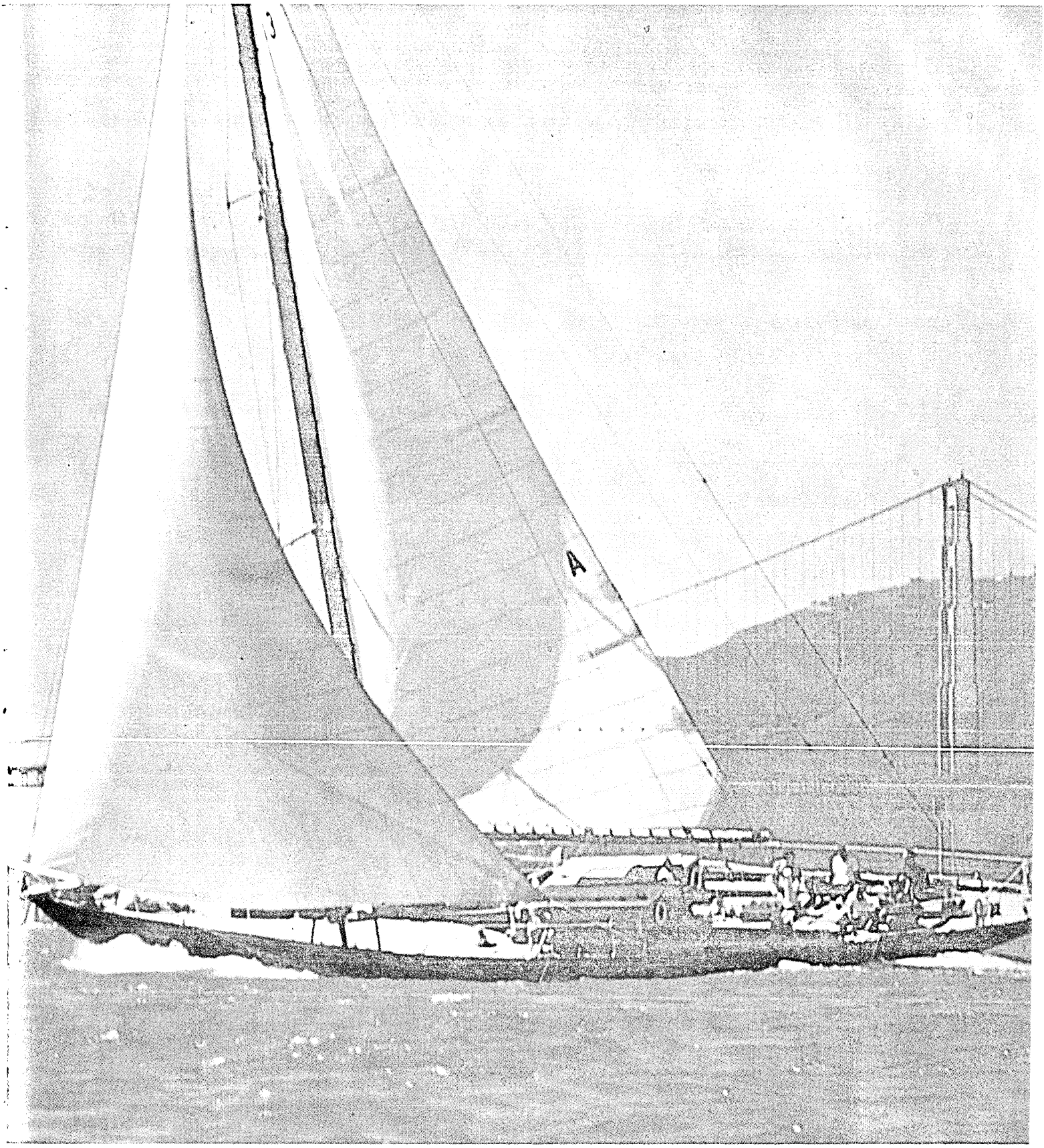
CIRCLE 59 ON READER CARD

The sloop on the left is Kialoa II; on the right, Baruna. For quality reproductions of this photograph, write us at Memorex.

THE TWO GREAT TAPES,



LIKE THE TWO GREAT SLOOPS, ARE NOT IDENTICAL.

At first glance, Kialoa II and Baruna seem pretty much alike.

Both are the splendid end-results of careful designing and careful crafting. Fast and incredibly responsive, they can sail the paint off anybody in their class. But race them against each other, and they won't necessarily finish in a dead heat.

The two great computer tapes—ours and the one made by a computer company—are in just about the same boat. Each is the precise end-result of intensive research. Each has been fastidiously manufactured to make pass after pass without a drop-out, long after other tapes have failed. But compare one with the other, and they won't necessarily perform exactly the same.

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MEMOREX

THREE VIE FOR TACFIRE JOB

$200 million contract

Burroughs, Litton, or IBM may, before the end of this year, receive the largest tactical dp system contract ever awarded by DOD. Worth up to $200 million, the contract will implement TACFIRE (see March '67, p. 17), a system for directing tactical artillery fire and performing several related data processing chores. Significant state-of-the-art advances in random access memory and graphic display components are likely byproducts.

Because of TACFIRE's size and complexity, each prospective supplier has formed a team. Burroughs, Sylvania, and Computer Usage are together; IBM is allied with Philco, while Litton is linked with RCA, Planning Research Corp., and Informatics.

December 30, 1967 is the projected award date. The contract—embodying a relatively new DOD procedure known as "total package procurement"—will include system development, prototype and quantity production, plus two years of field engineering support.

Originally, there were five contenders for the TACFIRE contract, but Univac and CDC were eliminated last March when the Army selected contractors to prepare competing system designs. The Burroughs, Litton, and IBM teams have until Aug. 4 to submit their designs. Each team is receiving between $1 million and $1.5 million for its labor. Five months from Aug. 4, hopefully, the winner will be announced. And 18 months after that the Army Automatic Data Field Systems Command expects to receive prototype TACFIRE configurations for test and evaluation.

The system will direct the fire of 150-175 mm. guns and various ground-ground artillery missiles. Its major functions relate to planning barrages, massing artillery fires, choosing targets, monitoring ammunition inventories, computing survey data, and distributing meteorological information. Now, only ballistic, and some survey, calculations are computerized.

Basically, TACFIRE consists of two inter-linked computer installations which will rely on standard circuitry. One installation, in each cannon battalion's fire detection center (FDC), controls three firing batteries. Among the peripherals are a digital message entry device—each forward observer is equipped with one of these—and a digital display unit at each firing battery. Both are linked to the computer by tactical wire and/or radio. The battalion FDC computer will have an add time on the order of 2-4 usec, a 24-32K core memory, and a 1-2 usec access time.

The division FDC installation will consist of one or two computers, similar to or common with those at the battalion level. The division equipment should have multiprogramming capability and possibly multi-processing capability also. The mainframe memory could total 64K words, each word consisting of 32-36 bits. It will be supplemented by 1-2 million words of external memory—partly mag tape, but mostly some form of random access storage, hopefully all solid state. One possibility is a core array etched on a permalloy surface. Such a system is in an advanced stage of development at the Laboratory for Electronics, Boston. Reportedly, the cost per storage bit is one-half to one cent. Conventional bulk core, by comparison, costs two to three cents per bit.

Among the peripherals at the division FDC will be a 4 x 4 ft. CRT-generated "electronic tactical map." Space and reliability constraints will mitigate against conventional projection techniques in the tactical army environment, so new ones are being explored. Electroluminescence, photochromics, fiber optics, and lasers have all been mentioned.

TACFIRE's programming language won't be decided until the design competition ends, but it may be a subset of JOVIAL. The winning contractor will supply a compiler for the selected POL.

The size of the procurement is also undetermined at the moment. Several procurement options will be considered by the three bidder teams. The resulting total package procurement may involve a total expenditure of $200 million, says an ADFSC spokesman.

When TACFIRE becomes operational, the FADAC computers now being used for artillery battalion ballistic and survey calculations will be reassigned. These units, in use since 1961, were supplied originally by Teledyne; but in 1963, a new contract was awarded to Magnavox. Reportedly, Teledyne couldn't deliver reliable disc memories. Total package procurement was a direct result of that experience, says a Pentagon source. Before buying the total package, he explains, the procuring agency evaluates each bidder's ability to produce hardware as well as develop software.

FADAC still uses a disc memory. So far, about 300 of these computers have been delivered; by next Jan. 1, the total should be 560. FADAC, in addition to its artillery role, has been used successfully, on a pilot basis, to diagnose malfunctions in electrical and automotive equipment, and this program could absorb a good many of the units made obsolescent by TACFIRE.

—PHIL HIRSCH

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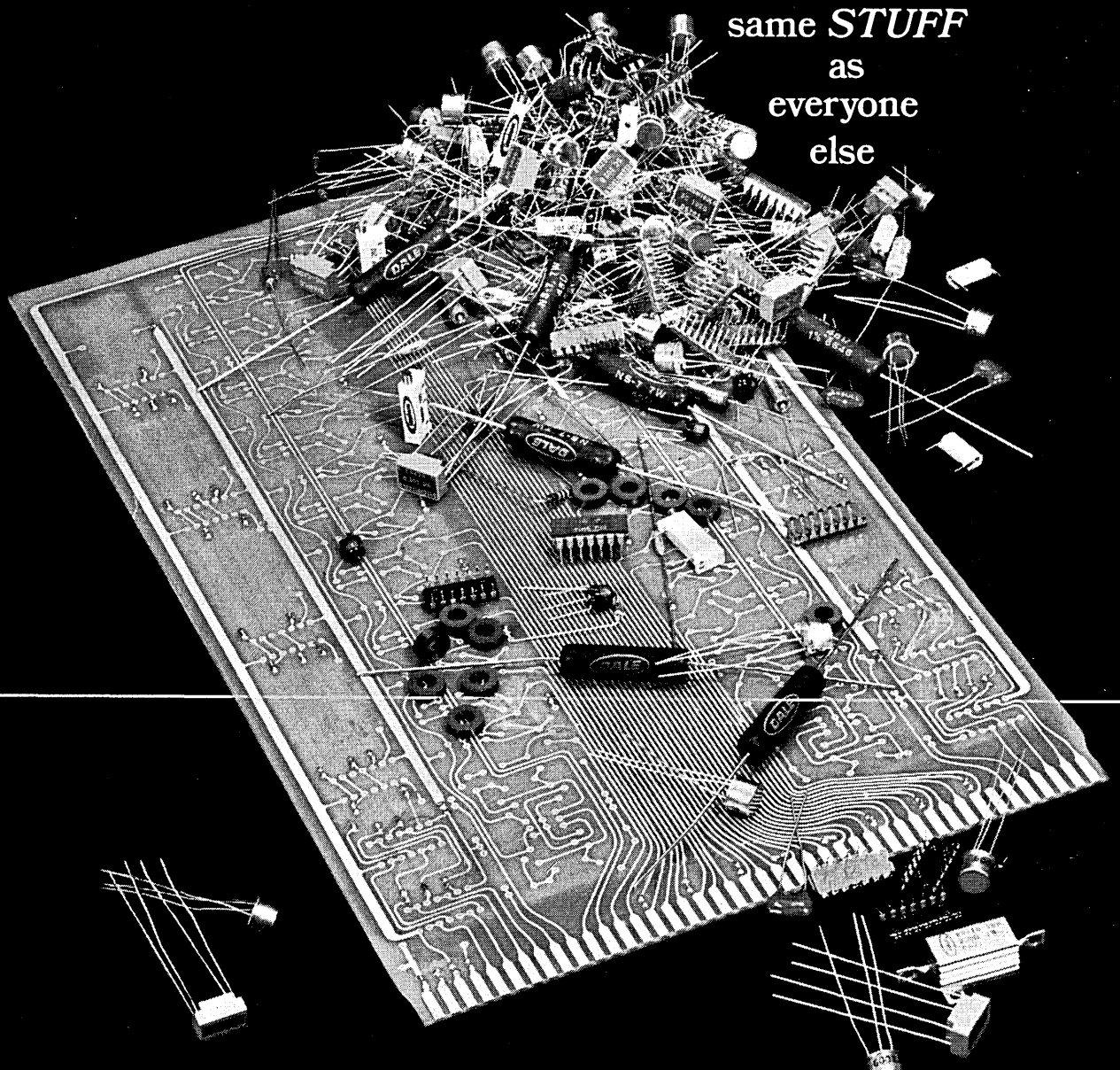

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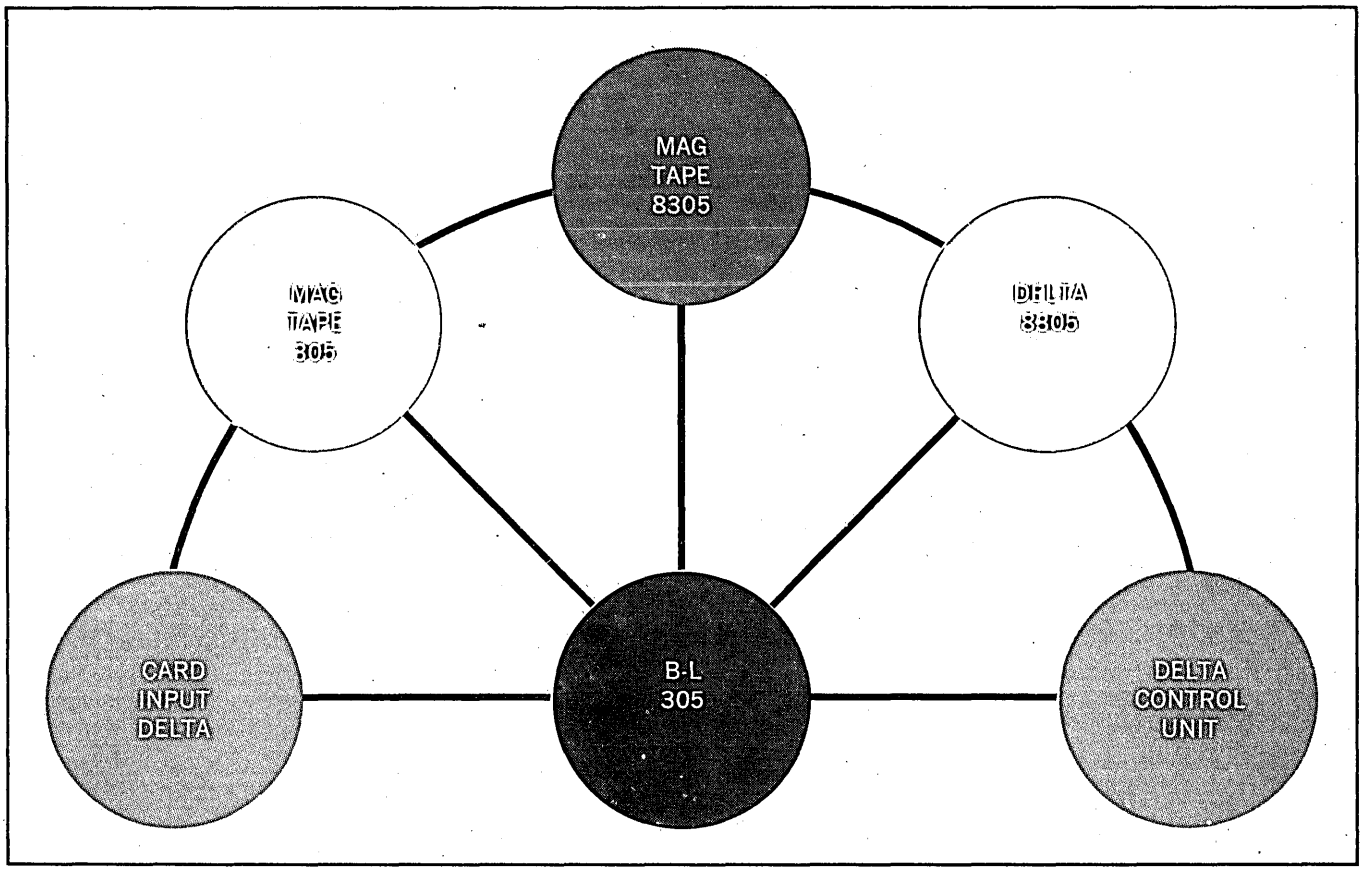

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CIRCLE 37 ON READER CARD

U. K. BANKS BATTLE POST OFFICE

Britain's banking industry is in the midst of an A-1 battle. And one thing is certain. Whatever the result, machine manufacturers will come out on the winning side. For two years the stockholding banks, dominated by the big five of Barclays, Westminster, Lloyds, Midland, and National Provincial, have been spoiling for a fight with the government over its plans to introduce a personal cheque clearing system through the Post Office. This is to be a replica of the Giro systems that have been working on the Continent for more than 30 years.

But as only Englishmen know how, the battle lines have been quietly aligned in the most gentlemanly of fashions. On the bank's side, they have armed themselves with $250 million worth of edp equipment. About half is in position now. Against this, the Post Office is ranging a much more modest $18 million worth. But at February's-end the London *Times* broke an uneasy truce, reporting that the banks were prepared to go into the service business in a big way to spike the guns of the National Giro before it came to fruition next year.

From that moment things happened fast. The Midland Bank elaborated on its plans to install a data communications net of nine machines worth over $20 million to link all its regional and 2,650 branch offices. (Here the conquerors were English Electric-Leo-Marconi with six big System 4-70s to be paired at three main centres, the rest made up of smaller systems.)

All this would mean the streamlining of new services that all the banks were prepared to introduce. Credit transfers between holders of bank accounts are to be free. Industrial accounts who received many credits can ask for special "collection accounts" to be made at head offices; and within 24 hours a machine list of amounts received, together with totals and originating credit transfer forms, will plump in the customer's office. Customers issuing 1,000 or more salary, wage or pensions credits at a time can send these direct to the bank's head office—instead of local branches—thus giving employers a chance to date their covering cheques at least one day later.

Arrangements have been made so that customers can use documents with both the bank's and their own machine processable codes. And by far the most far-reaching is a direct debiting scheme, under which firms—with the prior authorisation of their customers—can claim money direct from their customer's banking accounts. Customers using the direct debiting method can exchange magnetic tapes with the banks processing systems.

All these services are being brought into use now. With still 12 months to go before D-day, the Giro nevertheless counterattacked. It all seemed a modest affair and consisted of a statement that their computers (again System 4-70s, worth $9 million) would be fed by Recognition Equipment's electronic retina readers. A $1.4 million order included a new device called an inkjet printer. Attached to the reader, it prints out binary codes in fluorescent ink on the documents that it reads. This code will be used for high speed sorting.

Behind this idea is a way of extending Giro straight into the service business. The Post Office's banking system becomes more than a mere system for the small account holder who wants to pay his telephone, public utility, or milk purchase transactions through an organisation offering speedier turnaround and low cost per transaction. Giro will offer to provide shops with byproduct lists of sales, and similar services to mail order houses, local authorities, and nationalised gas and electricity undertakings. Like the banks, they are offering mixed coding formats for machine readable documents.

The main attraction of the Post Office is that payment can be made at one of the thousands of branches throughout the country (all of which are open longer than the banks) either in cash or through one's own Giro account. The most compelling argument for Giro would mean that, say, a chain store could send monthly accounts with preprinted Giro forms holding a Giro account number both for the store and for the customer. All the customer does is to push it in a mail box in a special post-free, pre-addressed envelope.

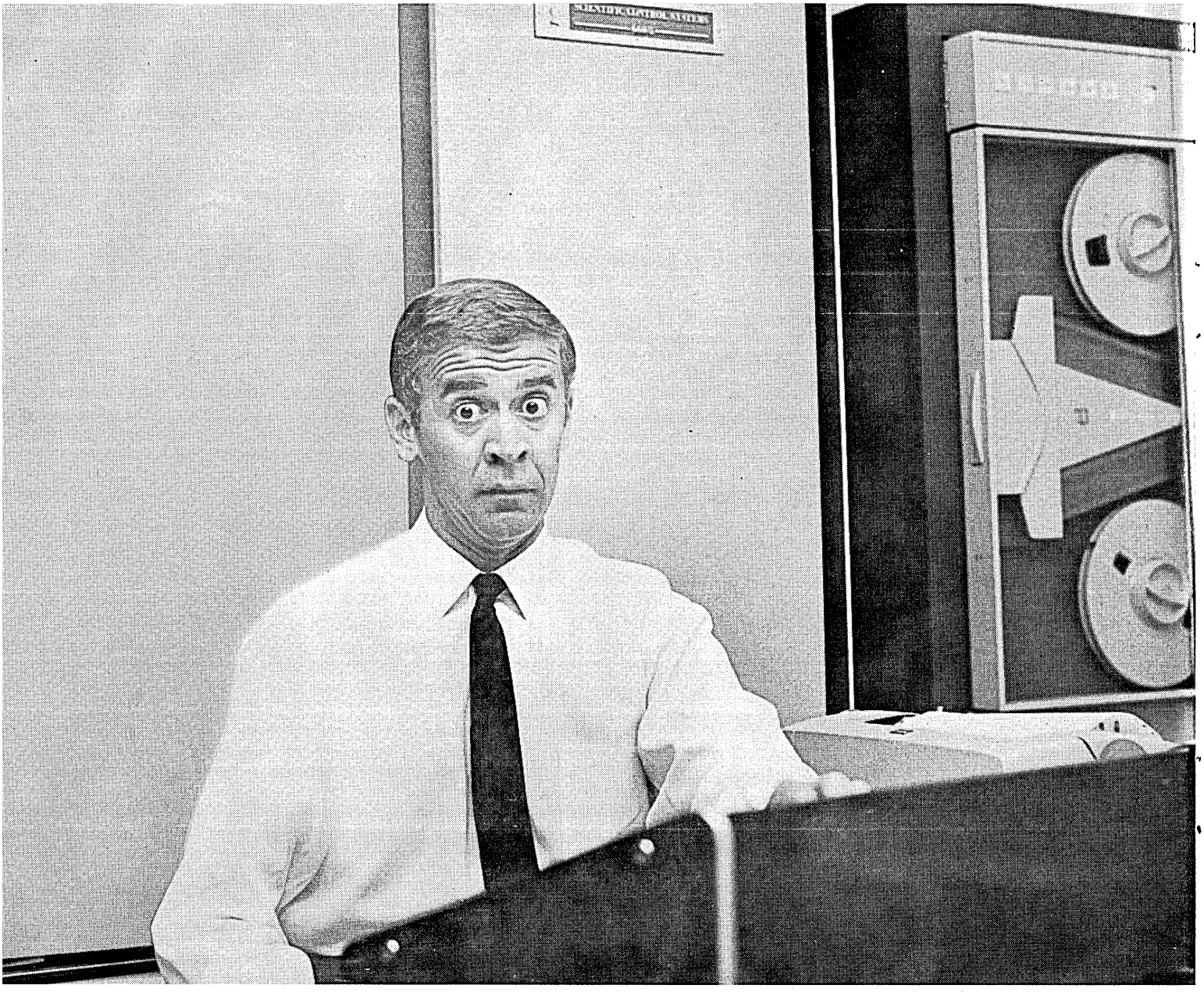
It is to combat this service that the banks are offering direct debiting. But even so, the Giro may have an advantage in speed of transaction because there is one Giro headquarters and machine centre. On the other hand the banking community includes another six organisations in addition to the "big five," to form the 11 clearing banks that handle the job of transferring business between different houses.

From the computer industry standpoint, there is one very fascinating aspect to all this. The orders to EELM by both Midland and Giro have given the manufacturer a much needed break into this lucrative market. To date, IBM has dominated. National Cash has made an impact that can be described as no more than comfortable, and ICT has virtually been ignored by the banking fraternity. Burroughs has moved up suddenly with a huge order from Barclays (see News Briefs). The scene is influenced by the decisions of the big five, and now that two of them have decided that another manufacturer is a worthy supplier, others may follow. Westminster is tipped to be the next likely customer to put out an additional equipment order.

Although the Giro orders are modest, the business from this area could gather momentum if it proved successful. For Post Offices in Britain are notoriously overloaded. And at certain hours of the day they have lengthy queues, which must only be lengthened by the introduction of of Giro. Development of the service must dictate resorting to counter mechanisation—and there are 23,000 Post Offices.

All this galactic excitement ended on a sombre note on March 10th for any service based on a computer. The week following all the attack and counterattack, one of Lloyds' IBM systems let the side down by grinding to a halt. Customers requesting on-demand statements were out of luck. The bank assured its mystified customers that full details of all transactions were being kept and there was no danger of anyone building up an enormous overdraft. The customer just cannot win.

—CHARLES WHITE



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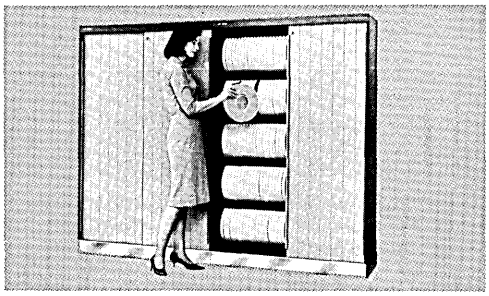

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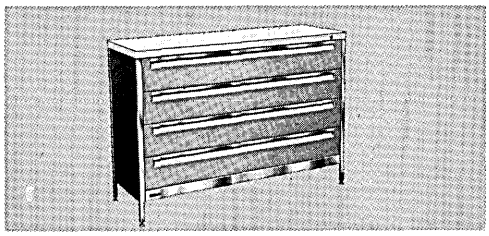

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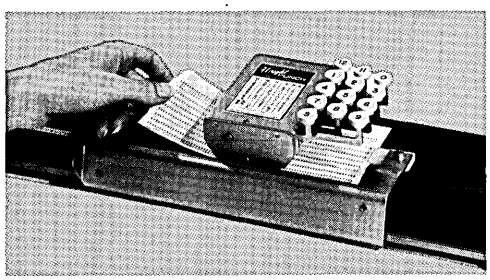

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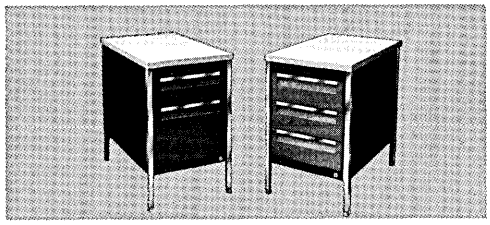

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COMPUTERS, COPS, AND CRIMINALS

It was cold the first day, warm the second and somewhat chilly and overcast the third day. So characterized the climate of both the city of Chicago and the first national symposium on Law Enforcement Science and Technology held on March 7–9. The conference, sponsored jointly by the Office of Law Enforcement Assistance, U.S. Dept. of Justice, and the Law Enforcement Science and Technology Center of the Illinois Institute of Technology Research Institute, was well conceived and well organized. However, it appeared to fall somewhat short of achieving its stated goals.

The purpose of the symposium was "to stimulate the application of science and technology to criminal justice—law enforcement, courts and corrections—by providing an annual professional forum for exchange of ideas and information, identifying the relevant capabilities of science and technology, fostering communication between the criminal justice and scientific and engineering communities . . ."

Although an excellent program was developed and the attendance overran the stated limit of 750 by at least 200 persons, there seemed to be a general conference climate whereby those representing the technological community and those from the professional areas dealing with the administration of justice were unable to establish a firm bridge of communication during the sessions.

The first day was spent in plenary session with presentations discussing the report of the President's Crime Commission and the area of organized crime. In addition, the attendees were welcomed by Mayor Richard Daley, who stated that effective policing requires citizen participation and, while science and technology can make major contributions in the area of the administration of justice, *social* action and community support were also required.

James Vorenberg, speaking on the work of the President's Crime Commission, made a key point when he noted that the studies conducted by the commission brought out the fact that a remarkable degree of misconception exists both in the public and professional community over exactly what problems were related to the administration of justice, including the nature and causes of crime, the victims of crime, and the size of the criminal population.

Vorenberg stated that he believed the Crime Bill presented to Congress by President Johnson had an excellent chance of passage. Such a bill would make funds available to agencies involved in the administration of justice for expanded research, development of improved dp and statistical facilities, and possibly even for the purchase of specialized equipment.

In a report on the work of the Science and Technology Task Force of the President's Crime Commission, Alfred Blumstein of the Institute for Defense Analysis specified that the efforts of that particular group emphasized the system sciences (information processing, communications and system analysis) and technological *requirements* and de-emphasized the behavioral sciences and criminalistics (e.g., fingerprinting, ballistics).

The papers on organized crime ranged from a detailed report by Ralph E. Salerno on the work of the New York City Police Dept. concerning the personnel structure of the "syndicate," to a paper by Robert L. Emrich of the Office of Law Enforcement Assistance on "Cultural Anthropological Analysis of Causes and Threat of Organized Crime." Dr. Emrich stated that the social sciences could make a contribution in the control of organized crime by providing justification for legalized gambling, building a basis for a strong democratic response to political corruption, and reestablishing relevant elements of the contemporary social ethic.

As one listened to all of the presentations on how much was known about the community of organized crime, the question of "Why isn't something more being done about this problem if so much is known?" surely rose in the minds of many in the audience. The discussion of the extent of "white collar" crime by Mr. Vorenberg, including statements that this type of activity was three times more costly than crimes against property or persons and that 91% of people interviewed by the President's Crime Commission admitted to having committed an act at least once for which they could be arrested, undoubtedly raised the question of whether our entire system for the administration of justice wasn't organized improperly in that the existing system essentially does not reach this level of criminal activity.

Some 152 additional papers were presented during the balance of the meeting. The papers were presented as parts of major groupings that included communications, corrections, criminalistics, information storage and retrieval, operations research, police management and operations, and surveillance and detection. Presentations by representatives of justice agencies, academic institutions, and private industry were made to each of these major groups. The category of private industry includes profit-making research and development firms, manufacturing firms, management consultant firms and the not-for-profit R&D organizations. Almost half of the papers presented involved this type of organization. In the area of surveillance and detection, almost all papers were presented by electronics firms. These papers discussed ways in which concepts such as infrared sensors, energy conversion systems, television, magnet-field sensors, and ra-

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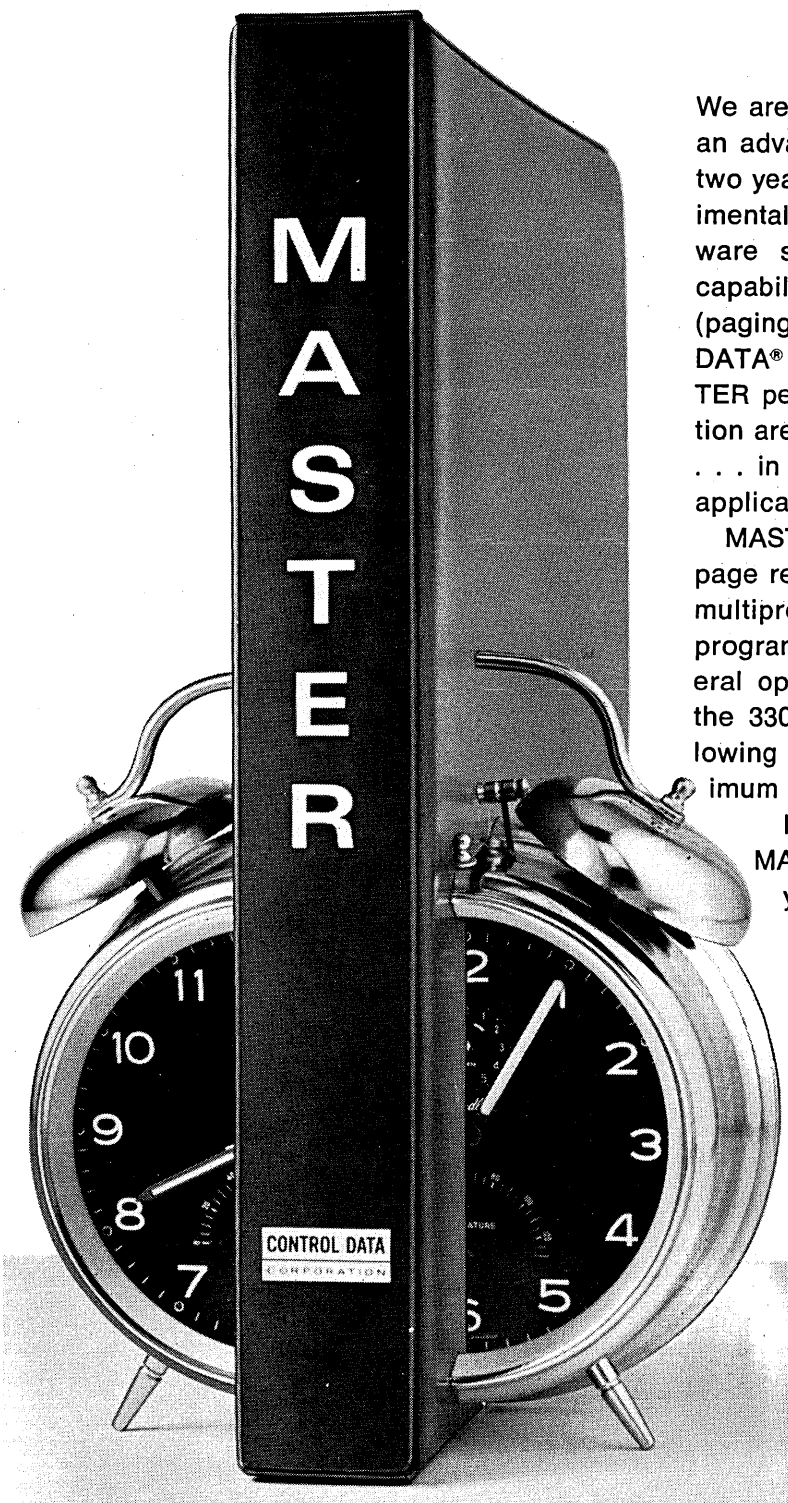

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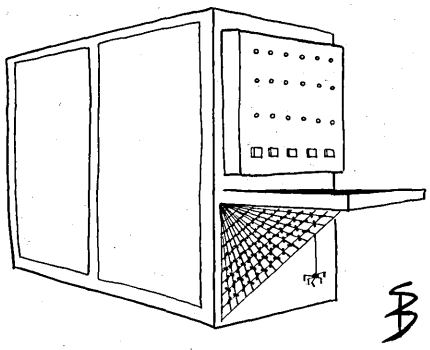
AND CRIMINALS . . .

dar, could be applied to the criminal justice community.

The area of information storage and retrieval was given significant attention during the symposium. In fact, so many papers were related to this subject that each major group, except surveillance and detection, included at least one related to information processing. For example, the communications sessions included a paper on "A Computer Simulation Model of a Police Communication System," by Daniel J. Duffy, et al, of the Polytechnic Institute of Brooklyn; the corrections sessions included a paper by Dr. Harland L. Hill of the Institute for the Study of Crime and Delinquency, Sacramento, Calif., on "Some Proposals for the Development of Information Systems in the Field of Corrections"; the criminalistics sessions included "A Computer Approach to the National Fraudulent Check File," by William D. Griffith of the F.B.I., and "Real-Time Hybrid Computer Analysis of Self-Regulated Feedback Control of Cardiac Activity," by Sherman D. Annsell, et al, of the Univ. of Wisconsin; the operations research session included papers such as "Computer Simulation and Law Enforcement: An Application to the Automobile Theft Problem," by William A. Wallace of Rensselaer Polytechnic Institute; and the police management and operations sessions included "Computer Mapping (SYMAP)—A New Technique for Crime Analysis," by J. Thomas McEwen, et al, of the St. Louis Board of Police Commissioners; and "Systems Analysis and Design Applications to Small-City Police Department Data Processing Operations," by L. C. Klein and J. D. Hodges of North American Aviation.

The information storage and retrieval session was divided into two subsections, fingerprint classification and information systems. The sessions on fingerprint classification contained two papers of particular interest. The first, entitled "Problems in Semi-Automated Fingerprint Classification," was presented by C. R. Kingston of the New York State Identification and Intelligence System. The two key problem areas cited were related to establishing the overall system context in which the device is to be used and the specific engineering and human factors problems involved in developing the device. The second paper, "Advanced Computer Based Fingerprint Automatic Classification Technique (FACT) was by Bernard M. Van Emden of Litton Industries. Van Emden stated that successful experiments have indicated the feasibility of such a system and he discussed the legal, methodological, equipment, economic requirements and problems in implementing such a system.

The sessions on information systems included descriptions of the planned or operational criminal justice information systems in the St. Louis Police Department; the states of Michigan, New York and California; Alameda County, Calif.; and the FBI. In addition, Kai R. Martensen of the International Assn. of Chiefs of Police discussed the general dp needs of the law enforcement community. He stated that "Information retrieval problems are not unique to any one level or department; however, one must overcome local provincialism and police traditionalism." John E. Gaffney Jr., and R. E. McDonnell of IBM discussed present and future hardware configurations for information processing and communications in the law enforcement field and pointed out that existing computer hardware is far ahead of the police ability to use it, and that a major effort must be made to close this gap for effective crime control and prevention. In a paper concerning the relation of system analysis to criminal justice information systems, Charles P. Smith and Roy B. McCabe of System



Development Corp. said that, in spite of the proven value of a thorough system analysis before implementing any modification to existing information systems, such a step is frequently and erroneously ignored due to political, personal or economic factors.

The symposium banquet was addressed by the Honorable James B. Parsons, U.S. District Court Judge and a member of the President's Commission on Law Enforcement and the Administration of Justice. Judge Parsons cited five areas requiring change in the criminal justice system. These were:

1. A more unified criminal code.
2. Greater participation by citizens in law enforcement.
3. A redefinition of the terms guilty and innocent; possibly oriented more to "degree of involvement."
4. A heavier emphasis on community treatment and a more specialized concept of institutionalization.
5. Continuation of research in the area related to the application of science and technology to the administration of justice.

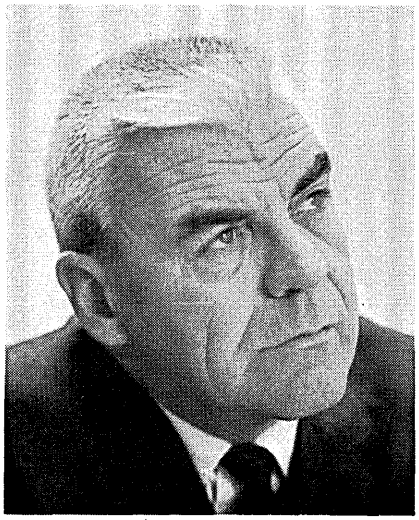
The symposium closed with a plenary session concerning federal assistance in developing the technology of criminal justice and a panel on crime prevention.

The conference chairman, Dr. S. A. Yefsky of the Illinois Institute of Technology Research Institute, and his committee, are to be commended for putting together a well organized, diversified program. The apparent lack of effective understanding or communication between the representatives of the scientific community and the criminal justice agencies is not unexpected. For example, the four studies conducted in California in 1965 by aerospace firms on problems of state government had a similar problem. These studies were criticized in that those persons from the private sector working with civil government did not have an adequate understanding of the substantive knowledge of the problem, that adequate time was not allowed for the studies; that legal, political and cost factors were given inadequate attention by the firms conducting the study; that better evaluation criteria needed to be developed and a more straightforward method of effective communication should have been established. The first national symposium on Law Enforcement Science and Technology was a big step in bridging the communications gap. It is expected that future conferences of this nature will result in great improvements in the utilization of scientific or sophisticated technological methods and they will become more adequately utilized in the administration of criminal justice.

A final thought to the scientist and the practitioner. Other than in the plenary sessions, all of the papers essentially dealt with ways in which to handle crimes against persons or property and that involve observed or adjudicated offenders. What can science and technology offer to attack the major problems of organized crime and "white collar" crimes which are far more costly to society than those traditionally attacked by the justice community?

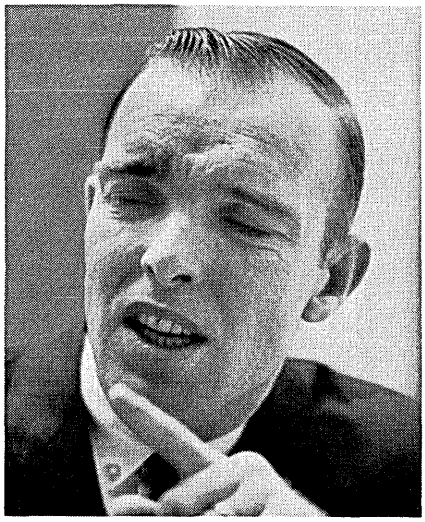
—CHARLES P. SMITH

the case of the misplaced print-out



There's I.D. Smith, Sales Manager, who needs last month's sales figures . . . now!

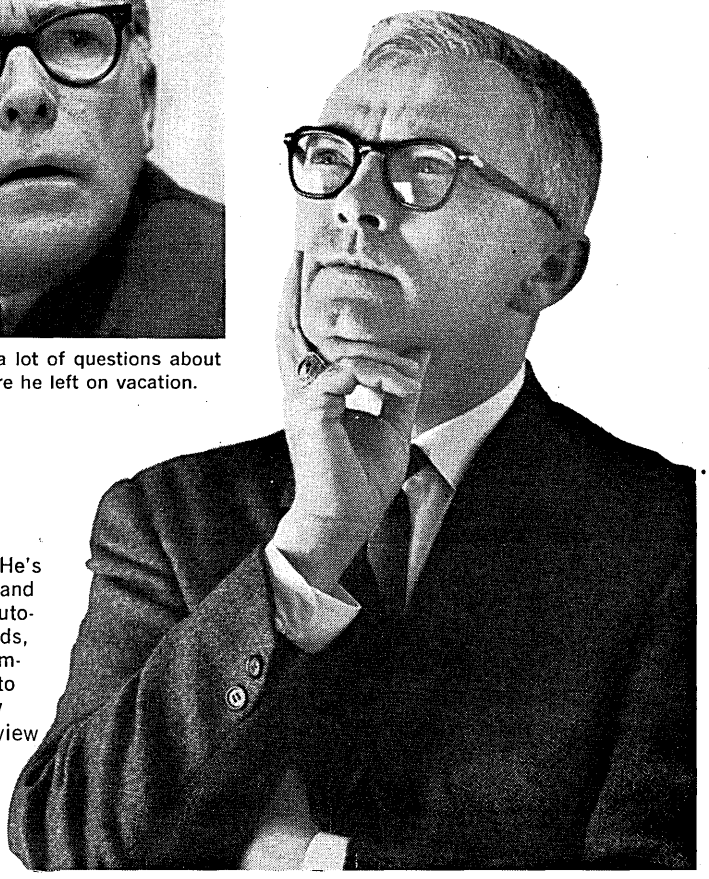
There's Bev Ballard in accounting, who used them yesterday, but she can't quite put her hands on them .



There's Peter Chadwick, Chief Accountant, who thought he'd transferred them to the Comptroller's Office, but he wouldn't swear to it.

There's Jean Rose, in the Comptroller's Office, who never laid eyes on them. She'd swear to it! But she did overhear . . .

David Scott asking a lot of questions about them . . . right before he left on vacation.



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CIRCLE 40 ON READER CARD

AMA'S BRIEFING ON THE COMPUTER UTILITY

The March briefing on "The Computer Utility," sponsored by the American Management Assn., was good for an overview of numerous questions and problems facing the development of this service industry—the most controversial of which is the possibility of government regulation. It was also good for the psyche of computer folk, who freely aired their gripes with the communications common carriers.

Packed with 350 owners and users of these on-line centers, the three-day briefing led off with neat classifications of types of utilities developing, given by Douglas Parkhill, co-chairman of the meeting and author of *The Challenge of the Computer Utility* (see DATAMATION, April, p. 149). He came up with five business categories, some shrouded in the term "natural monopoly": the computer utility common carrier (to sell bulk computer power, perhaps some communications services, as does Western Union); the service retailer (rent power from CUCC, offer special sofeware services); the supplier of remote computer services (own equipment, supply raw power to customers, as IBM's QUIKTRAN); integrated supplier of special services (own equipment and offer special software packages, as Credit Data Corp.); and finally, the total computer utility (supply all services, all computer power, maybe all communications—Western Union).

Parkhill indicated that the utility in some forms does have the appearance of developing into a natural monopoly because of size and prohibitive investment requirement, and very much involves the public interest; both elements are court considerations on regulation. He ventured that the government "might insist on a separation of the industry into a 'Common Carrier' and 'Service' sector and forbid any crossover of ownership and control between them. If this were to happen, the data processing portion of the facility element . . . would probably become a regulated industry."

This frightened not only Western Union, the most total utility you can get, but all on-line data center owners. Manley Irwin, FCC, consultant, who was the next speaker, offered several options to aid survival of free enterprise. First, one possible deterrent to regulation is requiring Western Union to break off its dp and message switching service operation into an affiliate company. Likewise, some suggest that computer manufacturers be forced to separate from their on-line centers, and that absorbing line costs be prohibited.

The investment requirement of the on-line data center owes much of its size to communications costs. The Federal Communications Commission inquiry on computer-communications interdependence hopes in part to determine the adequacy of carrier facilities and services in meeting the present and future needs of the computer industry, Bernard Strassburg, chief of the Common Carrier Bureau, reminded the group in his luncheon speech. According to many speakers during the three-day briefing, a great many of these needs are not presently being met.

Asked about carrier support at ITT Data Services, president Robert Leonard quipped, "We don't have any problems in working with the carriers—other than the fact that their schedules are terrible and their equipment is grossly inadequate." He recommended they particularly improve offerings in terminal-related equipment, such as low-cost channel-derivation equipment, so that the user can break out low-speed channels, a strip printer attached to touch-tone phones and better low-speed terminals than the "ridiculous" Bell 33 and 35. Also, switched broadband should be provided so that the user only pays for what he uses in high-speed lines.

James Babcock, of Allen-Babcock Computing, noted that the carriers would like the centers to use private lines, but they are too expensive for most, and the central dial-up exchange is rapidly becoming overloaded—a problem that will become extremely serious as more utilities, with their long holding-time requirements, pop up. A big threat is the policy that the carrier can discontinue service at any time. And, a costly equipment policy is that Bell requires that only its equipment be used in interfacing with dial-up lines.

The carriers are, of course, working on many of these problems. According to panelists Robert Hodgers of Western Union and S. F. Damkroger of AT&T, there is no answer for the holding-time problem at the moment, but both are studying new methods for charging for connection time, as by data volume transmitted. Switched broadband services have been under development for some time. Western Union planned to offer it last year but, Hodgers said, WU ran into technical problems with some existing switching equipment—a difficulty since solved, so that the service will be available between some locations this year.

As to computer utility plans, Damkroger reaffirmed AT&T has none, and will only do internal message switching.

Adapting to computer needs is obviously an expensive and long-term proposition for the common carrier, and Manley Irwin also noted some options to ease the carrier's burden: government establishment of a digital data network separate from the cc's; aid to the cc in adjusting to the facility requirements of time-sharing, via rapid write-offs and investment tax credit; FCC permission for the entry of new cc's with low-cost facilities; and use of private microwave, now more feasible because sharing is permitted. A question from the floor also brought out the fact that the communications utility is the only utility that is permitted to own a manufacturing company and does not have to submit equipment contracts for competitive bids, intimating that this is a factor which may in some situations result in additional costs to the user.

Legal advice was given to owners and users of computer utility services by Robert Bigelow, described by Guy Dobbs, co-chairman, as a pioneering lawyer in the computing field. His major message to both: consult your lawyer and insurance company before entering into a contract. Some contract considerations: program ownership (for example, a program widely-distributed and available to anyone tied into the system may be considered in the public domain); copyright law and data ownership; liability of the owner to produce what he promises; continuous availability of backup equipment in case of breakdown or

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Up to now, an engineer who didn't know COBOL or FORTRAN or anything else as complex, had a tough time getting his problems solved without someone around to translate for him.

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maintenance requirements; for the owner, exclusion of warranty so he won't be held responsible for data inaccuracies, errors in calculation, etc; liability of the supplier for negligence in file updating; creation of necessary hardcopy records for evidentiary purposes (the user should not become too enthusiastic with the "technological possibilities of doing away with all his paperwork"); and all aspects of file protection.

The user, Bigelow said, should also analyze the effects of regulation and non-regulation on his rates and should not contract for too long a time or commit himself to too large an investment. Too, the Justice Department will be on the look-out for firms in the same industry who use the same computer service and may be sharing data for market control. The same holds true for trade association data banks in relation to price-fixing. The utility must be careful not to so limit clientele that it is boycotting other users, particularly competitors of a customer.

The technical considerations for the user were also covered, several speeches providing guidelines in choosing whether or not to go to a commercial service and what available language and terminal equipment are suitable for what tasks. Jerome Wiener, head of Mandate Systems, warned that "if your job can be done in a batch mode conveniently, and you do it by remote batch on a time-sharing system, that system is costing you $2.50 for $1 worth of work you could get in-house." The reason is that three-fourths of the cost of a t-s system is in communications lines and keyboards and the auxiliary equipment the system requires. Time-sharing, he said, is for such tasks as short-run, casual problem solving, for intermittent computation, and for document generation when the cheapest way to get the job done on time is by using a computer on-line. "If you want to do fairly straightforward, conventional computations, conventional payrolls, run conventional COBOL; do not use time-sharing techniques."

Richard Mills of MIT's Project MAC summarized: "If there is a theme threading the position of the panelists, it is that one should not expect the tried-and-true business practices of the past to be suitable for controlling the new kind of resource which a multi-access system represents."

—ANGELINE PANTAGES

IBM's newest deskside computing system.

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We call it QUIKTRAN-2. It's a new system that puts a computer terminal within easy reach of engineers, scientists, researchers—problem solvers who can't afford to waste time with repetitive calculations. And its initial price is just $185 a month.

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In and Out
by
Toni Schuman

It has come to our attention that four years have passed without a definitive re-evaluation of the* INs *and* OUTs *of the computing industry. In order to rectify this oversight, an exhaustive study was conducted. Below, the results of this in-depth analysis:

The next time-sharing paper will be **OUT** no matter when, where or why it is presented, and the author will be **OUT** forever.

Herb Grosch has become much too square to be **IN** any longer. Programming languages are positively **OUT,** despite those fossils who are still fighting the battle.

Max Palevsky was really swinging in April '66, but just couldn't keep it up.

Computer-aided instruction will never be **IN** except in a very few, rich school districts.

Character recognition is going to be **IN** next year. Jack Strong is coming back **IN,** thank goodness.

Whatever happened to the Alwac, the PB250, Stretch & SOS?

Operating systems are **OUT.** They are now called other things.

Absolute binary is the happening thing.

If you claim you worked with Eckert and Mauchly, you are **OUT,** but if you **are** Eckert and Mauchly, you are **IN.**

Bananas?

Atlantic City was **never IN.**

FORTRAN, unfortunately, is going to be **IN** forever . . . Bridge, GO, Kriegspiel are **OUT.** Monopoly in French is **IN.**

Computer dating is **OUT,** unless you plan to marry a computer.

Flexowriters, believe it or not, are coming back **IN.**

Do you remember: the 604, Codasyl, batch processing, PL/I, the Alamo, Fortransit, Vacuum tubes, 150 lines per minute, the Brooks Bill, Tippecanoe and Tyler too?

Hexadecimal is too **OUT** for words.

Paper tape may be a figment of your imagination, but will be **IN** for 187 years.

If you can define the difference between real-time, time-sharing, on-line, multi-processing, multi-programming and multiple access you will be **IN** for life . . . but only if one other person agrees with you.

Copyrighting computer programs is patently **OUT.**

Why doesn't anyone talk about process control?

Consulting firms are on the way **OUT.**

Individual consultants are still sort of **IN.**

Female consultants are really and truly **IN.**

The Bureau of Standards, Department of Defense, Bureau of the Budget and Disneyland are **OUT.**

Information retrieval was **IN** for such a short time no one even knew about it.

The most **OUT** convention city west of the Mississippi is Anaheim.

"The pH of this solution is 3.5," Tom said, half-acidly.

Numerical analysis is **OUT.** Papers on numerical analysis are even more **OUT,** but numerical analysts who drink (or pretend to) are **IN.**

Beards are **OUT** in California and New England, **IN** in the mid-west, and irrelevant elsewhere.

The ACM will be **OUT** if the university types insist on staying **IN.** Some university types are OK.

BEMA is **IN** right now.

PERT has got to be **OUT.**

Chess-playing programs have been **OUT** for years, but John McCarthy doesn't seem to realize it.

3000 hours without machine failure is **IN.**

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We developed new DATAFINDER to protect your card punch operation from the Card Punch People Problem.

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Now there is a way to keep your operation efficient and solve the Card Punch People Problem. New Datafinder. We install it on your IBM card punch or verifier. It puts your operator under total, continuous, automatic instruction.

What happens? She learns faster; as much as 65% faster. She makes no operational decisions. She makes up to 70% fewer errors. She increases her thru-put an average of 25%. She's happier.

Datafinder makes the most complex form as easy as the simplest. As many as 12 different card formats can be punched with a single handling of the document. Brand new operators punch like veterans in just a few hours. And you should see what veterans do.

If you're suffering from the Card Punch People Problem—Datafinder was made for you. Write us at Tab Products, Machine Division, Post Office Box 1119, Menlo Park, California 94025.

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CIRCLE 42 ON READER CARD

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.

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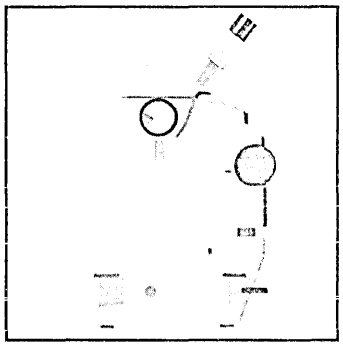
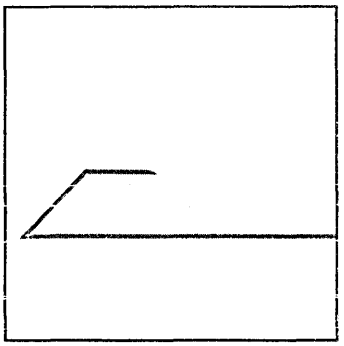


1953 3M PRODUCES FIRST ERROR-FREE TAPE

In 1953, 3M helped develop the modern age of data processing by successfully producing the first error-free computer tape capable of 100 bits-per-inch density. Like all 3M computer tapes that have followed, it provided a clean, stable base and coating, with consistently dependable magnetic and physical qualities.



1957 3M DEVELOPS SANDWICH TAPE

The demand for more rapid access time, through faster transport speeds, required a tape that could withstand high speed tension and wear. To meet this need, 3M introduced sandwich tape. This featured a micro-thin plastic coating over the recording surface to prevent rub-off and protect transport heads against wear.

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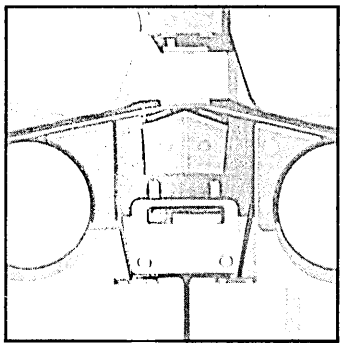
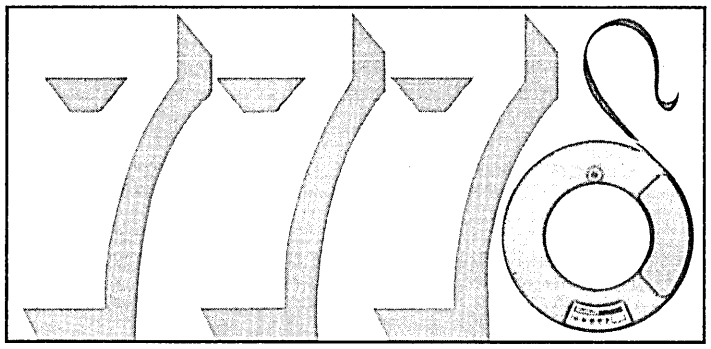


1960 3M PERFECTS HEAVY-DUTY TAPE

In 1960, 3M perfected the first heavy-duty computer tape providing complete compatibility and extended error-free operation at 200, 556 and 800 bpi densities. Proven consistently stable under humidity and temperature extremes, this heavy-duty tape soon became accepted as the standard of the computer industry.



NOW 3M INTRODUCES "SCOTCH" BRAND NO. 777

To reduce costly tape errors to an absolute minimum, today an even more critical tape is needed. This new tape must deliver the highest level of performance over the longest possible time. It must prevent generation of drop-outs during repeated passes. It must withstand temperature and humidity extremes in shipping and storage indefinitely without generating errors. And it must be completely compatible at all densities, including 1600 bpi (3200 fci). Meeting all these needs, 3M now introduces the exclusive breakthrough in long-range reliability with true economy: "Scotch" Brand No. 777.

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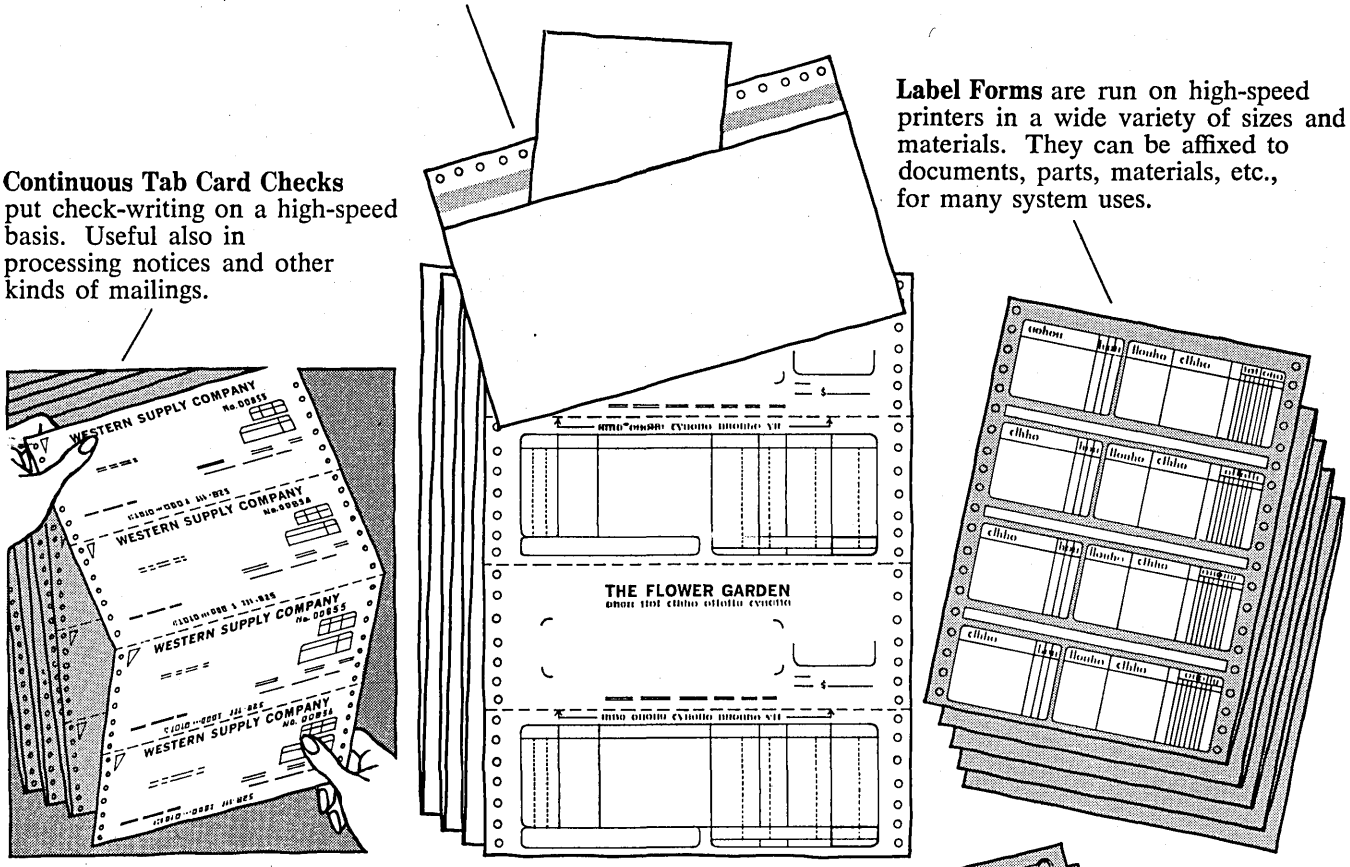

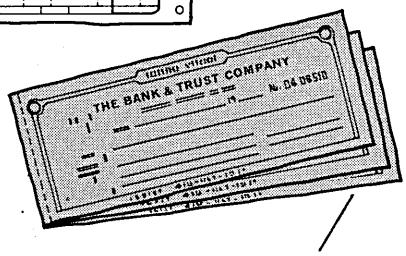

Tab Card Sets have prepunched data, and become a machinable source document to automate accounting procedures. Use for sales checks, credit vouchers, money orders, and many other purposes.

Your form does a job but—does it *expedite* jobs? It should.

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Or simplify functions and save steps; make a form automate procedures; make work flow smoothly, increase efficiency, shave costs.

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CIRCLE 45 ON READER CARD

news briefs

IBM STOPS SELLING 360/91 BUT WILL DELIVER FIRST SOON

The New York *Daily News* reported that IBM was no longer taking orders for System 360. IBM said that wasn't quite true. The *News*, victim of the numbers game, had left out the words "model 91." The $6 million system is the only announced model (August, 1964) of the "supercomputer" model 90 series, although IBM is building two higher performance systems, model 95, under special contract for NASA's Goddard Space Flight Center.

The firm, which will fill all contract orders, said the 91 is a special system meant only to serve the relatively few sophisticated users of large scale scientific systems and to advance IBM's computer development. Control Data has complained that it was instead a competitive move against the CDC 6600.

In January 1966, IBM announced that from then on only purchase orders would be taken, and also noted that six systems would be delivered in 1967. All six will not go out this year, IBM recently admitted, but one a month will be produced in 1968 as previously indicated. The first machine will be installed late this summer. Order totals are not disclosed, but at least 18 are indicated. Some systems were ordered after the purchase-only announcement. Four of the first orders were from Princeton Univ., Lockheed-California, and NASA's Goddard Space Flight Center, Greenbelt, Md., and Goddard Institute for Space Studies, N.Y.U.

The SLT circuit modules and software were said to be problems plaguing the system in May 1965, but IBM says those were solved and are not reasons for discontinuance. Some observers conjecture that the manufacturer reached the most optimal order level in relation to development costs and the pressing need to divert manpower and facilities to production of the rest of the 360 line.

The manufacturer says it has learned a great deal in engineering and manufacturing technology through the 91, making advances in submicrosecond memories, machine organization, and component technology. Original specifications for the 91 included a 180 nsec add time, 270 nsec multiply, 500 nsec cycle time with interleaving. But production models will have a 120 nsec add, 180 nsec multiply and 759 nsec cycle time with interleaving, IBM said.

UNIVAC, TOO, LOOKS FOR MORE BUYERS, FEWER RENTERS

Price changes designed to encourage the outright purchase of computer systems have been made by Sperry Rand's Univac Div. They affect 1108, 494, 9200 and 9300 systems and the DCT 2000 data communication terminal. The rental rates for these CPU's and their memory units have been raised 5%, but no changes on their purchase prices. The prices for their peripherals and the DCT 2000, however, have been cut by 2%, while the rental rates are up 3%. On five-year-lease arrangements for the processors, the monthly net rental rate is reduced by 15%. The changes are effective April 1.

This follows by exactly 18 months the date that IBM put into effect its new purchase-option plan, which, it was widely believed, would affect adversely the many computer leasing firms operating. Instead, the number of firms has increased and business is so good they're all out looking for cash to buy more computers that can be leased to more users. IBM's announcement was soon followed by Honeywell, who led the way for RCA, GE, and NCR.

LIFE INSURANCE FIRM GETS ON-LINE OFFICE NETWORK

One of the world's largest insurance companies, Metropolitan Life, is now on the air with the first phase of an on-line network that will by 1969

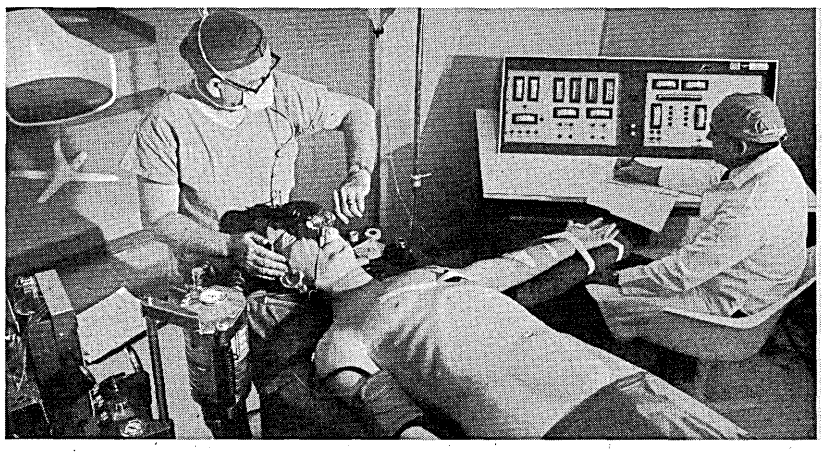
ANESTHESIOLOGISTS PRACTICE ON COMPUTER-BASED PATIENT

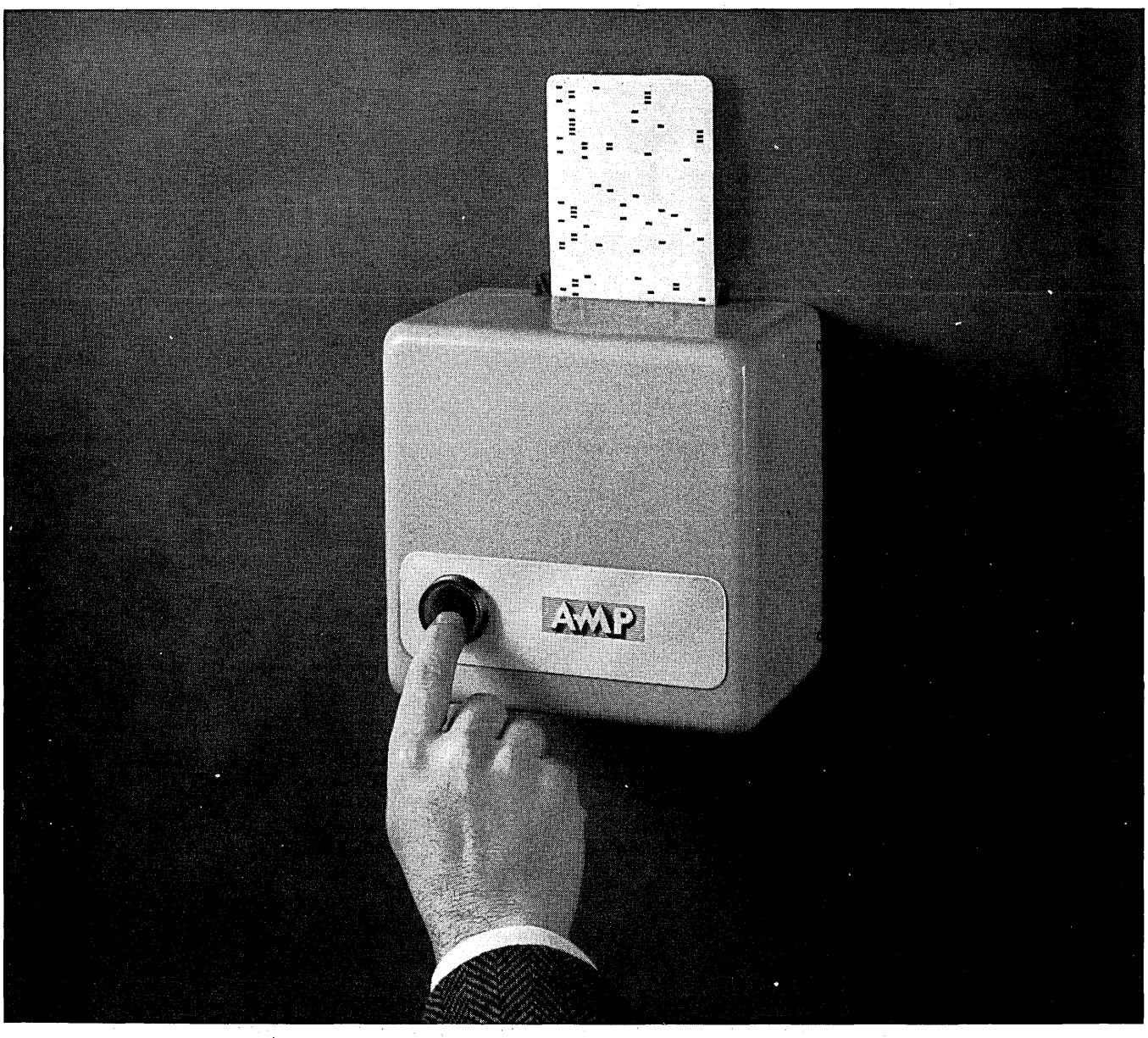
A mechanical, plastic mannikin with vinyl skin, Sim One is a computer-controlled patient simulator for training resident physicians in anesthesiology. The mannikin has all the head and facial characteristics of a human being: tongue, teeth, trachea, larynx, vocal cords; and other bodily functions involved with anesthesiology such as heartbeat, carotid and temporal pulse beats, dilation of the eyes.

Operating with an EAI hybrid 2400 computer (an EAI 231-R analog and a DDP-24 digital), programmed systems drive the actions of Sim One to simulate the symptoms and physiological responses that may confront the anesthesiologist during an operation, including responses to the injection of varying dosages of four drugs, oxygen and nitrous-oxide.

The instructor has a control console where he can monitor each step of the student's performance, and he may override the automatic responses of the computer to introduce problem situations (increase in heart rate, change of blood pressure, etc.), and develop emergencies (heart arrest, spasms). The computer will print out at any time exactly what has taken place up to that moment, and a pen recorder charts the actions of all vital signs as they occur.

Sim One was developed for the Univ. of Southern California School of Medicine by Aerojet-General Corp. and the Sierra Engineering Co.





For economical industrial control, push the button

The A-MP* Model 2900 Card Reader has been called the little tough guy of the line. It's rugged, economical and very reliable. It utilizes a standard Media I tabulating card, reading 22 of the 80 columns with push button operation. With isolated outputs, it is available with up to 44 inputs and 264 outputs.

For a little guy (7″ x 7″ x 4½″), the Model 2900 gets around. Due to its rugged construction it is at home in any plant environment for automatic machine control, batch plant control and automatic warehousing as well as data collection and retrieval.

The desk top model is motor driven; the panel mounted model can be manually operated or motor driven. Positive interlocks assure proper card orientation. Both models can be bussed by half columns, rows or column pairs.

This 7¼ pound "tough guy" will do all your heavy card reading tasks. For further information contact:

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INCORPORATED
Harrisburg, Pennsylvania

CIRCLE 46 ON READER CARD

link all its 900 offices to the central offices in New York and Canada. The $15 million network will be handling 500,000 transactions daily for the firm, which serves 47.5 million people.

As in many systems, the computer (Honeywell 1800) polls the offices in the evening, collecting, correcting and transferring data to mag tape for processing; then the next morning reports and replies are transmitted back to these offices. But the key feature is a specially developed remote console with a scanner for source document conversion which is reducing several hours/week in paper work for agents and eliminating data duplication for the firm. The unit, already installed in 100 offices, provides for more streamlined premium-collection and transaction procedures than now available with most computer-based insurance systems, simply because no punched card for the forms is needed.

Computer-generated premium notices and record cards contain a bar code (Orthocode) of data on the accounts. When a notice is returned by a policyholder, the scanner reads the coded data onto punched paper tape for transmission and onto a teleprinter (all integrated into one console) for the local office's hardcopy record. A transaction record card has a bar for each payment date, over which the agent puts a pencil mark each time a payment is made; this is also put into the scanner. (Once a card is filled with marks, the H-1800 automatically issues a new one to the agent.) From all this data, six different forms, previously manually prepared in the field, are now being automatically generated and maintained at the home office by a battery of Honeywell computers. (There are a total of five 1800's, two 800's and seven 200's for these and other functions.)

Presently, the 1800 is a 32K-word system with 30 tapes—six for communications use, two control units, and a backup 1800. (A "similar system" is to go into Canada.) Random access file storage is being considered for the future, and will afford on-line inquiries. In addition to previously mentioned elements, the remote console has a keyboard already modified to handle on-line requests. The special console, based on a scanner station in Honeywell's product line, is available from Honeywell on request.

COMPUTERS INVADE SHOW BIZ WITH ON-LINE TICKET SALES

An on-line seat reservation and ticket-issuing system for sports and entertainment events has been announced by Computer Sciences Corp., El Segundo, Calif. The Computicket system is slated initially for installation in Los Angeles, where a duplexed 360/40H (256K bytes) will drive more than 150 special-purpose terminals.

These terminals will be located in the branches of a large bank and the 52 retail outlets of the Ralph's Grocery Co. Other retail firms are also being approached, as are such large employers as aerospace firms. The terminals, for which engineering specs are to be developed by Litton's Advanced Data Systems by May, will be used to search for the best remaining seats at a given price, remove from inventory those that are sold, and print the tickets. CSC is quick to point out one huge advantage of this over the current ticket vending system: each terminal will have access to the complete inventory of seats, whereas today's ticket offices, scattered geographically within a city, each have only a handful; thus the buyer might get the best seats available at that office, but yet a poor selection from among the many still unsold.

Announcement of the system, under development for more than two years but not slated for operation for another 10 months, follows publication of stories on two similar ventures on the East Coast (see DATAMATION, April, p. 19, and *Variety*, March 22). These are the Ticket Reservation Systems Inc. in New York City and Ticketron Corp., Fort Lee, N.J. (*Variety's* story is headlined "Computer B.O. Coming." That's show biz talk for box office.)

Computicket Corp., recently-formed subsidiary of CSC, is looking for a downtown L.A. site for its hardware. The configuration will include the dual mod 40's, 12 mod 2311 discs holding up to 84 million bytes, and three 2702 data transmission controllers terminating in 93 lines. There will be three terminals hooked to each line, or a potential for 279 terminals. (More lines can be added.) All terminals will be polled by the computer, obviating the need for a dial-up.

According to Computicket, the equipment will be able to store information on the price and location of up to 10 million seats for as many as 800 different entertainment events. Sales of season tickets, advance and box-office tickets at the time of the event will all be handled by the system. The ducats, although printed at

The teleprinter that came in from the cold

From hush-hush government assignments comes the rapid-fire and silent TP-4000 Teleprinter, ready for duty in commercial communications networks. Now you can utilize the full data-carrying capacity of high-speed telephone service without the compromises and dubious trade-offs you've been faced with so far.

The TP-4000 easily prints out 3000 words per minute, the 2400 Baud transmission rate of voice-grade communications networks. Its electronic print-out is an immediate, permanent, reproducible copy.

The TP-4000 is typewriter-size, noiseless in operation, and more reliable than any other teleprinter on the market. In addition to all this it is lower priced than other teleprinters of comparable speed.

We could tell you much more—such as the fact that it uses only seven moving parts—but it takes time to break the hush-hush habit. If you'd like more data, ask us... we're warming up fast.

Write or call Data Communications Manager Chicago Center, 1450 N. Cicero Avenue, Chicago, Illinois 60651. Phone (312) 379-6700.

MOTOROLA
Government Electronics Division

CIRCLE 48 ON READER CARD

a remote site, will reportedly look much like today's version.

There will be no surcharge to the buyer of these tickets; the system expense is to be borne by the event promoters. In exchange, however, they're figuring on a 30% increase in sales, according to one market report. And quicker money: Computicket is promising payment to the promoters by the second banking day after the sale. Sales data is also being supplied; a promoter who learns that many tickets for an event are being sold in one part of the city can direct his promotional activities accordingly.

Following successful implementation of the system, plans are to expand to other metropolitan areas—San Francisco, Chicago and New York, among them. According to Walter T. McHale, originator of the idea and now vp and general manager of Computicket, there's room for only one system of this type in a city, so it'll be interesting to see how this is resolved.

BURROUGHS HAS BIGGEST BANK ORDER EVER FROM BARCLAYS

Banks in Great Britain are getting ready for the terrors of decimalization in the 1970's and the Burroughs Corp. seems to be getting the same kind of big bonuses from it as NCR did in Australia.

Midland Bank has ordered computers from English Electric but it's also getting $16.8 million worth of Burroughs' new TC-500 terminal processors for branch offices. Westminster will also get a batch. The real bonanza, however, is an order from Barclays for a B8500 and about 2,500 of the TC-500's to go with it. This is an outright purchase and the bill will come to $32 million.

The dual-processor 8500 will be installed at the bank's London headquarters early in 1969. It will have 128K of 500-nanosecond memory, two control modules with 512 duplex channels for two-way data communication at 36 million characters/second, and four billion characters of disc storage.

The TC-500 terminal processors are primarily tellers' machines but have a modest computing capacity of their own. Besides manual input they will accept paper tape, and they include 20 character/second printers.

Peak period loads of one million transactions per hour are expected by Barclays with response time maximum of 2.5 seconds. The system will also have enough capacity for handling accounting needs of the bank's commercial customers.

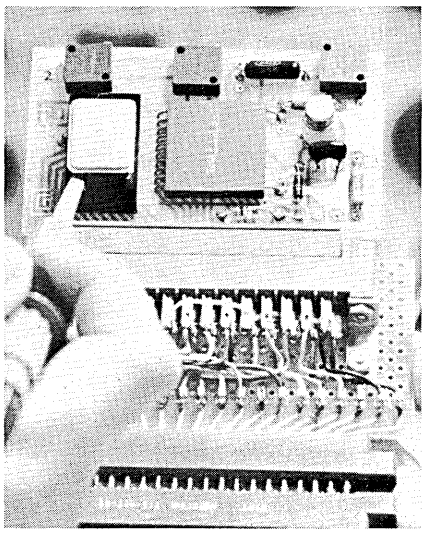
GENERAL INSTRUMENT SHOWS NEW INTEGRATED CIRCUITS

Integrated circuits described as the most complex ever produced commercially are now in production at General Instrument Corp.

They are made with a process the company calls MTOS (Metal Thick-Oxide Silicon) and are said to allow the construction of electronic systems using less than one-fiftieth the number of devices needed with conventional microelectronic circuitry. Circuitry made by the MTOS process has a layer of silicon oxide at crossover points that is ten times as thick as that used in standard MOS circuits. This eliminates the "pinholes" occurring with integrated circuits and has produced yields five times as great as those from typical MOS methods.

At the New York IEEE convention, the company introduced a 64-bit serial accumulator made by the MTOS process that operates at frequencies up to 5 MHz and is priced at approximately $1/bit. The accumulator consists of a 64-bit dynamic shift register plus logic and is on a single chip, 58 mils square, using 415 MTOS P-channel enhancement mode transistors.

An analog/digital and digital/analog converter on a single chip was also shown (see photo). It measures 62 by 104 mils and contains 348 MTOS transistors. It handles all logic and switching functions for 10-bit successive approximation analog-to-digital conversion and also operates in two other modes, as a 10-bit digital-to-analog converter or a 10-channel analog multiplexer. It's available in a 40-lead hermetically sealed in-line package with the longest dimension .85 inch. In conjunction with a precision ladder network, a voltage comparator, and several discrete components, this unit forms a complete analog/digital converter system on a circuit board 3 by 3¾ inches. The company says this product can replace conventional equipment 20 times the size and 10 times the cost. The circuit alone sells for $268 in quantities of 100 and up and the system for $800 singly or $600 in quantities of 100 or more. The system weighs three ounces and uses 300 milliwatts of power.



CIRCLE 130 ON READER CARD

CANADA BUILDS LAND USE DATA BANK WITH IBM HELP

Optimal land resource development for any nation poses a giant data capture and manipulation problem that defies manual methods and until now has not been fully tackled with computer-based systems. It's a matter of map-reading. In a pioneering effort, the Canadian government, in conjunction with IBM, has developed a Geographical Information System that will ultimately have a data bank on 30,000 maps covering the country's one million square miles. Trials begin this summer, routine use this fall.

GeoIS, under Canada Land Inventory agency, is primarily based on a specially developed cartographic scanner and advanced software (four years in development) operating in a 360/65 system with tape storage. Essentially, map drawings and descriptive information about them are being digitized and put into a five-level data bank. The result will be the power to "overlay" maps to obtain almost any combination of information helpful to determining present (good or bad) and potential uses of resources, such as land used for farming but not suitable for it, land good for forestry but which ought to be protected for its wild life and recreational potential, etc.

Specifically the data bank (which may later be on disc and handle on-line inquiries) provides the capability for: comparison of two types of mapped data (such as types of land) relating to the same area; a search for an area with a specified group of characteristics; a "nearest neighbor search" if the user does not find exactly what he wants; "search in context" in which the routine can be instructed to ignore otherwise desirable sites (like land for a helicopter port) if they do not occur in a desirable context (like in the middle of a swamp). The system is said to

accommodate easily new types of data or methods of handling it, using PL/I. All requests for data are ultimately entered in PL/I language, low-level requests being handled by macros in modular form, high-level inquiries by PL/I.

Concerning data input, boundary tracings of maps are digitized onto mag tape by the IBM map scanner (available as a special device on request). The drum scanner, which has an 8-channel optical head, accords one bit position to each .004 x .004-inch area of a map sheet. A 16-square-foot map can be scanned in less than 11 minutes. This done, the map and a transparent overlay with numbers (keys to descriptions of map elements) is placed on a manually operated *x-y* digitizer which converts the key to punched cards on tape. Corresponding classification data is also put on cards or tape. Output is graphic—to a plotter, or printed. CRT displays may be used later.

Data reduction and compression is also vital to GeoIS, since, for example, a 30x30-inch map generates over 56 megabits. Basically, each spot in the line of a segment of a map is assigned a V value indicating the number of data-carrying spots around it. The search algorithm follows the highest V value, thus locating only the center points along a line; *x-y* coordinates are recorded for these points. Descriptive information is related to the map segments by putting identification tags beside the lines. With compact notation, the code used to describe a coordinate is reduced from 16 to two bits.

FBI OPENS COMPUTER CENTER: STATES, CITIES TO TIE IN

Law enforcement agencies on all levels are plunging into automated information systems, and the largest network may soon be operated by the FBI, according to Donald R. Roderick, special agent and program supervisor of the new National Crime Information Center.

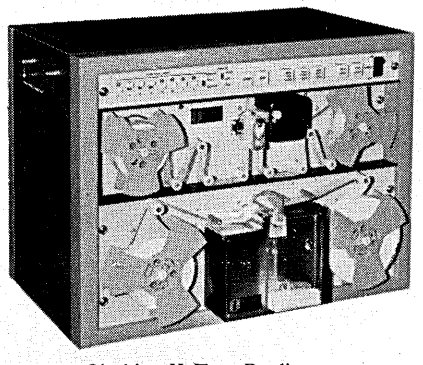
Roderick told 350 law enforcement officials at the first national symposium on Law Enforcement Science and Technology in Chicago that the center hopes to have terminals eventually in every state and in 25 major cities as well as information ties with other federal law enforcement agencies.

California first took part exchanging auto information through the highway patrol's system. It uses an IBM 7740 communications control system, which will be the western switching link for the nationwide network. Then the state added a file, from the California Department of Justice, of persons wanted for felonies, and the theft of firearms and other property identified by serial number.

The crime information center is a computerized index of basic information on crimes and criminals of national interest. Items on file now include stolen vehicles (reported 12-24 hours after discovery of loss), stolen articles with serial numbers, stolen weapons (this information kept indefinitely) and wanted persons (the complete FBI file and all extraditables).

Two IBM System 360 mod 40's went into operation with 11 terminals on-line January 27, when the first test phase began. One computer is now used for NCIC information storage, and the other for FBI administration duties and as a backup unit. Transmission control equipment is the 2702.

One of the problems in planning NCIC, Roderick said, was the necessity to interface with hardware from any major manufacturer that may be used in larger terminals. Smaller terminals can tie into the net-



Ohr-biter II, Tape Duplicator

The Dynamic Duo's Duplicator

Ohr-tronics ever-reliable 119 Reader and 110 Punch join forces to produce a versatile, self-contained tape duplicating system . . . Ohr-biter II. The system's highly sophisticated control panel permits not only straight tape duplication but skip mode erasure . . . partial duplication through search mode . . . keypunch of tape through optional keyboard mode.

Ohr-biter II was developed not innovated; this intra-breeding has resulted both in dependability and economy. Our dependability you know about . . . the economy is surprising —the Ohr-biter II tape duplicating system cost considerably less than $2000!

Dependability and economy characterize all our systems and components. Some of which are listed below, other information is no further away than your request.

Series 110, Paper Tape Punch . . . punches standard 5 to 8 channel paper tapes, asynchronously at speeds up to 30 characters per second. Parity switches for error checking . . . tape can be back spaced. Price: $695 with reels; $545 without reels.

Series 119, Paper Tape Reader . . . reads up to 8 channels of paper tape bidirectionally. Price: $320, complete. **Model 119R, Paper Tape Reader** . . . has additional spooling mechanism for bidirectional supply, take-up. Price: $525, complete.

Model 153, Flatbed Reader . . . is designed to be mounted flush on a horizontal surface. Same basic mechanism as 119. Price: $330, complete. **Model 131, Edge-punched Card Reader** . . . reads single, handfed edge-punched cards. Price: $415, complete.

Model 124, Flexi-bit Punch . . . punches single hole bits. Price: $89, complete. **Model 112-8 Spooler** . . . feeds tape and takes-up 8″ reels when harnessed to reader or punch. Price: $210, complete. 112-5, 5″ reels: $195.

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CIRCLE 50 ON READER CARD

Introducing

the DATA 620·I new systems computer

The DATA/620-I integrated circuit computer is the newest member of the DATA/620 family of system computers. DATA/620-I fills the gap between general purpose and special purpose computers. It belongs in a system, and solves problems previously considered too difficult or expensive for computer solution.

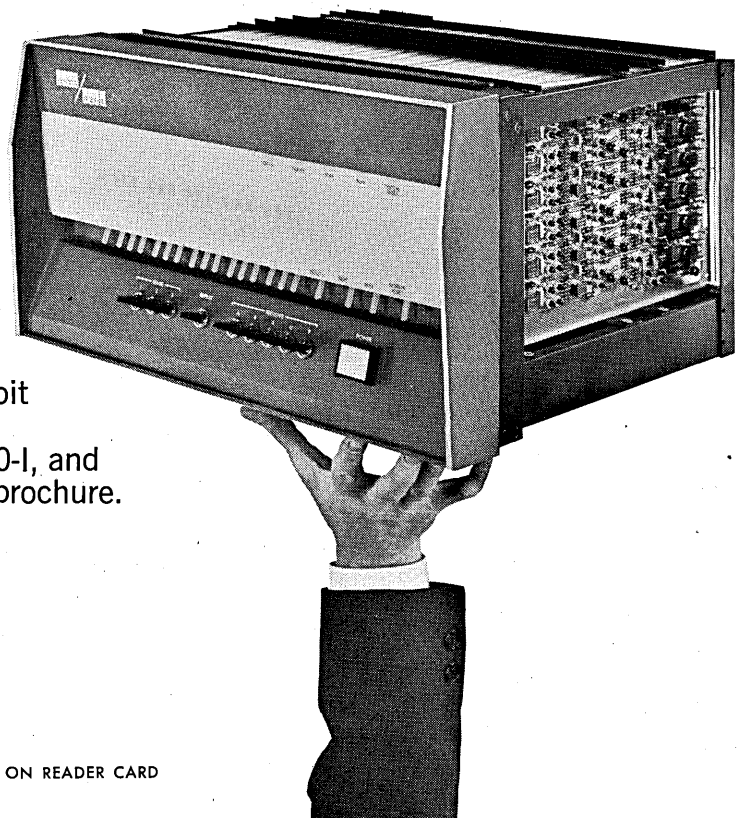
Designed for faster problem solution the DATA/620-I has a bigger instruction set, integrated circuit reliability, is smaller, has one-half the components, and costs less than any computer in its class.

DATA/620-I comes complete with software, field-proven and refined on the DATA/620.

Extremely compact, the DATA/620-I requires only 10″ of 19″ rack space. It's available with memory modules from 1024 to 32,768 words of 16 or 18 bits, and with a selection of control, arithmetic and I/O facilities, including D.M.I.'s unique Micro-Exec.

Price: $13,900 with 4096 words of 16 bit memory, including ASR 33 teletype.

We are very proud of our new DATA/620-I, and would like to tell you more in a fact filled brochure. Please write for one.



DATA MACHINES

1590 Monrovia Avenue, Newport Beach, California
Tel. (714) 646-9371 TWX (910) 596-1358
Division of DECISION Control, Inc.

CIRCLE 51 ON READER CARD

work with Teletype equipment alone, he said.

The initial system employs dedicated lines to each terminal, and line costs and some terminal costs are expected to be paid by the federal government, although the appropriation has not yet been approved, Roderick said. Programs for the system were written by the FBI and the manufacturer.

The National Crime Information Center is on the air six hours a day and is adding transmission time. Initial response, Roderick said, "was good, between 15 and 30 seconds after the request. One detective in Philadelphia was on the street, queried the central computer through a Philadelphia police department computer, and got a response while he waited on the telephone, a minute and a half later."

Roderick urged both law enforcement agencies and manufacturers to be alert to possible applications of new equipment to police work.

"New breakthroughs must be analyzed for application to law enforcement," he said. "We have been lagging behind and are just now beginning to realize what is available to us.

"Congressmen are considering legislation on Capitol Hill that would provide matching federal funds to state agencies that want to apply data processing to law enforcement."

Although NCIC plans to incorporate visual and audio terminals in the future, Roderick said there are a number of research areas still open:

- Conversion of personal identifiers, such as fingerprints and voice recognition, for computer systems.
- Less expensive methods for converting voluminous police records by scanners. There are 50 million index cards in the FBI files alone for conversion.
- Uncompromising security measures for transmission lines in the face of the capabilities of organized crime.
- Simplification of operations for remote terminals, where policemen, rather than trained personnel, will operate some equipment.
- Improvement and increased speed of facsimile transmission to handle increased daily volume.
- Standardization of communication devices, including immediate improvements in converters and eventual adoption of a standard code to avoid interface problems.
- Reduction in communication and terminal costs to allow smaller police bodies to participate in the network.
- Software development, including simplified techniques to encourage new users and improved man-machine communications.
- Educational techniques development to educate both actual users and their administrators.

RCA FORMS NEW CAI GROUP, OFFERS INSTRUCTION PACKAGE

RCA is jumping into the education market with a three-part project: they're setting up a computer-based instruction group, offering a complete package of equipment and programs for purchase by school systems, and supplying the service to schools wanting to tap into a computer in Palo Alto, Calif.

The newly announced organization is called RCA Instructional Systems and is headed by Alan B. Corderman. They are getting together a staff of about 100 and expect to reach 200 by the end of the year. The publishing firm of Random House, now owned by RCA, is also involved; they will work on preparation of instructional materials, including teachers' manuals. Another ingredient is the group at Stanford University's Institute for Mathematical Studies, headed by Dr. Patrick C. Suppes. He, and members of his organization, are acting as consultants and they are preparing the initial instructional material for the machine.

The present target is the elementary school, grades one to six. According to Corderman, they will be able to offer systems including equipment, basic programming, and all instructional materials for use in school districts by fall of this year.

The teaching materials consist of programs for individual student drill in elementary mathematics, reading, and spelling. Record-keeping functions go along with it, keeping track of each child's performance, relating it to previous scores, and so forth.

A school can get the service by subscribing to it, using the Palo Alto computer, or by acquiring the whole package. If they go for the package (one has already been sold to an unidentified "major city"), they get a 262K-byte Spectra 70/45 with 200 terminals and supporting peripherals including tapes and disc. The terminal used is a modified KSR33 called the RCA 735. On a lease basis, all this works out to about $50/child/year if there is one terminal for every 30 students. Buyers will be given training in the use of the system at Palo Alto and at their own schools.

RCA/IS plans to expand the project to cover basic practice materials for high school and college courses, as well as more programs for the elementary schools. They will also expand the equipment line and develop further administrative assistance.

Meanwhile, Dr. Suppes is also busy with the computer/instruction system at Stanford. This one uses a PDP-8 and a PDP-1 and has been available to local schools for two or three years. Now it is also being used by the Breckenridge School in Morehead, Ky., which is operated as part of Morehead State University, using GT&E's long-distance communications lines. Another PDP-8 at Morehead serves as a communications processor. The intention is to add other Kentucky schools when the next school year starts.

The project is financed by the U.S. Office of Education and coordinated by the Central Midwestern Regional Educational Laboratory.

HAWAIIAN CANE FIELDS MODELLED IN COMPUTER

Attendees at the March "non-dinner" meeting of the (San Francisco) Bay Area chapter of the ACM were treated recently to an interesting presentation on how to select sprinkler systems for sugar cane fields.

The speaker, R. George Glaser of McKinsey & Co. Inc., discussed the problems of selecting the optimum set of water delivery systems for a large and geologically varied sugar cane plantation in Hawaii. Optimum, in this case, meant the selection of that set of systems which optimized return on capital investment over a period of about 10 years.

Glaser gave an excellent presentation—liberally spiced with travelogue-quality slides of the plantation and the Pacific Ocean—of the overall problems and of the approaches used to provide a solution. After introducing the audience briefly to the concepts of discounted cash flow, he discussed the influence of soil, elevation, labor cost, and climatic factors on the water requirements of the various fields in the plantation. Using these as taxonomic criteria, 17 similar regions were established. The problem then was to determine which of several possible water delivery systems provided the greatest return in each of these areas.

Because of the common use of a main water channel and other facilities (e.g., power distribution lines), the problem had to be treated as a unit, but separate solutions were required for each area. Furthermore, opportunity costs were associated with the water supply left over

news briefs

from each possible set of solutions. Thus, the model developed had to be iterated many times to determine the best alternative solutions. Because certain assumptions in the model might be only approximately correct, it was also necessary to vary these to determine the sensitivity of the model to such changes.

The results of the analysis are currently being implemented, and the model has proven to be reasonably accurate to date. In sum, the talk demonstrated again the power of analytical systems techniques in combination with the computational capabilities of a computer. For the audience, the moral was plain to see: if you go to Hawaii, take a camera.

USASI PUBLISHES OCR STANDARD

The standard character set for optical recognition, approved July, 1966 and now published by the U.S. Standards Institute, should be a "significant stimulus to OCR as an alternative to keypunching for input," according to its sponsor, BEMA. It is hoped that the standard, which specifies print images and not typefaces, will be used in the design of fonts and of printing and scanning equipment used in OCR applications. Some scanners, such as the CDC 915, already use the standard. The set contains 10 numerals, 26 upper case letters, and 17 symbols; three image sizes are provided to accommodate printing from a broad range of sources —credit card systems, cash registers, typewriters, high speed printers. Basic rules and recommendations are also given for print quality, paper characteristics, format, and measuring techniques.

An international OCR standard, containing the U.S. set and letters and currency symbols used abroad, is now under consideration by the International Organization for Standardization.

The US Standard can be obtained at $4.50 a copy (discounted for 10 or more) from USASI, 10 E. 40th Street, New York, New York 10016.

COMPUTER FIELD INUNDATED BY GOVERNMENT STUDIES

The federal government has turned a full gaze on the computer industry. In the last six months, three fact-finding studies have been initiated which could ultimately lead to new decrees, policies, and regulations affecting the field: the Federal Communications Commission inquiry on computer/communications services and facilities; the Justice Department's preliminary antitrust investigation, which primarily focuses on IBM; and the most recently disclosed study by the House Antitrust Subcommittee (chaired by Emanuel Celler, D—NY) into the "antitrust and monoply problems" involving computer makers.

The House subcommittee study has not yet been publicly announced, but letters of intent have been sent to several manufacturers, including IBM, GE, Univac, Honeywell, and CDC. The letter said that the study hopes to "delineate the present structure of the U.S. computer market;" "ascertain the position of U.S. computer makers in the world market;" and "analyze current marketing policies and distribution practices" of the manufacturers.

There is said to be no conflict among the three inquiries, but each is somewhat related to the other. After the November announcement of the FCC inquiry, the Justice Department, aware of the monopoly and antitrust questions that could arise in the development of "computer utilities," sent a letter of encouragement saying, "We endorse the Commission's proposal to seek information concerning the economic effect of certain tariff provisions, regulations, and practices which will affect the structure and competitive performance of the industry, before large capital investments foreclose alternative choices." The department's own subsequently announced investigation of the computer field will probably draw from and include some aspects of the FCC study (i.e., manufacturers and their on-line service offerings and plans.) And finally, the House subcommittee study is characterized by many as a spur to the department, wielding the club of hearings if the department does not take antitrust action which may be called for by an analysis of the data gathered.

The information requested by Celler's group could produce a more complete body of information on the industry than has been available anywhere. According to a verified report published in the *Wall Street Journal*, this includes: 1. estimates of future uses and markets for computers used to determine sales and distribution policies; 2. statements on these policies concerning each model the firm makes; 3. quantities, by model, of computers sold or leased, plus order backlog, as of Dec. 31, 1966; 4. market reports on "activities of compet-

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cters: the names of customers.
could think of no reason for
omission. "Perhaps it's because
me lists would be too long," he sighed.)

BOSTON DPMA CONFERENCE IS JUNE 20-23

Workshops in three areas—management of systems projects, management of dp operations, and management of personnel—will be an innovation feature of the 16th annual International Conference and Business Exposition being sponsored by the Data Processing Management Assn. The conference will be held June 20-23 in the Sheraton-Boston Hotel and the adjoining War Memorial Auditorium.

The program will also include guideline seminars covering budgeting, accounting, and project scheduling, management seminars on financial models and time-sharing techniques, panels discussing COBOL, as well as industry panels on banking, insurance, manufacturing, and utility companies. Chairman of the event is William J. Horne, dp director of United Shoe Machinery Co.

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... 5-9, Elements of Simulation,

Institute, 10 West 35th
Ill.:
rical Control Semi-

nced APT Pro-

APT Part Pro-

July 27–28, Seminar in Symbolic Control, $70.
Aug. 28-Sept. 1, Basic APT Part Programming, $200.

Laboratory for Applied Industrial Control, Purdue Univ., Lafayette, Ind.:

June 5–16, Modern Automatic Control, $250.
June 12–21, Digital Process Control System, $250.
July 10–21, Modeling and Control of Distributed Systems, $250.

Univ. of Michigan, Dept. of Engineering, Ann Arbor, Mich.:

June 5–16, Computer Graphics, $300.
June 19–30, Introduction to Digital Computer Engineering, $300.
June 19–30, Foundations of Information Systems Engineering, $300.
June 19–30, Numerical Analysis, $300.
June 19–30, Computer and Program Organization—Fundamentals, $300.
June 19–30, Computer and Program Organization—Advanced, $300.
June 19–30, Programming Concepts, Automata and Adaptive Systems, $300.

Univ. of California at Los Angeles, Engineering Extension:

June 19–23, Heuristic Programming Approach to Artificial Intelligence, $225.
June 19–30, Interactive Time-Sharing Systems: Hardware and Software, $300.
July 31–Aug. 4, Computer Language and Their Philosophies, $225.
Aug. 21–25, Management Information Systems, $225.

Univ. of Missouri, College of Engineering, Columbia, Mo.:

Aug. 7–12, Workshop on Fortran, $150.
Aug. 14–18, Workshop on Analysis and Design of Electronic Circuits, $150.
Aug. 21–25, Workshop on Specialized Computer Applications, $150.

American Univ., Washington, D.C.:

June 19–23, Automating State & Local Governmental Records, National Archives Bldg., $150.

Univ. of Southern California, Electrical Engineering Dept., Los Angeles, Calif.:

July 17–28, Design Automation of Digital Computers.

● A national Center for Bibliographic Data Processing for journals in the humanities is being set up by New York Univ. and the 32-member American Council of Learned Societies. Under a $144K grant from IBM,

news briefs

NYU's Institute for Computer Research in the Humanities is developing software for the center which will ultimately contain a data bank of abstracts and cross-referenced indexes for 30 cooperating scholarly journals (first current issues, then back issues). An annotation language for standardizing input on the materials has already been developed and is being used by several journals; an index generator is in the works, as well as automatic routines to handle standard editing procedures in concordance and index compilation and other areas. A 360/30 is now being used at the center, with a 360/50 and two data cell drives being planned for the future.

● A cryogenic memory with a capacity of 14,120 bits has been fabricated by RCA. In microscopic "loop cells" made of superconductive materials deposited in thin films on glass slides, it stores information bits that can be stored or retrieved by electronic circuitry that is outside the superconductive environment. No access time is released, but the unit reportedly can recall information at almost a half million bits per second. RCA Labs reports that it can fabricate uniform loop structures so that a billion-bit storage unit is technically feasible.

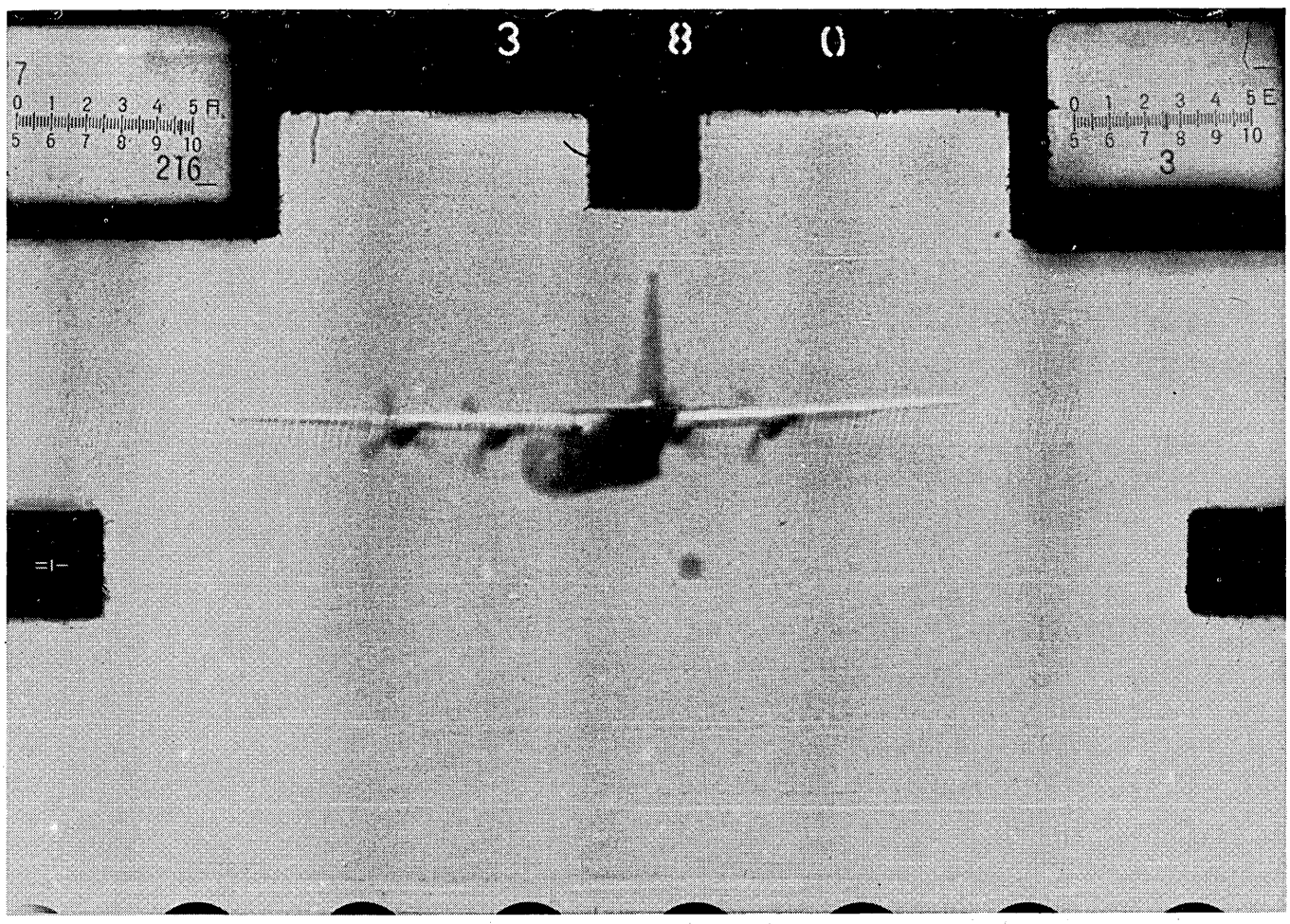
● An ACM Symposium on the Design and Implementation of Interactive Systems for Experimental Applied Mathematics will be held on August 26–28, just prior to the National ACM Conference, at the Sheraton-Park Hotel in Washington, D.C. Theme of the symposium will cover development of effective performance evaluation techniques of interactive computer systems and their new hardware and software, and a technical review of existing systems. Papers of 10-minutes and 30-minutes presentation length are invited. Long papers are due July 1; abstracts of short papers should be submitted by August 1. Contact is Dr. Melvin Klerer, Columbia University, Hudson Laboratories, Dobbs Ferry, N.Y., 10522.

● The International Federation for Information Processing (IFIP) has announced a competition for computer-composed music, to be judged by a panel of musicians and programmers, and performed at the IFIP Congress '68 in Edinburgh. Deadline for entries is January 31, 1968.

A recent meeting of the IFIP General Assembly announced the decision to form special interest groups on such topics as administrative data processing, to encourage international dialogue on problems common to the information processing industry. Also proposed was a technical committee to study computer techniques and applications in medical research and bio-medical practices. IFIP's organizing committee is also planning an international symposium on man/machine communications in business for early 1969.

short lines . . .

We just learned of a joint conference on Mechanized Information Storage, Retrieval and Dissemination that will be held June 14–17 in Rome, Italy. Sponsors are the Federation Internationale de la Documentation and the International Federation for Information Processing. Topics to be covered will range from principles to hardware and software to information networks and on-line systems—some 50 papers in all. In early '68, the proceedings will be published by the North Holland Publishing Co. . . . General Electric, wisely trying to stretch the life of its current computer line, has increased the main memory size of the 425 and 435 processors. Users of the 400's, previously restricted to 32K words of core can now have up to 131K, expandable in 16K modules. This means the maximum rental for a 425 processor is now $15,775, and for a 435, $18,500. Prices are $687,475 and $808,575, respectively. . . . For those interested in the application of computers to problems of environmental design and control, the ACM has chartered a Special Interest Committee on Civil Engineering, Architecture and Planning. A SICCAP Bulletin is planned. Those interested, who need not be members of the ACM, should contact SICCAP, Room 1-138, MIT, Cambridge, Mass. 02139. . . . Bolt Beranek and Newman Inc. is expanding its TELCOMP time-sharing service, based on a PDP-7, into the New York area. The new center, in East Orange, N.J., reportedly will service an area from Washington, D.C., to southern Connecticut. Currently, the company has three computers working on-line in Cambridge, Mass. . . . Invited and contributed papers are being accepted up to June 15 for the annual one-day symposium on The Application of Computers to the Problems of Urban Society. Sponsored by the ACM, it'll be held Nov. 10 at the New York Hilton. Address: Dr. E. S. Savas, IBM Corp., 590 Madison Ave., New York 10022. . . . An RW-300 digital computer, reportedly the first computer to control a chemical process in the U.S., to Ohio State Univ. the B. F. Goodrich plant at Calvert City, had been driving a monomer production uni ary 1960. . . . Recent IBM ments include an updated ing service, QUIKTRAN 2, to add five more centers, bri total up to 10 cities. Under still on a 7044, hours of availa will go up from the current four to 12 hours a day, the user can contract for only five hours a month, and the terminal can be the present 1050 or the new 2741 Selectric-like typewriter. New cities due to be opened this year are Boston, Cincinnati, Detroit, San Francisco, and Washington, D.C. IBM also announces the computer-assisted design and fabrication of masks for integrated circuits. Said to speed the production of masks by more than a factor of 10, the system has been used for IC chips with over 100 NOR circuits. Crux of the system is an experimental language used to describe the circuit patterns from a rough sketch. Additionally, IBM says it has produced mathematical holograms in computers; these are conceptualized objects, rather than real ones. A 360/50 produces two-dimensional holograms, but 3-D pictures reconstructed from digital holograms are expected. . . . Univac has consolidated its Defense Systems Div. and Federal Government Marketing Dept. into a new Federal Systems Div. Heading it is Gerald G. Probst, ex-head of Defense Systems. . . . Seven state colleges in Maryland will share a Honeywell 1200 system at the Towson State College, linked by voice-grade lines. At each of the other six campuses there will be a terminal consisting of a card reader, keyboard, and 400-lpm printer. They will operate in a batch mode, performing both administrative dp and some problem solving. . . . The Internal Revenue Service says the use of computers during 1966 brought in over $27 million of additional revenue, over what might have been caught by the manual processing of tax returns, and held back another $61 million in potential refunds to nearly 300,000 business and individual taxpayers. . . . In England, the former English Electric-Leo-Marconi Computers Ltd. has named English Electric Ltd. . . . The Society for in Business Educati national organization E. Dana Gibson of College, has for cal chapter. In S course. Ed Fix o lege was elected



Hey, you dropped something!

And we know where it is to an accuracy of a thousandth of a degree in azimuth and elevation, on this frame, and the next, and the next — as long as the theodolite follows it.

The positional information is on the film, in those dials at the upper corners. But getting the information off of the film into useable form — automatically — is a task so formidable that only our Programmable Film Reader -3 does it. (Some other pretty big outfits are still trying.)

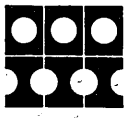
Think for a moment what is involved. First the computer-controlled scanning system has to locate the dials (they're not always in the same position on the film). Then it has to find and recognize two sets of arabic numbers. Then it has to determine where a tiny marker is on the linear scale and convert this into a number of three place accuracy. The last step is to find the parachute and correct for theodolite aiming error.

Sophistication fit for a human, but our Programmable Film Reader -3 is faster, more accurate and more reliable.

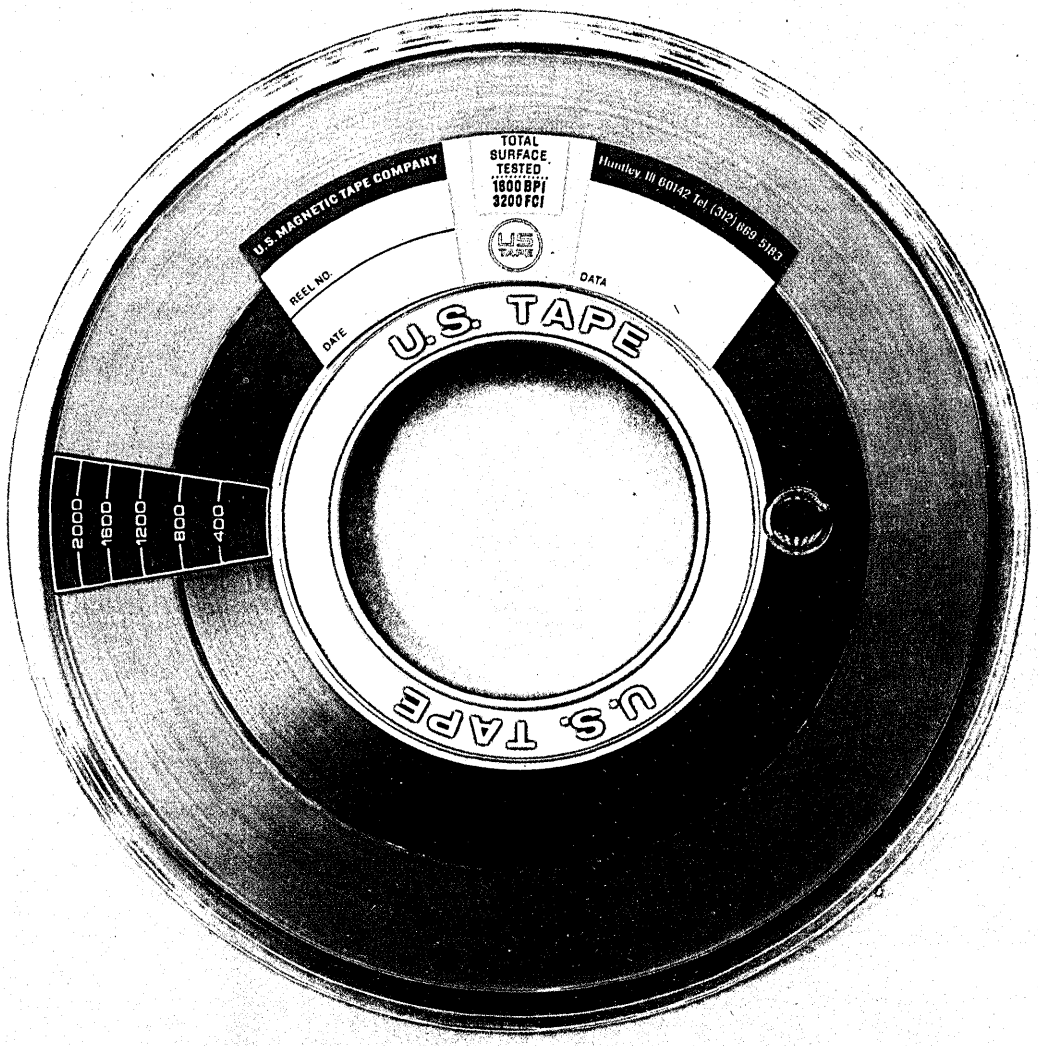
This kind of capability — to find, recognize, analyze, and convert visual information — can be applied to any problem, because the Programmable Film Reader -3 is just that: programmable. And the ultra-precise CRT in the optical system can record on film, too, with the same sophistication.

Other exciting new ideas in visual information processing are taking form at Information International. If you want to drop something yourself, how about in for an honest to goodness demonstration?

Information International Inc.
545 Technology Square, Cambridge, Massachusetts 02139 (617) 868-9810
11161 West Pico Boulevard, Los Angeles, California 90064 (213) 478-2571



CIRCLE 56 ON READER CARD



To be as good, some other tape would have to have Duramil 7.

No other tape has.

U.S. Magnetic Tape Company US TAPE **Huntley, Illinois 60142** / *A Subsidiary of Wabash Magnetics, Inc.*

CIRCLE 54 ON READER CARD

washington report

BUDGET CUT MAY HURT POST OFFICE AUTOMATION

The House has put the meat axe to the Post Office Dept.'s appropriation for fiscal '68, which could seriously hamper the department's automatic program. Specifically, salary money for several systems management people was eliminated. The PO claims it thus will be unable to make use of much of the data produced by the source data automation system.

ARMY SEEKS ON-LINE RESERVATION SYSTEM

Army headquarters expects to request bids soon on a time-shared, 1108-size computer complex that will include up to 500 remote I/Os -- 200 of them crt units. A one-year service bureau contract, part of the project, will be sought concurrently. The application encompasses PASTRAM, a travel reservation system for military personnel, and WHIST, which routes their household effects. Requiring a tie-in to commercial airline seat inventories, PASTRAM may encourage computerized interline reservation systems.

DP STANDARDS AMONG GOVERNMENTS SOUGHT

Federal, state, and local government officials are meeting regularly at BOB in an effort to promote greater adp standardization among the three levels. Ways of making federal equipment available to the other jurisdictions are also on the agenda. Massachusetts is among the states seeking such machine time.

TRANSATLANTIC "TELPAK" UNDERWAY AT COMSAT

A Telpak-like tariff, covering high-speed data transmission across the Atlantic by satellite, is in the works at COMSAT. It will provide 12 alternate voice-data channels and be available on an hourly, daily, and weekly, as well as monthly basis. Rates may be well below present cable tariffs. Last year, in a like case involving private line phone service to Hawaii, FCC persuaded the carriers to reduce their charges 40%.

CAPITOL BRIEFS

Federal adp users' reluctance to share equipment and standardize specs is wasting money, GAO will charge in upcoming reports. A number of "glaring" examples, involving DOD, NASA, and/or other agencies with extensive adp installations, will be detailed. ... Dr. Ruth Davis, staff assistant for national intelligence in the office of the Director of Defense Research and Engineering, has joined the National Library of Medicine as associate director, R&D. She'll develop information systems required by a project center for biomedical communication. ... Carlyle F. Van Aken, staff director of the House census and statistics subcommittee, died of a heart attack April 4; he has been succeeded by Robert D. Krook. ... IBM reportedly has won the Project NAPALM contract. ... Doug Parnell, head of adp management at the Post Office Department, has been wooed away by the Detroit National Bank, Detroit, Mich. ... Army adp managers will decide, about June 1, whether to use NCR 500's or Univac 1005's for a materiel readiness reporting application that will require about 200 systems. ... Two GS-16's -- a technical adviser and an information scientist -- are being sought for the Army's Office of Management Information Systems. The pay, in each case, ranges from $20-25,000 per year... Ed Brady, official of the National Standard Data Reference Service at NBS, has begun a study of a nationwide network of specialized information centers to serve science and scholars.

Hello, world.

To reach out through soundless space in order to be heard in the most remote corners of the earth . . . to design the systems, provide the technology for far-reaching communications . . . to put voices in the wilderness. This is a MITRE mission.

COMMUNICATIONS SYSTEMS PLANNING AND DEVELOPMENT

Among MITRE's current communications activities are included: conceptual design of new communications systems and analysis of their performance; analysis, investigation and development of advanced communication techniques; analysis and projection of Air Force tactical communications needs; and development of sophisticated simulation techniques for communications systems synthesis and evaluation.

Immediate staff and management level openings exist for: Communications Engineers and System Analysts experienced in the systems analysis and design of communications networks, modulation and signal processing techniques, switching systems and voice and data transmission; Operations Analysts with experience in simulation techniques and capable of establishing communications requirements and performing cost effectiveness trade-offs; Project Engineers for detailed engineering and specification of satellite communications systems; and specialists in airborne antenna and multiple access signal processing techniques.

TACTICAL SYSTEMS

These systems encompass mobile communications systems, electronics systems and operating facilities required for the command and control of deployed USAF tactical forces. Major emphasis is placed on detailing overall system design and performance to obtain increased improvements in operating capability. Immediate openings exist for programmers and analysts and systems engineers with development experience in: electromagnetic compatibility/countermeasures; airborne radar; radio frequency interference; communications and data processing; digital computers. Particularly important is experience with lightweight, compact, extremely reliable devices for use in mobile remote situations.

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, Massachusetts.

THE MITRE CORPORATION

An Equal Opportunity Employer (M & F)

Pioneer in the design and development of command and control systems. MITRE was formed in 1958 to provide technical support to agencies of the United States Government. MITRE's major responsibilities include serving as technical advisor and systems engineer for the Electronic Systems Division of the Air Force Systems Command and providing technical assistance to the Federal Aviation Agency and the Department of Defense.

CIRCLE 352 ON READER CARD

Remember when they started going together?

They have now been wed. And Informatics has been privileged to play a major role in this marriage of the century. In 1961, President Dr. Walter F. Bauer wrote, "The marriage of communications and digital computers is a very natural one. This application area will probably prove to be one of the largest commercial areas in the coming years."

Since then, Informatics has provided the software for some of the nation's largest and most advanced computer communications systems, including General Services Administration, Western Union and the U.S. State Department. In so doing, we have modified and interfaced with standard operating systems, such as those of IBM and UNIVAC, to accommodate communications.

Write for our new "Glossary of Data Communication/Message Switching Terms." Address your request to Vice President George J. Vosatka.

Ask him about Job Opportunities, too.

informatics inc.®
Room 500
5430 Van Nuys Boulevard
Sherman Oaks, California 91401

Architects to the Information Industry

A Honeywell Report on COBOL.

It's easy to talk

It's easy to talk

TALK TO IT IN THE LANGUAGE YOU KNOW BEST.

Use COBOL, the COmmon Business-Oriented Language that allows easy translation of business procedures into efficient data processing operations. Many of the nation's largest business data processing users have found that COBOL offers the best opportunity to achieve the benefits today's forward-looking managements expect from EDP. Here are a few of these benefits:

Aid in System Evaluation and Selection

COBOL simplifies the problem of system selection. It provides definite, precise answers to a user's data processing problems. COBOL is a powerful management tool that offers effective computer utilization as a key concept. As a result, more and more prospective users are making COBOL capabilities the pivotal issue in their system evaluation and selection process.

Intersystem Compatibility Via Machine Independence

COBOL is now implemented for almost every model and series of computer. COBOL offers the user the ability to move from one computer to another without a major reprogramming effort. Formerly, a prospective user had to be concerned with how the hardware differences that exist among various models of computers would affect their programming. COBOL alleviates

business to a Honeywell computer.

business to a Honeywell computer.

these considerations by providing the user with a high degree of machine independence. COBOL language is not dependent on the logic of any particular computer, thereby offering a sound basis for intersystem compatibility. The result? Lower programming costs, both initially and in the long run.

Improved Communication Between Manager and Programmer

Because COBOL consists of familiar business terminology, it offers a common basis for communication between management and the data processing staff. System proposals, flow charts, and programming conventions involve standard business nomenclature. Management objectives are easily translated into data processing applications with managers and programmers talking the same language. Their increased ability to organize and communicate ideas establishes a firm basis for mutual action and project success.

Standardization For Universal Effectiveness

COBOL brings a high degree of standardization and universality to business data processing. The language structure and syntax of COBOL are a product of years of experience and co-operation between computer manufacturers and business computer users. Standard terminology and usage produced by the CODASYL committee have helped establish a high level of efficiency in data processing applications. Both the language and the translator programs (compilers) must contain an extensive array of features and facilities to maintain the power and flexibility inherent in COBOL system specification.

Manufacturer's Know-How Pays You Dividends

One of the major features of COBOL is that the responsibility for efficient programming is shifted from the user's programming staff to the manufacturer. In effect, the experience and technical expertise of the manufacturer's programming staff are placed at the user's disposal via the COBOL compiler. The quality of the translation depends heavily upon the quality of the manufacturer's implementation of COBOL. If the manufacturer implements the full intent of COBOL language elements and syntax, then the user's programming potential will be both powerful and effective.

HOW TO EVALUATE COBOL SYSTEMS? The answer lies in four key areas:

1. Language Implementation — This includes not only the number of language elements but the overall power or richness of the language. Does it include time-saving coding tools, such as the "copy" verb or automatic segmentation of the object program?
2. Compile Time — An important consideration, since compilation is a parasitic operation using valuable machine time for non-production work. A compiler must offer optimum balance between a high compilation rate and efficient object code. A high-speed compiler makes it economically feasible to operate completely in source language for even the most trivial changes in the program. No machine-language patches are required.
3. Object Code Efficiency — How does the code produced by the compiler compare with the code produced by the computer's assembly system?
4. Reliability — How reliable is the compiler? Does it work when you want it to? Does the compiler introduce undetected errors into the object code?

HONEYWELL SERIES 200 COBOL

Honeywell, in implementing COBOL for Series 200 has taken a modular approach consistent with its operating system design concept. Series 200 COBOL consists of five levels, each identified by its minimum memory requirements. The five levels are: 8K, 16K, 32K, 65K, and 131K characters of memory, including operating system requirements. Each level affords a rich and powerful implementation of the COBOL language and a fast, efficient compiler. Moreover, all levels incorporate the full range of program preparation, execution, and maintenance capabilities that distinguish a total system from a simple compiler.

WRITE FOR MORE ON COBOL

Send for the Honeywell publication entitled "COBOL Orientation for Management." This booklet includes a description of all levels of Honeywell Series 200 COBOL. Wellesley Hills, Mass. 02181.

Honeywell
ELECTRONIC DATA PROCESSING

CIRCLE 57 ON READER CARD

Ambilog 200

the schizophrenia-free computer

It's not that all those other, conventional digital machines are mentally ill. But they do show signs of split personality when forced to process analog signals. Not so with Ambilog 200.

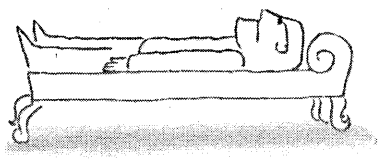
Ambilog 200 is a general purpose hybrid computer designed right from the start to operate in both the analog and digital worlds. We call Ambilog 200 hybrid because it integrates a parallel processing array with a sequential digital controller. The parallel array contains arithmetic elements which are combined analog-digital. Analog and digital data can be processed simultaneously in a single program step.

Ambilog 200 simply cannot be compared with conventional machines. It offers far greater computing power per unit cost. And when it comes to communicating with the analog world, Ambilog 200 doesn't need special adapters or extra linkages.

Ambilog 200 is a fully modular gp computer with a wide range of expansion options and I/O peripherals. System software includes a monitoring and operating system with on-line editing and debugging, and a self-extending macro assembler. Fortran, too. (We're at least that conventional.)

Perhaps you have an on-line application involving data acquisition and reduction, or signal analysis, simulation, or computer graphics. You could help support mental health by considering Ambilog 200.

At least it might help keep you off the couch.



Adage INC

1079 Commonwealth Avenue
Boston, Massachusetts 02215

CIRCLE 58 ON READER CARD

world report

RUSSIAN DISCUSSES PROGRESS WITH LEARNING MACHINE

An experimental character recognition and learning machine system has been developed at the Institute of Automation and Telemechanics in Moscow. During a tour of some western European installations in April, Prof. A. J. Lerner, doctor of engineering sciences at the Institute, took time off to describe the present state of work. Discussing methods of better diagnosis in engineering and medicine, he said learning programs had been written to identify tasks that were done by man with a certain degree of experience and that amounted to intuition. Early research on medical diagnosis showed that the machine system could tell the difference (from a pattern of symptoms) between a stomach cancer and a stomach inflammation, and between lung cancer and lung inflammation. He suggested that within three or four years the computer would be the most accurate diagnostician available. And it would quickly cut down the number of symptoms needed for an examination by weighing in importance the information. The Institute's most powerful machine is a BESM 6, which is about the same power and vintage as a 7090.

FRENCH FIRM UP PROGRAM FOR COMPUTER INDUSTRY

The French government seal finally has been embossed on the proposals for a Plan Calcul through which state aid is to be pumped into the computer industry over the next five years. About $100 million will go to Compagnie Internationale d'Informatique, which mergers the operations of CSF, CGE and Schneider. This will cover small to medium-scale machine development, with a further $90 million available for systems and software. A large part of R&D and manufacturing will be based around Toulouse, which has been chosen for development as a technological community. It is already the home of Sud Aviation, and the area has been growing rapidly with an influx of the avionics industry.

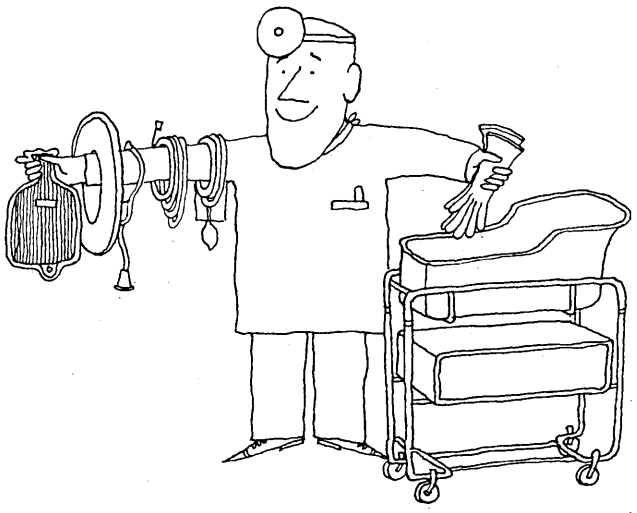
SOFTWARE FIRMS MERGE TO FIGHT U.S. HOUSES

Anglo-French relations took a turn for the better with the marriage of Computer Analysts & Programmers and Centre d'Analyse et de Programmation to form C.A.P. Europe as the largest software house this side of the Atlantic. With 220 professionals at hand and a new headquarters in Geneva, C.A.P. Europe is involved in everything from real-time languages and operating systems for military to basic dp contract programming. With claims of being the two most successful software houses in Europe, the managing director of the British end, Alex d'Agapeyeff, and the French chief, Bertrand Asscher, made it clear that one reason for joining forces was to fend off invading Americans. And there are strong hints they are establishing a position of strength to negotiate American-European cooperation.

CZECHOSLOVAKIA YES; RED CHINA NO

April closed with a note of dissension over the hoary old chestnut of east-west trade. It started when an ICT representative in Hong Kong let slip the word that a $1.5 million 1904 deal had been clinched with Peking.

(Continued on page 99)



Just what the doctor ordered

—and he ordered it yesterday, from an American Hospital Supply Corporation warehouse 300 miles away. He gets same-day service on 25,000 different supply items, because Bell System Data-Phone* service links his hospital to the warehouse over regular telephone lines. Prepunched cards containing order information are fed into card readers connected to Data-Phone sets which transmit the information from the hospital.

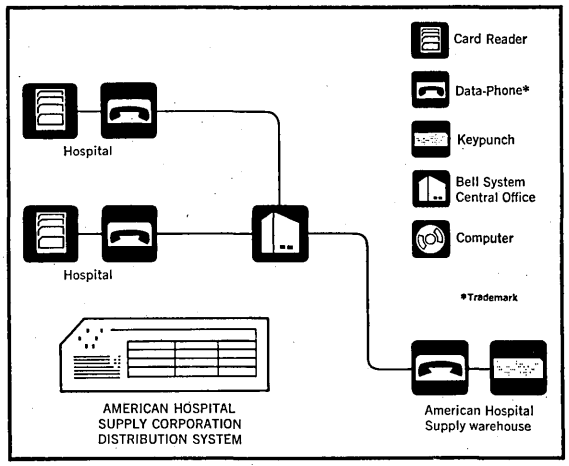
*Service mark

At the American Hospital Supply warehouse the information is automatically reproduced on an order form. The order is packed and shipped the same day. Because of the fast, accurate data communications, one warehouse in Atlanta serves a wide area in the South. Throughout the nation, American's automated ordering system helps hospitals reduce inventory and paper work and keeps the doctor happy.

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



Visit our exhibit at the 1967 meeting of the Data Processing Management Association in Boston.

(Continued from page 97)

This brought a smart rebuff in London (the home of ICT Hq), with a note of protest from Washington delivered to the British government. Although U.S. Embassy officials made it clear that there was no breach of a hard and fast agreement, there was more than a slight feeling that it offended the spirit of the strategic embargo rules of Nato countries drawn-up by the Cocom committee. Other U.K. companies, such as English Electric and Elliott Automation, have won orders from Red China, but have never completed the transactions because export licenses have been withheld. From past experience, it seems likely that the ICT deal will now bumble on for months in diplomatic limbo.

The China debacle followed more successful work by English Electric, who has sold two System 4-50 computers worth $650,000 each to Yugoslavia and Czechoslovakia. And without any of the usual recrimination about selling to the east. The Czech order is the second gained by English Electric for a steelworks. ICT has also picked up a $1 million order for a 1905 and 1901 for two Czech coal mining authorities, S.H.D. and O.K.D. This brings ICT's total for Czechoslovakia to over $3 million.

U.K. MARKETING PICTURE BECOMES CLEARER

Recent and sudden expenditures of more than $110 million by U.K. banks for computer systems mark the second chapter in the story, "Commercial Banks vs. the GPO" (see p. 57). This frantic activity also wrests a near monopoly grip on the banking market away from IBM, boosts Burroughs from almost computer obscurity to a formidable position (see News Briefs), and virtually defines the future of the indigenous U.K. industry.

The Midland Bank and the GPO, obvious competitors, have both ordered large-scale System 4-70's from English Electric. Coupled with a government-backed time-sharing project on a 4-70 at Edinburgh Univ., this virtually puts the onus for large machine development onto English Electric, leaving the small to medium-scale business to ICT. This may all have been the hand of Providence, but it also strengthens the hand of the Ministry of Technology if it ever wishes the merger of ICT and English Electric.

ANOTHER $30 MILLION FOR GE-BULL

GE is to consolidate its holdings and backing of the French GE-Bull company by subscribing for all of the next capital issue of the firm, which will be about $30 million. This is expected to more than tide GE-Bull over its present troubles. The company has been particularly problem-plagued for the past year, which resulted in a substantial personnel cut back earlier this year following management reorganisation and rationalisation of the product line.

BITS & PIECES

Some $8 million in Australian contracts will be split between IBM and Control Data. The former has sold two 360/65's to the Bureau of Meteorology, and the latter will add three 3300's to the Bureau of Census and Statistics' current network of CD computers. And a PDP-10 goes to the Aeronautical Research Labs ... Data Systems Analysts, Pennsauken, N.J., has entered a joint venture with a French software house, Centi-3S, for marketing in Europe.

This could be the start of something big.

A brick is a beginning.

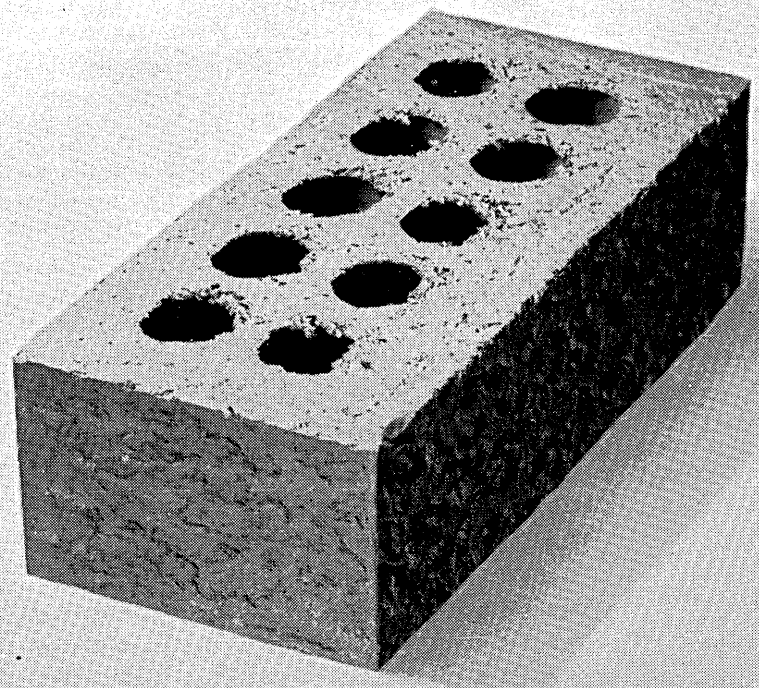
So is an NCR 315-100 computer. It gives you building modularity . . . like a brick. To increase the 315-100's size and scope you just add to it. And it's a magnetic file computer system that rents for under $3000 per month. Yet it offers on-line, real time random access capabilities.

Everything within the 315 Family is compatible. And this is important.

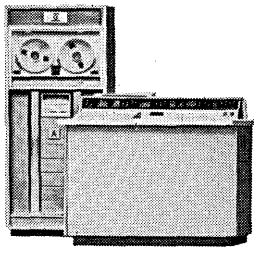
This flexibility gives the 315 user the ability to step up the power of his computer economically by just moving up to a new processor, or adding a few individual units. All of your previous programs and operating routines are usable right up the scale. In fact, you won't need **any** re-programming or re-compiling. This can mean an enormous savings to you in both time and expense. And you can forget about obsolescence.

When you think about electronic data processing, think ahead with NCR. See an EDP specialist from your local NCR office. Or drop us a line.

It could be the start of something big.



NCR



THE NATIONAL CASH REGISTER COMPANY, DAYTON, OHIO 45409 ®

CIRCLE 60 ON READER CARD

new products

electronic pen & tablet

Electronic ballpoint pen enables computer input through written symbols and diagrams which the pen and "notepad" convert to digital and analog signals. Data Tablet has a conductive surface on which electric waves travel in x and y directions; it is also transparent and can be placed over a CRT display to change and modify data already stored in computer. SYLVANIA ELECTRIC PRODUCTS, Waltham, Mass. For information:

CIRCLE 100 ON READER CARD

card patcher

BARC hole filler patches and corrects punched card errors by applying an opaque liquid plastic. Fluid dries in less than a minute and is compatible with all dp machines. Errors may be erased with a single stroke; a patched hole may be repunched without fouling the punch. BERKELEY APPLIED RESEARCH CORP., Alamo, Calif. For information:

CIRCLE 101 ON READER CARD

optical code reader

The 9620 Optical Code Reader will produce punched card input records at speeds reportedly 15 times faster than manual keypunching. The unit reads information in the company's Bar Code language recorded from plastic cards and variable keyboards on source documents, and converts the values to Hollerith code. Converted input data is punched into a separate output tab card; an alphanumeric keyboard permits manual entry of information into the punched card to supplement the scanned numeric data. ADDRESSOGRAPH MULTIGRAPH CORP., Cleveland, Ohio. For information:

CIRCLE 102 ON READER CARD

numerical control software

Two numerical control software programs, ADAPT and SUBADAPT, have been developed for basic and advanced machine tool processing. ADAPT, designed for the Honeywell 200 series computers, requires 49K characters of memory, and will handle two-dimensional cutting operations while maintaining a continuous milling path during tooling processes. SUBADAPT requires only a 24K memory, and performs basic machine-tool functions, such as continuous cutting of simple lines, circles, and point-to-point operations. Both systems operate from information on blueprints or engineering drawings, and are compatible with APT machine language. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 103 ON READER CARD

computer flooring

Decortile computer floor covering is held in position by block interlocks, reportedly as easily removed as elevated flooring blocks. Installed directly over elevated flooring, tile stops drafts, does not affect necessary humidity, and may be color-keyed to the equipment. MITCHELL RUBBER & PLASTIC DIV., ROYAL INDUSTRIES, Los Angeles, Calif. For information:

CIRCLE 104 ON READER CARD

multiprogramming

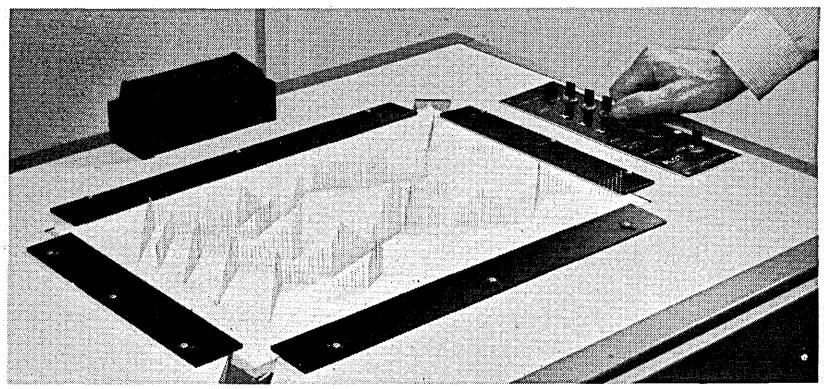
The MASTER software system utilizes the multiprogramming hardware on the 3300 time-sharing computer system. An operating system that simultaneously performs I/O functions and computes tasks from single or multiple jobs, MASTER (Multiple Ac-

Model 501 three-dimensional plotter is used with a digital computer, and has a resolution of 1/100 inches. Plotting is limited only by the size of the x-y positioning mechanism. The surface of the plotting board can be annotated with ink or pencil before or after a plot is made. The end product is a styrofoam board which supports a group of wire pins. Step-motor positioned dimensions on the board are represented by each pin's position; z dimension is pin height. About 100,000 pins per hour may be placed automatically in the 11″ × 17″ board to a height of 2″; with correct buffer electronics, the 501 will plot 3-D data from processors, magnetic and paper tape, and punched cards.

Unit operates by receiving data in incremental form from eight-level paper tape. The first six levels represent increments in x, y and z; increments in x and y operate the step motors directly; z increments are accumulated in the control unit until a seventh level code or plot command is received. The control unit then stops the tape reader and moves the z step motor a number of steps equal to the accumulated z value plus the thickness of the board. The wire projects from the top surface of the board to the proper length, and the cutter solenoid is operated, and starts the tape reader. This cycle is repeated until all the points are plotted. An eighth level code signifies the end of the plot and stops the plotter.

Input data in punched paper tape format is prepared for the Model 501 by a Fortran program, PINPLOT. SPATIAL DATA SYSTEMS, Goleta, Calif. For information:

CIRCLE 105 ON READER CARD



cess Shared Time Executive Routine) allows many active jobs to be resident in core memory simultaneously. With the 3311 multiprogramming module, core memory is divided into pages—2,048 words to a page. These pages are halved and quartered for the handling of short programs. Individual page units, regardless of their location in memory, can be assigned to the same program. Background peripheral processing routines provide for reading, punching, and printing of job-associated files. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 106 ON READER CARD

film reader

The Semi-Automatic Coordinate Reader (SACR) film reader uses an on-line SDS 910 computer to perform image scale transformation, translation and rotation. The reader can measure the coordinate of any number of pre-selected points on a 10″ square field with an rms accuracy of better than one micron, and can handle either roll film (70 mm to 9.5″ wide) or glass plates (up to 10.5″ × 18.5″). The system uses a granite-base, air-bearing measuring engine that transports the photographic material in both the x and y directions. The system also includes an optomechanical assembly, card punch, format viewer and cabinets. NRI, DIV. OF HOUSTON FEARLESS CORP., Berkeley, Calif. For information:

CIRCLE 107 ON READER CARD

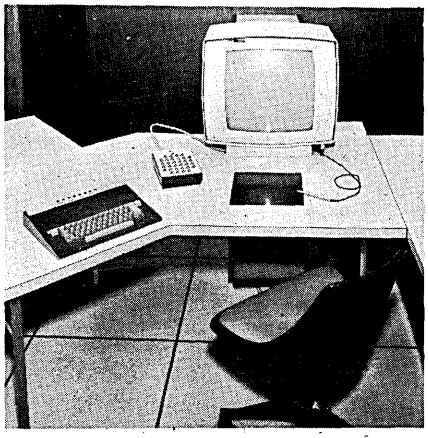
analog plotter

1133 series analog Variplotter has 10 push-button selected input scale factors from 0.5 mv to 10 v/in. on each axis. A variable scale factor control provides continuous adjustment between the push-button steps. Accuracy is ±0.2% of full scale, with the added facility for calibration of ±0.1% on any one range. The 10″ × 15″ recording area is available with inch or metric calibration. ELECTRONIC ASSOCIATES, INC., West Long Branch, N.J. For information:

CIRCLE 108 ON READER CARD

graphic input system

The GI/360 graphic input system interfaces the BBN Grafacon 1010A (based on the Rand Tablet; see DATAMATION, May '65, p. 99) to the IBM 360. GI/360 allows an operator to trace or sketch material from hard copy into the computer; graphic input has a maximum resolution of 100



points per inch. Programmer may specify the rate at which the CPU is interrupted to input graphic data; programs can specify both an elapsed time criterion and a change-in-stylus-position criterion. BOLT BERANEK & NEWMAN, INC., Orange, Calif. For information:

CIRCLE 109 ON READER CARD

printer

The Ink-Jet Printer prints coded information on paper documents at a speed of 72K characters per minute. Some 48,000 electrically-charged drops of ink are sprayed from a nozzle every second, and are deflected in an electrical field to form the desired shapes. Fluorescent ink is used so that the coded information will be in sharp contrast with the paper upon which it is printed. Printer will be available January '68 in both alphanumeric and numeric versions. RECOGNITION EQUIPMENT INC., Dallas, Tex. For information:

CIRCLE 110 ON READER CARD

credit card software

Bankserv Credit Card System 1401 is software for processing credit card accounting on an IBM 1401. The system includes system design, computer programs on card decks, layouts of data formats and forms, and documentation of all system elements. Bankserv requires a configuration of four mag tape drives, a card reader/punch and a printer. INFORMATION SCIENCE ASSOC., Cherry Hill, N.J. For information:

CIRCLE 111 ON READER CARD

file management program

Mark IV File Management system is a proprietary package designed for third-generation computers. The instructions from user to machine are in the form of check lists, and lessen the need for skilled and experienced programmers and analysts. Mark IV handles maintenance, sorting, selection of data and creation of reports. INFORMATICS, INC., Sherman Oaks, Calif. For information:

CIRCLE 112 ON READER CARD

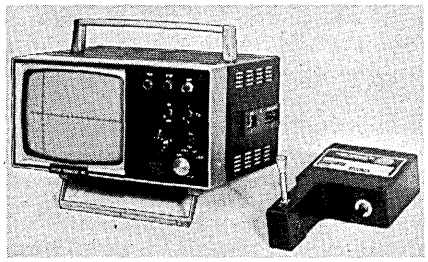
tape cleaner

The Mark II is a table-top cleaner that operates with mag tapes of ½, ¾, or 1-inch widths on reels of up to 10 inches in diameter. The unit has a self-sharpening blade to remove the dirt from the oxide surface, a vacuum to clear the blades, and pads in place of replacement tissues. Time through a 2400-foot reel is three minutes, six minutes including the rewind. CERTA CORP., Los Angeles, Calif. For information:

CIRCLE 113 ON READER CARD

psycho-motor tests

The MK IV Critical Task Tester is a portable psycho-motor device consisting of a computer, CRT display assembly and control stick. Unit yields a human operator's tracking time delay characteristic in a motivat-



ing test situation; task selection of increasing difficulty is computer-programmed to evaluate the test subject's ability to track a dynamically displayed line on the CRT. SYSTEMS TECHNOLOGY, INC., Hawthorne, Calif. For information:

CIRCLE 114 ON READER CARD

tape coupling system

Designed to improve IBM 7094 efficiency, TIC (Tape Intersystem Connection) operating system couples the 7094 with a 360/30 or larger computer. The 360 then acts as a support processor, handling all of 7094 I/O requirements. TIC hardware devices allow I/O data to be passed between channels of the two processors, and permits simultaneous I/O activities on the support processor. SERVICE BUREAU CORP., New York, N.Y. For information:

CIRCLE 115 ON READER CARD

dual processor system

The 6500 dual processor system provides two independent (6400) processors which are interchangeable

EXPERIENCE EXTRAORDINARY: Last year we designed and delivered **more** compilers than **any** other software company.

DESIGN EFFICIENCY: In just 6 months, we designed and delivered a FORTRAN IV (IBM Version 13 compatible), with only 5308 in-instructions and constants, offering in-line assembly language and realtime language extensions, generating recursive subroutines with dynamic storage allocation.

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INFORMATION DEVELOPMENT COMPANY

new products

and can operate simultaneously. Available with 65K or 131K word (60-bit) core memory, each of the processors has 24 operating registers, and 10 peripheral and control processors with 4K (12-bit) words of programmable memory. System also has an exchange jump for multiprogramming. It is software-compatible with the rest of the 6000 series. CONTROL DATA CORP., Minneapolis, Minn. For information:

CIRCLE 116 ON READER CARD

keypunch instructor

Datafinder attaches to a standard IBM card punch or verifier, and provides operator with continuous automatic instruction while increasing her punching speed and accuracy. Unit uses an electronically-controlled light beam that acts as a ruler; Datafinder can substitute its own memory with respect to card field sequence and data location of the source document. TAB PRODUCTS CO., Menlo Park, Calif. For information:

CIRCLE 117 ON READER CARD

line printer

Designed for the Univac 1108 and 494 computer systems, model 0758 line printer can print 43 contiguous characters of a 63-character set at a rate of 1600 lines per minute, or a full set at 1200 lpm. Unit has a paper skipping rate of 33″/second at six lines/inch or 22″/second at eight lines/inch. Printer and paper feeding mechanism will accept at least 6-part continuously-sprocketed form from 4-22″ wide and up to 22″ long. An adapter is needed to adjust the timing and interface differences of the CPU and the printer. Uses currently available 1108 and 494 software. UNIVAC DIV., SPERRY RAND CORP., Philadelphia, Pa. For information:

CIRCLE 118 ON READER CARD

remote terminal

CC-30 communications station can be used as a single remote user display and data entry station, or as an on-line I/O device. Unit includes the CC-301 display controller which drives a standard TV receiver or TV monitor (any TV set can be used for CRT readout). The controller contains a buffer memory, allows interface to a computer either directly or over serial or parallel common carrier transmission paths. CC-30 is capable of buffering and displaying up to 800 characters from a standard 64-character set on the face of a screen. Codes are compatible with ASCII stan-

Flutter correction now a reality

CEC's new VR 5000 has a flutter correction capability *five times more efficient* than any other instrumentation recorder known today.

As a result, tape speed errors and flutter components from dc to 300 Hz introduced while recording on other systems (due to high vibration environment or other causes) are eliminated. When recording on the VR 5000, a high inertia is inserted in the system to provide a minimum of recorded flutter components, which, in turn, makes this the only recorder capable of translating the ideal system concept into a working reality—*high mass recording and low mass reproduce.*

This performance advantage has been achieved by means of the unique Dual Inertia* (DATALOCK™) tape drive system which provides the low flutter introduction advantages of high mass recording coupled with low mass reproduce. Both are under the control of the most effective wideband phase lock servo available. The drive system also eliminates the need for pinch rollers and other rotating members in the tape path.

Further advantages:

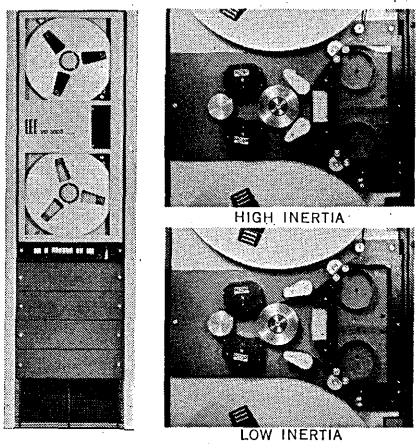
Longer tape life, fewer "drop-outs", and better amplitude stability are assured by the VR 5000's unequaled servo system, which holds tape tension variations to such a low value they cannot be measured with gages presently available.

Positive air pressure tape buffering prevents errors, due to reel perturbations, while solving the contamination and "sticktion" problems normally associated with vacuum systems.

A high inertia flywheel is inserted into the drive system during the record mode to achieve an absolute minimum of recorded flutter components. In the reproduce mode, the flywheel is automatically removed from the tape drive system, and the low inertia system is employed using either the recorded reference track or the internal tachometer, resulting in unexcelled time base characteristics.

For complete information about the revolutionary new VR 5000, call your nearest CEC Field Office. Or write Consolidated Electrodynamics, Pasadena, California 91109. A subsidiary of Bell & Howell. Bulletin VR 5000-X1.

*Patent Pending



CEC/DATATAPE PRODUCTS

BELL & HOWELL

CIRCLE 62 ON READER CARD

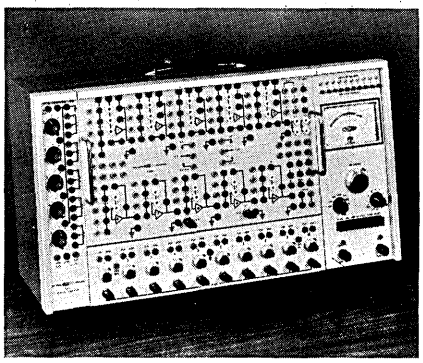
new products

dards. COMPUTER COMMUNICATIONS, INC., Inglewood, Calif. For information:

CIRCLE 119 ON READER CARD

analog computer

Model SD 3300 is a portable, desktop analog computer designed primarily for educational use in under-



graduate technical course work. It is all solid-state ±100 volt design, REP-OP mode control, removable problem board, and null reference system, and has a complement of six operational amplifiers and five coefficient potentiometers. Maximum expansion is to 10 amplifiers and 15 coefficient potentiometers. SYSTRON DONNER CORP., Concord, Calif. For information:

CIRCLE 120 ON READER CARD

problem-oriented compiler

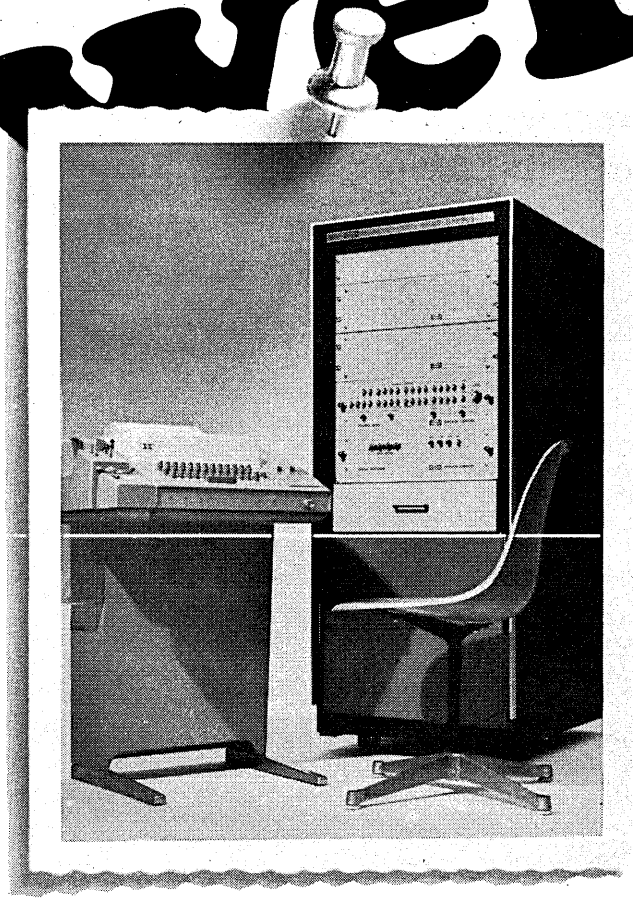
Utility/Coder-360 is a compiler with a free-format problem-oriented language which allows a "relatively unsophisticated user" to specify a wide range of data manipulation tasks. UC-360 is described as more powerful than RPG, and a subset of COBOL in syntax and function, with more flexibility than the higher-level language. Its utility capabilities can be used in transcribing files on tapes or cards, creating sub-files, or reblocking a tape; logical-selection features provide for file updating and analysis, record retrieval, and user-specified data formatting. UC-360 can be used on any 360 system with 32K bytes of memory. CAMBRIDGE COMPUTER ASSOC. INC., Cambridge, Mass. For information:

CIRCLE 121 ON READER CARD

digitizer

Model 303 digitizer reduces analog graphical data to digital magnetic tape form for computer processing and analysis. The 303 has Variable Interval Programmed (VIP) digitizing which monitors the output recorder and outputs a data point as

Price & Power



The new Raytheon 703 IC systems computer—$15K.

RAYTHEON

Raytheon Computer is expanding its data systems product line of Integrated Circuit modules, multiplexers and conversion equipment with a new low-cost 16-bit IC digital computer. The 703 is designed to replace core buffers and special logic as the central element in data acquisition, processing and control systems.

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- ASR 33 with paper-tape reader and punch
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- 2's complement arithmetic
- 71 hardware instructions
- Direct and indexed addressing
- 4K memory
- Byte and word addressing
- Byte manipulation
- Register entry and display control panel
- Programmed word transfer via 16-bit I/O bus
- 2 μsec cycle time
- software-diagnostics, assembler and executive routine

YOU CAN HAVE:

- Up to 32K memory
- Direct memory access channel
- High-speed hardware multiply/divide
- Real time clock
- Peripherals including mag tape, disk and Raytheon Computer's exclusive Multiverter®.

WE WILL SEND YOU FREE: Bulletin SP-244 with all you need to know. Raytheon Computer, 2700 S. Fairview St., Santa Ana, Calif. 92704. (714) 546-7160.

CIRCLE 63 ON READER CARD

often as the recorder can accept and record data. When points are generated too quickly for the output recorder to accept them, they are counted and stored in a register until the recorder is free to accept them. The VIP system allows an overall maximum digitizing speed of 1875″ per minute with a resolution of 0.01″. CALMA CO., Santa Clara, Calif. For information:

CIRCLE 122 ON READER CARD

facility location program

Facility Location Package (FLP-1) is a program which provides an optimal solution in determining a company's new plant and warehouse locations, effectiveness of present facilities, and assignment of customers to each facility. Data input includes potential sites and existing facilities, warehousing and distribution costs, and customer demands. Mathematical programming techniques are used to evaluate all decision alternatives and arrive at an optimal integer solution, as opposed to the numerous studies required by simulation techniques. FLP-1 is available for $8K in two forms: a three-phase 1410/7010 program in FORTRAN II, requiring 80K characters of core; and a one-phase System/360 program written in FORTRAN II, requiring 120K bytes. FISHER STEVENS, INC. & R. SHRIVER ASSOC., Clifton, N.J. For information:

CIRCLE 123 ON READER CARD

card reader

The model 2900 card reader senses the first 22 columns of an 80-column card, and is designed for commercial applications requiring a maximum of 264 input data bits. The reader measures 7″ × 7″ × 4½″, and can be mounted vertically or horizontally. Safety interlocks prevent operation unless the card is properly inserted; total opening and closing times average one second. The 264 normally-open input contacts are available with bussed row, bussed half-column, or bussed column-pair outputs. AMP INC., Harrisburg, Pa. For information:

CIRCLE 124 ON READER CARD

remote alarm system

DIGITOR 400 fire alarm monitoring, data acquisition and remote control system can protect any plant, school, freight facility, etc., with a minimum of 80-100 monitor circuits. Device cyclically monitors sprinkler systems, manual fire pull boxes, watchman tour stations, smoke detectors, thermostats and limit sensors at a rate of 10-15 circuits/second. Operator is warned by a continuous audible alarm, and printer records time and date of all system changes. Alarm/print cycle requires only .25 second. ITT CORP., New York, N.Y. For information:

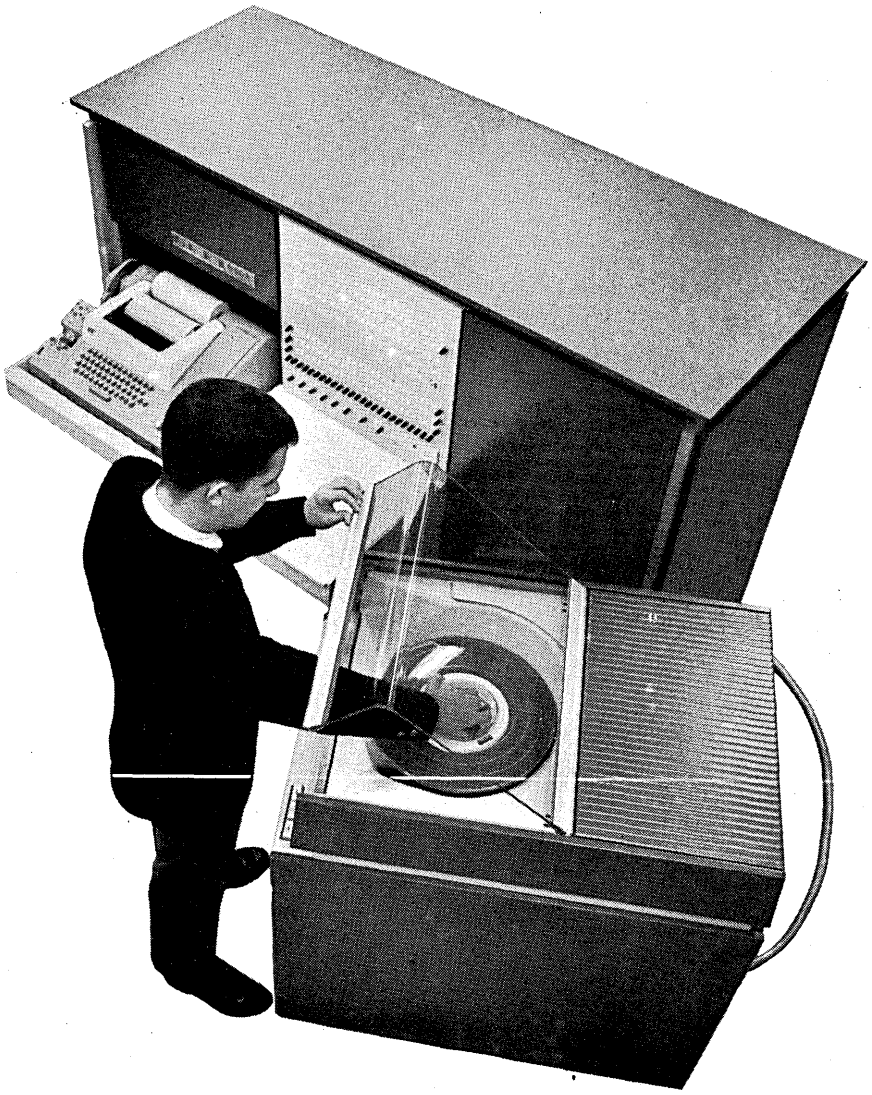
CIRCLE 125 ON READER CARD

memory exerciser

Model 3602 is a general-purpose memory exerciser for production and development testing of sub-microsecond core memory systems. The unit provides a range of cycle speeds from 400 nsec–500 msec, and will test and stop on an error with memories having a 100 nsec access time. It performs error check and generates a new address in 200 nsec. The exerciser features a timing stability of ±1% and a jitter of ±.1%. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 126 ON READER CARD

The first real real-time monitor for a 24-bit computer.



Only our SEL-840A general-purpose parallel computer has it. A unique monitor permits time-sharing execution, including batch processing of background programs, task scheduling of foreground programs and on-line debugging.

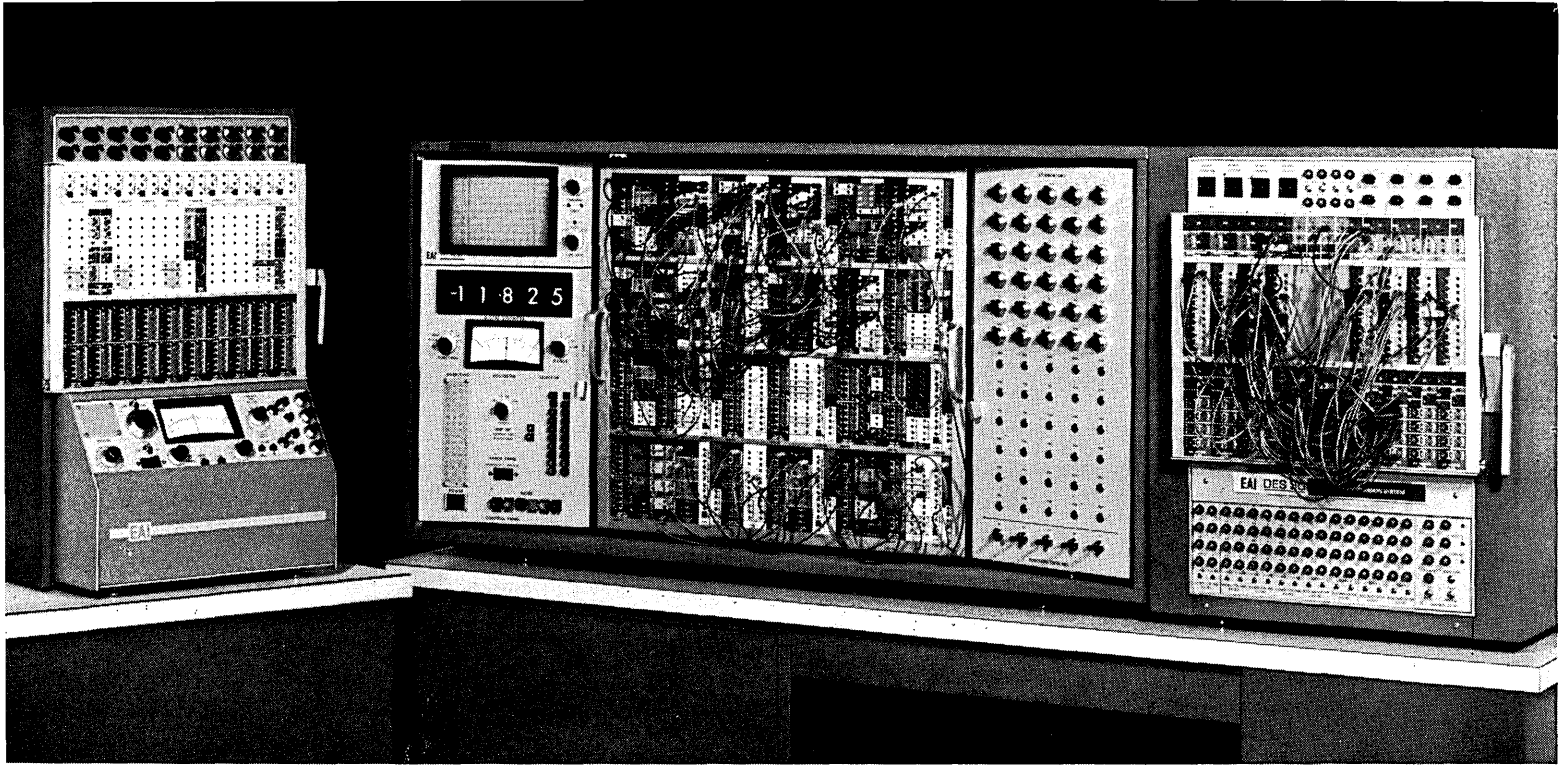
Takes full advantage of disc, tape and concurrent floating-point hardware—another exclusive feature of the SEL-840A. Additional features include up to 60 levels of priority interrupt, and up to 64 high-speed data channels.

Twenty percent less expensive and with twice the throughput rate (572 words/sec.) of its nearest competitor, the SEL-840A is the hottest real-time, software/hardware system going 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

CIRCLE 64 ON READER CARD



Our desk-top analog computers: We've sold over 2000.

Our back-up services: We've never sold a dime's worth.

They're free.

Start with the installation. When you buy a TR-20 or a TR-48/DES 30—the computers you see in the picture—an EAI service engineer will be calling on you shortly to see that everything's OK. You get this installation call free. Part of the reason we can do it is that there are over 50 EAI service centers all over the United States.

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Our interest doesn't end there. Only EAI gives you a continually updated Applications Reference Library, a series of studies that show analog and hybrid programming routines illustrating both general techniques and specific problem solutions. For example, we've just introduced a new Educator's Demonstration Series to help busy professors in course preparation. And we keep you continuously informed with regular distributions of technical information and literature.

For additional technical back-up, we've established seven EAI Computation Centers. EAI customers can call on the most sophisticated skills to solve simulation, design, optimization, data processing and other scientific/engineering problems. Nobody has the experience we do in analog and hybrid computation. And no other manufacturer of analog offers the extent of continuing post-delivery support.

Less servicing is part of our service. We've designed our computers for reliability and precision, with an eye to the future. A TR-10 purchased in 1959 accepts virtually all the latest components designed for the TR-20. Continuing product development has added new high-speed amplifiers, electronic mode control, DES-30 digital logic for hybrid capability, and higher-accuracy components to the EAI TR-48. It's the ultimate desk-top analog/hybrid computer you can buy today.

No other computers have been so well accepted by the scientific and educational community. We'd like to tell you more about the "hardware." The services speak for themselves.

Send for this new brochure on the TR-48/DES-30 desk-top analog/hybrid computing system today.

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West Long Branch, New Jersey

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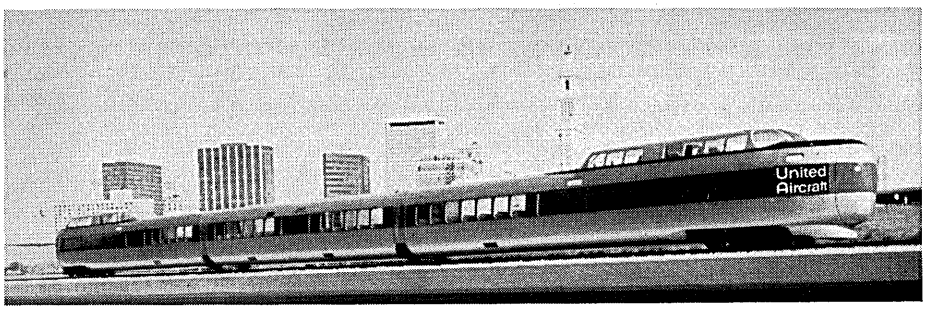

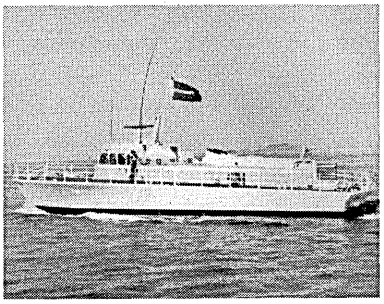

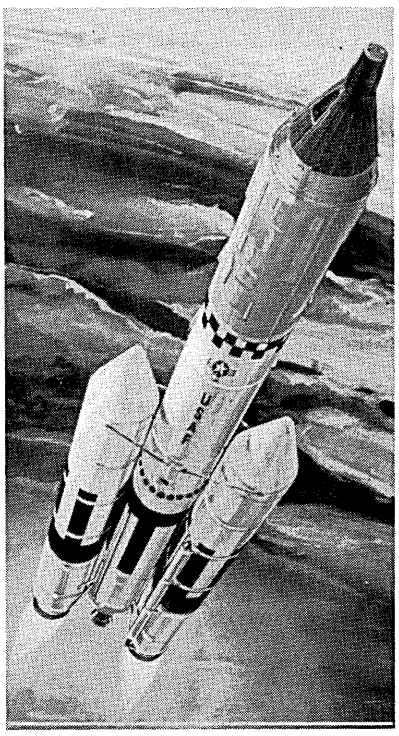

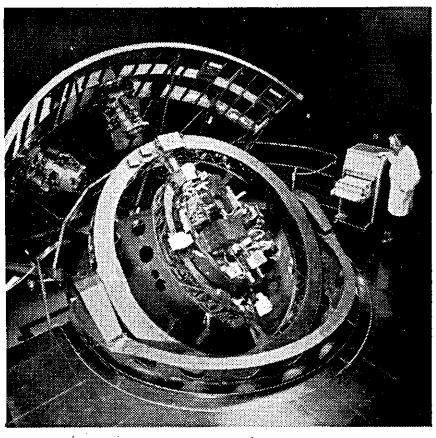

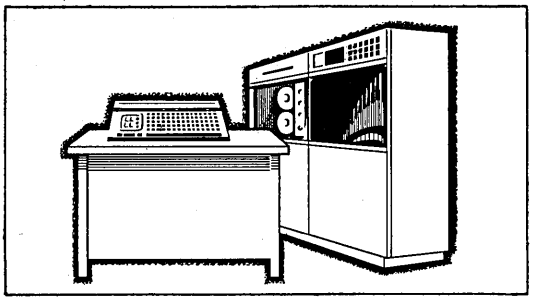

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Requires BS Math, Engineering or Physics, 7 to 8 years experience, and the ability to plan and execute study and analysis programs involving the application of data processing systems, equipment and techniques to general areas of the design of real-time data processing systems. Strong in systems design: familiar with computers, information retrieval systems, executive programs and displays. Proposal preparation and technical writing capability necessary.

SENIOR COMPUTER SYSTEMS ANALYST

Programmer/analyst familiar with large or medium scale computer information systems applications utilizing random access techniques. Programming experience with assembly-level language required; background in use of real-time, direct-inquiry software, plus some version of an operating system desirable. Potential applications: crime intelligence, library, educational, manufacturing, inventory, and similarly diverse areas. BS degree required.

SENIOR SYSTEMS ANALYST

Requires BS or MS in EE or ME, Math and 3 to 5 years experience in systems — especially library systems. Interest and experience in computer application or computer systems.

COMPUTATIONAL ANALYST

Requires BS degree in Math and 3 to 5 years experience in digital computers and equipment to handle non-routine and non-numerical application of machines efficiently. Must also have experience in machine languages.

Resumes and salary requirements should be sent to Mr. John A. Henley, United Aircraft Corporate Systems Center, 1690 New Britain Avenue, Farmington, Conn. 06032. We are an equal opportunity employer.

United Aircraft Corporate Systems Center

DIVISION OF UNITED AIRCRAFT CORPORATION

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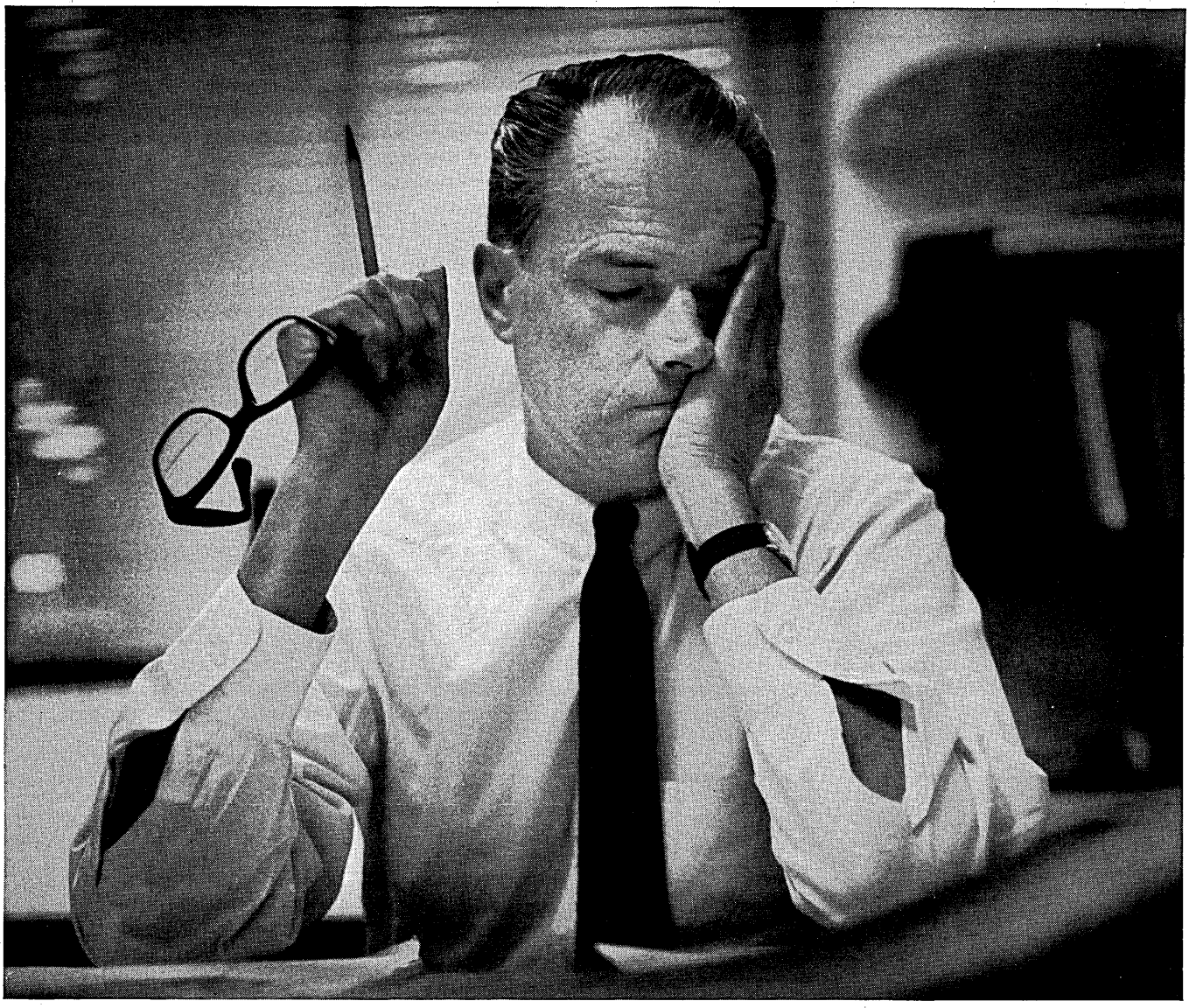
SOME MORNINGS ARE REALLY BAD



Getting down to work can be a real battle. Especially when it's the same programming assignment, week after week, after week. Even an interesting project gets boring if it goes on forever.

That's why RCA Service Company changes job assignments frequently, to keep our programmers happy and stimulated. We like to bring out the best in a programmer.

We have openings in both business and scientific programming. Business assignments include management information systems, random access applications, and information retrieval systems, among others. You'll have the opportunity to train on third generation computer systems.

Openings in scientific programming vary widely. We ask for experience in either real-time or communications programming, or scientific applications on medium to large scale computers.

You can find out more by writing or sending your resume to: Mr. J. B. Burke, Manager of Employment. RCA Service Company, Dept. Y-109, Bldg. 201-2, Cherry Hill, Camden, N.J. 08101

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new literature

TIME-SHARING: Six-page brochure describes plan which offers rate/hour on a sliding scale which is determined by the number of terminal hours used/month. Subscriber dials the computer, types in a program at a keyboard and receives printed results at the same keyboard. Typical applications are illustrated for engineering, manufacturing, accounting, education and research. Included are stress analysis, circuit design, heat transfer, multiple regression, inventory control, time and attendance, parts order, payroll and sales analysis. COM-SHARE INC., Chicago, Ill. For copy:

CIRCLE 140 ON READER CARD

CONVERTING TO THIRD GENERATION: Wall chart acts as reminder of significant areas to be considered in converting. Pointed out are the extent to which the corporate organization is both affected by and involved with the activity of a third-generation computer system. Chart is set up in six-month intervals, beginning with the 30th month before delivery, outlining which items should be considered first. THE DIEBOLD GROUP INC., New York, N.Y. For copy:

CIRCLE 141 ON READER CARD

PROCESS CONTROL COMPUTER: The Bailey 855 is described in 20-page illustrated brochure. Advantages of the 855 to the programmer, operator, engineer and to management are illustrated. Also included are discussions of peripheral equipment, man-machine and programming interface, detailed lists of specifications and command format and command list. BAILEY METER CO., Wickliffe, Ohio. For copy:

CIRCLE 142 ON READER CARD

GP COMPUTER: 14-page booklet describes computer which permits direct execution of programs written for other machines without sifting, lifting or patching. Design concept, third generation technology and advantages of using the IC-6000 are covered. STANDARD COMPUTER CORP., Santa Ana, Calif. For copy:

CIRCLE 143 ON READER CARD

X-Y PLOTTER: High- and Low-speed Series 1110 11″ x 17″ VARIPLOTTER is designed for such applications as data reduction, readout, phase plots and transistor and potentiometer testing. Brochure describes plotter, lists features, applications, specifications and operational accessories. ELECTRONIC ASSOCIATES INC., West Long Branch, N.J. For copy:

CIRCLE 144 ON READER CARD

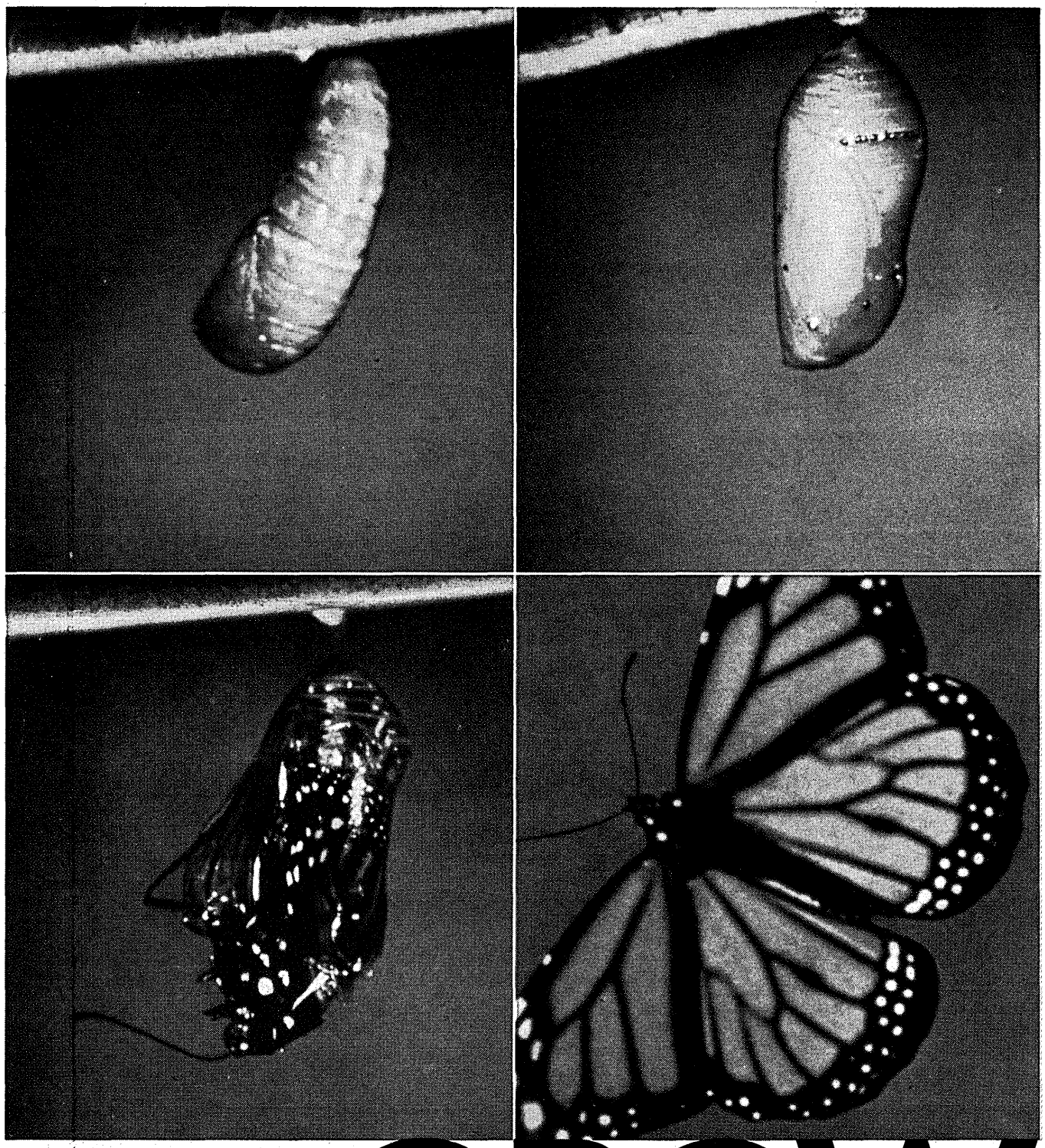
SOFTWARE PACKAGE: Called Direct Access Programming Systems (DAPS), four page brochure describes the system which provides the GE-400's with multiprogramming and communications capabilities, permitting their use for information retrieval, file inquiry and updating, program debugging from remote locations, load-sharing among computer centers, and/or source data collection, accumulation and transmission. GENERAL ELECTRIC CO., INFORMATION SYSTEMS MARKETING OPERATION, Phoenix, Ariz. For copy:

CIRCLE 145 ON READER CARD

MEMORY SYSTEM: Brochure details features of Model CE-100 which is available in 4, 8 and 16K word capacity and up to 36-bits. Series is available for 30 to 60 days delivery depending upon configuration. Pricing is between $6,000 and $10,000 for basic models. LOCKHEED ELECTRONICS CO., MEMORY PRODUCTS DEPT., Los Angeles, Calif. For copy:

CIRCLE 146 ON READER CARD

SCHOOL FORMS: Portfolio contains samples of forms including enrollment and assignment, grade progress and attendance, dismissal notices and alumni records. For use with dp equipment, there are multipart card sets for enrollments, class change orders, fee cards and, for the office, accounts payable checks, payroll and purchasing. Self-mailing dp forms eliminate envelope stuffing, economize large mailings and have proved to be



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new literature

successful for sending out grade reports. SHELBY BUSINESS FORMS, INC., Shelby, Ohio. For copy:

CIRCLE 147 ON READER CARD

CORE MEMORY SYSTEM: Eight-page brochure describes FX-18 family of 0.5K-bit memories with access time of less than 4 usec. Listed are operating and access modes, logic levels, timing, standard configurations, ambient temperature and humidity, mechanical features and details. Applications include communications, computer and data libraries. FERROXCUBE CORPORATION OF AMERICA, Saugerties, N.Y. For copy:

CIRCLE 148 ON READER CARD

DOCUMENT STORAGE AND RETRIEVAL: Brochure describes Bibliographic On-Line Display (BOLD) and lists features which include a browse capability, patterned after features found in conventional libraries; a search capability using coordinate index terms that the machine helps the user to specify; and instant display of document numbers, titles, authors and abstracts. SYSTEM DEVELOPMENT CORP., Santa Monica, Calif. For copy:

CIRCLE 149 ON READER CARD

RANDOM ACCESS STORAGE SYSTEMS: Explained and illustrated in summary sheet are general specifications of various magnetic storage drums and disc file systems. BRYANT COMPUTER PRODUCTS, Walled Lake, Mich. For copy:

CIRCLE 150 ON READER CARD

NC PROGRAMMING SYSTEM: Four-page brochure is written specifically for shop owners, foremen or parts programmers who are presently doing their programming manually or through an outside service. Principle of operation, the programming language SHOP (Shop Oriented Program) and the various machine tools that can be programmed on the PDS 1020 are described. PACIFIC DATA SYSTEMS INC., Santa Ana, Calif. For copy:

CIRCLE 151 ON READER CARD

LOW COST COMPUTER: Six-page brochure details features, specifications, system software, peripheral equipment and typical prices of the Data/620 I. Computer occupies 10½" of a 19" x 24" relay rack, weighs less than 100 lbs., and requires 350 watts. The processor is supplied with memories operating at 1.8 usec, cycle time and ranging from 1,024 to 32,768 words of 16 or 18 bits. DATA MACHINES INC., Newport Beach, Calif. For copy:

CIRCLE 152 ON READER CARD

PRINTING CALCULATOR: EPIC 3000 can perform up to 42 steps and shows line-by-line printed record of calculations. 10-page brochure explains the features and gives sample program instructions for solving quadratic equations and per cent change problems. MONROE INTERNATIONAL INC., Orange, N.J. For copy:

CIRCLE 153 ON READER CARD

SUSPENSION DRAWER CABINETS: Brochure describes in detail equipment designed for disc pack storage and explains advantages of full-suspension drawer storage, plastic laminate work tops, full length drawer handles and high visibility labelling. WRIGHT LINE, Worcester, Mass. For copy:

CIRCLE 154 ON READER CARD

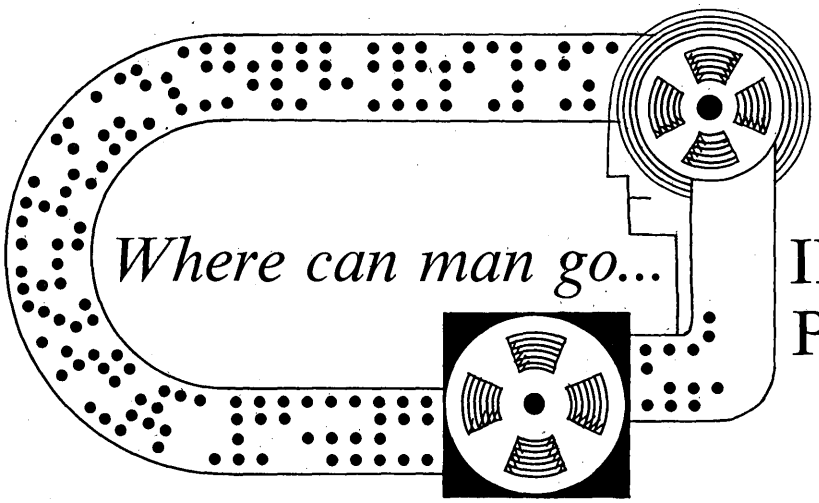
PAPER TAPE PUNCH: How data can be received and punched on paper at 240 cps is described in eight-page brochure. The DRPE operates on 5, 6, 7, or 8-level codes, including ASCII. When teamed with computers and other business machines, the unit can serve as a high-speed output device with its punched paper tape subsequently relayed by Teletype high- or standard-speed paper tape readers. TELETYPE CORP., Skokie, Ill. For copy:

CIRCLE 155 ON READER CARD

FERRITE CORE MEMORY SYSTEMS: Set of four technical data sheets describe the militarized systems that flew in Lunar Orbiter, Pioneer and Nuclear Detection Satellite programs and in a spacecraft command storage device. Capacities, speeds, size, weight, power consumption, operating temperature ranges and special features of each memory system are given. ELECTRONIC MEMORIES INC., Hawthorne, Calif. For copy:

CIRCLE 156 ON READER CARD

EVALUATING MESSAGE RETRIEVAL SYSTEMS: Various methods of evaluation of materials, processing and retrieval in terms of potential mathematical techniques, manual versus automatic procedures and user requirements and satisfaction are described in 190-page book. Cost: $3; microfiche $.65. AD-642 829. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.



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New York

meet

Ed Golden

Ed Golden is a computer professional

As with all our staff, Ed's computer background is extensive. He brings to our firm ten years of proven and varied computer experience gained with International Telephone and Telegraph (as Data Processing Manager—Europe) and with IBM (as Account Manager, District Systems Engineering Manager and Branch Marketing Manager). Ed's formal education includes a Bachelors degree in Mechanical Engineering (Dartmouth), a Masters degree with specialization in Computer Sciences (Stanford) and an M.B.A. (Harvard).

Ed Golden is a computer professional

On May 1, Ed opened our new suite of offices in New York City. If you are career oriented, this is important to you, since Ed's addition further extends our policy of professional career guidance and placement from coast to coast.

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Through his managerial experiences, Ed is uniquely able to understand your background. He realizes and appreciates individual differences, individual desires and individual objectives. In short, Ed can provide the type of intelligent career planning you justifiably demand to achieve your professional goals.

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We also have several outstanding scientific/commercial programmer analyst positions available with aggressive companies. Your current employer will not be contacted without your permission. Send resume in confidence or request our resume form.

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These positions are available in the rapidly expanding Engineering Department which will be moved to the new Computer Systems Division plant in the Pittsburgh area this summer. Outstanding employe benefits program and the opportunity for continued professional advancement in a growth industry.

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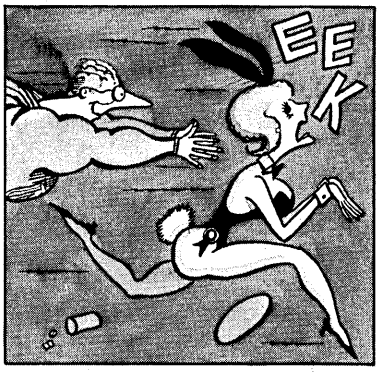
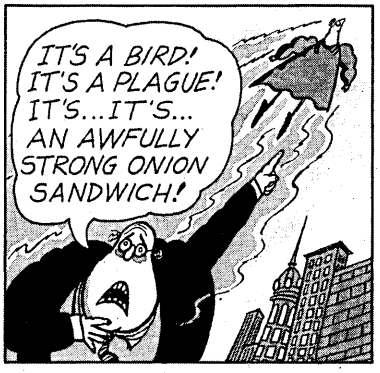
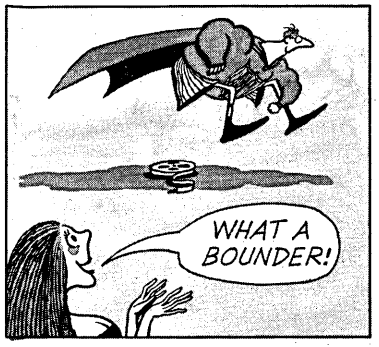
FASTER THAN A SPEEDING RABBIT.....



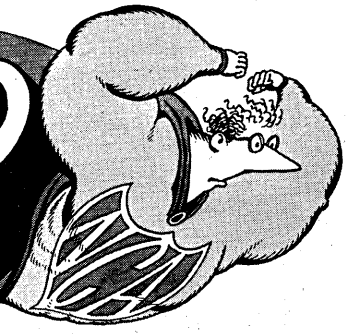
...STRONGER THAN AN ONION SANDWICH....



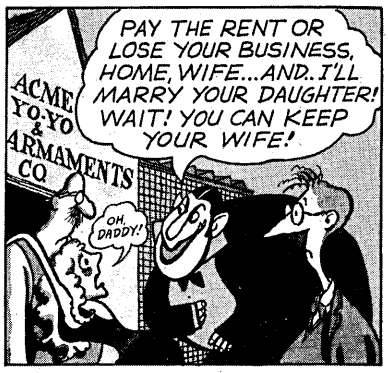
ABLE TO LEAP TALL OPERATING SYSTEMS AT A SINGLE BOUND...OR TWO...



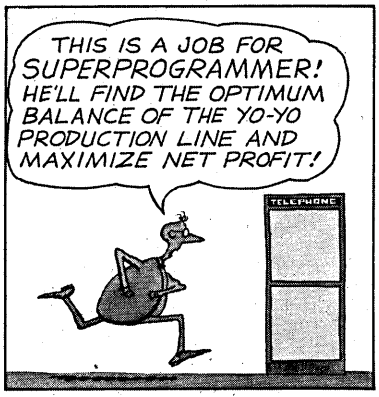
...IT'S SUPERPROGRAMMER



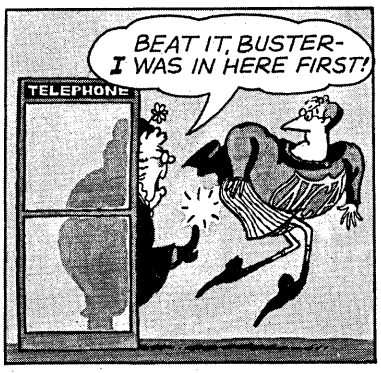
WHILE IN HIS EVERYDAY DISGUISE AS A MERE HUMAN, CLARK CANT OVERHEARS...

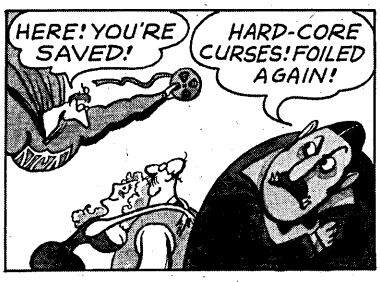


CLARK CANT DASHES INTO A HANDY PHONE BOOTH...



..AND EMERGES AS A TYPICAL NATIONAL COMPUTER ANALYSTS' SUPERPROGRAMMER!





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We intend to accelerate the generations at RCA.

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So we're looking for systems programmers who can take software into the 4th, 5th and 6th generations.

Programmers who won't be content to work on a single project for years on end.

Programmers who want a say in hardware design.

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The rewards are greater than you think.

Write to us if you've had experience in language processors, operating systems, utility systems or communications systems.

We also have openings in Sales, Field Systems Support, Product Planning and Engineering.

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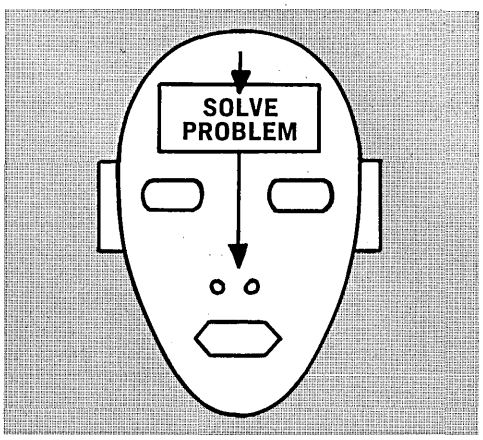

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Every individual in our growing corps of professionals is offered a variety of challenges to choose from and apply himself to.

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- Systems (6600 Software, 36/3800 Remote Multiple Access Systems)

EQUIPMENT OPPORTUNITIES

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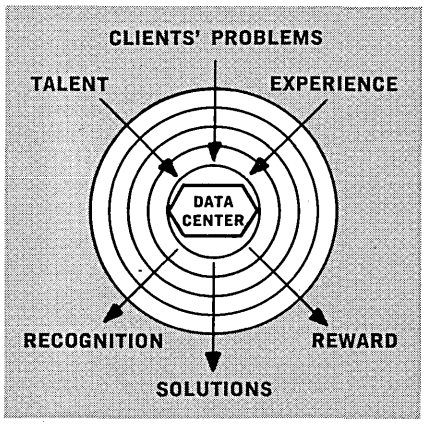
- 1604
- 8090
- 3600
- 160A
- 3800
- 3100
- 6600
- 3200



REQUIREMENTS

- Intelligence
- Imagination
- Initiative
- Computer Experience: 3 to 5 years
- Problem Area Experience: highly desirable!
- Degree Preferred — but not essential

REWARDS

- Very great. We know the value of our professional talent and it **is** financially acknowledged.

For further information, contact or send resume to:

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SPACE SYSTEMS CENTER, Bethesda, Maryland. Responsible for space vehicle programs at Huntsville, Alabama; Cape Kennedy, Florida; Los Angeles, California; and for space system design at its Washington Engineering Laboratory.

FEDERAL SYSTEMS CENTER, Gaithersburg, Maryland (Washington metropolitan area). Responsible for command, intelligence, ground support, management information and marine systems.

These are the Federal Systems Division's primary responsibilities. If you'd like to help us shoulder them, write to: Mr. J. F. Ryan, Dept. 701E, IBM Corporation, 18100 Frederick Pike, Gaithersburg, Md. 20706, and line up an appointment today.

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look ahead

(Continued from page 19)

Area. The present group grew from a three-way merger. Hochschild Associates combined with California Operations Analysis in '65 to form Western Operations Analysis. Then that company joined Bissell & Co. to make the present WO; Buford Bissell is executive vp of the latest organization.

The company avoids such chores as compiler writing and isn't considering development of proprietary programs. Instead, they concentrate on getting an installation into efficient operation -- helping with conversion, rewriting parts of the manufacturer-supplied software. And it turns out there are lots of 360 customers who could use some help.

It seems to be working out. WO is up to 40 people from eight when they started, did about $250,000 last year, and is aiming for $1 million this year.

DIGITEK CUTS EXPENSES, KEEPS DOORS OPEN

Although rumors continue to fly about Digitek, L.A. software house which has had more than its share of problems, the company is still alive and kicking, still solvent and meeting its payrolls, actually has $60K in the bank, plus a backlog of several months' work. Now down to 30 people (from one time top of 53), Digitek is negotiating to cut down office space, reduce other costs. No hot merger talks are going on, but several doors are still open. More likely is the prospect of the firm giving up partial control in return for financial help. The stock, which at one time was down to $2, has been as high as $7½; at time of writing it was in the $6 neighborhood.

RUMORS AND RAW RANDOM DATA

ACM has voted to raise its annual dues from $18 to $25, starting in Oct., will beef up its staff, turn out Computing Reviews monthly starting in '68, but nixed a move of Hq to Washington, D.C. ... Programmatics has signed an agreement with Interdata which calls for the payment of a royalty on every "Big 'I'" machine sold in exchange for Programmatics-developed software. It's probably the first such arrangement, and could start a new fad. ... University Computing has signed up for five 1108's, will probably opt for nine more later. The company has also ordered 200 Uptime 1500-cpm card readers for its new Cope .45 terminal. Uptime, by the way, is for sale. ... Merger talks between UCC and Scientific Control Corp. are off, but the UCC acquisition of Benson-Lehner is still a hot possibility. ... Among developers of microfiche and micro-microfiche, there's a move underway to standardize on the generic name, HR-fiche (high reduction film card). This might be applied to reductions of 40:1 or greater, and result in designations like 150:1 HR-fiche. ... Rumors are that housing and transportation problems may force the FJCC to abandon Anaheim as its site for next fall in favor of Las Vegas. ... Calcomp may have initiated a new way to order computers. They have purchased a GE 425 with an option to lease. ... A product that should improve the Teletype image with time-sharers is the new mod 37. It has a 150-wpm speed, generates all 128 ASCII characters, includes upper and lower case and repeat features. Keyboard has math and other special symbols. Available early next year, it will cost about 10% more than the mod 35. ... Rixon, puffed up by the recent University Computing order for 400 Sebit-48M modems (4800 bps), has also hauled in a Service Bureau Corp. contract for 70 more, to be installed in centers around the U.S.

There aren't any jobs with Lockheed Electronics at the Manned Spacecraft Center in Houston.

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It is a mission that will take generations. A mission in which Project Apollo is just the beginning. And some of the finest and most imaginative scientists and engineers are involved.

Join them, and work with Lockheed alongside NASA. You'll be able to make a direct and significant contribution on such varied projects as interplanetary trajectory simulations which are used to plan future space missions; the design of 1/6 Gravity Simulators; a comprehensive geological, geophysical and geochemical study of the lunar surface; the bit-by-bit programming of the Apollo on-board computer.

There's something special about living in Houston, too. You'll find all the educational and cultural facilities that you'd expect of the nation's sixth largest city. Yet you can live within walking distance of the Manned Spacecraft Center—with wide-open golf courses and waterways at hand.

Interested? Right now we have career openings for scientists, engineers, analysts, and programmers. Write to Mr. R. K. Glasgow, Lockheed Electronics Company, 1681 El Camino Real, Houston, Texas.

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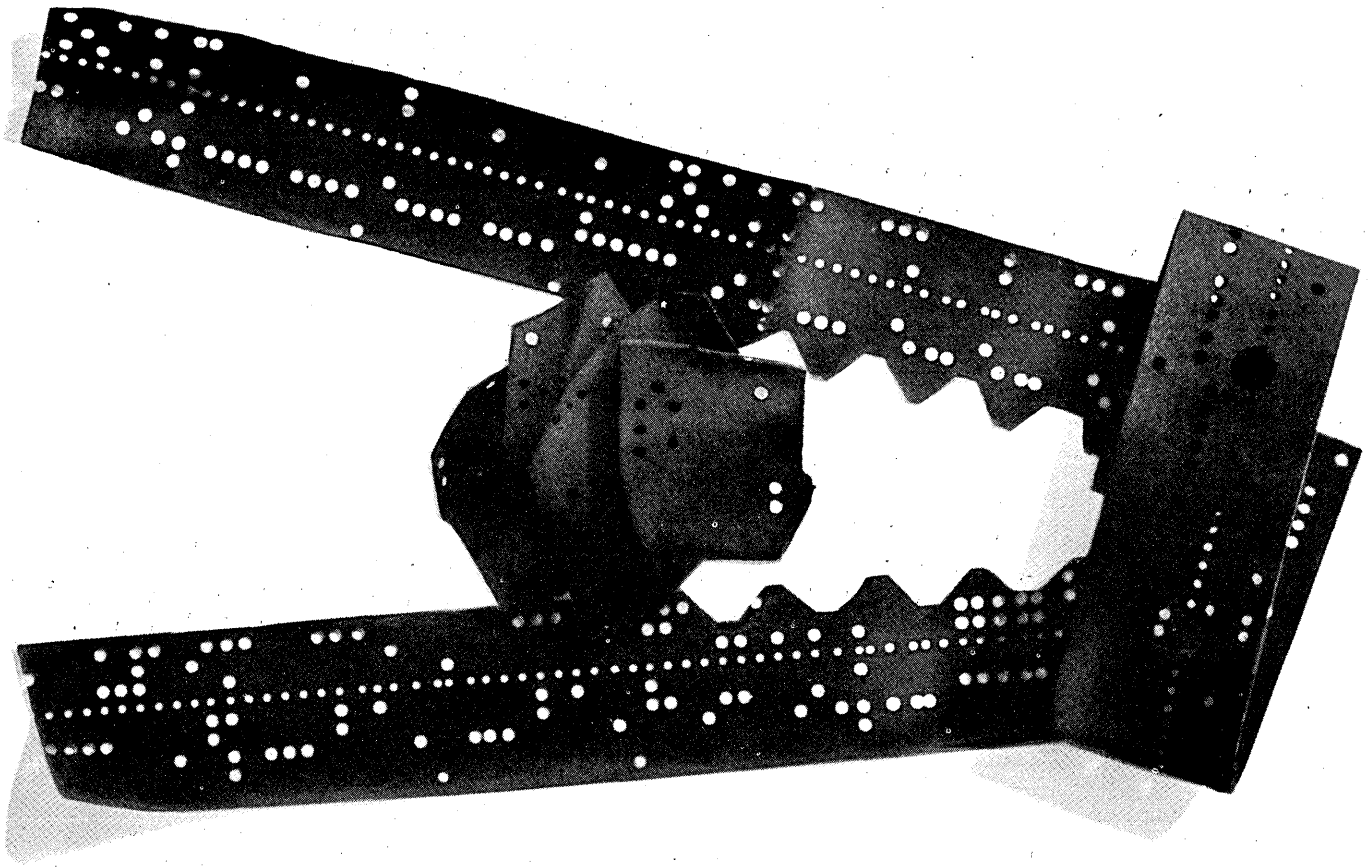

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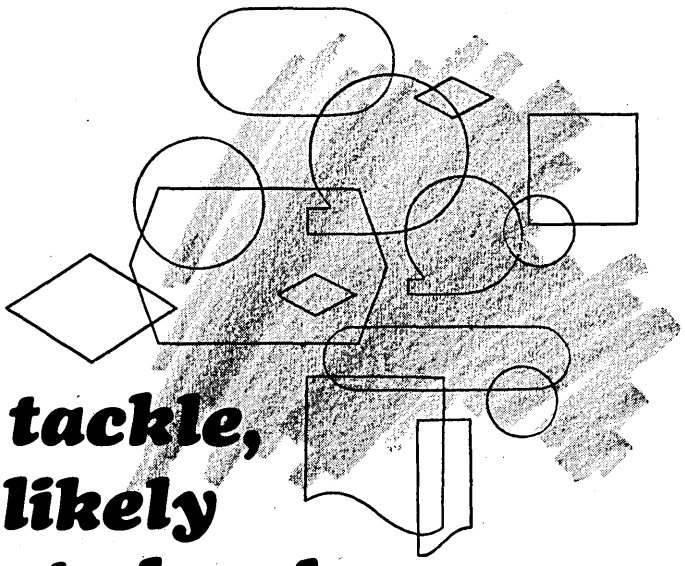

☐ Take the examples we cite. When you run head-on into problems as large and as demanding of your best as these, growth ceases to be problematical.

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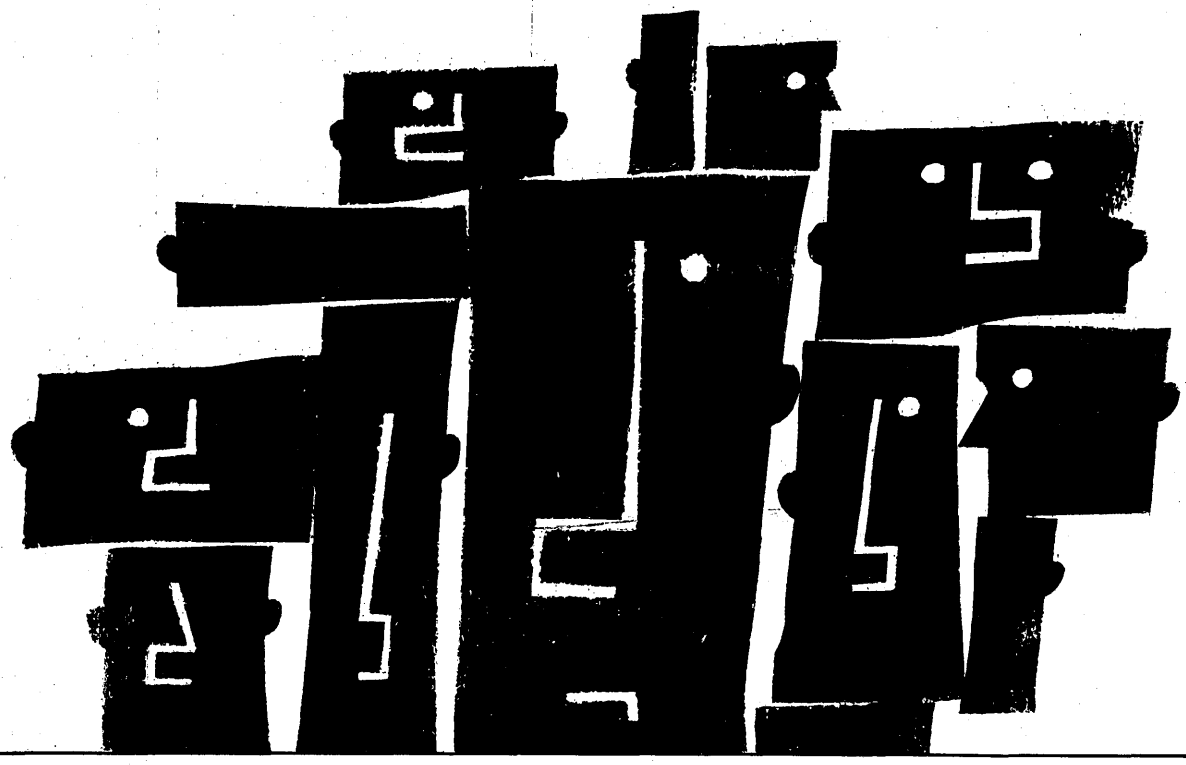

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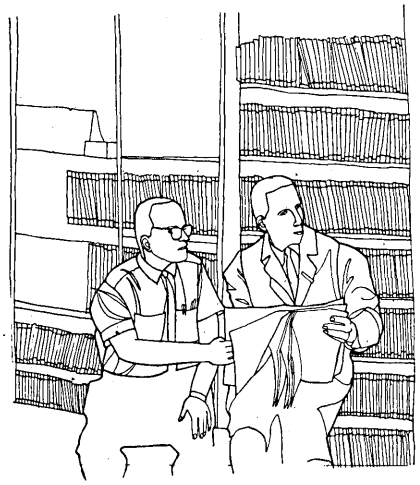
books

Pattern Recognition, Ed. L. Uhr, John Wiley, $8.95 (paperbound $5.95). The collection of published papers selected by Leonard Uhr for the volume Pattern Recognition constitutes a representative sampled-documentary of developments in this field over approximately the past 50 years.

The sampling proceeds in logical order from philosophical speculation early in this century through recent experiments on computer-simulated pattern recognition models. In between, the results of psychological experiments on humans and animals, some basic abstract models of pattern recognition, and neurological findings made possible by the development of the microelectrode are reported.

The 381 pages are broken in that arrangement into five sections, whose contents may be summarized as: 1) philosophy (Pierce, Cassirer, Craik, Wittgenstein), 2) psychological experiments (Vernon, Wohlwill, Attneave and Arnoult, Hake), 3) pre-computer models (Deutsch, Dodwell, Marshall and Talbot, Reichardt), 4)



microelectrode studies (Barlow, Burns, Heron and Pritchard, Hubel and Wiesel, Young), and 5) computer models (Roberts, Bledsoe and Browning, Grimsdale et al, Selfridge, Uhr and Vossler).

The intended audience for this collection is not specified, but is most likely to lie in the area of psychology, for two reasons. The weight of selection has been in the direction of papers with the flavor of behavioral or neural modelling. And emphasis is light on specific techniques which have been in the main stream of mechanized pattern recognition for the last five years. With the exception of Uhr's own concluding paper published in 1965, no inclusion is less than four years old.

For the purposes of current practitioners of mechanized pattern recognition, the book's contents probably err in the direction of excessive history. To one steeped in computer technology, otherwise excellent scientists such as Pierce and Cassirer seem unduly vague, confused and badly in need of training in semantics when they attempt to grapple with the nature of pattern recognition on the basis of early twentieth century thought.

The section on psychological test results contains good general background on the subject of human capabilities and limitations, but is probably more suitable for teacher training in elementary schools than for engineering modelling. It is interesting to observe, however, that mechanized pattern recognition techniques are sometimes used in trying to solve problems difficult for humans. Cases in point are Wohlwill's findings on the effect of age upon matching projected (retinal) sizes of objects, and Hake's report that recognition rates are affected by object rotation.

Of the pre-computer models for pattern recognition, Deutsch's paper on the possible utility of broadcast or two-dimensional propagation of information in neural-like networks stands as a unique contribution. It has spawned a number of subsequent studies, none of which, unfortunately, has been adequately simulated. The other papers contain useful reviews of prior work in their own right, together with extensive bibliographies. Reichardt's development of a servo-like model of beetle behavior is a tribute to the prediction ability of relatively linear models. It is unfortunate that the editor was compelled to omit from this section the work by Lashley, which is frequently referenced by the other authors, as is that by McCullock and Pitts.

The section on microelectrode studies in the optic neural pathways of animals essentially culminates in the outstanding paper by Hubel and Wiesel on the nature of retinal receptive fields in the cat. The identification of localized "shape detectors" for frequently occurring pattern fragments such as edges, straight lines and contrast gradients in biological organisms has probably done more to strengthen the confidence of engineering approaches along these lines than any other single finding of the past decade. Again, it is understandable

books

but unfortunate that other work in this area, such as that by Lettvin, had to be omitted because of space limitations.

Papers in the section on computer models, while providing a good historical roundup of some basic concepts, suffer from being somewhat outdated at this time. Most use printed or handwritten alphabetic characters as experimental material, and cite computer recognition times in the range of seconds per character, a m. leading rate by present standards. The perceptron (learning) approach tc pattern recognition, represented by Roberts' paper, is seriously under-reported due to the omission of convergence proofs (of which many now exist), size-limits (Cover's work relating variable weights to number of trainable patterns) and related Madaline work. Bledsoe and Browning's classical (1959) paper on n-tuple "feature" extraction is a useful historical inclusion. Selfridge's description of Pandemonium and related "hill-climbing" techniques is also of conceptual interest, but suffers from the lack (1958) of experimental confirmation. Uhr and Vossler's unique concept of using features abstracted from the pattern environment for a form of "evolutionary" recognition properly deserves its place among models of this general era.

In Uhr's concluding paper (1965) it is clear that the editor is aware of the main streams in modern machine pattern recognition technology. One can only object to his summary on grounds of emphasis, in the discussions which may not properly represent two-level as opposed to multi-level decision structures. His statement of the scientific method in the field of pattern recognition is to be commended: "We can objectify the hunch . . . into the form of a computer program, and simply see how well it works . . ."—J. K. HAWKINS

book briefs

(For further information on the books listed below, please write directly to the publishing company.)

Computer Design, Ivan Flores. Prentice-Hall, Inc., Englewood Cliffs, N.J. 1967. 465 pages. $10.50.

Detailed discussion on the digital uses of transistor circuits, including all programming and software fundamentals needed for comprehension of logical

design. Intended for introductory courses in computer design at college level.

***Applied Microelectronics*, edited by C. F. O'Donnell. America House, Washington, D.C. 1966. 267 pages.**

An applications guide for the system and subsystem designer based on experiences in applying microelectronics to advanced electronic systems. Discusses ability to combine several discrete electronic functions in a single semiconductor chip. Chapters by editor and four co-authors.

***Hierarchical Structure: A Model of Design and Planning Processes*, Marvin L. Manheim, M.I.T. Press, Cambridge, Mass. 1966. 228 pages. $8.50.**

An experiment in the use of Bayesian decision theory for guiding an engineering process; example situation is the description of the process of solving a highway location problem.

***Control Systems Functions and Programming Approaches (Volume A: Theory)*, Dimitris N. Chorafas. Academic Press, New York and London. 1966. 395 pages. $16.**

Fundamental programming aspects of control systems, with application examples in petroleum, chemical, power, steel, transportation, and other areas. Intended for management at policy levels, as well as computer users.

***Mathematical Methods for Digital Computers, vol. 2, edited by* Anthony Ralston and Herbert S. Wilf, John Wiley & Sons, Inc. 1967. 287 pages.**

A sequel to the first volume, containing new material. Contents include a comparison of ALGOL and FORTRAN, chapters on the quotient-difference algorithm, numerical linear algebra, numerical quadrature, numerical solution of equations, and miscellaneous methods.

***Legibility of Alphanumeric Characters and Other Symbols: II, A Reference Handbook*, D. Y. Cornog and F. C. Rose. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 460 pages. $4.25.**

Second of a series of related reports on projects at the Institute of Applied Technology, National Bureau of Standards. Purpose of the handbook is to give the user enough information about these projects to enable him to decide if he wants to go to the original sources.

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people

■ Dr. Roger N. van Norton has been appointed professor of systems engineering and director of the computer center, Univ. of Arizona, Tempe, Ariz. He was formerly a senior scientist with New York Univ.'s Courant Institute.

■ Solomon L. Pollack has joined the staff of Information Management Inc., San Francisco, Calif., as director of consulting services. He was formerly manager of operating systems at North American Aviation's Space and Information Systems Div.

■ J. A. Haddad has been elected vice president for engineering, programming and technology, IBM Corp., Armonk, N.Y. Employed by IBM for over 20 years, he was instrumental in the design and construction of the 701 computer.

■ Jim McPherson has joined Applications Software Inc., San Pedro, Calif., as manager of applications programming. He was previously associated with Computer Sciences Corp.

■ George H. Mealy is now an independent consultant, specializing in operating systems, in the Boston area. An ex-IBMer, he had worked on the SHARE OS for the IBM 709 and, most recently, the planning and design of OS/360.

■ Richard M. Bloch has been named a vice president of the Auerbach Corp., Philadelphia, Pa. He is a former vp of Honeywell EDP in Wellesley Hills, Mass.

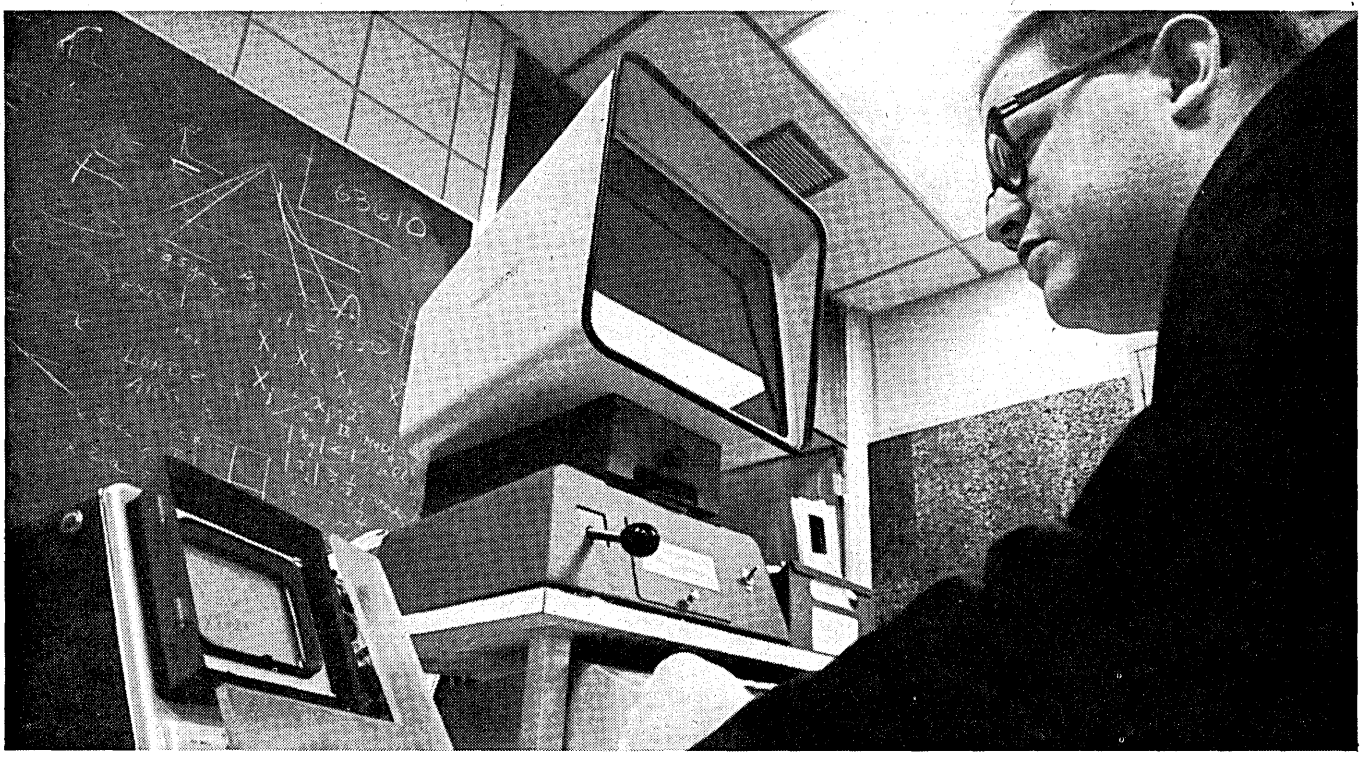
■ Meade C. Camp has been named regional manager for McDonnell Automation Center's new Washington, D.C. office. He was formerly with C-E-I-R, Inc.

■ Broadus H. King, Jr., is now executive vice president, ARIES Corp., McLean, Virginia. He was previously vp, operations.

■ Marc de Ferranti has been named executive vice president, Electronic Associates, Inc., West Long Branch, N.J. He was formerly director of the telecommunications group of the Plessey Co., Ltd., in England.

■ David A. Nelson, a vp and founder of Programmatics Inc., has resigned the company to become an independent computer programming consultant in Moorestown, N.J.

TRW is Tom Vickers optimizing spacecraft reliability



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CIRCLE 349 ON READER CARD

the forum

The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

DIARY OF AN ON-LINE INSTALLATION

(Although names and numbers have been changed, this adventure is not fictional.)

The following is a description of the problems we encountered with the installation of a keyboard/printer terminal and the use of the XYZ Corp.'s time-sharing system. If we are experts in the field of computer communications, the non-experts must really have trouble.

Dec. 5, 1966—The whole thing started when XYZ offered us the use of their time-sharing system, for free, if we would supply the terminal, data-set, and line. In return they would benefit from experience gained by expert users plus any programs we developed which might be of general interest. XYZ was already using keyboard/printers over voice lines. We were told that they were Model 66's with 808C data-sets and the ASCII character set, so that's what we ordered.

Feb. 4, 1967—The terminal was installed and checked out by the supplier. The first attempts to use the system met with complete failure. The first problem we uncovered was half expected, based on an identical experience in connection with another on-line operation in August. "808C" is not a complete description of that data-set. XYZ uses 806A dataphones. "806A" is also an incomplete description. There are 806A1 dataphones and there are 806A2 data phones, and they don't talk to each other. An 808C is an 806A mounted in the same chassis. We had an 808C2 and XYZ had . . . you guessed it . . . 806A1's. Fortunately (?), XYZ did have one 806A2. Its use was normally restricted to the XYZ head office; however, they were willing to allow us to use it on a low priority basis until more 806A2's were available.

With hope in heart and all that, we dialed the 806A2 and got a connection. Anything we typed in was either greeted by stony silence or, at unpredictable times, the message *TRY AGAIN. We knew that this message is an indication from the computer that the information received is not something that can be recognized as having validity to the system. The most obvious place to look for trouble is at the end of each input line. If the computer does not recognize that we have completed a line, it will not take correct action. We called the people at XYZ and, after verifying that all other terminals were working properly, we asked if the key labeled ESC would function as the end-of-line indicator, since it occupied the same space on the keyboard as their end-of-line character. On their terminals this is labeled ALT MODE. The answer, of course, was no. What do you do if you have no ALT MODE key? Would you believe "get one"? All right, we then called the supplier to order an ALT MODE key. Go to the head of the class if you have already figured that it is an obsolete feature and you can't get them no more. The people at XYZ are very accommodating. Because of the trouble we were having and the fact that the function of that key has changed three times in the past 15 months, they agreed to rewire their communications line adapters and reprogram the system to accept a carriage return (RETURN) as the end-of-line character. We don't expect the function of that key to change.

Feb. 13, 1967—By working through a weekend, XYZ made the changes necessary to get us on the air. With fresh hope and a luncheon bet riding on the results, we dialed the only 806A2 at XYZ. The connection was made and we keyed in a request for ECOMP, the engineering calculator program. Wonder of wonders, the system responded as it was supposed to, with a cheery *OK, and asked for a user identification. We entered one known to be valid and were rewarded with a quick carriage return and a typeout of the vertical arrow. We knew that changes had been made to the system so we weren't sure whether it was good or bad, but we went on to attempt some calculations. We got a lot of nasty comments from the terminal about the validity of our inputs and nothing else. They also have a very simple checking program which accepts a string of characters ,and types them back. We tried it with very confusing results. Sometimes it worked and sometimes it didn't. After a while, we discovered that the pattern was predictable. Any character whose ASCII representation contains an odd number of bits was accepted, and those which have an even number were rejected. We called the salesman at the supplier and were told that all their terminals generate an 8-bit which is transmitted with every character. By calling XYZ and taking over the computer for our exclusive use, we discovered that all of the characters that were failing were causing a character to be generated in the system which had the same bit pattern as the RUB-OUT from the terminal. The computer program is written so that when this character is followed by the end-of-line, the entire preceding line is cancelled. This was an extra character and, to add to the general confusion, we found that we could transmit any combination of characters as long as the last one had an odd number of bits.

We were also told by the supplier that terminals are available which generate the 8-bit only when it is needed to make transmission parity even. Since we were now sure that our problem had to do with parity, we again called our salesman to find out how difficult and how long it will be to get an even-parity terminal. We were told that he was out of his office,

would not be back until tomorrow, and there was no one available to handle his business. We will try again tomorrow morning.

Feb. 13, 1967, pm—There are some interesting facts which have come to light. When XYZ bought their terminals, they bought the least expensive models available. That means that their machines do not have the parity generator. If we can't operate when they do, we must have the even-parity keyboard. We have done a little internal snooping and have convinced ourselves that this is most probably true. Now the question is, did we, inadvertently or otherwise, order the even-parity feature, or did we just get lucky and get it for free?

Another interesting occurrence is that we were able to communicate directly with the "terminal in a suitcase" built by ZYX Company. This is one of the no-parity terminals connected to an adaptor manufactured by another company which allows any Model 400 handset to be used as if it were a sending data-set.

Feb. 14, 1967—Our Valentine's Day present from the supplier. The man there says XYZ does have the standard (no-parity) terminals. If we don't work when they do, we must have the even-parity machine. We did not order same and they will swap at no cost to us. The only question at this point is: how long will it take to come up with a replacement machine?

I guess there is one more question. What will the next problem be?

Feb. 16, 1967—Guess what? The problem didn't go away. The supplier's friendly local repairman was out this morning. He says that all Model 66's come with even parity now. Actually, they have been that way for the last six or seven months. The sales manuals are a little out of date. He will try to find a non-parity keyboard and replace the one we have. He expects to be able to do it this morning. If he can't find one, we will have to get in line again or something like that.

Later

The world is like a barrel. The repairman just called and said that he has a non-parity keyboard, but there is one small problem. We will have to take an ALT MODE key in place of the ESC key. I have just lost all faith in the world.

—Dr. Rufus Pooble, Jr.

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CIRCLE 2 ON READER CARD

Core, plane or stack problems?

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Application: Core memory stack for real-time display system in ship-board fire control computer.

Problem: Hostile thermal environment, critically limited space restrictions.

Solution: Single-area, double matted printed-circuit board construction; bus-wire bridging to allow air-flow cooling of 30-mil wide temperature range cores.

Application: Core memory stack for navigational guidance computer in commercial avionics system.

Problem: Mil-reliability at commercial prices; NDRO operation; volume reproducibility.

Solution: Single-area, single-matted plane, plastic laminated terminal frame construction; bootstrap patterns with 30-mil cores on extremely tight centers.

Application: Low cost core memory stack for state-of-the-art commercial-computer main memory.

Problem: High speed, low noise, high output uniformity, repairability, expandability, 650 ns cycle time, ease of access and interface.

Solution: 2½D organization; planar construction to offer lowest cost and convenient access; 20-mil cores; stack mounted diode modules.

Application: Core memory stack for guidance computer in missile-borne avionics package.

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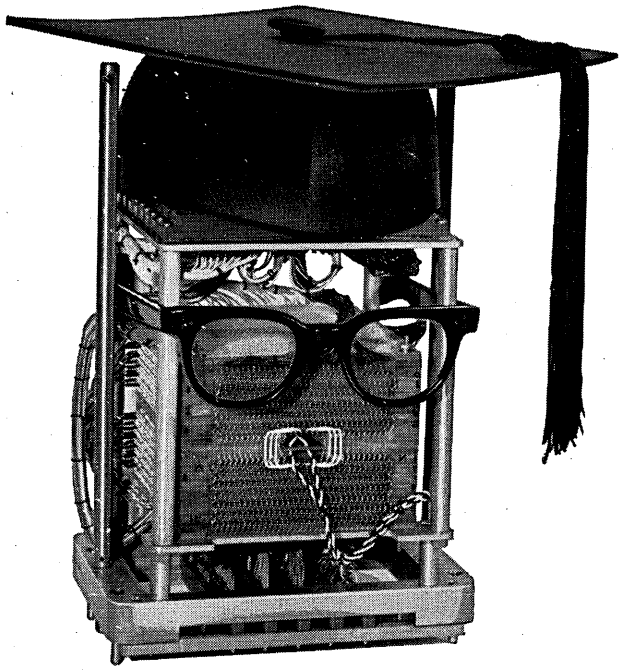

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CIRCLE 3 ON READER CARD