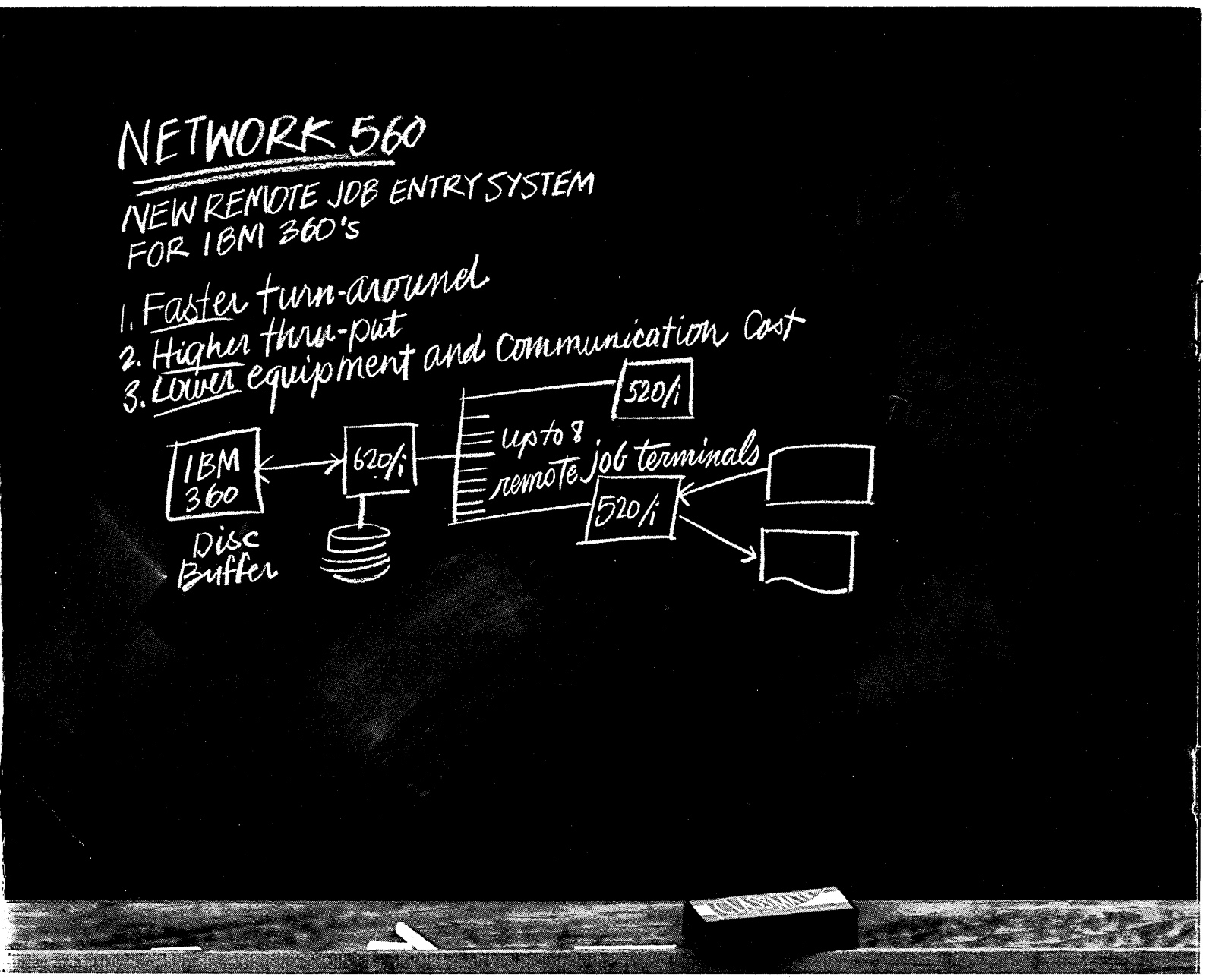
DATAMATION®

69

May

a pattern for progress emerges

hospital edp



Now try to erase that from your mind.

Not that you'd want to. Because Varian Data's new Network 560 Remote Job Entry System offers demonstrable advantages to every user and seller of 360 computer time.

This batch terminal package, as indicated above, is a complete turnkey system using standard full duplex telephone lines. Just plug it into your 360, and you're in business. All hardware and software are included, so no changes are necessary to existing programs, operating procedures or hardware.

And, since the Network 560 is as compatible to a 360 as one of its own tape units, the new system can be installed virtually overnight.

So if you agree that greatly increased earning capacity and equally lower equipment and communications costs make sense, then it's time your 360 and the Network 560 got together.

Why not call today or write for the new brochure?

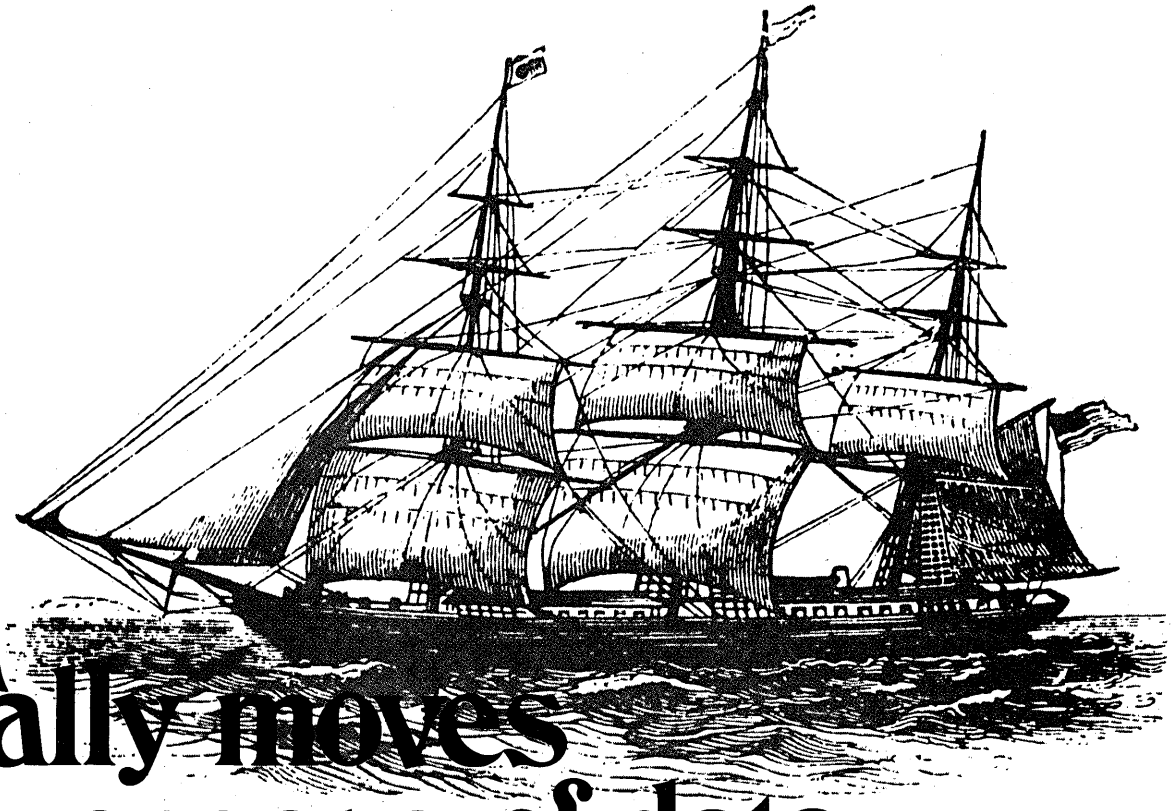
varian data machines

a varian subsidiary
2722 Michelson Drive / Irvine / California 92664
(714) 833-2400

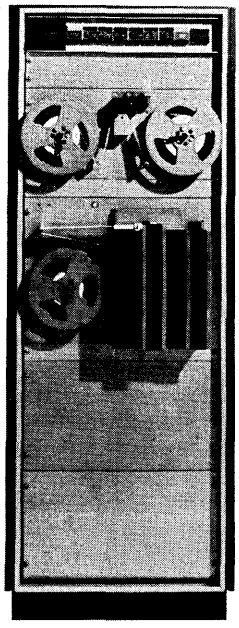
See the Network 560 at the SJCC Varian Booth 2104-2108.

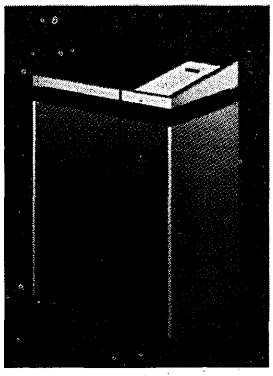
SALES OFFICES: U.S., San Diego, Santa Monica and San Francisco, California; Vernon and Westport, Connecticut; Chicago, Illinois; Houston, Texas; Fort Washington, Pennsylvania; Washington, D.C.; Waltham, Massachusetts. INTERNATIONAL: Australia, Belgium, Canada, France, Germany, India, Italy, South Africa, Sweden, Switzerland, United Kingdom and Ireland.

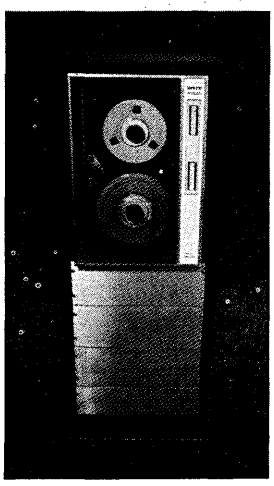
CIRCLE 1 ON READER CARD



Tally moves oceans of data for less.







Besides moving huge volumes of data over domestic telephone lines, Tally transmitters also move oceans of data over miles of ocean. Both overland and under, with communications satellites or undersea cable, Tally customers link far-flung operations with their central management information center.

Tally makes the broadest line of data communication terminals on the market today. Systems that handle source data from perforated tape, magnetic tape, or punched cards. For high speed computer throughput, there's our 360 communications buffer.

A proven performer, the System 311 transmits paper tape at 1200 words per minute and automatically eliminates transmission errors as they occur. Tally's new serial printer delivers hard copy data at 60 characters per second.

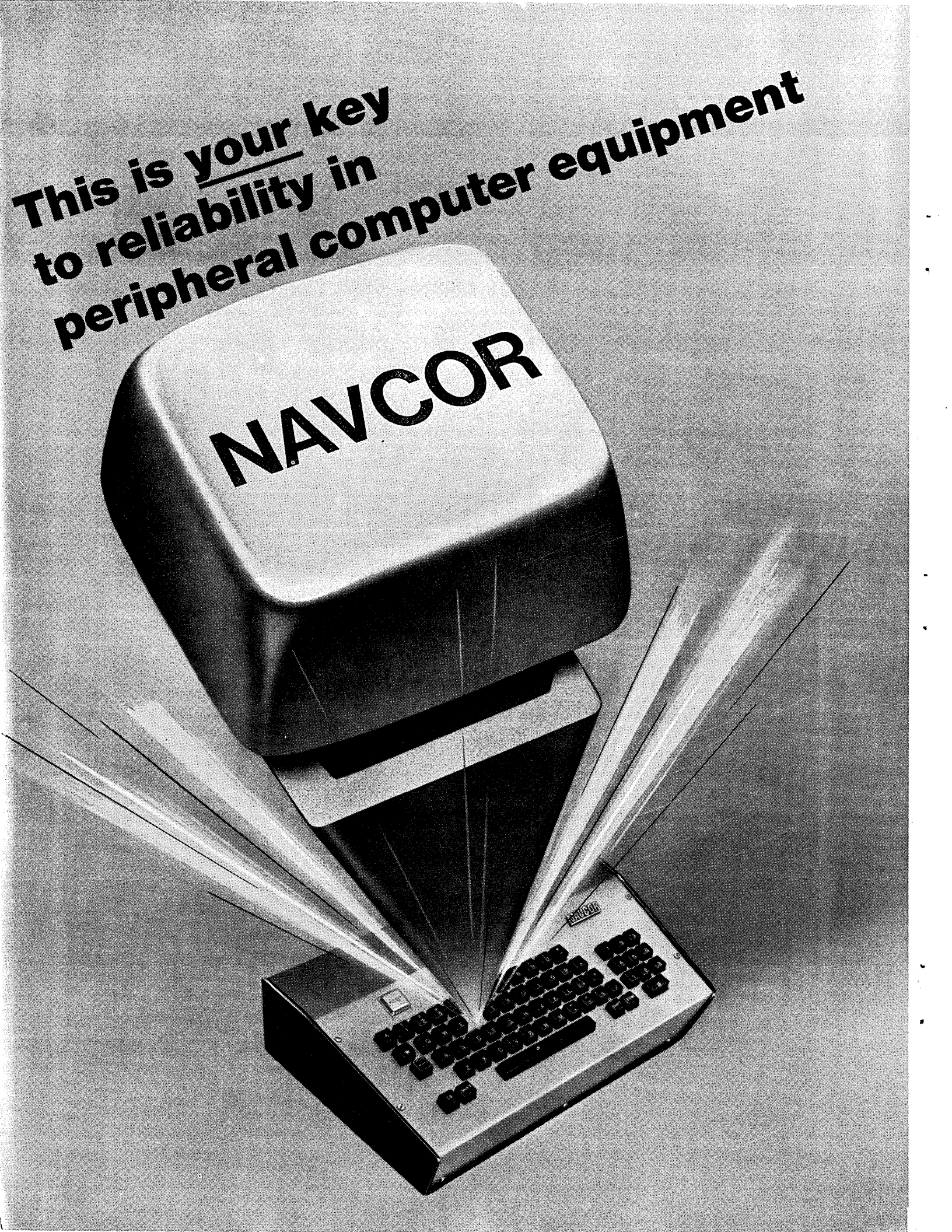
The System 4031 magnetic tape send/receive terminal operates with all Tally systems to provide computer compatible tape in 800, 556, or 200 CPI, 9 or 7 track formats.

For more information about Tally data systems, write or call today. Tally Corporation, 1310 Mercer Street, Seattle, Washington 98109. Phone (206) 624-0760.

Or contact one of the regional offices:
New York: 45 N.Village, Rockville Centre 516-678-4220
Chicago: 33 N. Addison Rd., Addison, Ill. 312-279-9200
Los Angeles: 1222 E. Pomona, Santa Ana 714-542-1196
Seattle: 1310 Mercer St., Seattle, Wash. 206-624-0760
Washington, D.C.: 1901 Ft. Myer Dr., Arlington, Va. 703-525-8500
England: 6a George St., Croydon, Surrey (01) 686-6836

TALLY®

This is your key to reliability in peripheral computer equipment



And, since this is a key on the NAVCOR Model 1050 keyboard, it has a life expectancy of over 100-million operations. That's reliability . . . NAVCOR reliability!

But NAVCOR is not just keyboards. It's tape punches and readers, logic modules and electro/mechanical peripheral systems . . . most of all, NAVCOR is ideas! Ideas on how to help you turn the "weak" peripheral equipment link in your computer system into one of the strongest, most reliable parts of the operation. Here are a few of the items that can eliminate costly downtime.

Keyboards

Fully electronic, NAVCOR keyboards are versatile, reliable and easy to operate. Available in a variety of standard or special configurations. Key signals may be used in direct interface or can be coded, as required. An electronic interlock prevents double strike errors. All components are modular for fast, easy replacements. **Need an electronic mil spec keyboard? . . . NAVCOR makes them!**

Tape Readers

One for every budget . . . one for every job. NAVCOR's compact tape readers accommodate either paper or Mylar® tapes and are compatible with 5, 6, 7 or 8 level formats. Internally driven, they are designed to offer positive interrogation of well-worn tapes. Synchronous and asynchronous operation, with speeds to 300 characters per second.

Keyboard Perforator

Keyboard operated, this desk-top unit prepares 8-level, 1-inch perforated tape on paper or Mylar®. Completely self-contained, it has the "feel" of a standard electric typewriter. Interlock prevents double-strike and modular construction keeps maintenance to a minimum. **Customized to fit your application requirements.**

What's Your Problem?

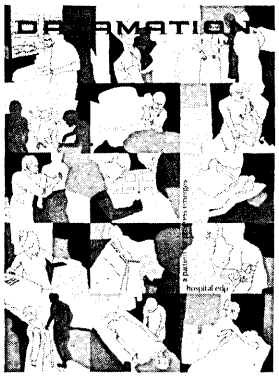
Need a special keyboard? . . . Have a unique problem for punched paper tape input or output? . . . If so, come to NAVCOR first. Chances are, you will in the end anyway. The men at NAVCOR pride themselves in being problem solvers . . . and they haven't been stumped yet. Try them on a really tough one . . . at times even their competitors do. For more information, call 215-666-6531, or write, NAVCOR, Inc., Valley Forge Industrial Park, Norristown, Pennsylvania 19401.

NAVCOR, INC.

A DIVISION OF KDI CORPORATION

CIRCLE 5 ON READER CARD

NAVCOR INC.



may 1969

volume 15 number 5

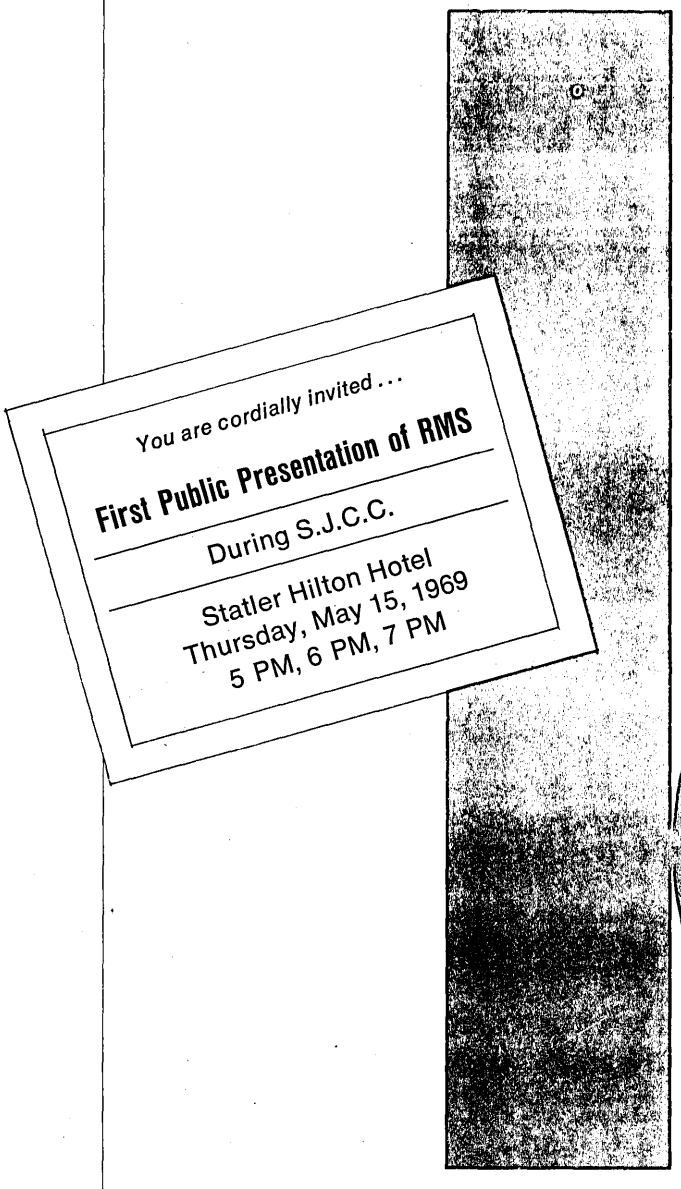
BRANDON
APPLIED SYSTEMS

announces

Resource Management System

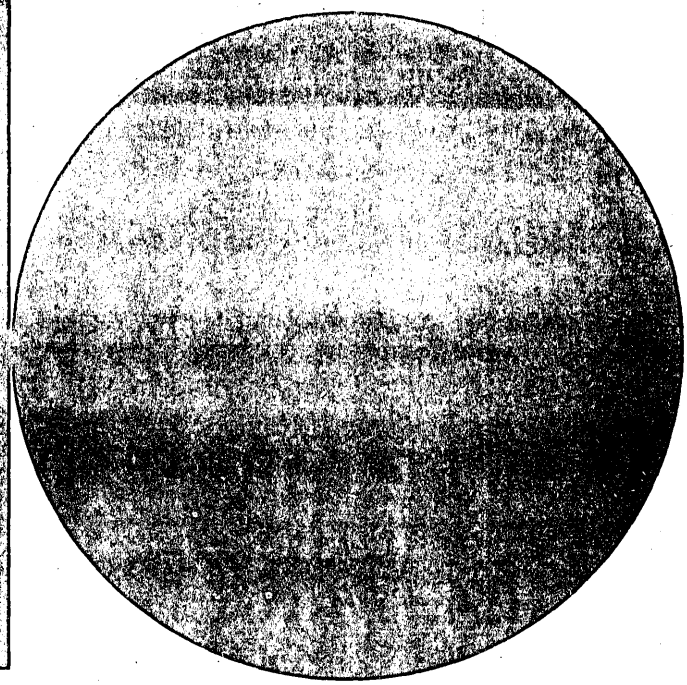
A new, computer-based system for planning, scheduling, and controlling equipment and personnel in data processing installations. Designed in conjunction with some of the nation's most progressive computer users, RMS is truly a management-oriented software system for improved EDP performance.

- Improved equipment utilization
- Improved scheduling of personnel
- Job and cost allocations
- Automatic schedules, budget estimates, reports
- Notification of potential equipment shortages
- Ability to test scheduling alternatives
- Automatic re-scheduling of backlogs
- Complete tape and disc library facility



We would like to send you detailed information. Write to us, requesting RMS brochure.

BRANDON APPLIED SYSTEMS, INC.
1700 Broadway, New York, N.Y., 10019



DATA PROCESSING ☐ CONSULTING ☐ TRAINING ☐ PROPRIETARY SOFTWARE ☐ SYSTEMS DESIGN ☐ STANDARDS ☐ PUBLISHING

BRANDON APPLIED SYSTEMS, INC.

NEW YORK CHICAGO WASHINGTON DALLAS PRINCETON LONDON

From the original painting by Neil Boyle

AESCULAPIUS

Health services is one of the fields for which Planning Research Corporation is designing computer systems. Forty-two current projects in the computer sciences range all the way from the design of systems for all types of business, including stock brokerage houses...to very large, very complex management information systems for state governments and Federal agencies... to the most difficult scientific programming required in advanced space systems.

For businesses we design and implement systems to produce *information* (not raw data) that management uses to improve operations.

We can do this because, in addition to the computer sciences, our professional staff of 2,000 members represents *more than 40 other areas of knowledge,* including business administration, economics, the physical, life, and behavioral sciences, and most branches of engineering.

We probably already have some knowledge of your field of activity; but we believe that only by knowing as much as you do about your operation *and your people* can we begin to design a business system that is optimal for you.

A brochure, *Computer Systems Design,* describes our capability. For a complimentary copy, write to Mr. John N. Graham, Jr., Vice President for Computer Systems Design.

PLANNING RESEARCH CORPORATION

Home office: 1100 Glendon Avenue, Los Angeles, California 90024

An Equal Opportunity Employer. Candidates are invited to write to the Administrator for Professional Staffing.

DATAMATION 69®

may
1969

volume 15 number 5

automatic
information
processing
for business
industry & science

datamation departments

ASI-ST

the industry's most advanced, general-purpose information management system shifts your costly programming burden to the computer

A proprietary system designed and implemented by Applications Software, Inc., ASI-ST is now operational on a wide variety of computers including IBM 360 (OS and DOS) Models 30-75 and RCA Spectra 70 (TDOS) Models 35, 45, and 55. It is currently being developed for other third-generation machines including an on-line conversational version.

USER BENEFITS

Easy-to-use ASI-ST language notation enables nonprogrammers to use it successfully after less than one day's training. ASI-ST's flexibility breaks the programming bottleneck traditionally associated with most EDP applications. ASI-ST saves you time and money while increasing the productivity of your staff.

WHY IT'S GOOD

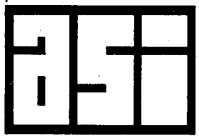
ASI-ST is a nonprocedural language compiler that processes multiple jobs accessing one or more data files in parallel. Its efficiency in compiling and executing many jobs concurrently is a primary built-in design characteristic. As an illustration, the degree of simultaneity achieved by ASI-ST on a machine as modest as an IBM 360/30 (DOS) with 32K yields a throughput much larger and faster machines operating in a multiprogramming mode can't approach . . . unless, of course, such installations have ASI-ST! Because ASI-ST produces object programs resembling those traditionally tied to assembly language code, its performance is further enhanced. By contrast, the more common interpretive and table-driven file management systems perform poorly. ASI-ST's modularity makes it the focal point of a comprehensive management information system.

WHO DEVELOPED IT

ASI-ST is the direct outgrowth of more "hands-on" experience in successfully developing more predecessor systems across a wider variety of computers than any other software firm in the industry. Examples of packages that the ASI-ST development team members have played major roles in developing include MARK I, MARK II, MARK III, SDS MANAGE, ASI MANAGE, FRUGAL, and the general-purpose information retrieval and report-preparation system currently used by the Office of the Secretary of Defense. In addition, members of the development team participated actively in the development of six COBOL compilers and three FORTRAN compilers.

The blend of talent, disciplines, and experience reflected by these accomplishments has resulted in a general-purpose software product that is THE state-of-the-art tool for business data processing.

For further information on how ASI-ST can help you, contact:



Applications Software Inc.
21515 Hawthorne Blvd.
Torrance, California 90503

CIRCLE 8 ON READER CARD

the new GA 18/30 from General Automation

Here's a new industrial computer system completely software compatible with IBM's 1800 and 1130. This program compatibility allows you, the IBM 1800 and 1130 user, to apply your experience to automation projects throughout your company.

With this compatibility you can take advantage of your software investment and add compatible computer power at less than 40% of the cost of IBM equipment.

For sheer computer power, the new GA 18/30 processor executes over 400,000 instructions per second, has an 18-bit (including parity and protection) word length, and a 960-nanosecond directly addressable memory available from 4K to 32K. The GA 18/30 has 16 GP hardware registers with an extra-powerful class of register-to-register commands.

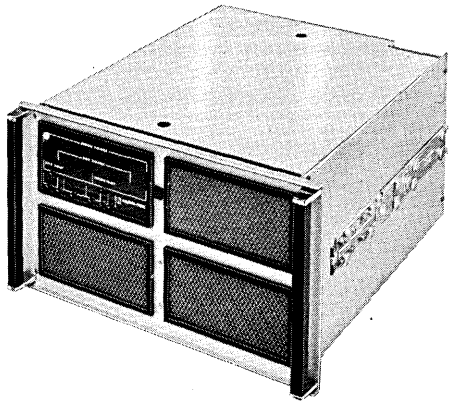
The GA 18/30 system includes data processing, communication, and process I/O. The data processing I/O includes magnetic, paper tape, discs, cards, printers and plotters. The process I/O includes — analog, digital, communications and contacts.

With its low cost and early delivery the new GA 18/30 will allow you to immediately undertake new automation projects.

We have all the facts and figures on the GA 18/30 in a new brochure. Write for it today.

Sales Offices: Waltham, Mass. (617) 899-6170 • Willow Grove, Pa. (215) 657-2657 • New Rochelle, N.Y. (914) 235-9300 • Eau Gallie, Fla. (305) 727-3205 • Wheeling, Ill. (312) 537-3500 • Cleveland, O. (216) 333-8366 • Dallas, Tex. (214) 358-0271 • Los Altos, Calif. (415) 941-5966 • Orange, Calif. (714) 633-1091

Space trade-offs are a pain in the rack



...and Fabri-Tek's NEW 380 Core Memory System packs 655,380 bits of fast relief in a case that's only 10½" x 19" x 21" ... including complete power supply!

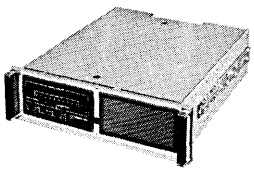
Or maybe you need even more capacity. Fine. The new 380 System is *expandable to over 2.6 megabits!* Which is a lot of storage.

And you don't have to trade off reliability or maintainability to get that kind of capacity, either. We've included plenty of plug-ins for fast access to *all* subassemblies. Interchangeable printed-circuit cards to help simplify trouble-shooting. A pluggable tester (optional) for fast, on-line maintenance. Unique DC coupling in and out of the memory stack (for stable operating margins, fewer components, and increased reliability). Plus sliding mounting arms that permit the chassis to be pulled out of the rack easily and tilted 90° either way for fast servicing.

The 380 also includes our *automatic* DATA SAVER™ feature to minimize recovery time after any unpredicted temporary loss of external power. (Guards against any loss of data, too — *and there's no manual reset required to get back on line!)*

Speed? 950 nanoseconds. And of course word or byte control plus parity generation and checking are available.

If your storage requirements are less than 655,380 bits, you can save even more rack space by going to our **370 system.** It's got the same major advantages as the 380 system scaled down to a 5¼" x 19" x 21" case with a capacity of 163,840 bits (field-expandable in increments to 655,380 bits), and speeds ranging from 750 nanoseconds to 1.5 microseconds. Both systems are ideal for nearly any kind of data processing. See your Fabri-tek Representative for complete specs, or call or write us direct.



Fabri-Tek is a leader in advanced memory research, development and production. Our experienced Application Engineers are ready to help you find solutions to static and dynamic storage applications: Buffer Memories • Extender Memories • Peripheral Mass Memories • Mil-Spec Memories.

FABRI-TEK

5901 South County Road 18 • Minneapolis, Minnesota 55436 • Tel: 612-935-8811 TWX: 910-576-2913
Blantyre Industrial Estate • High Blantyre, Lanarkshire, Scotland • Tel: Blantyre 2474 TWX: 851-778-448

CIRCLE 14 ON READER CARD

The big ones are in Canada.

In Canada emotions are usually well-controlled no matter how big the catch or how exciting the accomplishment. So we apologize for bursting with excitement over our new time-sharing system. You'll understand our lack of restraint when you've checked the system out for yourself.

It's a dedicated one language (BASIC) time-sharing system with remarkable capabilities at a remarkably low price. You can lease a complete system starting at $2,445 per month or buy the system outright for less than $90,000.

* It can accommodate up to 50 terminals.
* It provides removable pack disk storage of up to 60 million bytes.
* It uses IBM 1316 and 2316 Disk Packs or equivalent.
* It uses IBM compatible tape.
* It uses a high speed drum for program swapping.
* It has access to a wide range of program libraries *and*, it responds *fast*, real *fast* to all users.

Arrange to test this system now, from your location, by calling or writing:
Mr. George L. Athanas, Box 5308, High Point, North Carolina. Telephone 919-883-9818 or Mers Kutt at 416-366-7643.

CONSOLIDATED COMPUTER SERVICES LIMITED
48 YONGE ST., TORONTO 1, ONTARIO, CANADA

CIRCLE 15 ON READER CARD

Have you been buying top-of-the-line computer tape, because you wouldn't dare try anything else?

Stop. Write here.

US TAPE

USTape can help. We'll analyze your computer operation and recommend a proper grade of tape to meet your needs. You may still require a top-of-the-line tape. If you do, we can provide the very *top*. We're the only manufacturer to produce a tape that meets U.S. Government Type I standards.

Or you might find that another, less expensive grade, will be just right for your application. In either case, we'll tell you precisely *why*. The service is free. Our recommendations are drawn from the basic inputs provided by your answers to this questionnaire. Fill it out and mail it to us clipped to your letterhead. We promise a prompt, helpful reply.

Check appropriate block(s).

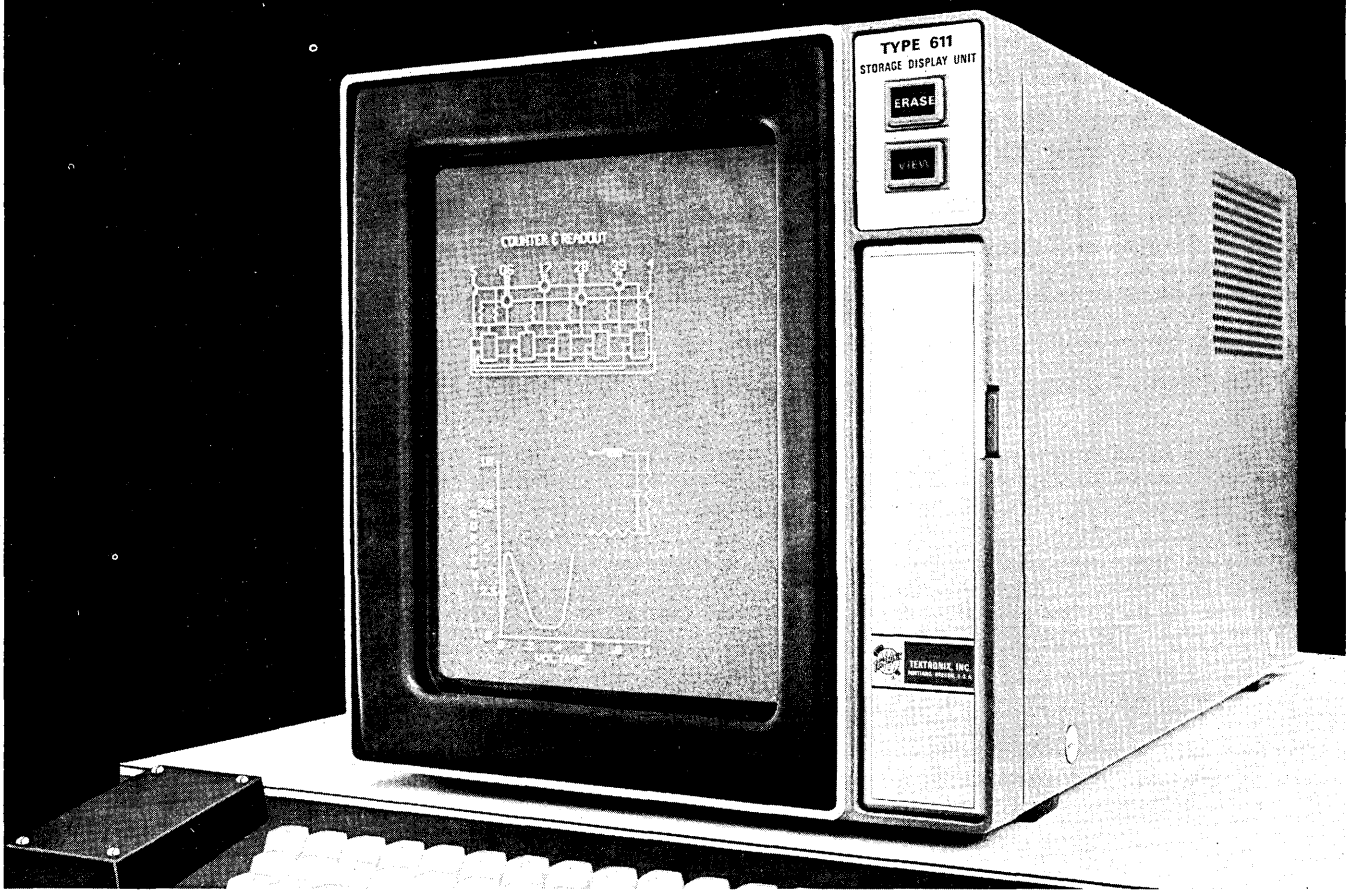
1. Do you use ☐ third generation computers?
   ☐ second generation computers?
   ☐ both?

2. Would you describe your computer applications as:
   ☐ **extremely critical:** recording single opportunity, non-recurring data?
   ☐ **select critical:** high-activity files and active master tapes such as those used in banking, airlines, etc.?
   ☐ **general purpose:** covering total spectrum of data processing transport requirements?
   ☐ **standard:** journal and historical record tapes?
   ☐ **non-critical:** high volume production runs, updating and listing?

3. How many reels of tape do you use annually? (Average) _____

U. S. MAGNETIC TAPE COMPANY *A Subsidiary of Wabash Magnetics, Inc.*
Huntley, Illinois 60142

Information Displays Without Refreshing



CRT Storage Affords flicker-free displays of both complex graphics and high-density alphanumerics

The Type 611 Storage Display Unit is designed to function as a readout device for computer consoles and remote terminals. With X, Y and Z inputs provided by peripheral equipment, this new instrument produces displays of high density alphanumeric and complex graphic information without drift or annoying flicker.

The Type 611 Storage Display Unit features an 11-inch, magnetically deflected, bistable storage display tube. This new storage tube offers high information density and excellent resolution on a 21-cm x 16.3-cm screen. 4000 characters, 90 x 70 mils in size, may be clearly displayed with good spacing. Resolution is equivalent to 400 stored line pairs along the vertical axis and 300 stored line pairs along the horizontal axis. Dot settling time is 3.5 μs/cm + 5 μs and dot writing time is 20 μs. Time required to erase and return to ready-to-write status is 0.5 seconds. Operating functions are remotely programmable through a rear-panel connector. A "Write-Through" feature provides an index to the writing beam position without storing new information or altering previously stored information.

Type 611 Storage Display Unit $2500

U.S. Sales Prices FOB Beaverton, Oregon

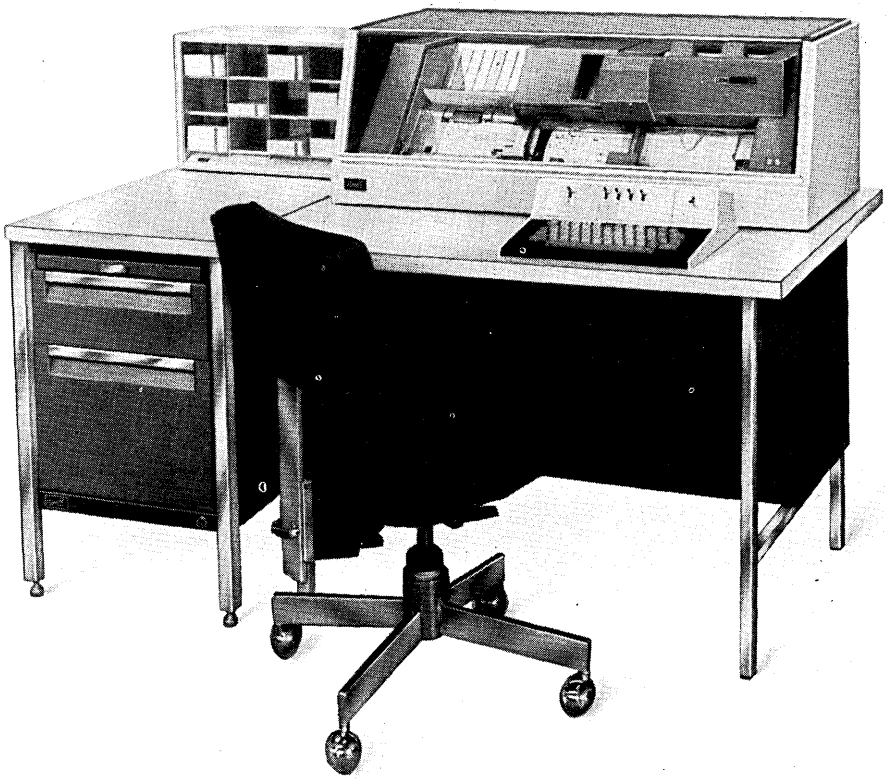
For a demonstration, contact your nearby Tektronix field engineer or write: Tektronix, Inc., P.O. Box 500, Beaverton, Oregon 97005.

Tektronix, Inc.

committed to progress in waveform measurement

Wright LINE

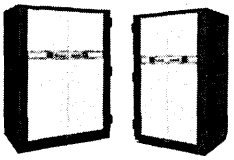
EVERYTHING FOR DATA PROCESSING ...except the computer



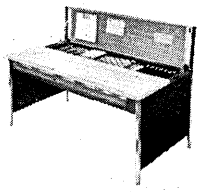
NEW **KEYPUNCH WORK STATION** Now any 026 or 029 Keypunch can become a quiet, efficient total work station with the addition of Cousticover and other Wright Line keypunch accessories. Cousticover reduces keypunch noise level by 60-75%. Its hinged and counter balanced formed acrylic top gives easy access to the keypunch . . . And, since the top is clear, no additional lighting or consequent heat build up is involved.

Other accessories include Wright Line keypunch desks, posture chairs, card racks, and almost everything else needed for keypunch convenience and efficiency.
For complete details, circle readers service number 104

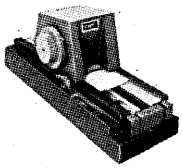
GOLD STAR FILES The most beautiful and versatile card files available. Line includes three wide files and counter-top model with plastic-laminate surface.
For details circle Readers Service No. 103



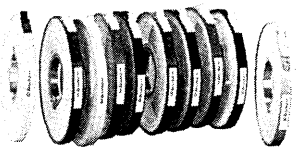
DATA BANK A "double safe" vault for the protection of vital records stored on tape or disks. It carries an Underwriters 150°, four hour label. Four models available.
For details circle Readers Service No. 101



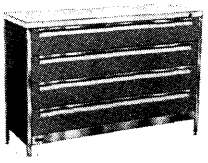
DATA STATIONS combine the best features of a desk and tub file with custom storage for cards and supplies.
For details circle Readers Service No. 108



PORTABLE CARD PUNCHES for punching cards and plastic cards. Printing punch has tab stops and prints and punches simultaneously.
For details circle Readers Service No. 105



TAPE-SEAL® SYSTEM The safest, easiest handling, most economical method of storing tape. Line includes cabinets. trucks and accessories.
For details circle Readers Service No. 106



DISK PACKS AND DISK PACK STORAGE 1316, 2316, and 2315 Disk Packs with Data Coat Surface and a complete line of storage units to give you maximum safety and protection.
For details circle Readers Service No. 102

Wright LINE
DATA PROCESSING ACCESSORIES

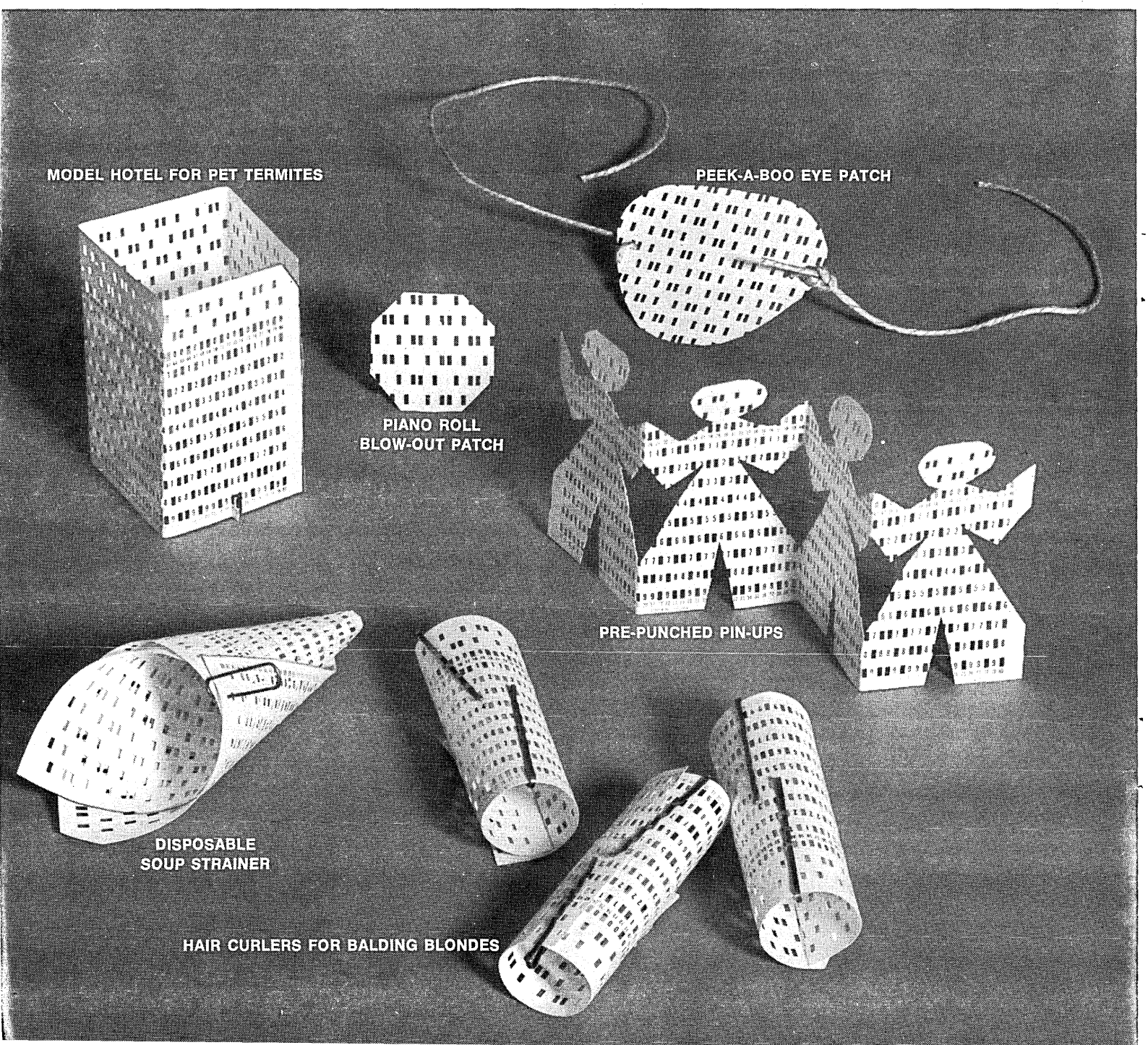
160 GOLD STAR BOULEVARD, WORCESTER, MASSACHUSETTS 01606
A DIVISION OF BARRY WRIGHT CORPORATION

MOHAWK DATA-RECORDERS are creating new uses for punched cards

When you use Mohawk Data-Recorders to upgrade your computer input preparation, you'll no longer need to punch little holes in millions of cards.

But don't throw away your left-over cards. Give them to art instructors, kindergarten teachers, Boys' Clubs, Senior Citizen groups and similar organizations. They're always looking for materials to keep hands and minds creatively busy.

The trend to ultra-sophisticated computers . . . now stretching toward the fourth generation . . . further widens the gap between punched cards and the CPU. *If your present computer calls for magnetic tape input, and you're still starting with punched cards, you're pitting a horse and buggy against a jet-age electronic phenomenon.*



Data-Recorders offer the most practical method of *speeding up and cleaning up* input preparation. With about 15,000 Data-Recorders now in use in the U. S., Canada, Great Britain and Europe, you can believe they're doing what they're intended to do.

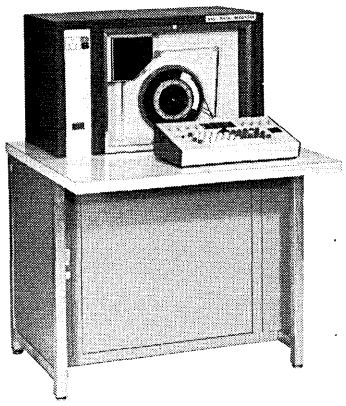
The Mohawk Data-Recorder was the *original* keyboard-to-magnetic tape unit. *It eliminates punched card input preparation . . . permits transcribing of raw data, from source documents, direct to computer-compatible magnetic tape . . . and verifying on the same machine.*

PUNCHED CARDS VS. DATA-RECORDER

In many large EDP installations, costs of punched card input preparation exceed computer processing costs!

Even the fastest operator is limited by the operational speed of the key punch. Key punch equipment is noisy, contributes to operator fatigue . . . and errors. Error correction with cards is a slow, costly process. Lost cards and mixed batches are common occurrences. Card storage frequently is expensive. There's a shortage of key punch operators. Scheduling becomes complicated . . . standby equipment for peak loads generally is necessary, and once a batch of cards is completed, the punched data still must be converted to computer-compatible language on magnetic tape.

DATA-RECORDER USERS claim substantial operator productivity increases. Your former key punch operators handle more work on Data-Recorders. MDS training enables them to swing quickly from key punches to Data Recorders.



Key-entered data is first stored in the Data-Recorder's memory. Sensed errors can be corrected immediately, *in the memory,* before they reach the tape. Any errors found in verification also are easily corrected. Thus, fewer errors reach your computer.

Keyboard operation is effortless . . . operators can maintain an even keying cadence. The Data-Recorder is pleasantly silent, compared to key punch equipment. Operators make *fewer* errors because they're not overpowered by error-inducing fatigue.

You can have single-operator responsibility. She can both record and verify, on the same machine. No need to involve several operators. Responsibility for accuracy is pinpointed.

Once a record is on tape you can't drop it, spill it or accidentally mix it with another batch. Tape can be reused many times, if desired . . . and, compared to cards, it requires minimum storage space.

Many users have found they're not bound to 80-column records with the Data-Recorder. There's almost no limit to the logical record size you can write. The operator can capture all the data from a document on *one* pass, under *one* program control, the way she reads a book page . . . left to right, top to bottom.

Data-Recorders come in combinations for long distance data communication, card reading, adding machine control, paper tape reading, input/output typewriter, and line printout.

Your man from MDS will be glad to work with you, show how you can *improve your throughput with Data-Recorder input.* Phone or write.

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CIRCLE 19 ON READER CARD

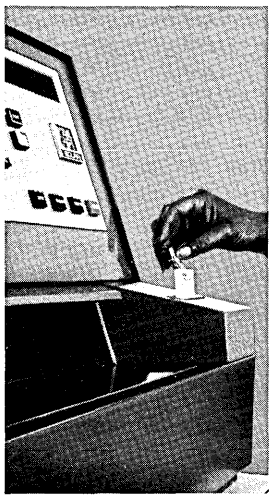
MOHAWK DATA-RECORDER MODELS: 1101 . . . 1102 MTP (Multi-Tape Pooler) . . . 1103 LDC (Long Distance Communications) . . . 1104 AMC (Adding Machine Control) . . . 1105 PTR (Paper Tape Reader) . . . 1106 PCR (Punched Card Reader) . . . 1109 DPC (Data Preparation Card Reader) . . . 1112 DPA (Data Preparation Adding Machine) . . . 1115 DPT (Data Preparation Tape Reader) . . . 1118 DLP (Data List Printer) . . . 1122/902 (7/9 Channel Converter) . . . 1181 TWK (Input/Output Typewriter) . . . 1183 DPP (Data Preparation Printer). All 1100 Series Models record data on 7-channel magnetic tape at 200 BPI. The following 6400 Series Models (9-channel, 800 PBI) also are available: 6401 . . . 6402 . . . 6403 . . . 6404 . . . 6405 . . . 6406 . . . 6409 . . . 6412 . . . 6415.

How to come back from SJCC and interface with your Production VP: Tell him what you saw at DPI's booth KK5

Three years ago we decided that manufacturers needed better ways to collect data for timekeeping, inventory control and other big production jobs. Now we have the best data collection and reporting systems on the market. We can supply complete turnkey systems for off-line or on-line data collection using state-of-the-art hardware and software designed for your needs. Here's how it works:

Input terminals • In its ready mode, each Data Pathing terminal is a timeclock. It reports a worker's arrival when he inserts his ID badge (even if he sleepily puts it in backwards).

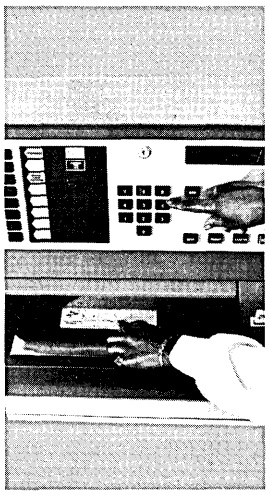
Using IC's throughout, the terminal is quiet, cool, and rugged enough for the grimiest plant locations. Terminals time-share ordinary 2-wire lines which can extend as far as two and one-half miles to reach the corners of the user's facilities. Even longer distances are possible through the use of communications adapters.



DPI Data Collection Terminal "turns on" when I.D. badge is inserted.

Job or parts data can be inserted into the system at the human-engineered input terminal with only the worker's badge and punched cards. Sequenced commands —in plain English—tell the worker how to enter the data correctly. Carefully programmed checks keep the system virtually error-free.

The data collected is transmitted to the system's processor at 2400 bits per second. One aerospace customer reports that DPI terminals clear the plant of 8000 prime shift workers within two and one-half minutes. As many as 30 people use the same terminal in one minute. That's throughput!



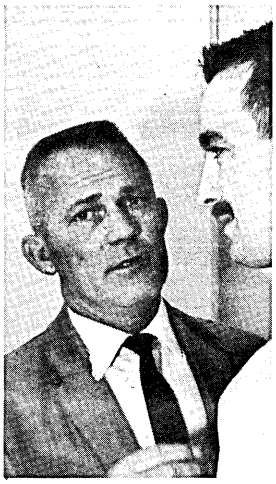
Sequenced commands stored in Processor Memory tell worker how to enter data. Built in checks verify information as it is being read by scanners.

Communications processor • We now have three sizes of processors so we can provide a data collection system as small as 15 terminals or as large as you might need it.

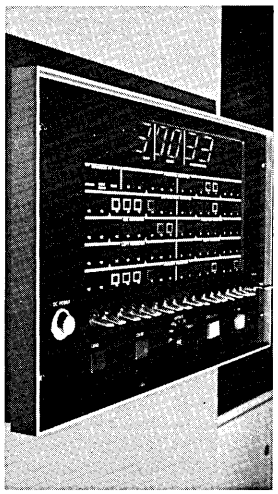
Each processor contains its own software-storing memory modules. Our staff of programmers will study your plant operations and develop a software package suited to your exact needs. At no extra cost.

Polling programs are built into each processor. They dynamically poll each of the terminals and also perform periodic diagnostic checks to certify the correct operation of each terminal. "Off-the-air" terminals are spotted quickly and reported along with any symptom information available.

The processor receives data from each terminal, checks it for proper transmission and then processes it. It code-converts and reformats all data for input to your computer. Day of the week, time, terminal identification, or other constants



"You computer guys sure spend a lot of time at shows!"

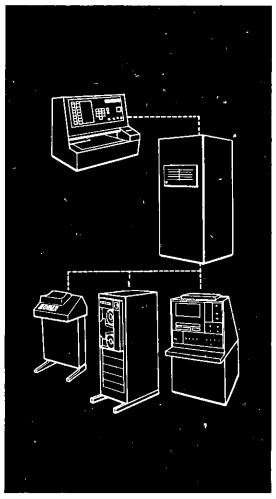


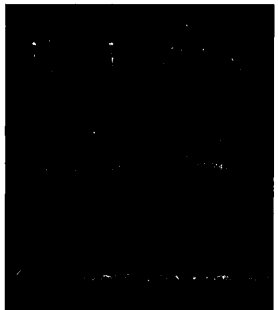
Once verified, the data is immediately formatted, coded, and fed to output.

Output can be magnetic tape, teletype, or direct to on-line computer.

may be added to the data transmission as required.

Output options • Data Pathing systems can be ordered with magnetic tape output, engineered to operate on-line with your computer or designed to use teletype printers for remote feedback of data entered at certain terminals.





With magnetic tape output, the processor prepares the data in 7 or 9 track formats with recording densities of 556 or 800 cpi. Coding will be according to the customer's current data processing system.

Most exciting is the real-time on-line capability of Data Pathing collection systems. Currently, we have systems operating on-line with IBM System 360's and with Burroughs 2500. The savings of time and money are obvious. So are the advantages of computer utilization.

We ask for the order • If you have read this far, you must see far-off glimmerings of hope in what you read. We know that our system is faster, better, and more economical than any other. And it's backed up by a nation-wide service organization. We're also sure that your V.P. of Production will pay your way to FJCC if you tell him that many of the Fortune 500 now use it to monitor labor, inventory, quality control, and many other manufacturing operations—and get **virtually real-time feedback.**

"You mean you've figured out a way for that big idiot machine of yours to help me?"

We would like to have a chance to present our program to your people. Please call our President, Russ DuBois, at 408-734-0100 to arrange an appointment at your plant. Or write us at 370 San Aleso Ave., Sunnyvale, California 94086.

Data Pathing Incorporated

Out front in data communications

CIRCLE 11 ON READER CARD

We're being seen in all the best places.

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NATIONAL INSTITUTES OF HEALTH
NASA/SHELL/HUGHES
DEPARTMENT OF DEFENSE
NAVAL UNDERSEA WARFARE CENTER
BOEING/N.Y.U./STANFORD

Adage computer graphics are in. Right now our interactive graphics terminals are operating in government agencies, aerospace firms, the oil industry, and in universities. And they're playing key roles in some very intriguing applications.

Scientists at Columbia University, for example, are creating and interacting with molecular structures with the AGT/50, the most powerful model in our line. M.I.T. is using its graphics terminal, an AGT/30, as a general-purpose simulator with special emphasis on 3-D dynamic displays.

Hughes Aircraft has an Adage AGT/10 that they are using for automated PC-board production. N.U.W.C. is using its display terminal for simulating submarine tracking and intercept guidance systems. Biochemists at N.I.H. are viewing and testing mathematical models of large drug molecules; the Adage terminal frees them from tedious, drawn-out laboratory testing required by classical methods.

And there are many other exciting applications. NASA's system simulates lunar terrain as seen from a spacecraft. Stanford's helps develop new techniques in information retrieval and decision making. Signal analysis is the prime application for several other display terminals.

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

There are excellent reasons for Adage's acceptance. You can see some of them in our free 16mm demonstration film of the Adage Graphics Terminal in action. Please request your copy of this film, or more information about how our customers are using our interactive graphics systems, by writing Marketing Services, Adage, Inc., 1079 Commonwealth Avenue, Boston, Massachusetts, 02215.

adage
Computer
Graphics

CIRCLE 22 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/CONTACT
June 5-6	Micrographics Conference	Bryan, Texas	Texas A&M Univ., College Station, Texas 77843
June 8-12	6th Annual Design Automation Workshop	Miami Beach	ACM, IEEE/N. Garaffa RCA ISD, Bldg. 13-2-8 Camden, N. J. 08101
June 9-11	Remote Terminal Symposium	Washington, D.C.	Nat'l Archives & Recs. Gen. Services Admin. Washington, D.C. 20408
June 10-12	Int'l Communications Conference	Boulder, Colo.	IEEE/A. J. Estin Radio Standards Engrg. Div., NBS, Boulder, Colorado 80302
June 16-18	Int'l Symposium: Computer Applications Earth Sciences	Lawrence, Kansas	IAMG/R. F. Treece Extension Bldg., Univ. of Kansas Lawrence, Kan. 66044
June 16-19	Int'l DP Conference & Business Exposition	Montreal	DPMA, 505 Busse Hwy. Park Ridge, Ill. 60068
June 17-19	Computer Group Conference	Minneapolis	IEEE/Robert M. Kalb Univac, 2276 Highcrest Dr., Roseville, Minn. 55113
June 19-20	Management Conference	Minneapolis	ADAPSO/J. L. Dreyer 420 Lexington Ave., New York, N. Y. 10017
June 19-20	Computer Conference	Chicago	ASME, ACM/IITRI 10 W. 35 St., Chicago, Ill. 60616
June 30-July 1	Continuous System Simulation Languages Conference	San Francisco	ACM/ Robert Brennan IBM Scientific Center, 2670 Hanover St., Palo Alto, Calif. 94304
July 14-15	Computer Reliability Workshop	Los Angeles	ACM/Prof. Algirdas Avizienis Boelter Hall 3732, UCLA Los Ang., Calif. 90024
Aug. 19-22	Western Electronic Show and Convention	San Francisco	WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005
Aug. 26-28	National Conference & Exposition	San Francisco	ACM 69, P. O. Box 2867, San Francisco, Calif. 94126
Aug. 25-29	Datafair	Manchester, England	British Computer Society No. 23 Dorset Square, London, N.W. 1, England

machines that make data move

TELETYPE

data's low-price three

It's Teletype's Model 33 line. Check the tag. Check around. You'll find nothing on-line today that will corner data more reliably at such a low price. Another answer from Teletype R&D for making data ends meet with utmost economy.

* * * *

Slip into a seat. Turn on a Model 33. And relax. Watch the data move over the miles. Quickly. Accurately. Reliably. Everything you need for economical business communications is at your fingertips.

For this line has RO (receive-only), KSR (keyboard send-receive) and ASR (automatic send-receive) sets. Options and accessories are available to extend the Model 33's versatility.

Rides with ASCII

The Model 33 communicates in ASCII (U.S.A. Standard Code for Information Interchange). It's a handy time-sharing set. Makes the ins and outs of computer communication easy. Can help you process orders, track inventory; or give you tighter control of production scheduling and delivery. The Model 33 is compatible with most other business machines. As a data link can bring distant branch office data home in minutes. Keep all of the vital data management needs for profitable operation accessible.

Zips forms cross country fast

Model 33 equipment is available with optional pin feed platen. Enabling you to type multiple-copy business forms on-line. Move them to any number of remote locations economically. A simple 4-row keyboard, similar to a typewriter, makes data preparation easy.

Automatic drive

For automatic operations, the Model 33 ASR set with paper tape reader and punch is ideal. This snappy performer can pick up data from its own keyboard or tape reader, or from distant sets, as page copy with or without tape. Move forms automatically at 100 words per minute.

The Model 33 line is one of many exciting moves in *moving data at very little cost* being made by Teletype R&D. Nowhere will you find so much terminal for so little money. If you would like more details about Model 33 capabilities, write Teletype Corporation, Dept. 81E, 5555 Touhy Avenue, Skokie, Illinois 60076.

for on-line storage.

PDP-10's large scale storage disk provides on-line storage for less than 0.28 cents per 36-bit word. Imagine 104,000,000 words of on-line storage for less than 0.008 cents/bit. You also get fast access times. And 407,000 words with a single disk rotation. All for pennies.

PDP-10 has other storage besides. Fixed head disks for moving programs in and out of core in a hurry. Removable disk packs for inexpensive on-line storage. A variety of magnetic tape drives, too.

What's the price for the most cost effective system on the market today? A system that 63 users can time share and use for batch and real-time operations, too? With the large disk, communications equipment, and a full set of peripherals, the PDP-10 still costs less than $800,000.

PDP-10. Every bit a better buy.

PDP-10 digital COMPUTERS · MODULES

Digital Equipment Corporation
Maynard, Mass.

letters

pi on you

Sir:
Reference: "The Evolution of Number Systems," by Donald E. Knuth, Feb. '69.

Perhaps the reason that old Jemshîd ibn Mes'ûd al-Kashî's short treatise appeared without fanfare is that he gave the value of pi incorrectly.

VINCENT E. MARIER
Laurel, Maryland.

Ed. note: Dr. Knuth states that this value of pi was taken from the "History of Mathematics 1" by David Eugene Smith (Boston: Ginn and Co., 1923). The correct value of two pi had originally been given by al-Kashî and apparently someone connected with the Smith book had divided by two, incorrectly. Dr. Knuth also tells us that the value of pi has been calculated, in France with the aid of a computer, to 500,000 places. For those who wish a not so crucial value to operate with, here is the value of pi to 100 places: 3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706 79.

nostrum rostrum

Sir:
Dr. Ida R. Hoos misses the whole point of systems analysis in her Forum article in the February issue by arguing in terms of it being a "nostrum for all manner of social ailments" or there being no final solution or right or wrong one. It is a tool and not the cure, and a valuable tool in clarifying the interrelationships and boundaries of potential action (or inaction).

In the hands of a professional, it does not "concentrate on miniscule portions of isolated variables simply because they are quantifiable," but rather defines the variables only after coming to grips with the objectives and the restraints. And the definition of the variables itself is a major contribution towards understanding the problem and consequently towards achieving a solution.

As far as systems analysts being salesmen in disguise, where is the disguise? Don't we all try to sell our ideas, and shouldn't we? And the purpose of systems analysis is to assist in the development of an action program if analysis indicates action is better than inaction. I see no conflict.

Systems analysis does not make decisions. It requires human decision makers to follow up and decide among alternatives after recognizing consequences of each alternative. As a matter of fact, one might not be stretching too much to argue that without systems analysis one does not need a human decision maker. Without any facts, the path can be chosen by the toss of a coin, which a machine can do. The human is needed to apply the value judgments at the end of the analysis—to push the go-no-go button.

Systems analysis has made, and shall continue to make, significant contributions towards the solution of urban problems but only as the tool, not the cure-all, much the same way that the doctor is not the cure but rather the tool.

I recently underwent ear surgery; the doctor explained the potential benefits, the definite risks, costs in terms of dollars, time and restrictions, the alternatives to undergoing surgery and the consequences. He made his recommendation and left the decision to me. It would have been easier for me if there was no choice, but real life is not that simple.

I think this is similar to any systems analysis of urban problems, although obviously the scale is different. The systems analyst (in that case, the doctor) researched all facets of the problem (examination of me and examination and history of similar cases), presented facts and alternatives to decision maker (me), who then had to apply a set of values (my own) to make the decision and then put my decision into action. Now it appears that I made a very wise decision, the negative consequences were minimal and the positive consequences were great. But there were no guaranties beforehand; as a matter of fact, I had to sign a statement for the doctor and the hospital that I understood the risk.

So, too, in systems analysis for urban ills. The systems analyst will seek out the facts, analyze the alternatives and recommend one or several possible or feasible paths of action, but the user must make the decision to implement. Perhaps all users of systems analysis should also sign a statement before the procedure that they too understand the risks. There is no guarantee in this very human world we live in, but that is no argument to do nothing.

Just to carry the analogy one step further in response to Dr. Hoos' criticism of incompetent systems analysts—one does not select his own doctor just because he is an M.D. Systems analysts should be selected for any given assignment with the same care as one selects a doctor or any other service. Again the user has a responsibility here.

In summary, systems analysis is a powerful tool requiring responsible professionals and responsible users for it to provide the benefits potential in the power of the tool.

JUDITH MOSS
Mountain View, California

Dr. Hoos replies: Miss Moss misses the point of my article so completely that I am inclined to wonder whether she might not have made the very mistake I have underscored—namely, of choosing the wrong kind of expert. Perhaps, instead of an otologist, she needed an ophthalmologist. Her reaction is symptomatic of the very type of systems analysts I described; for them, rhetoric and faulty analogies replace substantive knowledge. My comments about selling and salesmanship, as even casual reading clearly indicates, were concerned with the confusion as between selling, salving, and solving. I carry no brief against merchandising within certain constraints, especially the moral and ethical. What I do object to is the packaging of sale as solution, and this is all the more deplorable when, as Miss Moss demonstrates, the analysts themselves do not know when they are selling and when they are solving.

I do admire Miss Moss' judicious objectivity in the definitional distinction between a tool and a cure. I would hope that such scientific purity and exemplary intellectual honesty would leap forth from more of the systems analysis studies of societal problems. Hers is a mini-lecture on the pure theory of systems analysis; my article was on the real-life users, the sellers and the over-sold, all apparently devoid of Miss Moss' pristine purity of motive and clear-eyed vision as to the ultimate objectives of society at large.

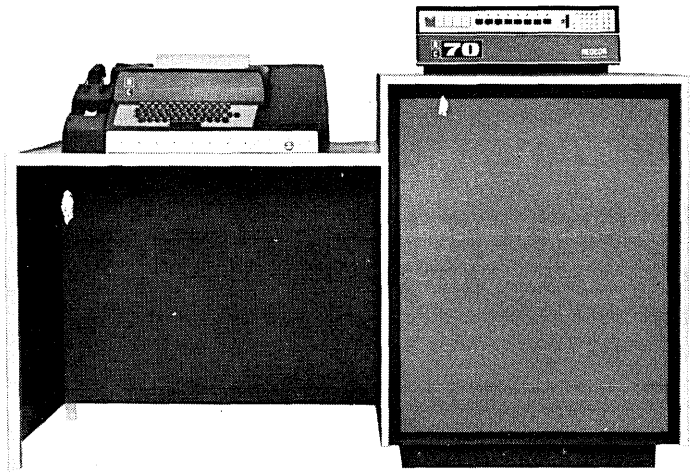
In her use of the analogy of her ear operation, Miss Moss fails to note that the specialist was not only skilled in the use of the tools, i.e., the knives, scalpels, etc., but also a master in the knowledge of the anatomical parts on which he operated. For years, he had studied physiology, and he knew the subject on as well as *with* which he was working. This, Miss Moss, is why you went to an ear specialist for your operation; you didn't go to the medical instrument manufacturer. If your doctor knew as little about the anatomy and physiology of your ear as most "urban systems specialists" know about crime, welfare, poverty, pollution, and the like, he would not have operated.

Doctors have the Oath of Hippocrates; poets have license; but where is a professional code that will assure us competence and integrity of

If the 1108 is a **MAXI,**
And the PDP-8 is a **MINI,**
What's a **MIDI?**

RC 70

The MIDI* Computer



Since 1956, REDCOR Corporation has established a reputation as a quality supplier of instrumentation. In its instrumentation systems, REDCOR developed a set of computer requirements filling the void between high-performance, high-priced 32-bit machines and the overabundant marginal mini's. The RC 70 has no hidden costs — it does today's job and is field expandable to meet future requirements.

Establishing its own classification — REDCOR's RC 70 — the MIDI computer — provides the most computer power for the money.

Standard features include:

- 860-nanosecond cycle time
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- ASR 33
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***MIDI COMPUTER:** Submicrosecond 16-bit computer compactly packaged with megacycle throughput word rate for OEM and system requirements. The MIDI classification includes the RC 70, 516, SIGMA 2, 2116B, 810B, 1700.

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letters

performance on the part of ubiquitous systems analysts? Surely, after having succumbed to the giant oversell, harried and hopeful public administrators should not have to sign a *caveat emptor* release. Instead, perhaps a strict cost-benefit measure should be put to the vast expenditures on systems analyses, and the results be subject to the same damage suits as occur in the case of other shoddy merchandise turned out by poor technicians, faulty procedures or sloppy quality controls.

Using relative frequency weights as a basis for my conclusion, I should report that, in comparison to Miss Moss' solitary view, the many appreciative comments I have received, plus mention of the Forum in Congress by Congressman Gallagher, indicate that my message did not fall on deaf ears.

executing the elements

Sir:
We read with interest your March News Brief on IMI's COBOL Compiler Validation System (p. 117). However, the article contains one misstatement that I would like to correct. The test results do not "show the object code that should be produced by a compiler." Rather, the test routines compare precomputed results against the actual results obtained by executing the elements being tested. Those results that differ are flagged for further investigation, but are not in any sense automatically considered "discrepancies" by the system. This technique provides a facile and equitable means for measuring a COBOL compiler's compliance with USA Standard COBOL.

HARRY T. HICKS, JR.
Information Management, Inc.
San Francisco, California

the heretic's reward

Sir:
My reaction from reading Mr. Bromberg's Forum thesis (March issue) was one of nostalgia. As a novice programmer in 1964 I was one of many who were directly influenced and personally motivated by Mr. Bromberg and his associates at CEIR and its subsidiaries.

Since that time there have been occasions when I have tactlessly expressed such a philosophy, only to be greeted with the silence afforded the lunatic or the verbal assault which is the heretic's reward. There are others who have known the same circumstances, and who welcome the perspective Mr. Bromberg has offered in the wilderness of data processing.

It is quite possible that Mr. Bromberg's remarks will meet silent concurrence in rather unexpected areas of the industry, especially from dp executives who have found themselves "out of the ballpark" for failing to recognize the need for the "technician" in decision making.

I sincerely believe that, if he were alive today, Frederick W. Taylor would recognize the validity of Mr. Bromberg's thesis.

ROBERT R. CROMER
Southfield, Michigan

Ed. note: Mr. Taylor is considered by many to have been the father of management science, and the first to do motion studies and to establish a psychology of management.

Sir:
Mr. Bromberg's superb thesis in The Forum, that a good programmer should be well paid, is marred by two ideas which I consider misconceptions. First, that the quality of a programmer is measured by his years of experience (which I am sure Mr. Bromberg doesn't really mean). Second, that the work of a programmer is essentially different from the work of a systems analyst. I believe that a good program is 90% design and 10% coding, and the only difference between a programmer and a systems analyst is that the latter doesn't write code. After all, when a "system" is operating on a computer, from the computer's point of view it is a "program" which is operating. That is, a system is a big program—and supposed differences are merely artificially introduced verbal definitions which do more harm than good.

JOHN T. DWYER
San Jose, California

on credit

Credit bureaus do indeed serve a valuable and legitimate function for the business community, as indicated in your System Spotlight (March, '69, p. 148). However, credit bureau systems have come under close scrutiny by governmental investigative groups for a variety of reasons.

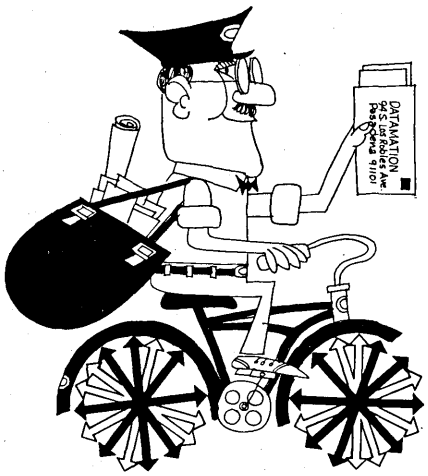
The major *ethical* issues are the protection of privacy, reputation, and financial security for the millions of citizens whose dossiers are maintained by these organizations. The most interesting and challenging *technical* problems are the system procedures which implement moral and ethical standards and controls for the protection of individuals. Your article skirts both areas, gives the impression no problems exist, and raises some questions itself.

Here are some of the problem areas:

1. The single most important control on credit bureau abuse is the right of an individual to inspect his file. Unless he has the ability to challenge the correctness of the data, error correction can be only trivial. Without his challenge to the propriety of items, there is no check on what can be entered; without his challenge to file inquiries, there is no control of promiscuous use. If I live in New York, why should a store in Kentucky need my dossier, if I have nothing to do with them (or a store in N.Y.)?

2. Any difference of opinion between an individual and an organization submitting data is permanently resolved (for credit purposes) against the individual. What automatic correction procedure is used if the credit grantor is found wrong by law or arbitration?

3. Another important issue is the data stored. The article states that "very little information of a very personal nature is included" in dossiers. Perhaps so. However, "other data" are easily obtainable for inexpensive purchase. These include organization membership lists, subscription lists, party rolls, real estate tax rolls, automotive registrations, school records, police blotters, etc. There are associations of credit bureaus, which could trade data among themselves. The chairman of a congressional investigative committee asserted recently that an association of 2,200 credit bureaus owns a welcoming organization, which sends hostesses into new homes to, possibly among other things, compile data for credit reports.

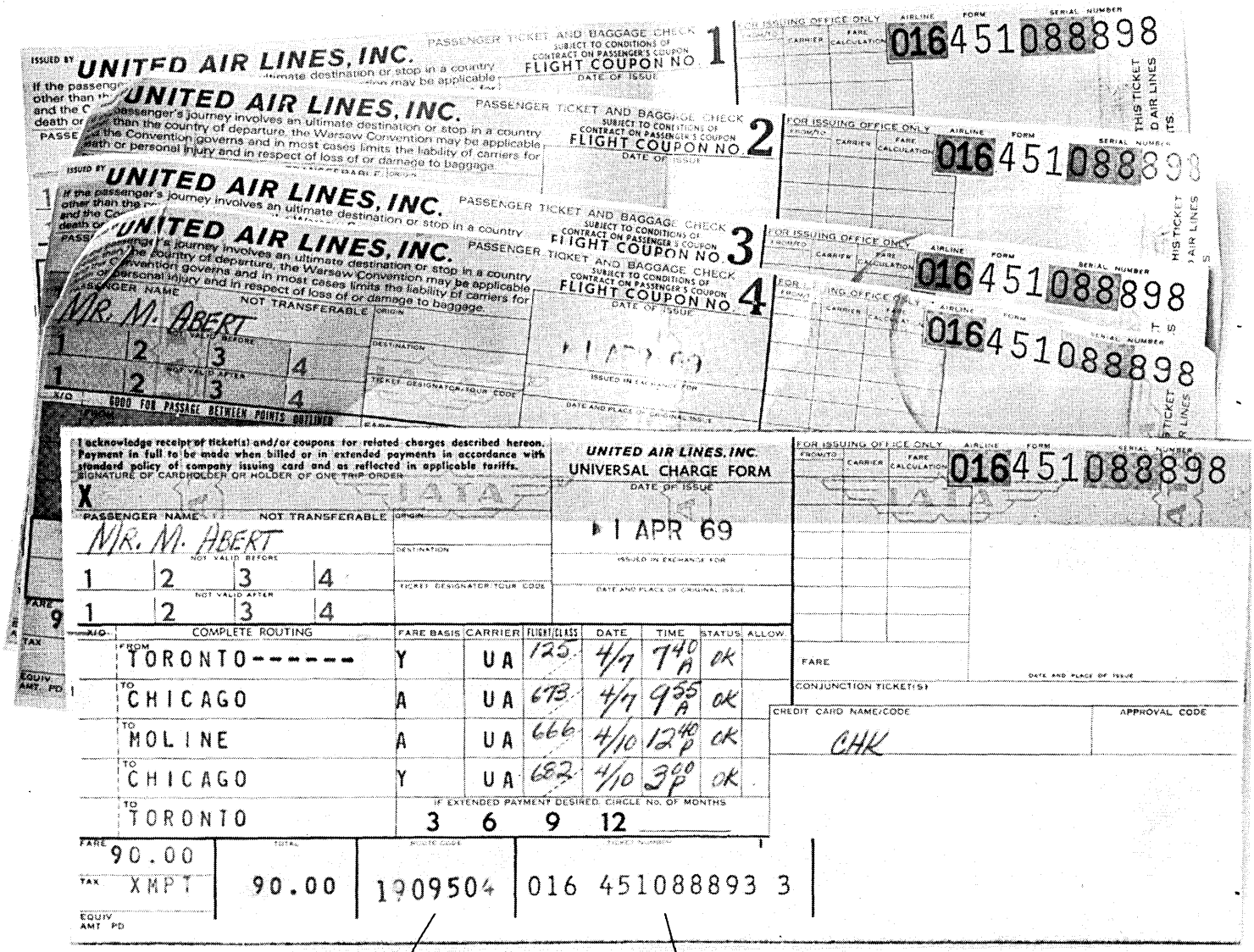


If enough paying customers request such information, *other* credit bureaus, less scrupulous than the one reported in the article, might be willing to supply them. The social security number provides for a simple merge procedure.

4. The credit agency's customers might not all be credit grantors who

How United's computer

United Air Lines used to have a problem keeping up with revenues. It was impossible to process all the tickets that poured in from thousands of airports, United offices and travel agents every day. So they only sampled five percent. But airline tickets were still coming in faster than punched cards were going out. And passenger volume was growing over ten percent a year.



Imprinted number (carbon impression)

Preprinted number

learned to read airline tickets.

Then United tried something new. The Electronic Retina* Computing Reader. An optical reading system that could process *all* the tickets just the way they came in. (Smudges, tears, weak strokes, wrinkles, misaligned characters and all.)

Nothing has been the same since.

United's data center breezes through airline tickets like the morning paper. Today's tickets are processed today. Over 2.5 million a month.

The system reads preprinted ticket numbers and imprinted route codes from auditors' coupons sent in at the time of sale. It records the data directly on magnetic tape in computer language. Which updates the unearned revenue data in the computer.

When the tickets are actually used, the system processes passenger coupons sent in for each leg of the trip. And appropriate amounts are automatically transferred from unearned to earned revenue. And now United knows exactly how much money it's making. And when.

Since the system was installed, United has found more than a dozen other jobs it can do. From processing airbills to reading and sorting bank drafts and checks. (It reads MICR optically better than MICR readers do magnetically.) United uses its reader more than 400 hours a month. It saves them $20,000 to $25,000 a month in input preparation costs.

Similar systems are also cutting costs for American Airlines, Pan Am, TWA and Air Canada. But you don't have to be an airline to benefit from an Electronic Retina Computing Reader. They're being used by banks, oil companies, credit card companies, the Library of Congress, the U.S. Army, the State of Michigan, and dozens of other organizations from Los Angeles to Liverpool. Every week our systems process over 100 million documents—more than all other OCR equipment in use combined.

And every week, the Electronic Retina Computing Reader proves an important point: There's nothing in the world quite like it. It reads complete upper and lower case alphabets (plus numbers). Any type face from any typewriter or office machine in the world. At speeds up to 2400 characters a second. It handles anything from flimsy, carbon-backed airline tickets to card stock. And it's the only system that comes with a full-time resident field engineer. And there's a good chance it's the only one that can do something permanent about your input bottleneck.

Write us on your company letterhead. We'll send you more facts you'll find hard to believe.

Recognition Equipment Incorporated

1500 West Mockingbird Lane
Dallas, Texas 75235 (214) 637-2210

Offices in principal cities throughout the United States. Subsidiaries in Frankfurt, London, Paris, Rome, Stockholm, Toronto and Tokyo.

*Electronic Retina is a Trademark of Recognition Equipment Incorporated

In manufacturing control, where should the computer leave off and people take over?

Burroughs lets you choose!

ACT!ON SYSTEM

This is a new physical inventory system that gives production, purchasing and engineering people a big assist. It monitors all inventory transactions. And updates related bill-of-material, inventory, order and accounting data. It also looks ahead for potential off-schedule conditions. If it finds any, your planner gets the equivalent of a "hurricane warning" report. In addition, ACT!ON coordinates manual operations, forms, management planning, and computer operations. This unique software requires unique hardware. And only Burroughs has it all: data base orientation, head-per-track disk file, COBOL, and multiprogramming.

PRODUCTION CONTROL SYSTEM

This new COBOL-based system gives production, purchasing and engineering people an even bigger assist. It uses the computer to maintain: (1) product structures by engineering release dates (2) plant routings (3) planned requirements (4) inventory and related account data (5) work-in-process (6) work center load conditions. Most important, this system also relates these elements so that the production planner sees the whole production process. This unique software also requires unique hardware. Again, only Burroughs has it all. For more information about ACT!ON, Production Control, and Burroughs 500 Series computers, call our local office. Or write us in Detroit, 48232.

Burroughs

look ahead

COULD INTEGRATION SEGREGATE FOREIGN PERIPHERALS FROM 360?

IBM, anxious to protect its share of the expanding peripheral market without offending any legal edicts, is said to be considering more integration of its control units into the cpu's of upcoming systems. One source says the circuitry would be scattered throughout the cpu to take more efficient advantage of the nanosecond cpu logic.

This is a many-headed monster. While the user could conceivably get a price break on the controller because of the integration, he would also lose some flexibility in attaching foreign peripherals. In fact, such peripherals would need to be almost 100% compatible with their IBM counterparts to ease the interfacing problem. The non-compatible peripheral maker could be hurt seriously in the IBM market. The more sophisticated users and service companies trying to put together a system with the most bang for the dollar might also balk--to the point of not buying IBM--at the loss of the ability to tack on a cheaper non-compatible unit. But you can bet if that is all true, IBM either won't do it or will come up with compensating features for the large user.

SDS REFUGEES LAUNCH TIME-SHARING GEMINI COMPUTERS

Computer Operations, Inc., a corporate shell created by ex-Information Development Co. president Pete Warkenton, comes out of its shell this month, launching a new computer series specifically designed for commercial time-sharing.

The Gemini series, four models ranging from $1.5 to $4.5 million, are designed to permit from 64 to 1024 simultaneous users. Throughput-per-buck is claimed to be 10 times that of third generation systems.

The microprogrammed cpu's of the models 25, 50, 75 and 150 will offer, respectively, 250K, 500K, 750K, and 1.5-million instructions per second...and span the range between the 360/50 and CDC's 6500. The cpu's will use one-usec mass cores of up to 16 megabytes plus up to 16 200-megabyte 2314's.

Both the I/O and communications processors will also feature microprogrammed control. These plus firmware/software interpreters for the 360, 1108 and 940 hint at the new firm's marketing strategy based on ease of conversion from current popular T-S systems. The 360-compatible communications processor will handle up to 256 full-duplex lines of up to 3600 baud. Users can maintain up to 32,768 distinct accounts, claims COI.

Key personnel under Warkenton include Norman D. Heller, vp hardware development, formerly Sigma 5/7 product manager; David L. Stein, vp software development, who was manager of Timesharing Utility systems development at SDS; and Jon P. Davis, director of computer development, a senior consulting engineer at SDS. Ex-SDS-ers C. Allen Burns and Robert J. Parra

will head up development programming and quality assurance, respectively.

The company aims to deliver its first system in early 1971, is shooting for annual revenue of $100-million by its fourth year.

SPEEDY KENO TO MAKE MINT GREEN

The Las Vegas Mint (where they coin money in a different way) is installing this month a $265K system for computerized Keno play. Developed by Ricca Data Systems, Santa Ana, Cal., the system includes a Raytheon 703 and a Memorex 2311-compatible disc, and will provide 10 RDS terminals spotted at various points around the casino for on-line gambling.

The way it works: The Keno player marks 20 numbers he has judiciously picked to win out of 80 contained on a Keno card. The terminal optically scans the card and prints a duplicate for the player. After the winning numbers are selected, the computer prints out the serial numbers of the winning cards, the amounts of the winnings, and the total gross receipts for that game (of interest to the Nevada Gaming Commission). All of this will halve the time required by humans to do the same thing, which will mean twice as many games can be played in the same time. But who's going to shout "Bingo"?

SERVICE BUREAUS READY UNBUNDLING BUNDLE

ADAPSO will shortly issue a policy statement on unbundling, which recommends that system engineering support, training, and application software should be priced separately, but not operating systems or equipment maintenance. Two future policy statements may have greater impact:

One will suggest to ADAPSO members that they consider suing universities that exploit educational discounts by offering machine time to commercial users at cut rates. The University of California and University of Georgia are said to be among the major offenders.

Another policy statement will ask why, if IBM cannot operate commercial dp service centers, other manufacturers should be allowed to.

RAYTHEON GOES SEISMIC, SHAKES UP, OUT, PEOPLE

Having abandoned the custom system business ("We don't have enough money to pioneer a market"), Raytheon Computer, Santa Ana, Cal., has lopped off some 125 people, mostly engineers who were working on now-completed custom jobs. They're starting to deliver the 706, however, are beefing up the 703 with memory protect, added peripherals for greater flexibility. And they have high hopes for a fast-fourier transformer (array processor), which will sell in the $35-40K range, appeal primarily to the seismic market.

CONNECTICUT COMPUTER CONFLICTS

Two Connecticut firms, Computaumation, Inc., Newtown, and Connecticut Technical Corp., Hartford, are marketing nearly identical lines of devices which transfer MT/ST cartridge tape data to various computer media. But Computaumation claims CTC stole its idea for the products and has filed both temporary and permanent injunctions against CTC. The firm alleges CTC built prototypes for Computaumation and then began marketing the devices as their own products, breaking a "confidential disclosure relationship." CTC, however, denies the charges, saying it built no

(Continued on page 243)

If you have to service time-sharers while running batch.

Get one Sigma.

Most machines can't handle both. A few fake it by treating batch like a time-sharing terminal, so it gets worked on a few milliseconds at a time.

Sigma 5 and 7 handle both, concurrently. Our new BTM software allocates core memory and time for effective batch time-sharing. But if all your 38 time-sharers aren't time-sharing, BTM automatically takes up the slack to speed batch processing.

As a result, batch runs smoothly at central site, or from remote batch terminals. BTM even lets time-sharers have access to the batch job stream for greater computing power and flexibility.

If batch isn't running fast enough for you, terminal users can be gracefully dismissed from the system so all available time and memory can be given to batch. Without stopping the system or dumping files just to change modes.

But just because Sigma uses half its mind for batch and half for time-sharing, don't expect half-witted programs. There's a long list of conversational languages and services such as SDS Basic, Fortran IV H, and Symbol, which are compatible for batch operations. Plus powerful batch processors like SDS Fortran IV, SDS Cobol 65, FMPS, SL-1, Manage and others.

This sounds like a promise of things to come. It isn't. We'll come to your office and demonstrate it. Now.

SDS

Scientific Data Systems,
El Segundo, California

editor's read*ut

THE BITS AND PIECES WORLD OF MEDICAL EDP

Medical applications of computers have that built-in "human interest" quality so beloved of city editors, so the newspapers regularly report on the latest batch of breakthroughs that will make us all live forever in glowing health. But out there in the real hospital world of bedpans, catheters, and endless paperwork is a scene that verges on desperation—with understaffed medical institutions struggling to keep up with the demands on their resources. It seems obvious that computers could help. Have they?

Here are some clues:

—Dr. Richard J. Johns, director of biomedical engineering at Johns Hopkins University, as quoted in Electronic News: many systems are "just a patchwork of scattered instruments and computers . . . "

—According to the Los Angeles Times, one of the reasons for some 20% to 30% of California's $600 million Medi-Cal payments being wasted last year was "accidental double billing."

—The Mayo Clinic decided after a 22-month study that their approach to entering patient data from terminals was not as efficient as the former manual methods.

—And Dr. Selwyn S. Berg, biophysicist at City of Hope Medical Center, said at the last Wescon meeting that "the difference in training of engineers and physicians precludes effective communication directly between these two professions."

Meanwhile, the problem keeps growing—in record keeping and other aspects of administration as well as direct medical care. A President's Task Force, mentioned by Dr. Gabrieli in his conference report in this issue, estimated that Medicare would generate some half billion pieces of paper just dealing with prescription drugs in the 1970's. (Does that remind you of the check problem before the banks were pushed into getting together on MICR?) Another source estimates that about $125 million worth of patient-monitoring equipment could save 24,000 lives per year. A final note for systems analysts to ponder: pharmacists are spending 40% of their high-priced time typing labels to paste on the pill bottles.

We don't think this much waste and confusion is necessary at this stage of data processing development. In fact, as the articles in this issue suggest, many of these problems have been solved—but in isolated places and partly by trial and error.

One way to make a start toward some coordination is to consider consultant Norman Reilly's suggestion of an exchange of information based on practical experience—a national conference on hospital computer planning. A possible sponsor would be the National Institutes of Health.

In Mr. Reilly's view, such a conference would *not* be a place for vendors to push their wares. We have enough of these. Instead, it would be a series of sessions for medical and administrative representatives to cover such topics as:

1. Who else has tried what we want to do?
2. Which approaches have worked and why?
3. Which have failed and what were the consequences?
4. Should we buy our own computer or time-share?

Proposed sessions would cover user experience in the business office, clinical laboratory, admissions, radiology, pharmacy, monitoring, screening and diagnosis, patient data handling, and information presentation.

Maybe this sounds elementary to the computer-wise. But the hospital staffs don't know what you do, they're having trouble finding out, and it's their procedures that determine whether you—as an inevitable patient—live or die.

—WR

a survey

COMPUTER-BASED HOSPITAL INFORMATION SYSTEMS

by J. Peter Singer

Computer-based hospital information systems have been receiving a great deal of attention lately in the business press. Announcements from computer manufacturers, service bureaus, hospitalization insurance companies, banks, computer software firms, and even hospitals have publicized the development of "all-inclusive," "integrated" hospital information systems. Computer systems have been heralded as the solution not only to the day-to-day financial and accounting problems of hospitals but also to problems of medical care such as patient monitoring, direct hookup with laboratory test machines (auto-analyzers, for example), reporting and analysis of test results, diagnostics, dietary planning and food management, and patient profile data. In the face of all this publicity, it is not at all surprising if hospital administrators are becoming increasingly bewildered by the question of how best to proceed in their own development and use of computer-based information systems.

A medium-size general practice hospital in the San Francisco Bay Area recently faced this computer dilemma. The hospital had been using a medium-scale computer for accounting applications but was interested in expanding the use of this computer, or perhaps a new computer, into areas which would more directly affect patient care. To that end, it requested the author and his associates to visit and review at first hand a representative sample of hospital computer systems in operation or close to implementation. The locations selection for study were examples of advanced computer processing techniques and equipment concepts. A prime objective of the survey was to evaluate both the benefits and the costs of each system in order to derive some measure of its relative "cost-effectiveness."

This article is a review of the current "state of the art" of computer-based hospital information systems based on the above-described survey. Its purpose is to provide some guidelines for the hospital administrator who is planning to install a new computer system or to modify his present system in the near future. The information presented here was derived from approximately 20 hospitals and other medical-care institutions throughout the United States. The survey, conducted by the author, was directed primarily to the study of systems using on-line and real-time computer techniques.

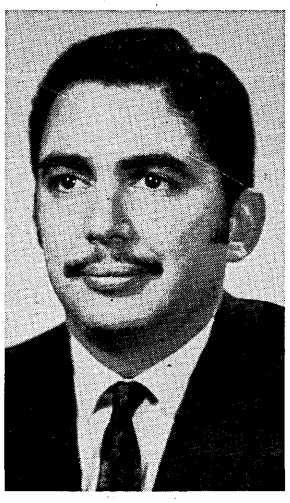
As used throughout this article, the term "on-line" refers to systems in which terminals at remote locations are connected directly to the computer for data input, inquiry, or communication purposes. "Real-time" refers to immediate processing by the computer of transactions entered through on-line terminals. Examples of real-time processing could be message switching, file update, or responses to inquiries.

"Message switching" refers to the process by which the computer receives a message from an input device at point A (for example, a nursing station) and routes that message to an output device at point B (for example, the lab). The appropriate routing may be specified in the input message itself or may be determined by the computer from an analysis of the type of message involved.

"File update" refers to the process by which the computer locates one or more historical records and changes the record(s) according to the input message. An example is a charge for lab work being added to a patient record and accumulated into revenue and statistical records.

types of systems studied

For the purposes of this article, the various computer systems studied have been divided into four basic categories, as follows:



Mr. Singer is a managing associate at Arthur Young & Company's San Francisco office. As a consultant, he has had about 10 years' experience in the development of information systems for both hospital and industrial clients. He has an MA from Cornell Univ. and an MBA from Harvard Univ.

1. *Large-scale, multi-hospital systems* involving comprehensive data base concepts and utilizing on-line, real-time techniques. A data base (or data bank) may be described as a very extensive file containing all the data necessary to extract structured output reports (aged trial balance, pay checks, daily census prelist), structured inquiry responses (patient balance due), and unstructured reports or responses (those which were not planned for at the time of file construction and are not regular in content).

2. *Large-scale, single-hospital systems,* which generally utilize on-line, real-time techniques.

3. *Shared-service-bureau hospital systems,* which at present are typically limited to patient accounting.

4. *Computer systems dedicated to servicing specialized application areas*—typically other than accounting applications.

Following the discussion of each of these four types of systems, we will briefly consider the role of data terminals in a teleprocessing-oriented hospital information system.

large-scale, multi-hospital systems

During the past two years, large computers have been developed which offer economies of scale as a result of significant advances in internal processing speed, the ability to operate on more than one program simultaneously, large random-access file storage devices, and teleprocessing techniques. These giant computers and peripheral equipment have directed considerable attention toward time-shared systems. The potential advantages of time-shared systems are (1) a more capable piece of equipment at lower hardware cost to each individual user and (2) reduction of programming cost through the sharing of common programs built to service a wide group of common users. Another potential advantage envisaged for the hospital industry is the establishment of data banks or data bases which could provide medical information or research for an entire area.

As a result of this growing interest in computer time-sharing, a number of organizations have obtained public financing for the experimental design of such systems, computer manufacturers have begun to design such systems to obtain a marketing advantage, and potential users have been banding together for joint-venture efforts.

These on-line, real-time systems are typically based on the concept of a large, complex data base comprising all the data on a number of subjects pertaining to a hospital's activities. This approach is conceived as a substitute for some of the multiple file search and update techniques which necessitate additional time and increase the possibility of error. At present, however, knowledge of the data base requirements of hospitals is still quite limited. Also, techniques for retrieving information from the data base are not highly developed. Furthermore, a data base operation must be staffed with personnel with extensive and detailed knowledge of computers, data base file organization, information retrieval techniques, and hospital file requirements. Because of the general shortage of people skilled in these areas, it appears that an all-inclusive data base cannot be built, maintained, and updated in the hospital industry at the present time.

As noted above, the two basic design approaches underlying these systems are: (1) use of on-line, real-time techniques, and (2) use of on-line data collection and batch updating of files. The use of these approaches—especially the former—has not proved satisfactory to date from either an operational or a cost-effectiveness standpoint. Among the problems noted, the following seem to be most critical:

1. *On-line, real-time systems require complex computer operating systems and queuing routines.* Although computer manufacturers offer these routines, they are apparently operational only for large-scale computer systems dedicated to communications-oriented processing. Most computer systems involving background/foreground processing (i.e., batch processing at the same time as teleprocessing) appear to require that a large amount of the internal core memory capacity be used for "overhead" purposes and are generally successful only when sections of the computer memory are dedicated to each task. Computer "overhead" comprises the routine internal program instructions required to recognize, understand, approve, and allocate resources to handle an incoming bit of data prior to acting on the first user instruction of the application program. Such overhead may be thought of as housekeeping or nonproductive time.

2. *The cost of software and hardware to support the real-time system is probably twice that of a non-real-time system.* This added expense cannot be balanced by compensating savings, either tangible or intangible, to the user hospitals. In addition, both services provided by the manufacturer and the capabilities of the programmer staff needed to operate in the on-line, real-time environment must be of a relatively high level, and thus quite costly.

3. *The demands upon a system to service general practice hospitals, private hospitals, teaching hospitals, and district hospitals can vary significantly.* It does not appear that a package of programs can be built on a sufficiently generalized basis to satisfy these varying needs without significant tailoring of individual programs. This tailoring can result in significant costs because of the complexities of specialized systems concepts, the use of data base concepts, and other unique software.

Among the best-known of these large-scale, multi-hospital information systems are the Medi-Data system, based on Burroughs equipment; the Medinet system, based on GE equipment; the Medical Information Systems Program, based on IBM equipment; and the Lockheed Missiles & Space Co.'s hospital information system.

medi-data system

Unique among the four systems mentioned above is the Medi-Data concept, in that it avoids the use of real-time processing. This system records messages in the computer for periodic updating. Output reports are produced on a regularly scheduled basis each hour. Because of this approach, Medi-Data costs are reported to be significantly less to the hospital user on a per-patient-day basis than costs of the other large-scale systems.

This system has some other significant differences from the other large-scale systems. For example, all input/output terminals are designed to be operated by trained data-processing personnel rather than by nurses or other medical staff personnel—the intention being to reduce operating costs and to increase accuracy of input. Though each of the institutions jointly using the Medi-Data system is to have an integrated data system, each participant would retain its separate identity. There will be complete mechanization and standardization of medical records. Statistics will be produced for outpatient clinics. There will be a common medical-record data base for a community. Detailed components of nursing care by patient and class of service will be provided. As a result of this design concept, there has been a significant number of requests from physicians to have terminals in their offices connected into the Medi-Data system for information retrieval and input of orders.

The list of applications planned for Medi-Data is ambitious, to say the least. In addition to a complete set of administrative and accounting reports, personnel, payroll, and labor distribution reports, the system, as conceived, includes input of doctors' orders, completed services, vital signs, nurses' notes, and medical records coding. The ultimate goal is to provide a visual display in the doctors' lounge which will enable doctors to review medical charts; the patient list, with conditions scheduled, tests and treatments; room reservations; and the surgery schedule. The original timetable called for the first user hospital to receive a basic

level of Medi-Data service before the end of 1968. However, problems of obtaining consensus on systems design have delayed implementation to early 1969.

medinet system

The Medinet system is currently being tested in a number of hospitals throughout New England and is in use at one hospital. Medinet is developing the following application packages: admissions and census data, including preadmission bookings, bed control, inquiry, transfers, and registrations; Medicare recertifications and insurance prorating; a laboratory system, including remotely entered orders, scheduling, and exception notices on lab results; a pharmacy system, including development of routine and detailed formulary, along with adverse drug reaction analyses; food service; a medical-record subsystem, including maintenance of service, discharge analysis, status of records, and patient index; demand billing systems, including inpatient and outpatient billings and receivables; and psychiatric nursing notes, including analysis of notes and tests.

The original design concept of the Medinet system was to build an all-inclusive generalized system applicable to all user hospitals. The system in use at a New York hospital is a scaled-down version of the original concept. The Medinet staff includes a number of personnel trained in various hospital fields in order to ensure a realistic and appropriate design. Because of the complexity of such an over-all system, it will probably be extremely difficult for users to modify the programs relating to input data. More pertinent, however, is that at present none of the subsystems has been detail-designed to completion. No estimate could be secured at the time of this survey of the cost per patient-day for the Medinet system.

ibm's misp

The original purpose of IBM's Medical Information Systems Program (MISP) was to provide a standard set of programs capable of being operated within reasonable cost parameters for a moderate-size general practice hospital. In the original concept, these programs were to be maintained by IBM. These programs were to utilize the resources of a common data base, so that all inquiries and transactions entered into the system from terminals strategically placed around the hospital could be handled on a real-time basis. MISP was to be designed to serve not only as a source of billing data but as a complete information system for an entire hospital.

The present status and direction of MISP, however, appear to be quite different from these original objectives. For instance:

1. The programs are being written at a number of teaching hospitals. As a result, they may not be applicable to the general practice hospital and therefore might have to be user-modified for such applications.
2. IBM will release MISP first to these and other teaching hospitals where research grants are available for further experimentation. Following this stage, these programs may later be released to general practice hospitals.
3. To what extent these programs will be applicable to nonteaching hospitals and whether they can be integrated into a single system are open questions. Further, since the programs will not be maintained by IBM, it is up to the user to do so. In this respect, these programs will be similar to the PAL package available to hospitals on the IBM 1440 computer. However, early indications are that the MISP programs will be better designed and written and have a higher level of documentation than was the case with the earlier PAL package.
4. The hardware required for MISP will probably be too expensive for a 300- to 400-bed hospital. The present specifications call for a 360/40 computer with a minimum of 131K core storage.
5. The terminal concept currently supported by MISP is limited to a single type of device rather than, as originally publicized, allowing for the use of any type of terminal or a variety of terminals. This means that while some hospital departments will have a device suitable to their needs, others may not.

lockheed's hospital plan

The Lockheed Missiles & Space Co. (LMSC) hospital plan envisions 50 or 60 regional centers located in hospital service bureaus throughout the country. Major market areas have been determined, and the design of a two-level LMSC service for hospitals is now under way.

The basic system for Business Office Service (BOS), now being implemented at two hospitals in California, includes: payroll, patient billing, accounts payable, and general ledger.

Some operational problems have arisen with the basic system. The original systems design was developed in detail by the Lockheed staff, augmented by a small cadre of hospital-experienced personnel. As a result, some of the differences between the accounting practices of a hospital and those of Lockheed were not adequately recognized or reflected in the design of the system. As Lockheed increased its staff of hospital-trained or hospital-oriented personnel, more competence is now being provided the user or potential user. The BOS system is now being substantially revised and upgraded in preparation for service to three additional hospitals. This service will begin in mid-1969.

The system's second level of service will involve visual display terminals actuated by light pens. One display terminal was installed in one of the California hospitals on an experimental basis in November, 1968. The terminal is to be a specially designed wide-screen visual display to be used by the doctor in a conversational mode. The Lockheed concept is to involve the doctor in the computer-oriented order procedure. For example, ordering digitalis would require a six-step selection process in which the operator would call up successively more detailed multiple-choice pages, selecting the desired page by pointing to it with the light pen. At each step in the process, the cumulative order would be displayed at the top of the screen.

The ultimate level of service is to be "a complete hospital information system." Although the design is not firmly established, it is clearly intended to be a complete patient care system. The cost of this system was estimated at $4 to $6 per patient-day. One reason for this relatively high cost, it appears, is the design parameter of a modular package individualized to meet the needs of each user. Another significant cost element is the nonstandard visual display unit. The use of this concept is premised on the acceptance by the medical staff of a unique data entering system and on the assumption that doctors will be willing to wait on queue to use the terminal. Other hospitals thus far have not seen sufficient advantage in this visual concept to hasten its development.

In summary, large-scale, multi-hospital information systems do not appear to be "just around the corner." One of the most widely-publicized systems has already undergone three changes in equipment, location, and concept. More significantly, this system now offers far less in scope than the original plan and is far more costly than the original specifications. Two other systems, conceived from the start as time-sharing systems, have thus far incurred costs of hundreds of thousands, if not millions, of dollars, and are not yet out of the design stage. Basic problems in handling the on-line, real-time features of the equipment have proven far more complex than was initially anticipated. Finally, the

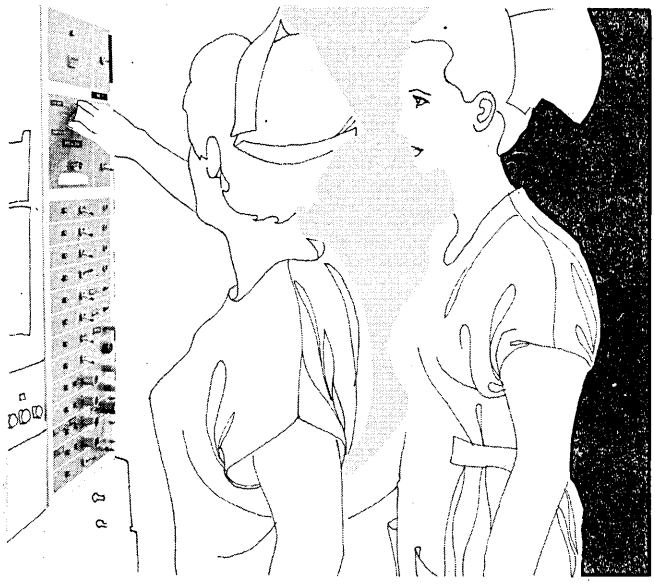
design and implementation schedules of these systems have suffered from a highly mobile high-turnover profession which has caused a loss of continuity in program development.

large-scale single-hospital systems

There was wide divergence in the design approaches of the single-hospital systems reviewed. Not surveyed were the several institutions successfully using second-generation computer equipment to process accounting applications in a batch mode.

The largest single-hospital information system in operation today is at the Downstate Medical Center in New York which, in a 350-bed hospital, has more than 100 terminals on-line to a computer. The hospital estimated that about 85% of its administrative activities are based on the computer system. Also advanced in its actual use of a computer-based system is the Children's Hospital in Akron, Ohio. However, the limitations of the computer file and the awkwardness of the terminals place restrictions on this system.

Both the New York and Akron systems are based on the use of on-line, real-time techniques. It was noted that the cost evaluations made within the institutions did not show any tangible compensating advantages with respect to the cost of the real-time aspects of each system.



If these hospitals, and other hospitals visited, are typical, it could be concluded that systems developed at a single hospital are not readily transferable for use in another hospital. The data-processing equipment may be appropriate only for that particular institution at the particular time it was ordered. Certainly the system design itself is tailored to the specific needs and desires of the hospital administration and to the hospital's role in the community. Adapting such a system to another institution with medical specialties —requires a detailed understanding of the reasoning behind the system approach, as well as an in-depth comparison of the similarities and differences between the originating hospital and the prospective user. This constraint also applies to shared systems or service bureau packages developed as an outgrowth of service to a single hospital. In spite of these problems, however, some conclusions as to the value of the processing concepts or techniques involved or the cost-effectiveness of the various application concepts should be of interest to other users.

downstate system

A unique aspect of the Downstate Medical Center installation is that the computer system was designed and put into effect concurrently with the opening of the hospital. The initial implementation included the following:

1. An ordering subsystem for services and supplies for the hospital, the clinic, the medical school, and the research units.
2. A patient admitting subsystem which will admit and discharge either inpatients or outpatients, select an available bed, maintain a patient census, and establish medical and financial records.
3. A patient billing subsystem which will offer on demand at a decentralized location a current bill for payment as well as handling third-party accounting, charge and revenue distributions, and financial management reports.
4. An educational research subsystem for the outpatient clinic, with emphasis on patient appointment scheduling, selective assignment of student-doctor to patient via a tentative diagnosis, arrangement for the continuity of student-patient relationships, student progress evaluation reporting, and interaction with all other medical center facilities (pharmacy, specialty clinics, hospital, and so forth). In another area of education, the computer system will be involved in a curriculum being developed for graduate study in biostatistics.
5. Medical records subsystem for information pertaining to the patients' hospital stay is recorded, organized, and stored with the intention of assembling a vast electronic file of medical information which may be retrieved and used in all the research areas previously described.

The medical research applications in phase one are to include such projects, presently being developed and processed, as nerve system analysis, heart disease study, fetal heart study, psycho-pharmacological studies, and tumor pathology.

No conclusions can be drawn with respect to tangible savings because the hospital had never operated without the use of the computer and, at the time of the survey, maximum utilization was at a 30% to 40% level of occupancy. Furthermore, within a short time after the initial installation, changes of both the computer equipment and the terminals became necessary which increased the cost of data processing to some degree. It should be noted, however, that the original justification for the development of the computer system was related primarily to medical care and the intangible benefits of increased accuracy.

akron children's hospital system

At Children's Hospital in Akron, the following systems have been implemented:

Laboratory: Pickup of lab orders, listing for lab work, and collection schedules.

Dietary: Pickup of special diet requirements for different age groups and in conformity to doctors' orders. These are summarized in various ways to assist preparation and distribution.

Oxygen therapy: Pickup of doctors' orders and listing for scheduling purposes.

There are 14 terminals in the system. All data entered are coded numerically. The nurses are expected to use the terminals. At this point, after more than a year of operation, there is no indication that tangible savings equal to the cost of the system have been realized. Some tangible and intangible improvements have been realized in ancillary areas—for example, the collection of all dietary orders to facilitate meal preparation, and the listing of the laboratory collection requirements. Major intangible advantages are claimed too with respect to the acceptance and use of the system by the medical staff. The experience at this hospital is a valuable guide to systems designers and planners, because it highlights two major problems: (1) acceptance of the system on the part of the personnel responsible for data entry, and (2) machine capability. With respect to machine capa-

bility, it very soon became obvious that the equipment, which may have been appropriate at the time of the order, was not in fact sufficient to accomplish the specified tasks. A significant narrowing of scope was necessary to permit the system to operate within the limits of the computer's capability.

tirr system

The Texas Institute for Rehabilitation and Research (TIRR) is in the process of implementing one of the most ambitious computer systems of any single hospital reviewed. The system places priority on patient-care services rather than administrative functions. It is based on real-time techniques involving about 20 terminals. The system's substantial cost is reduced to some extent by sharing a large-scale computer with a university medical school. Although such a costly system is not likely to be implemented elsewhere without public funding, the report structures and information requirements that were designed and implemented on an older computer can certainly be adapted to other hospitals.

At TIRR, reports were first generated on a batch basis while experience in teleprocessing was accumulated for one year. The goal of this large system is the nearly complete automation of:

Medical records
Ordering of medications
Lab results
ICU vital sign monitoring
Staff and patient scheduling
Occupational and physical therapy reports
Billing and other business office requirements

The core of the system is a single data file containing all patient information. An extremely flexible retrieval system is employed which allows a variety of users to select data in the form they desire.

Present plans call for 20 to 24 terminals. To add vector display of vital signs to the system, TIRR is considering various alternatives such as remote plotters and closed-circuit TV focused on a single plotter.

The developmental cost of the program to date has been estimated at between 64 and 100 man-years. A portion of this time was devoted to writing an operating system, because the manufacturer's operating system for the particular computer in use was found to be insufficient. The operational cost of the system is estimated at $10 per patient-day.

The developmental and operational costs of this system probably far exceed any commensurate benefits of economics or better patient care that could be derived by a medium-size general practice hospital. However, the reports and profile data generated by this system are valuable pointers to what may become desirable tools for the physician. Some of these reports can, in the author's opinion, be approximated through substantially less expensive techniques.

manchester memorial system

Early in 1964 a small computer was installed at Manchester Memorial Hospital in Connecticut to handle patient accounting, payroll, and patient statistical data. It was one of the earliest teleprocessing systems installed in the country, with a network of eight Teletype stations linked to the computer. The system terminals are located in admitting, business office, medical records, pharmacy, laboratory, X-ray, emergency room, and the data-processing center.

The system does not substitute for manually prepared data (e.g., orders for ancillary services, bed transfers) but is used basically as a device for recording results. Charges entered through the terminals are priced by the computer. Entry and discharge diagnoses are entered to the computer and various statistics are derived from these data:

Units of care by type of service by zone of care
Number of consultations by service code
Disease statistics by service code by zone of care
Disease and operation indices
Length of stay by disease and zone of care
Analysis of doctors' practices by disease and operation

These data are useful for Medicare analyses, financial planning, utilization committee and quality control, and medical staff planning.

A unique feature of this system is that the responsibility for inputting data to the system is assigned to data-processing personnel, who move from department to department entering data through the Teletypes. Although this system is not used for many of the advanced applications noted in other hospitals, it is significant that the total accounting-administrative cost in this hospital is approximately half that of any of the other hospitals included in this survey that were using on-line, real-time techniques.

Many of the single-hospital systems covered in this survey started with great expectations but have experienced subsequent delays, scope changes, and, most important, greater costs than early projections.

The most frequent problem encountered was equipment limitations. One hospital surveyed had undergone five computer conversions in six years, while another had two conversions within one year. Downstate Medical Center increased its machine capacity before two years of operation.

The second most common problem relates to the operating system—normally supplied by the computer manufacturer. Typically, these programs have been insufficient for handling the requirements of real-time hospital computer systems and have had to be substantially modified by the user.

shared-service-bureau hospital systems

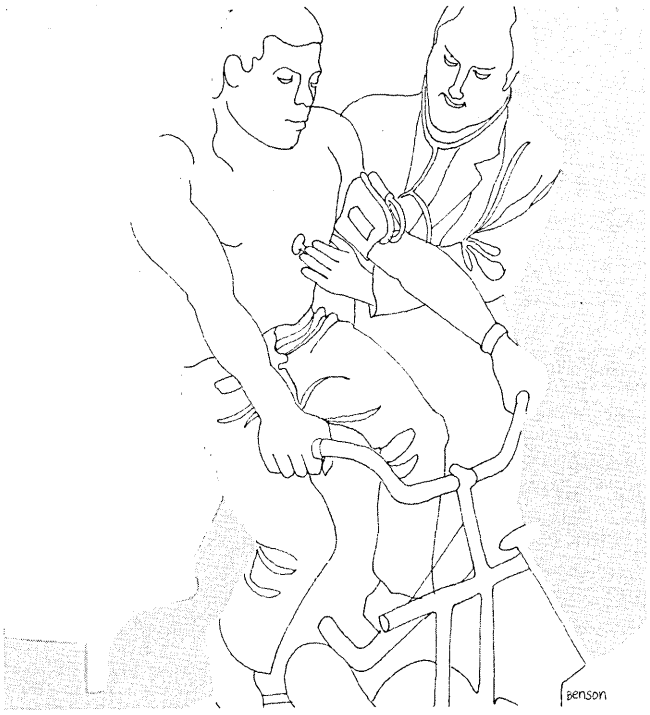
A large number of organizations are attempting to achieve the benefits of a shared-computer system through a service bureau approach. The EDCO system in Delaware, using IBM equipment, the Minnesota Blue Cross system, using Honeywell equipment, and IBM's SHAS are three of the most widely publicized. The comprehensive quality of the Minnesota system is such that it is now being marketed by Blue Cross organizations in Phoenix and Denver. Other groups of hospitals based in Norfolk, Va., and St. Louis, Mo., are going to use Honeywell equipment and presumably will also start with the Blue Cross package.

Recently IBM has announced its shared hospital system (SHAS). Presently planning to use this system are: CHART (an association of hospitals in upstate New York), Milwaukee Blue Cross, Omaha Blue Cross, Emanuel Hospital in Portland, Ore., and Fairview Hospital in Minneapolis, Minn., among others. The applications are patient billing and accounts receivable, and general accounting. Some non-test-site locations have started to implement portions of the system on a batch basis. Indications are that considerable effort is required to tailor the highly complex programs to a specific user's needs. SHAS is not now planned to go beyond the applications listed above and will not include applications such as payroll or accounts payable. SHAS is designed as a teleprocessing system but few, if any, hospitals, are using it as such. SHAS is somewhere between the MISP program and a manufacturer's package. However, many of the comments about MISP made earlier in this article may apply here.

Regular service bureaus in many local areas have developed hospital patient billing packages. In Northern California, for example, the Central Valley National Bank in Oakland and the Peninsula Tabulating Service in Burlin-

game (a division of Computer Applications, Inc.) are both marketing localized service with varying degrees of success. Apparent limitations of a service bureau approach are:

1. The applications offered to date center around patient accounting.
2. There is a sufficient divergence of requirements at the individual participating hospitals to cause extensive modifications of the package program.
3. The service is subject to the same qualifications that



would apply to any other commercial user of service bureaus.

4. Systems design in the hands of a service bureau is not likely to be entirely adequate.

As the service bureaus' approach is extended to areas beyond patient accounting and other relatively simple financial reporting applications, it seems likely that the cost of tailored system design and programming may prove uneconomical to the bureaus.

The Blue Cross system is a good example of an advanced service bureau concept. Yet, basically, the Blue Cross system is a batch processing operation providing on-line access to the computer for data collection and inquiry. Each hospital has a separate line to the computer and its data are edited on input. Charges are entered by service codes only. Pricing is handled by the computer, except for pharmacy charges, which are currently entered with dollar amounts. As charges are entered, the hospital is signaled as to whether the data received are in the proper format. Input may be made at any time, and the hospital may inquire at any time as to the latest patient charge. Daily, weekly, and monthly reports are available. Three times a day, batch proofs are run at the computer center and batch totals are sent back to the hospitals via the Teletype for control purposes. The report structure provided by the Blue Cross system is extremely complete and well controlled on the patient billing applications. Some minor limitations do exist on the output, however.

Certain problems are generic to the development of any package system. They can be found in the development of the Blue Cross System and in all the other service bureau packages evaluated. These problems relate to the ability to build on an economic and timely basis a broad, generalized package suitable for many different hospitals, each of which believes it has a unique environment with respect to patient type, collection problems, types of services rendered, organizational structure, physical layout, and relations with its medical staff. Because of these and other factors, each hospital wants a system to reflect its own individual personality. Obviously, this expectation works against the philosophy of a service bureau package. To the extent that any given hospital's peculiar characteristics are in contrast to the strengths and weaknesses of a particular package, that package becomes inappropriate for that hospital.

The areas of payroll, patient billing, and accounts receivable lend themselves better to package presentation than applications relating to medical care because the former are highly structured by the requirements of outside agencies—e.g., insurance companies; federal, state, and local government regulations; and accounting conventions.

Even in these accounting packages, however, different treatments or methods apply. For example, some packages prorate for all insurance carriers, some for only a few carriers, and others do no prorating at all. Some packages and some hospitals assume subordination of insurance benefits, while others do not. Some packages handle accounts receivable only, while other packages handle inpatient charges only, with no provision for accounts receivable. Some packages provide no separate handling of out-patient charges, and few, if any, packages deal effectively with clinic patient accounting. Some hospitals prefer to bill by individual patient, while others prefer to combine all charges to the family on a single statement. Aging of accounts receivable may be programmed for date of service or date of last activity. Finally, some package approaches to statements permit open-item treatment while others utilize balance-forward files.

dedicated systems—specialized areas

Under the auspices of the National Institutes of Health, the U.S. Public Health Service, and other government agencies, a number of research grants have been awarded to explore various single aspects of medical information systems. Some of these systems relate directly to medical care, others are oriented more to administration. Almost all may be characterized as being extremely expensive, overemphasized approaches to a total hospital system. Each, however, points the way to medical areas in which a computer might be quite useful. In the construction of a total system, therefore, some recognition should be given to the problems addressed by these "dedicated" systems.

A number of on-line, real-time systems are being used on an experimental basis in the area of medical care. At the Presbyterian Medical Center in San Francisco, 12 transducers measure blood pressure, heart action, respiratory functions, and temperature of patients in the cardio-pulmonary intensive-care unit. The computer to which these transducers are connected also performs a predictive function, and is credited with positively identifying at least one condition previously subject to guesswork. Also at this hospital, monitoring is performed on a continuous basis.

At the shock research unit of the University of California's School of Medicine at the Los Angeles County Hospital, a computer system has been designed to report on patients with circulatory shock resulting from a variety of causes. According to University of California personnel, the mortality rate for such patients is typically over 66% because when blood circulation is ineffective not enough oxygen and nutrients are delivered to the vital organs to sustain them. Rather than continuous monitoring, the measuring devices transmit data about every five minutes on the primary physiological variables, including blood pressure, ECG, temperatures of different parts of the body, liquid output, and optical densities of blood. The computer processes the information and plots a summary of elected patient data. Even with periodic monitoring, the present sys-

tem is limited in that a critical situation, such as cardiac arrest, imposes too much of a demand on a small computer. Adding to this problem is the fact that a monitoring computer must be operable 24 hours a day and, to be economic, capable of servicing more than one patient.

At the Massachusetts General Hospital in Boston, a questionnaire is programmed into a computer servicing a Teletype network. Through this programming, the computer asks for data in a logical order with respect to the course of testing, the validity of the medication order, and all other information about the patient related to disease classification. This system has been operating on an experimental basis at Massachusetts General for a number of years, yet the hospital has recently decided not to expand the system for general-purpose use.

A number of hospitals throughout the United States are using the computer for measurement and analysis of various tests. For example, approximately 30,000 ECG's per year are reviewed by a computer at the Public Health Service Center in Washington, D.C. Mount Sinai Hospital in New York and the New York University Medical Center have also utilized the computer in experimental systems to assist in analysis of ECG.

Laboratory systems at the University of Missouri and the Youngstown Ohio Hospital are examples of the use of computer equipment to read auto-analyzer test results directly. At the University of Missouri, terminals are used to enter lab results off-line. At the Youngstown Ohio Hospital, the auto-analyzer is connected directly to the computer.

The Berkeley Scientific Co. in Berkeley, Calif., has developed a highly sophisticated set of analog recording devices which have been successfully interfaced with a Digital Equipment PDP-8 computer for use in a number of independent laboratories throughout the United States. Recently a Perth Amboy, N.J., hospital initiated use of a package laboratory system capable of interfacing directly to the SMA-4, SMA-12, and a scanning densitometer. This system (SPEAR) is also being marketed to independent laboratories.

Perhaps one of the most complex uses of the computer in hospital systems is a diagnostic aid. The multiphasic screening test developed at the Kaiser Foundation Hospital in Oakland, Calif., is an example of tying in a complete physical examination to a computer for analytical purposes. Approximately 4,000 people per month go through a 19-step health examination in which everything from their weight to their cholesterol level is measured. All the data are fed into the computer as the patient goes through the examination. The computer compares the measurements with the pre-established standards of the program. Within 10 to 20 minutes after all the examination procedures have been completed, the computer report is ready. The report indicates tests which should be repeated and additional tests which should be taken, and suggests explanations for the abnormal readings.

For about three years now, IBM has supported a project called the Clinical Decision Support system, which is intended to reduce large, complex medical diagnoses into networks of micro-decision modules that can be programmed. Each of these modules would contain a specific item to be processed by a computer according to an expressed rule to reach a defined decision. The CDS system envisions a dialogue between the doctor and the computer. As the doctor sits at a typewriter keyboard inputting information about the patient, the computer responds with questions displayed on a crt. The doctor's answers lead to further computer questions which narrow the area of diagnosis. At any time, the physician can ask the computer what diseases are under consideration—and why. Experiments with the CDS system have been limited to date to internal medicine.

The Tulane Medical Center experimented with marksense cards to aid physicians in entering information on case histories and physical examinations to a computer. This system involved a deck of no fewer than 200 cards, each with about 20 questions. Later it was modified to utilize optical scanning techniques. Besides checking off the results of the examination, the doctor may express an opinion in a brief statement which can be entered by a keypunch operator. The result of these procedures was to build up a data bank about a patient.

Along with these systems that are highly oriented to the practice of medicine, there have been experiments with other advanced hospital systems relating to administrative techniques. Examples of such systems are the food management programs at Tulane University and Florida State, and the admissions and transfer system and clinic appointments system at Children's Hospital in Boston.

The Tulane project attempts menu planning and purchasing through a linear-programming concept. The program covers food values and appetizing combinations, along with food prices for the forecast portion. All these factors are then related to inventory management and economic purchase quantities. The Children's Hospital project represents pioneering use of visual display devices in the hospital industry. The intention is to improve computer utilization through on-line, real-time control. Obviously, if utilization can be improved a significant additional revenue can be generated.

Within the hospital environment, each transaction involves multiple communications. In contrast, most systems have only one-way communication from various terminals to the computer, or one-way response back to a particular terminal. The Medelco THIS system, first installed at St. John's Hospital in Joplin, Mo., represents a unique message-switching concept designed primarily to eliminate all telephone communications and to allow for continuous availability of charge data. Although experience with the system was too limited for comparative evaluation, the potential for significant improvement in hospital systems is already evident. For instance, this system accomplishes some of the results of the Boston Children's Bed Utilization System, yet at a much lower cost. The system involves a patient card coded with nursing station, bed number, patient name and number, and other statistics. This card is used for every message pertaining to a single patient. In addition, there is an order card which contains the addresses of the terminals at which the message is to be printed, and for verification purposes the message is also printed at the sending station. The order may be augmented or modified by a third or fourth card (e.g., quantity information). Administrative, housekeeping, maintenance, and other messages may also be entered through the system. Basic reports are an end-of-the-day register of charges by patient for postings, an on-demand listing of today's charges up to the minute, bed utilization, and other similar information from the contents of the drum memory.

In the operation at St. John's there are 3,000 to 4,000 cards at each nursing station. The ward clerk pulls cards directly at a doctor's order and refiles the entered cards. The nurse does no transcribing or writing. There are no phone interruptions at any location with respect to orders or service. There are no problems of "busy" phones, no need to retain a clerk merely to answer phones, and no "idle conversations" arising from phone calls. At the time of the survey, this hospital anticipated a saving of about 5% of nursing time after moving to its new facility. This time can be used to provide better patient care. Another feature of the Medelco concept is the automatic typing of medication labels as a by-product of entering orders. This feature will save about one-third of pharmacists' time. Further savings are

being realized in maintenance, housekeeping, and central services. Similar savings are being realized at Providence Hospital in El Paso, Texas, another Medelco user.

Thus far we have, for the most part, considered those computer systems in which (1) the use of on-line and real-time techniques has been implemented, (2) the direction of the system is leading toward the use of these techniques, or (3) such techniques are at least under consideration. The typical approach to data collection in a batch processing environment is by means of keypunching devices and trained operators. Mark-sense, optical scanning, and badge reader devices exemplify opposing attempts to bring the responsibility for accurate data input back to the originator of the data. In the off-line mode, however, the originator of data input never interacted with the computer, and therefore was not really part of the computer system psychologically.

The development of time-sharing or on-line systems has placed the terminal operator in a position of directly affecting the computer, all of the information stored within it, and the results of the processing of that information. In practice, users of on-line or time-sharing systems in other industries have noted important differences in the psychological factors associated with response time, verbosity or terseness of computer responses, isolation of remote users, and the lesser computer expertise of the users. In other words, in the on-line computer system, the terminal device or console used to supply input to and receive output from the central computer is a critical element. To the user, the terminal *is* the computer, so the success or failure of the on-line computer system may depend critically upon the human engineering factors built into the terminal device for the benefit of the user.

Experience indicates that the selection of an appropriate terminal to match the needs of the user may be critical to the success or failure of the system. In the selection process, careful thought must be given to the possible use of various terminals in different locations to serve different needs. Typewriter, push-button matrix terminals, visual display devices, voice answerback units and other terminals each have advantages and disadvantages in any particular operating environment and must be matched to the characteristics of the user.

conclusions

This survey substantiates that the data-processing alternatives available to a hospital administrator today are indeed many and complex. He must be able to ascertain requirements and desires and balance them against the available resources. He must be able to sort the practical from the theoretical. And lastly, he must have on hand the technical expertise necessary to evaluate the weaknesses and limitations of the specific alternatives available to him.

Certain generalized conclusions may be derived from the survey:

1. Highly developed computer-based hospital information systems are not currently in general use and will probably not be developed for general use within the next two or three years.

2. To go beyond the "bread and butter" applications of patient billing, accounts receivable, payroll, and general ledger accounting will demand new skills, new techniques, and new controls on the part of the administrator.

3. The most important phases of the development and installation of a new computer system are planning and systems design. No package useful to one hospital is necessarily valid for any other. The planning should be based on the total scope of the hospital's activities, not merely concerned with the question of equipment selection. The planner should define specifications in terms of the range of services provided by the hospital, the philosophy of its management, the hospital's role in the community, and the needs of the users. The systems design should cover the total impact on the hospital of computerization, not merely the processing techniques. Need, use, and methods of data preparation, data collection, and data output are also extremely important. Adequate attention to these aspects of the computer program can save thousands of dollars in operational costs.

4. Equipment configurations should be carefully selected on the basis of meeting well-defined specifications and demonstrated capability. Alternatives between on-site or off-site service should be carefully analyzed. All too frequently in the past, users have submitted no specifications against which to measure equipment proposed by the manufacturer, have not sought competitive bids, and have relied on vaguely stated promises by the manufacturer that his equipment can be modified to meet any future needs. While this latter concept has some validity, no estimate can be made of the additional cost to provide this flexibility.

5. The cost of developing an integrated system is high. This survey included systems for which the developmental costs have already exceeded $1 million to $2 million. A typical cost range for an on-site system using terminals is $350,000 to $700,000. A large portion of developmental cost has been spent in modifying or augmenting software thought to have been supplied by the manufacturer in satisfactory working order.

6. Operational costs of on-line, real-time systems are high. They may be expected to approach $3 to $5 per patient-day. In many currently operating or planned systems, the inefficient use of computer hardware has led to even higher operating costs.

7. Development and implementation of a multi-year program to install an integrated hospital system requires the services of a highly competent computer-oriented systems staff and, more importantly, a top management deeply committed to the implementation of this type of system and capable of controlling the construction of the system.

There should be no basic difference between the processes of justification, specification, and selection of a computer system and those involved in any other large-scale capital acquisition. If there is any significant difference it should be that the selection of data-processing and management information equipment must be more carefully handled in comparison to other capital improvements. The reasons for this difference are obvious, but worth repeating:

1. The impact of such systems is more far-reaching and much more significant in terms of operational and attitudinal changes than is true of most other equipment related to patient care. Without the proper foundation, there can be a serious adverse impact on morale and work efficiency—an impact which may take considerable time, effort, and cost to remedy.

2. The use of computers in hospitals, contrary to the impression that one may get from certain experimental applications, is still basically as an administrative tool rather than a tool of direct medical benefit to the patient. As such, it is an element of "overhead" rather than a direct cost. The fact that these costs may be reimbursed by grant or by third-party carriers and not directly borne by the patient should not lessen management's interest in their proper control.

It has been the intention of this article to report the experience of innovators in hospital data processing, with the thought that those who innovate in any area point the way to easier and less costly solutions to common problems. No criticism is intended, nor should any be inferred, of the users or manufacturers involved in the installations discussed here. The experience of these innovators, which they graciously made available to the author and his associates, has been reported here to assist administrators faced with the need to make decisions on computer-based hospital information systems. ■

a look at the market

COMPUTERS IN MEDICINE

by Norman B. Reilly

Interdisciplinary communication problems have often been a main deterrent to the smooth marriage of computer technology and the life sciences. Many computer and equipment manufacturers who have not traditionally serviced the medical field have found it rough going in their first efforts to apply standard marketing techniques to what on the surface appears to be a ripe plum.

There is a natural tendency for engineering people to automatically regard their product as the solution to a problem somewhere in the medical environment. A classical example is the continual re-invention from year to year of the electronic stethoscope. The notion is at first appealing when one considers the number of doctors that constitute the potential market. But a simple count of potential users has little practical meaning when competitive advantages such as price and ease of maintenance are not considered.

There is an equally strong tendency for medical people to view the engineer pretty much as a novice whose primary orientation is toward the placement of his own equipment and not necessarily toward the best health care or system efficiency. For this reason, medical institutions often lean on government agencies and non-profits for advice on how to proceed.

This article will characterize a number of areas in the life sciences where computers are currently in use, and hopefully serve to indicate where marketing people might do some homework.

administration

The biggest dollar volume area for the next five years will continue to be the use of data processing equipment in the "total hospital information system concept."

The notion here is to plan a central computing facility to furnish total hospital information processing needs. These include such functions as accounting, admissions, room scheduling, orders and inventories, scheduling of X-ray and operating room facilities, laboratory report tests, diet planning, patient information retrieval, etc.

It is not unusual to find scattered examples of computer use in each category. Examples are a lone blood bank inventory system or an isolated taxonomy program.

It is unusual to find a totally integrated approach such as the one recently begun at a San Fernando Valley hospital in California. The hospital is presently organizing a multidisciplinary research team to conduct systems operations and job analysis. Career positions have been filled involving

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talents of industrial engineers, training specialists, mathematician-programmers, psychologists, and human factors specialists.

In general, however, the field is in its infancy. Less than 10% of the hospitals in the country have gone beyond the punched card stage. But some have made a start. For example, the Minnesota Hospitals Program involves 10 participating hospitals sharing equipment at a Blue Cross computation center. Stage I, which was scheduled for completion in 1968, consists of programs to handle patient accounting, payroll, inventory control and purchasing, accounts payable, property ledger, maintenance scheduling and general ledger accounting. The Blue Cross computing center uses two Honeywell series 200 computers plus peripherals.

Another example is an organization formed by the Hospital Association of New York State which provides on-line accounting assistance for a growing number of member hospitals. Medicare was a big consideration in its formation. The center has an IBM 360/30 and claims that at its inception it was the first shared center in the country that did not require a standard accounting procedure among its members.

There is room for the commercial development of systems as well. Medelco, Inc., is currently enjoying a 2.8 million dollar backlog for its commercially available Hospital Information System, and Intellectron, Inc., has developed an automated Laboratory Information Management System, (LIMS), designed specifically for medical laboratories.

Medicare has forced many hospitals into considering processing equipment before they might normally have done so. Some seem unconcerned with long term planning; some seem to feel that there is little beyond basic accounting procedures that the machine can be useful for.

In any case, marketing people must be sophisticated from a medical systems standpoint and be prepared to invest the time required to build necessary confidence.

Ideally, a manufacturer would like to get involved early in the analysis and planning stages, especially when a big complex is in the making. This is not easy when medical administrators are increasingly turning to agencies and nonprofits for planning help.

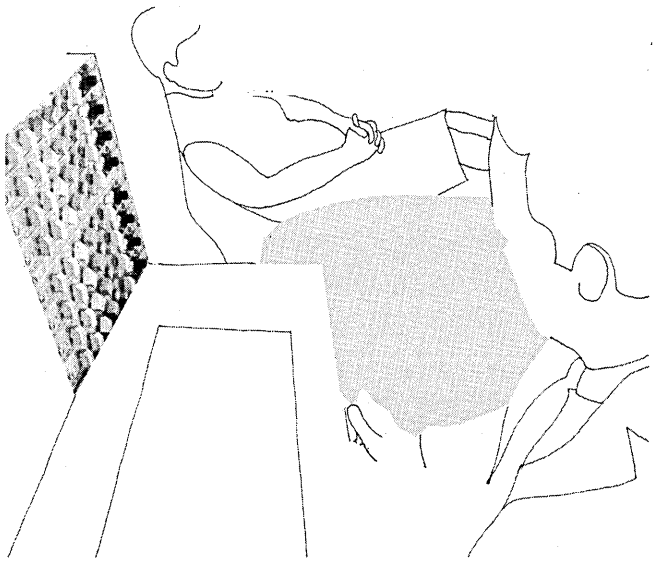
For example, the Veterans Administration has been active in developing the pilot Automated Hospital Information System (AHIS) which is comprised of a number of automated subsystems. One of these is the medication subsystem, composed of a number of activities linking those organizational entities of the hospital involved in the ordering, preparation, distribution, administration and use of the medications and supplies issued by the pharmacy. The subsystem consists of:

1. Medication ordering
2. Ward medication administration control
3. Ward drug inventory control
4. Medication statistic reporting
5. Pharmacy inventory control
6. Drug expiration data control
7. Formulary revision
8. Management reporting

The computer used is an IBM 360 Model 40, with random access storage facilities, a teleprocessing control unit and a complement of peripheral devices (card reader-punch, high speed printer, paper tape reader, etc.). The terminal is an IBM Model 1092/1052/1051, consisting of a programmed keyboard, a printer keyboard, and a control unit linked by a communication line to the computer. The programmed keyboard is designed to accept plastic keymats with field and key designations printed on them. The 1052, which serves as a printer for receiving output messages and verifying entries, has a conventional typewriter keyboard for entering textual information. Transactions entered from the 1092, with a keymat in place, will be translated immediately and printed on the 1052 for verification by the user. All entries are verified before the computer system will accept them for processing.

Another example of government sponsored planning activity involves the Air Force hospital complex. Air Force planners are working out the concept of a 200-unit computerized data handling system for all AF hospitals. It will process medical data ranging from laboratory tests to record storage. Regional centers would have their own computers and data storage, but with total access to the central system at Lackland, Texas. The planners would use social security numbers as ID symbols, and the system would be compatible with other federal services. Some features are: admissions, medical records, patient monitoring, scheduling, medication, lab tests, and research programs.

In the fall of 1967, the California Health Data Corporation (CHD) was incorporated as a nonprofit scientific and educational organization, under the sponsorship of the California Hospital Association and the California Medical Association. Representatives of the Health and Welfare



Agency and particularly the State Department of Public Health have been deeply involved in the development of CHD.

CHD represents an attempt to give organizational expression to the mutual concerns of the so-called public and private sectors of health care in California, at least in regard to health data systems.

The purpose of CHD is to become *the* health data gathering organization for the state of California. CHD has decided to sponsor for California hospitals the commercially available Medi-Record system. Medi-Record is a medical record information service that produces disease, operation, and physician indexes, and patient statistics.

In some instances, industries and universities team together to conduct studies and make proposals. One such joint venture teams Bolt Beranek and Newman with the Massachusetts General Hospital in Cambridge. The effort is aimed at bringing computational and processing capabilities to areas of patient care, research and administration.

These are typical examples of how information systems are formulated for hospitals and indicates at least one kind of strategic place to be if you wish to make your product or service capabilities known.

systems analysis

There is a considerable market here for systems analysis studies and the intelligent integration of computing facili-

ties into the hospital environment. There are no pat solutions to everybody's needs. Of the near 7100 registered hospitals in the U.S., about 5645 are non-profit, charitable or religious organizations, 1100 are privately owned and about 355 are federal hospitals. But approximately 80% of the 7100 total are short term, general hospitals with average patient stays of one week. Size and hospital specialties are also factors in administrative needs.

As a general rule, hospitals with fewer than 250 beds should consider using independent data processing service organizations. Those with between 250 and 450 beds may use a time sharing system or get their own small machine. Hospitals with more than 450 beds would probably want to get their own machine. But every institution is different, has its own unique problems, has different long term goals and may already have been "burned" by being over or undersold.

While the biggest payoff to date in computer use has been in alleviating administrative burdens, there are other important areas where the creative application of computing power to the needs of the medical community are becoming of increasing importance. Among those to be discussed here are the areas of patient screening, diagnosis, laboratory automation, monitoring systems and research.

screening—diagnosis—lab automation

Patient Screening (or Multiphasic Screening) refers to a program where patients receive periodic health examinations in an automated multitest laboratory. For example, in the much publicized Kaiser Permenente plan at Oakland, California, the patient moves through 20 stations receiving a battery of about 13 tests and fills out two questionnaires.

While tests are underway, data processing determines whether additional tests or re-tests are necessary. The physician and patient then subsequently review the test data together. Currently some 4,000 patients a month are being processed at K-P.

In the past decade 55 organizations have initiated multiphasic screening programs. A number of industrial firms confronted with the rising costs of employees' medical and insurance benefits have discovered that benefit costs per employee can be substantially reduced through preventive medicine projects.

Other interest groups include state and educational institutions. One example is the Minnesota Multiphasic Personality Inventory (MMPI) test.

The test is valuable in supplying a computerized personality profile of test subjects. Another example of an attempt to formalize the medical inquiry is the Cornell Medical Health Index where the patient is asked to punch out his own health history on a card used for direct computer input.

There is a market here for a wide variety of products.

Another screening concept currently in vogue is to bring the equipment to the patient. Mobile health screening units can effectively process large numbers of people for specific defects who may not normally have the benefit of an early diagnosis.

One such traveling lab incorporates a SAM12 Auto Analyzer and other necessary equipment for X-ray, blood pressure, and cardiographs. Also included is an oscilloscope for viewing cardiographic tracings and a device that records blood pressure from the fingertip. Information related to each test for each subject is stored in an IBM 1800 computer. A physician can later interrogate the data base from a remote terminal to evaluate test results. So far 6% abnormal conditions have been found; thus enabling the physician to find pathological conditions before the symptoms arise.

Automated diagnosis has been most fruitful in the processing of electrocardiographic data (EKG). This is due primarily to the high correlation between the nature of the EKG signal and cardiac pathology. This is not generally true with other bio-potentials.

General diagnosis based on medical knowledge and probabilities should continue to progress as a computerized art and as an aid to the diagnostician. Much of this is still in the research phase, however, and current markets—judging from the nature of installations—lie in the on-line automated diagnostic aid area in the analysis of EKG.

Laboratory automation has its place both in the multiphasic screening programs and in the hospital laboratory environment. A large lab might run 700,000 tests per year. The tests are generally of four types: 1) clinical chemistry, 2) clinical microbiology, 3) clinical microscopy, and 4) blood bank activity. Hospitals are the big buyers. Currently, more than half the electronic instruments are bought by registered hospitals. Two thirds of this amount is purchased by the 1300 hospitals with more than 200 beds. The rest is purchased by laboratories, research institutions, agencies and the 250,000 physicians in the U.S.

In general, one can expect diagnosis, automated screening and laboratory equipment needs to steadily increase because the patient-to-physician ratio is on the rise and government funds are being made available to people who previously could not afford medical care.

monitoring systems

Patient monitoring can take place in one or more of three general areas; the operating room (O.R.), the recovery rooms, and the wards. Monitoring needs are very much a function of the particular environment. In the post-operative and intensive care ward situations, there are rarely requirements to monitor more than just a few parameters although these typically change from case to case. In the O.R. there is generally a need for more extensive monitoring, including determination of difficult-to-measure bodily functions and states through computations carried out on more easily measurable quantities. For example, the anesthesiologist may call for measurement of respiratory gas flow rates of O_2, CO_2 and anesthetizing agent and then use a hybrid computing system to compute uptake and output of each,

plus compliance and resistance of the lungs and minute volume. A knowledge of the condition of the patient is of critical importance to the anesthetist. He is charged with rapid attainment of a desired plane or depth of anesthesia. Computers can be expected to play an increasing role in providing the anesthesiologist with information not normally available through standard measurements.

The size of the hospital plays a role too. Larger hospitals might have special areas for particular monitoring needs. For example, post-operative areas for monitoring myocardial infarction patients, another for intracranial surgery, another for open-heart surgery, etc. Small hospitals might have portable general-purpose monitoring carts.

Companies manufacturing equipment used in the intensive-care wards of hospitals have realized a 60% increase per year in this segment of their effort.

The engineer moving into these areas should realize that success is not just a matter of supplying equipment that makes use of his own particular gadgetry. Monitoring needs can be very diverse. Close to 90% of all hospital patients need no monitoring whatsoever during the course of their stay but where it is useful, proper monitoring can be very important. For example, estimates indicate that nearly half of the coronary patients who die in hospitals could be saved through proper monitoring. (For every 100 coronary patients in hospitals, 40 die. This means 20 of these 40 could be saved through monitoring. This assumes, of course, that the patient is in a hospital. For every 100 coronary patients in the hospital, 190 deaths occur due to coronaries outside of hospitals . . . These are not generalizations but statistics related by Dr. Robert F. Shaw of Presbyterian Medical Center in San Francisco.)

By "proper monitoring" I simply mean the appropriate alerting of nursing personnel to patient stress through various electronic equipment. It is a matter of logistics in that one nurse cannot be expected to continuously sample details of patient status over an entire ward simultaneously. It is not even my intent to suggest that the fault lies with people or even with machines but rather that they can both come together here to perform more effectively; namely, to save half the coronary patients that currently die in hospitals.

In connection with this, it is a mistake to claim that monitoring equipment will save nursing and hospital costs. Such equipment may save lives but probably not money.

research

The research field is unique from the marketeer's standpoint in that it is not uncommon for a customer to be fully capable of evaluating a product.

Expenditures in the research field are dominated by the National Institutes of Health and other groups in the Public Health Service. NIH budgets have run over a billion dollars. Other funding is by universities, medical schools, industry, foundations, etc. Total expenditures are near two billion dollars per year and an increase of 15% per year is anticipated.

NIH generally gives grants only, but occasionally offers contracts, usually to non-profits. Average grants run between $25-30K. However, large projects involving outlays of ten times that have been made. Subcontracting on such projects is generally the way profitmaking organizations participate.

Research on prosthetics involves the need for implantable sensors, transducers, telemetry and mechanical devices and a good knowledge of control theory. Eventual use of ultra small mini-computers is a possibility. There is a real need here for the discovery and/or development of materials that can be successfully implanted without being rejected by the host. This is probably the central issue in the field today.

Finally, privately owned foundations should be included as possible funding sources for studies and for equipment design and development. Of the many foundations in the U.S., about 25 or 30 are specifically interested in medical areas and also have sizable budgets ranging from 40 thousand to 26 million dollars per year. Some have relatively specific interests, such as projects aimed at reducing the time lag between laboratory findings and applications, others an interest in "areas not normally covered by other agencies."

conclusion

The health business is the third largest in the United States—behind only the food business, which is first, and national defense, which runs second.[1] Approximately $40 billion was spent for health care services of all kinds in 1966, in contrast to the electronics industry, for example, where total spending amounted to $20 billion. The U.S. Department of Commerce anticipates health expenditures in 1968 to reach $46 billion.

Fig. 1, based on a 1965 Predicasts Publication indicates past and predicted expenditures in three related categories. Arthur D. Little, Inc., estimates a 15% per year increase in

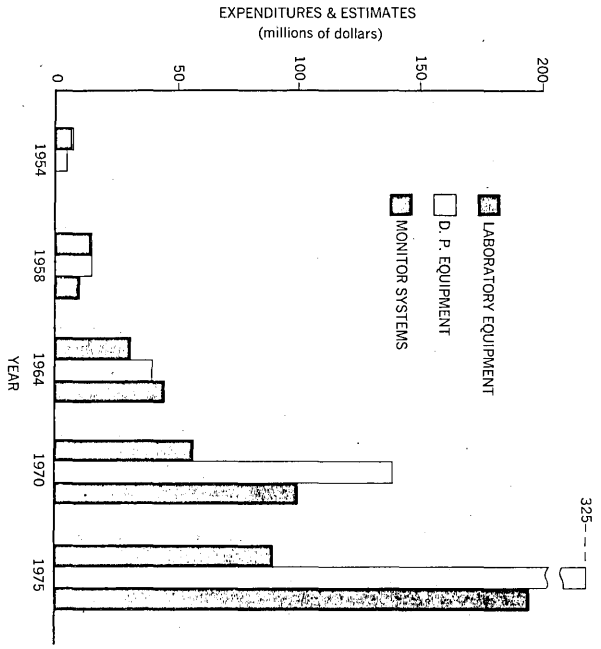


Fig. 1

the totals. Beckman Instruments sees an increase to $1 billion per year by 1975.

There is an important need for medical personnel to interact with informed and commercially disinterested third parties, to make good use of related experience in evolving their own best plan. Equipment investments can be big, but mistakes are even costlier in both time and money.

The intelligent marketing approach for those who intend to be in for the long pull requires caution, a willingness to invest time in study and an honest effort to understand the growing needs of medical people.

Also required is a willingness to commit a good portion of resources to a continuing front line support activity.

It seems particularly true in this field that those who are continually successful are guided primarily by the best interests of their customers. ■

[1] R. S. Shaw "Rx for Medical Instrumentation: realism, patience, communication," Electronics, July 10, 1967, p. 17.

ON-LINE PATIENT MONITORING SYSTEM

heartening

by James O. Beaumont

The Pacific Medical Center in San Francisco is the site of one of several major projects in the United States concerned with the development and application of on-line computer monitoring techniques to improve the care of patients with critical problems of the heart or lungs. It is, however, unique in terms of its medical orientation.

While others are using automated techniques for the collection and rapid retrieval of readings of the conventional variables, we are using automation to define and measure new parameters of physiological performance. The former approach is aimed at improving patient care by reducing the record-keeping workload of the nursing staff and improving the access to needed physiological data; ours is aimed at spotting potentially dangerous conditions early enough in their development cycle to correct them easily and minimize their medical effect on the patient. Naturally, we also are concerned with providing the fastest possible access to the data needed to do this.

dual role

The system at the Pacific Medical Center has been developed as a joint project with IBM, funded in part by a Public Health Service grant from the National Institute of Health. The system went into operation late in 1966 and since then has evolved to the point where we are on the threshold of significantly expanding both its functional scope and operational size.

The initial general objective of the project was to develop a system that would supply, within the normal economic constraints of a hospital, a useful new dimension to the clinical-care and research activities of the center in the area of cardio-pulmonary medicine. Clinical care involves the treatment of intensive-care patients in the cardio-pulmonary unit of the Presbyterian Hospital, a part of the medical

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center. Research involves the work of the department of cardiovascular research of the Institute of Medical Sciences, another part of the medical center, on more effective ways of measuring physiological performance.

The two roles of the system are closely allied. Dr. John J. Osborn, M.D., a specialist in cardiac physiology and the director of Pacific Medical Center's Cardio-Pulmonary Unit, has for years been concerned about the shortcomings of the stethoscope and electrocardiogram as the basic tools of cardiac analysis. The stethoscope permits the doctor to hear only the vibrations which are rather indirectly related to real changes. The electrocardiogram produces a more complete picture of the heart functions but provides a poor indication of the conditions leading to a deterioration of these functions—a serious handicap in treating patients who are acutely ill and have very little tolerance left for crises. With them, survival often depends more upon the prevention than the treatment of crisis situations.

The medical direction established for the project, therefore, was to attempt to define more useful parameters for measuring heart performance and to employ them in improving clinical care. The system has made significant progress in this direction. New parameters that provide an early warning of a number of potentially critical conditions have been developed. On the clinical-care side, these parameters have helped provide an understanding of otherwise unexplained cardiac arrest. And respiratory measurements have been established as an important new class of intensive-care variables in cardiac cases.

Using an IBM 1800 data acquisition and control system that rents for approximately $8,000 a month, we monitor the condition of five patients simultaneously, but the system has the capability to expand to several dozen patients. Simultaneously, it runs extensive analysis on the readings, displays a broad range of data in both alphanumeric and graphic form, responds to special requests for analyses, runs unrelated jobs in a batch mode, and still has enough unused computer time to expand our services substantially without increasing basic equipment costs.

system functions

The system is used as a clinical-care tool mostly for patients who have undergone open-heart surgery within the past three days, but also for ones suffering from heart attacks or a serious respiratory illness. It also is used to monitor patients being tested in the exercise laboratory.

The functions of the system are to collect variables, analyze them, and display both measured and derived values in real-time. Most of the collection and analysis is done at regular 10-minute intervals and upon demand between intervals. Data from the exercise lab is handled on a somewhat different schedule: only on demand, and then at 30-second intervals for the duration of the exercise period.

The results of all analyses are automatically displayed—either in alphanumerics or a combination of alphanumerics and graphic time plots (Fig. 1, p. 54) on a television monitor. They also can be produced in the form of hard-copy time plots, upon request, and in series of two, on a strip-chart recorder. Both display media, hard and soft, can be used to produce, upon demand, a one-to-24-hour review of variables.

At the end of each day, the system produces a 24-hour log of all activity, including the results of each analysis performed. It also produces a graphic record of the results, by patient, that plots the behavior of the variables monitored against time.

The system performs some alarm functions in the conventional sense of generating sound and flashing visual signals when variables exceed high-low limits. In most cases, though, we merely produce display and, in some instances, printed messages when established limits are exceeded in certain selected variables and combinations of variables. The use of the more conventional alarm is limited to blood pressure, heart rate, the measurements of the mechanical performance of the lungs, and a simple measurement of respiratory gas.

Four categories of variables are measured: temperature, heart, respiratory and blood. Of these, the respiratory measurements are unique to this system. The others are traditional measures of heart performance.

The system is concerned with monitoring some 30 major variables (see Fig. 2, p. 55), plus a number of minor ones. Of the 30, less than half are basic variables produced by primary sensors. The rest are derived by computer analysis or computation. Most of the basic variables are read from fully automatic on-line transducers.

variables monitored

Temperature is monitored through three variables: the internal and skin temperature of the patient, which provide indications of infection and a measure of metabolic activity, and the ambient temperature of the room. All of these variables are basic ones, produced by primary sensors.

Heart action is monitored through two variables, both of which are derived from an on-line reading of electrocardio-

gram waveforms. One is the heart rate. The other is the rate of premature ventricular contractions (PVC). The latter is the most common type of abnormal heart beat, called ectopic because the abnormality is caused by an impulse originating in the wrong part of the heart. Ectopic beats are a sign of irritation in the heart muscle, and their rate is a good indicator of the degree of irritation.

More than a dozen major variables are used to monitor the respiratory system of the patient. Most of them are derived. The system reads only four basic ones: pressure, flow, and the partial pressures of carbon dioxide and oxygen. These readings are taken from both sides of the breathing cycle: inspiration (inhalation) and expiration (exhalation).

The flow readings on the expiration side of the cycle are used to derive three variables: tidal volume—the volume of air in a single breath; minute volume—the volume of air breathed per minute; and the respiratory rate—the number

of breaths taken per minute.

The combination of flow and pressure on the inspiration side of the cycle are used to derive a number of variables that measure the mechanical action of the lungs: compliance—a measure of the elastic action of the lungs that is analogous to the capacitance in an electrical circuit; work of inspiration—a measure of how much work is being done by the respirator to inflate the lungs, and conversely, how much work the patient would have to perform if the respirator were removed; and nonelastic resistance—a measure of the resistance in the respiratory system that is analogous to the resistance in the respiratory system that is analogous to the resistance in an electrical circuit.

The readings of the partial pressures of carbon dioxide and oxygen are made on the expiratory side of the cycle and are combined with flow measurements from the same side to derive the quantities of these gases. These measurements are used, in turn, to compute two more variables. The carbon-dioxide value is used to derive both the carbon-dioxide output volume per minute and the peak concentration of carbon dioxide per expiration (ECO-2).

The oxygen value is used with tidal volume to compute oxygen uptake, which is the difference between the oxygen volumes of inspiration and expiration. This is a measure of the amount of oxygen consumed and an important indication of the level of metabolic activity, which determines the amount of oxygen needed.

In addition, the carbon-dioxide output and the oxygen uptake are used to derive the respiratory quotient. This shows the type, rather than the level, of metabolic activity taking place.

These respiratory variables have turned out to be extremely useful. They are helping us spot, before any of the traditional clinical signs appear, incorrect respirator settings, malfunctions in the respiratory equipment, and deterioration in the efficiency of the patient's lung mechanics —all situations that can become extremely critical if not corrected in time.

The improvement in understanding unexplained cardiac

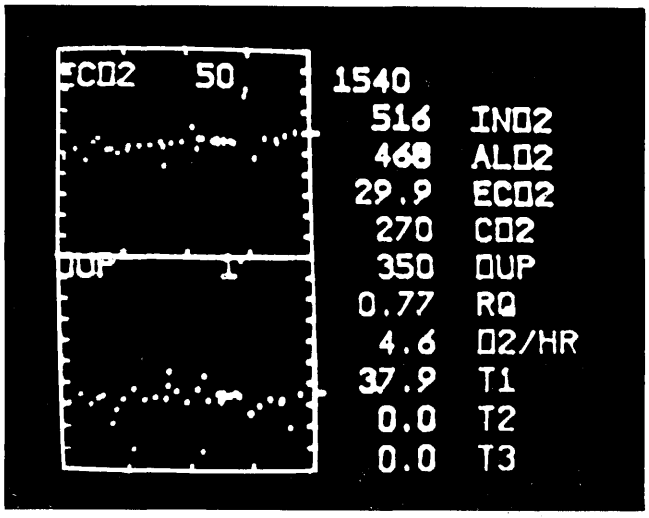


Fig. 1 Results of on-line analysis of cardio-pulmonary patient in intensive care. The plot can go back as far as four hours.

arrest can be attributed to the monitoring and effective staff interpretation of these variables. In one case, a sharp increase in oxygen uptake led to the discovery of almost imperceptible shivering of the patient's skeletal muscles, a situation that would have had a drastic effect on the patient if it went undetected. In another case, hemothorax, a buildup of blood in the chest cavity that radically lowers the mechanical efficiency of the heart and lungs as it progresses, was diagnosed by a sudden drop in compliance before it was obvious clinically.

The end-expiratory carbon dioxide measurement has proved to be especially valuable by providing an early warning of hyperventilation, which can cause a serious drop in the carbon dioxide level of the blood. The amount of carbon dioxide in the blood is very important; if hyperventilation drives it below a certain level, the rhythm of the heart action is radically and dangerously upset, a condition called cardiac arrhythmia.

blood measurements

The circulatory system of the patient is monitored through 14 variables, six of which are basic.

Three of the basic variables are pressures: arterial, venous (right atrium chamber of the heart), and atrial (left atrium chamber). The venous pressure provides a measure of how much blood reaches the heart, while the atrial shows the performance of certain valve functions.

The arterial pressure is the basis for a number of derived variables. Probably the most familiar are the systolic (high) and diastolic (low) blood pressures. Others that are particularly important are: mean pressure of the aorta—a measure of the amount of blood reaching the vital organs; maximum first derivative—a measurement of the upstroke of the arterial pressure curve that is related to the ability of the heart muscle to contract; and arterial pulse pressure, which is used in combination with the basic arterial pressure to measure peripheral resistance in the circulatory system.

The other three basic variables are all concerned with the chemistry of the blood. They are the oxygen saturation on both the venous and arterial sides of the heart and the hemoglobin count. All three, plus the value for oxygen uptake from the respiratory data, are used to derive a measurement of cardiac output by means of a technique named for its developer, Fick. In addition, we also measure cardiac output by a dye-dilution method in which the computer calculates cardiac output not from the variables mentioned above but from a dye-intensity curve produced from a blood sample.

Besides being used in one of the measurements of cardiac output, the venous oxygen saturation and the hemoglobin count are useful in their own right as measures of the oxygen-transport capability of the blood.

system operation

Most of the basic variables monitored by the system are collected from on-line patient-monitoring units containing transducers to measure ECG, temperatures, blood pressures, and respiratory flow and pressures from sensors attached to the patients. These units also contain I/O controls, the television display and strip-chart recorder mentioned earlier, and an oscilloscope for the independent and continuous display of the analog wave forms generated by the primary ECG and blood-pressure instrumentation.

There are several variations of these patient-monitoring units. For two intensive care rooms, each with two beds, we have four complete units housed in two double cabinets. Each of the double cabinets has two full sets of instrumentation (except for a single, shared television display) and is capable of monitoring two patients simultaneously. A single unit with all the instrumentation except the analog monitor and that needed for blood pressures is used in the exercise lab. An additional mobile unit with the instrumentation needed for respiratory and cardiac monitoring can be connected to any one of 13 beds.

The only basic variables not read from the patient-monitoring units are the ones concerned with blood chemistry. Those previously mentioned—the oxygen saturations and

hemoglobin—are read from semi-automatic equipment that is on-line. The dye-intensity curve used for one of the cardiac-output measurements also is read from on-line semi-automatic equipment. Additional blood-chemistry tests are run manually and entered into the system through an 1816 keyboard-printer terminal. This terminal also is used to enter patient names and information on equipment in use, to set high-low limits for variables, and to request some special analyses, such as the Fick cardiac output.

The 1800 computer in this system has a 32K, 2 usec main memory, 128 digital input positions (16 voltage sense and 112 contact sense), 32 process-interrupt positions, 192 digital output positions (160 electronic-contact-operate lines, 16 pulse output lines, and one 16-bit output register), two analog-to-digital converters, two solid-state multiplexors of 32 inputs each, one low-level multiplexor of the same capacity, and six digital-to-analog-converter output lines. The cpu is supported by three 2310 discs of 500K words each, a 1442 card reader punch, a 1443 line printer, an 1816 keyboard printer, and one 1627 plotter.

The only special equipment in the central configuration are three display channels, each consisting of a storage oscilloscope and closed-circuit television link; analog terminating amplifiers; and a crystal oscillator for synchronizing the sampling of analog inputs.

The cpu operates under the MPX (Multiprogramming Executive) operating system of the 1800. Core is divided into a 20K system executive; a 1K special area for high-priority interrupt routines that for purposes of flexibility we don't want to build into the system executive; a 5K foreground processing partition for the exclusive use of process programs; and a 6K background partition that is used by both process and non-process programs. The system executive is divided into 12K for the nucleus, 4K FORTRAN and I/O routines, and 4K for a common data area shared by all programs.

During normal operation, about two-thirds of the cpu time is available for non-process programs. A complete analysis of a patient requires only about three seconds, two for respiratory and one for cardio-vascular. Operating at an input rate of 2500 words per second, the cpu analyzes, on an alternating basis, two 500-word input buffers at 200 msec intervals. By analyzing on the fly this way, we save the considerable overhead that would be involved in streaming all inputs to disc and then bringing them back for analysis.

The system continues to evolve in many directions. One particularly important one concerns the packaging of information for maximum utility. The large number of variables now being displayed make it difficult for the staff to dig out those that are most significant. This problem is complicated by the fact that significance often depends upon the relationship between two or more variables.

We are moving toward a solution to this problem by adding to the system functions the task of making correlations between variables and certain unfavorable conditions. These correlations will be based on patterns that have been observed and medically validated by two years of clinical experience with the system.

Naturally, the correlations made by the system initially will be very simple ones, such as: a fall in compliance below a given level indicates the possibility of hemothorax; the rise of maximum inspiratory pressure above the respirator setting indicates the possibility of an obstruction; and a large increase in the work of inspiration, coupled with erratic changes in compliance, point to the patient being out of phase with the respirator.

In keeping with our philosophy of avoiding unnecessary alarm situations, these correlations will be reported simply as events that should be examined. Every time such an event occurs, the system will activate a signal light on the patient-monitoring unit and display both the variable values and the condition they indicate.

We also plan to automate the collection of information normally contained in the nurses' notes and to reduce the recordkeeping workload of the medical staff in every other way that is practical.

The system also will be expanded in terms of the number of patients monitored on a full scale. In addition to the mobile unit that is now used, another will be installed in the catheter lab where tests requiring internal sensors are run.

In addition to monitoring the full range of variables on up to seven patients, the system also will run ectopic-beat analysis on four to 10 additional patients. ■

Fig. 2 Measured and derived variables monitored on-line.

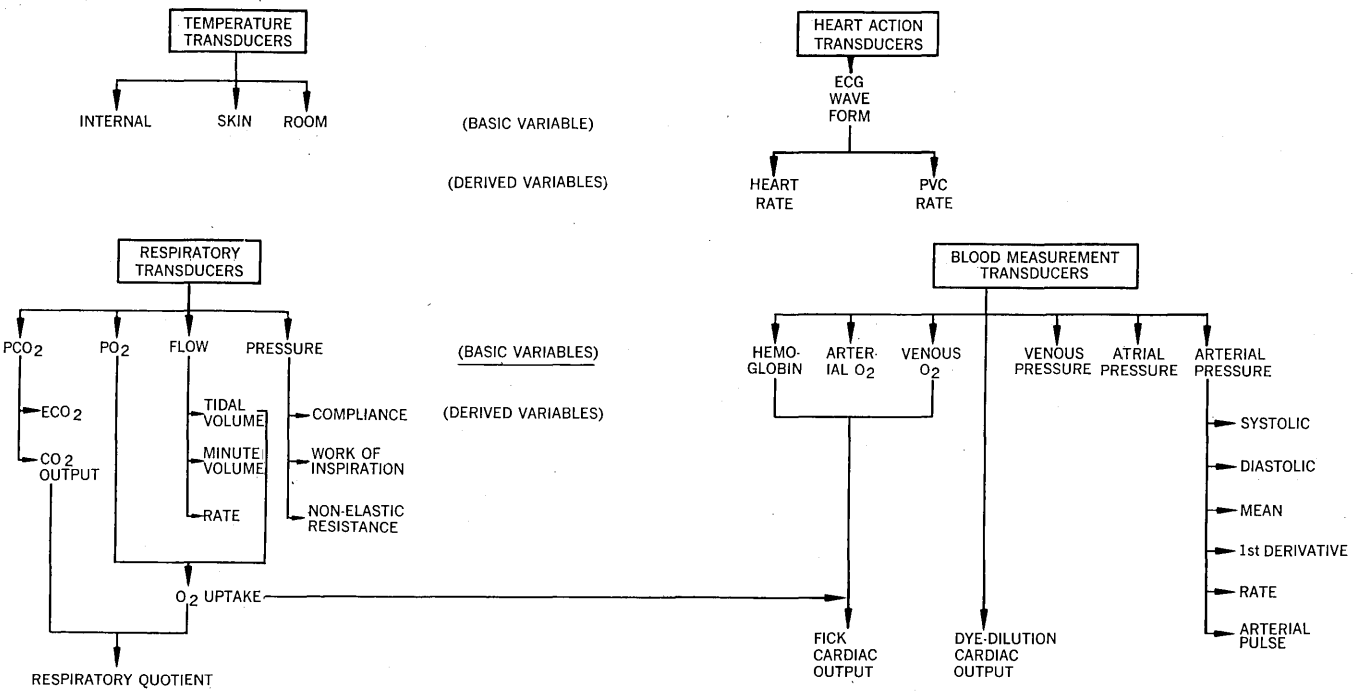


FIG. 2 MEASURED AND DERIVED VARIABLES MONITORED ON-LINE

INFORMATION HANDLING COSTS IN HOSPITALS

by Goeffrey G. Jackson

Hospitals, by and large, are far behind their industrial neighbors in making effective use of the computer. Computerized payroll and billing systems, which have been common in industry for over ten years are just now being developed by hospitals on a large scale. Like industry, we too must deal with increasing complexities, which for us are not manufacturing and selling a product, but rather the delivery of health care. In addition, the cost of our manpower is increasing at a much faster rate than in industry. No longer is it really possible to effectively administer an active community hospital "by the seat of the pants." Most thoughtful administrators recognize these factors, but the real question is what direction to move in. There are no "pat" answers.

What follows is basically an analysis of an exhaustive document study concerning the cost of information handling at the Rochester General Hospital, Rochester, New York, relating the identified documents to computer applications. This study, entitled "Analysis of the Cost of Information Handling in Hospitals," by Malvern J. Gross, Rochester Regional Council, Inc., was published on September 21, 1964. Table I, "Names of the Most Time Consuming Documents at RGH," is the single most pertinent abstract from this study listing 38 documents which represent 50% of all information handling in terms of time.

The documents listed in this table are as common to hospitals in 1969 as they were in 1964, with perhaps some variation in nomenclature, and the five years which have elapsed since the completion of the study have done little or nothing to either eliminate the need for the document or to change the time consumed with each document. Only those hospitals which have begun to effectively utilize systems analysis techniques and the computer would, in all probability, show significant variation with the findings in this analysis. And, even this limited number are primarily only involved with computer applications in the accounting area.

It should also be understood that there are other important factors, such as acceptance by the group affected in the hospital, potential gain (or loss) of revenue as a result of a given computer application, and the technological capability of existing hardware and software. Nevertheless, information handling costs are recognized to be in the area of 25% of total hospital expense by more than one authority who has conducted time and motion studies in hospitals. Furthermore, there is little doubt that the computer can materially assist in the reduction of these costs.

the time-consumers

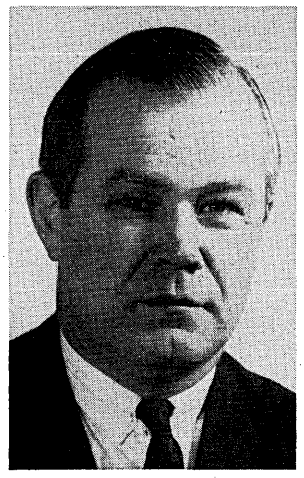
The basic elements I have dealt with are the 38 "documents." I have not dealt with the 800 or more other documents that were identified, and it should be indicated that it is possible that other application areas not identified by me may involve a significant number of documents in the remaining 800 and thus would demand consideration. The initial task was to take the 38 documents and relate them to the "man year" effort indicated in the study. Note that they are listed in order of employee time. Since each document was not specifically identified in man years time, a geometric distribution curve was developed (Table II) to approximate as reasonably as possible the total 50% of cost represented by the documents.

Once the per cent value of the documents had been established, the next step was to relate the documents to potential computer applications. A matrix (Table III) was then developed listing the documents on one axis and the applications on the other. A considerable amount of time was taken in filling in this matrix which in essence is an attempt to relate multiple documents to their appropriate application area in terms of percentage. It should be noted that in some instances, the precentages do not equal 100%, as it was determined that the computer assistance in certain information handling activities was limited.

Without going into specific, detailed descriptions of the fifteen application areas selected, some definitions and assumptions are required to understand the results. Initially, we are assuming a fully developed interactive real-time computer system. Thus, the final results would require modification for specific applications in a limited system. For example, a bed inventory control system (such as that in use at Children's Hospital Medical Center, Boston, Mass.) which is an integral part of an admissions and census application would be severely limited in the absence of real-time capability. On the other hand, certain portions of an admission/census application are feasible with limited systems capability. The pre-admission application at Mass. Eye & Ear Infirmary, Boston, is a good example of this.

A number of the primarily business type applications noted have been in use for some years and therefore need no further definition for our purposes here. Briefly, the con-

The author acknowledges the assistance of Adrian J. Grossman of General Electric Co. in the development and manipulation of data used in this article.



Mr. Jackson is assistant director of Peter Bent Brigham Hospital, associated with Harvard Medical School. Prior to this appointment he was manager of market research & development for General Electric's MEDINET application operation. He has an MS in administrative medicine from Columbia Univ. and has held administrative positions at Massachusetts General Hospital and Boston Univ. Medical Center.

cepts involved in the other applications are as follows:

1. Dietary Management could perhaps be more aptly titled Food Management. We are not dealing with therapeutic menu planning.

2. Nurse Staff Scheduling is primarily related to the allocation of nursing personnel to the daily changing needs of the individual nursing units. Much of the work done by the MHA Systems Engineering Division is related to this activity.

3. The Pharmacy and Laboratory applications have been viewed in two sections. One is the internal departmental information handling activities, which in the case of pharmacy would include such things as inventory control with automated purchase order generation, statistical analyses indicating drug usage patterns, etc.; and in the case of the laboratories (chemistry, hematology and bacteriology), the system of result data gathering + work scheduling. The second would be the activities within the nursing station which are an integral part of the two subsystems, such as ordering, development of medication schedules, development of specimen collection lists, etc.

4. The M.D. Orders (fixed format) application is one in which we envision specific orders from physicians for nursing procedures. This application would also be centered at the nursing unit and like the lab and pharmacy applications would develop work schedules relative to these activities, etc.

5. The three applications listed under the heading Diagnostic Commentary are really sort of "blue sky" concepts. Here we are dealing with essentially random text which the computer would search, organize and provide diagnostic assistance. Those reports, such as pathology and radiology interpretations, would fall in the "ancillary" category.

inter-relationships

Once the matrix had been filled out, calculations were performed taking the percentage of each document and multiplying it with its percentage of information handling value. The net result is the percentage of information handling cost for each of the 15 identified computer applications (Table IV).

You will recall that I noted that percentages in the matrix did not necessarily equal 100%; the total percentage relationship is 32.4 of a total 46.6 possible. In order to view the relationships between the various applications more easily, I have normalized the figures to 100%; therefore, the normalized figures must not be taken to represent a direct percentage to information handling cost.

Having gone through this laborious exercise, what reasonable observations can be made?

1. Although we have looked at only 38 documents, they

TABLE I

NAMES OF THE MOST TIME CONSUMING DOCUMENTS AT RGH
(Listed in Approximate Order of Total Employee Time)

TAKING MORE THAN 5 MAN YEARS* EACH

1. Bedside Notes (i.e., nurses' notes)
2. Patient's Chart as a whole (i.e., the time to assemble and reassemble, file and refile, transmit, etc., not assignable to any specific part)
3. Doctors' Notes (used for admitting, progress and other notes)
4. Nursing Care Kardex Cards (actually a set of 2 different cards)
5. Radiological Consultation
6. Medicine Ticket
7. Scratch Paper Notes about Patients
8. Patient's Menu
9. Graphic Chart
10. Miscellaneous Requisition and Charge Forms (for drugs, X-ray and many miscellaneous items—approximately 250,000 used per year)

TAKING 2 TO 5 MAN YEARS EACH

11. In-Patient Ledger Card
12. Doctor's Order Sheet
13. X-Ray Film (including all sizes)
14. Narcotics Records (2 forms)
15. E.D. Admitting
16. Operative Record
17. Necropsy Report (front sheet and following plain paper pages)
18. Nursing Team Assignment Sheets (2 forms)
19. Patient Admission, Discharge and Condition List (Ward Report)
20. Hematology Requisition and Charge Form
21. Surgical Tissue Report
22. Bedside Intake-Output
23. Diet Order Sheet
24. Vendors' Invoices

TAKING 1 TO 2 MAN YEARS EACH

25. TPR Work Sheet
26. Purchase Orders
27. Blood Pressure and Pulse Graph
28. Medication Record
29. Miscellaneous Laboratory Requisition and Charge Form
30. Chemistry Requisition and Charge Form
31. Newborn Record
32. Time Card
33. Blackboards (23 or more of them)
34. Urine Requisition and Charge Form
35. Physician Medicine History, Examination, etc.
36. 9-Line Addressograph Plate
37. Daily Audit and Analysis of Cash Receipts, Debits and Credits
38. Disease and Operation Code Card

TAKING ½ TO 1 MAN YEAR EACH
24 Documents

TAKING LESS THAN ½ MAN YEAR EACH
More than 800 additional documents

*American Hospital Association statistics reveal that of the 7,172 hospitals in the United States, 3,357 are classified as "Non-Profit General Hospitals" (of the same type as the Rochester General Hospital) which expend $8,561,034,000 annually, or more than 50% of all U.S. Hospital costs. The average size of these hospitals is 161 beds with 341 employees averaging $4,501 per year. Thus the information handling activity associated with a document involving "2 Man Years" would have an approximate cost of $9,000, etc.

do represent half of the information handling costs and it is reasonable to assume that the applications reflecting the highest percentage/cost relationship should be investigated in more detail.

2. The document listing and the matrix points up the significant inter-relationships between various areas of activity. Also, it suggests that considerable attention should be paid to these inter-relationships and further suggests that systems engineering methods might be employed to great advantage.

3. It is significant that much of the high value is focused on the nursing station. Furthermore, it suggests that many of these activities overlap. By this I mean that a system standardizing ordering procedures, for example, could reap a significant benefit.

4. It is interesting to note that both a fully developed Laboratory & Pharmacy System exceeds the potential value of Billing & Accounts Receivable Systems. It should be pointed out, however, that such systems are far more complex both in terms of system design and in practical application in the hospital.

5. Very evident is the importance of patient identification. Were an Admissions and Census Application to provide assistance in this area through computer automation, much would be gained throughout the entire information system.

I would like to re-emphasize that there is little doubt that a critical analysis of the documents listed in the study and their proportionate distribution as represented by the matrix might lead to a valid redistribution and percentage reassignment. The percentage assignments are my best judgment with relation to the concept of computer-assisted systems. Furthermore, the resultant proportional cost distribution is, in my opinion, not an accurate document but rather a reasonable model of the distribution of information handling cost when viewed in the framework of potential computer applications.

Overall, this analysis supports my conviction that there is much more interaction of information subsystems as represented by the designated applications and their relationships to the listed documents than is generally recognized. I believe that this limited exercise clearly points out the necessity of tying various systems—which have heretofore been dealt with on an individual basis—together.

A good example of the problems one may well encounter when viewing subsystems as separate entities can be found in clinical laboratories. In recent years, we have seen the rapid advance of automated analytic devices in both the chemistry and hematology laboratories. How many of such devices have been installed in an environment where the related data byproducts are effectively utilized? We have electronically eliminated considerable technical man hours but done little or nothing to effect the supporting information system necessary to making use of the resultant data.

I submit that this study gives one only an overall indication of the complexities of the so-called "Hospital Information System." What is really required is meaningful detailed systems analysis. I do not mean to imply, however, that systems analysis necessarily directs one to the computer, but certainly there is a logical relationship between these two activities.

There are countless cases where a manufacturer of computer equipment has provided a "packaged" or "canned" application which simply did not meet the requirements of the hospital; yet the hospital purchased (or leased) the equipment only to have it sit minimally utilized for months or even longer. To embark on any computer adventure without a detailed knowledge of the existing system in comparison to the "packaged" version is folly. By detailed knowledge, I mean a fully documented systems study which should include not only narrative description but information flow charts as well. Once this has been accomplished, and only then, can effective redesigning of the system be undertaken to optimize the capabilities of the computer. This kind of activity should be undertaken by trained systems analysts, not amateurs.

In conclusion, then, I believe two strong points come across:

1. Information handling costs, when analysed and distributed in terms of subsystems or applications, can provide a useful guidepost to future utilization of the computer.

2. Clearly interelated subsystems should not be viewed as separate entities. This leads to the necessity of effective systems analysis.

TABLE II

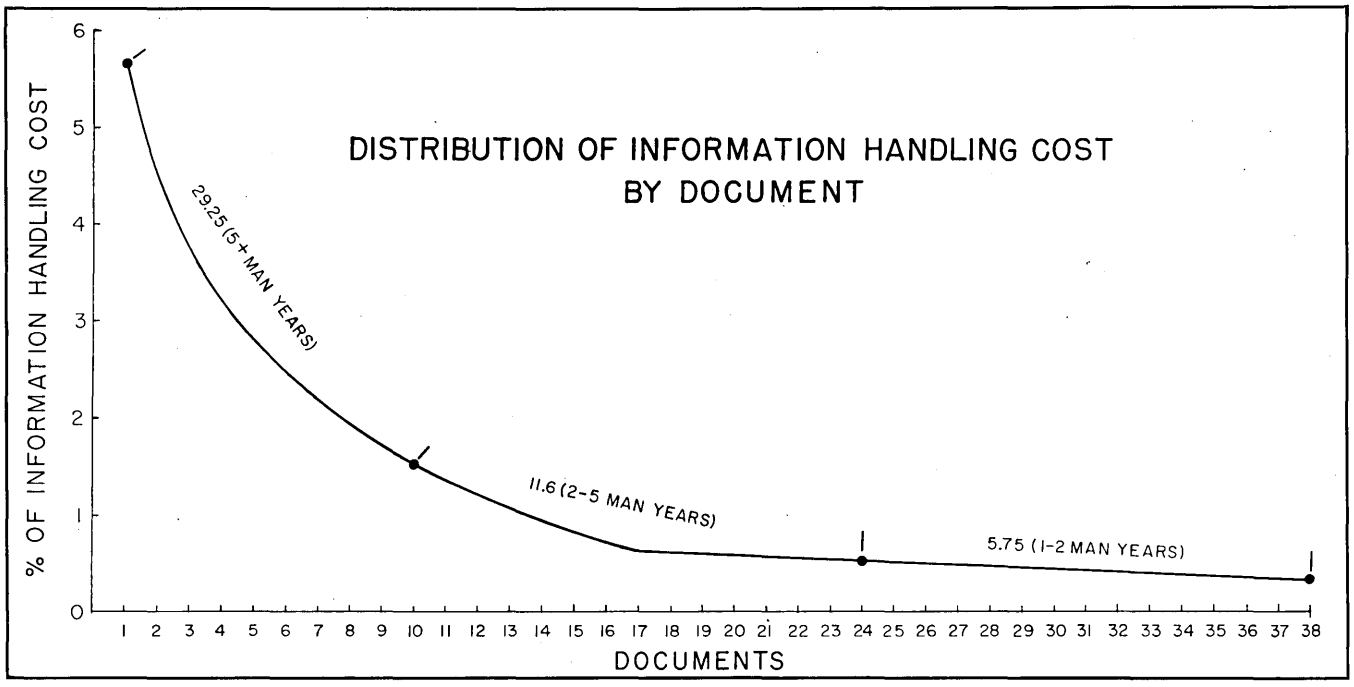


TABLE III

DOCUMENT DISTRIBUTION BY APPLICATION

Documents	Adm./ Cen.	Bill/ AR	Pay-roll	Diet. Mgt.	Gen. Inv.	Nurse Staff Sched.	Med. Rec. Coding	Pharm. Int.	Pharm. N.S.	Lab. Int.	Lab. N.S.	M.D. Orders	Diag. Commen. R.N.	Diag. Commen. M.D.	Diag. Commen. Ancillary
1. Nursing Notes	(5)*												80		
2. Patient Chart	(5)								5		15	10	20	15	10
3. Doctors Notes	(5)													90	
4. Nursing Care Cards	(5)								15			15	15	15	
5. X-Ray Consult	(5)														90
6. Medicine Ticket	(5)								50						
8. Patient Menu	(5)			50											
9. Graphic Chart	(5)														
10. X-Ray, Drug, Req. & Chg.	(5)	15						20	20			40			
11. In-Patient Ledger	(5)	95													
12. Doctors Order Sheet	(5)											50			
14. Narcotic Record	(5)							10	75						
15. Admitting Form	95														
16. Operative Record	(5)													90	
17. Necropsy Report	(5)														
18. Nursing Team Assignment	(5)					75									
19. Adm. Disch. & Cond. Rpt.	95												5		
20. Hematology Req. & Chg.	(5)	15								40	40				
21. Surg. Tissue Rpt.	(5)														
22. Intake-Output Rpt.	(5)														
23. Diet Order Sheet	(5)			25								70			
24. Vendors Invoice					50										
25. TPR Worksheet	(5)														
26. Purchase Orders				20	50			20							
27. BP & Pulse Graph	(5)														
28. Medication Req.	(5)								95						
29. Misc. Lab. Req. & Chg.	(5)	15								40	40				
30. Chem. Req. & Chg.	(5)	15								40	40				
31. Newborn Record	(5)											30	10	20	
32. Time Card			75												
34. Urine Req. & Chg.	(5)	15								40	40				
35. Physical History	(5)											60		30	
36. Addressograph Plate															
37. Daily Audit & Cash Anal.		95													
38. Disease & OP Code Card	(5)						95								

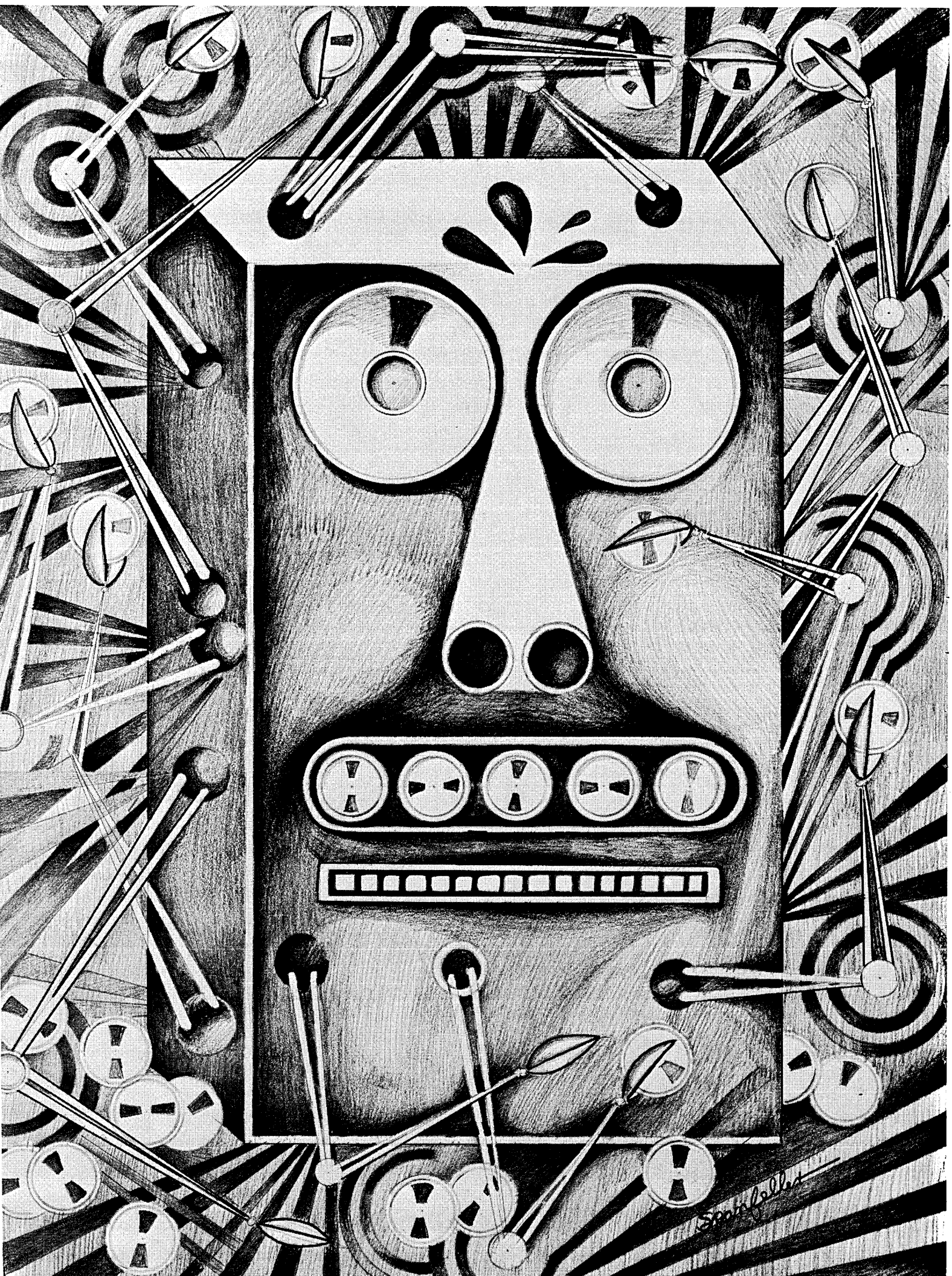
*Values in parentheses ( ) are delayed values, indicating they have no value unless associated with another application.

TABLE IV

PROPORTION OF COST BY APPLICATION

	% of Cost		Normalized to 100%	
1. Admissions/Census	1.93	3.45	6.1	10.6
	(1.47)*		4.5	
2. Billing/AR	2.14		6.6	
3. Payroll	.30		1.0	
4. Dietary Mgt.	1.20		3.7	
5. Gen'l Inventory	.53		1.6	
6. Nurse Staff Scheduling	.53		1.6	
7. Medical Record Coding	.29		.9	
8. Pharmacy—Internal	.51	3.85	1.6	11.9
9. —Nursing Station	3.34		10.3	
10. Laboratories—Internal	.76	2.29	2.3	7.0
11. —Nursing Station	1.53		4.7	
12. M.D. Orders (Fixed Format)	2.91		9.0	
13. Diagnostic Commentary—R.N.	6.65		20.6	
14. —M.D.	5.47		16.9	
15. —Ancillaries	2.79		8.6	
	(32.40)		(100)	

*Delayed Value.



Is your computer really putting in an honest days work?

Is it as busy as it looks, or could your computer handle a great deal more?

Do you really need a larger machine, or could a different approach to the software or low cost hardware enhancement expand the system to meet greatly increased loads?

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What it is

SCERT is a sophisticated modeling technique that allows its user to take his existing or planned EDP system and simulate that system on any state-of-the-art EDP equipment. The result is precise cost/performance information on the systems hardware and software—information that clearly guides the user in optimizing his decisions.

How it works

SCERT has five functional phases—

1. First, SCERT builds a model of your present or planned system. And this step is easier for the user than it might at first sound. You describe your system to SCERT in a common systems-oriented definition language . . . "Sort, Merge, Update, Validate, Table Look-Up" for example. And with the aid of special SCERT input forms, you include such pertinent environmental considerations as size of staff, their years of experience, salary levels, and equipment on which their experience was gained. SCERT explodes all this information into a full mathematical model of your system.

2. Then, separately, SCERT models any hardware configuration you select. In its constantly updated hardware factor library, SCERT maintains full performance files on virtually every computer and every piece of peripheral gear manufactured in the Free World. Thousands of electro-mechanical characteristics are recorded on hardware performance, as well as hundreds on compilers and operating systems.

3. Then, on instruction, SCERT merges the systems model and the hardware model in pre-simulation—a linear representation of what happens in performing the tasks requested of the functioning system.

4. Full simulation then takes place. Here the multiprocessing, multiprogramming, time sharing, and real-time characteristics of the total system are taken into account. In this phase, the entire system functions as it would in an actual working environment with all the hardware and software in place and debugged.

5. The fifth and last phase of SCERT is its output management reports—reports that detail cost/performance data on the overall system and on every facet of the system—the software, the input format, each piece of hardware. Reports that identify every possible bottleneck clearly and quantitatively. Reports that guide the user to change any element of his system and resimulate with SCERT until he's confirmed the optimum system for his needs.

How it's used

With an understanding of how SCERT works, its many uses and advantages are clear to see. Three main categories cover most of the key ones—

As a Management Review and Planning Tool—SCERT gives you a precise, detailed mathematical model of your present EDP system and the means to simulate any and all changes you might be evaluating.

As such, SCERT gives you a working tool to measure the efficiency of your present systems versus all other likely systems. A tool to measure efficiency under today's workloads versus possible future workloads. A tool to predict the programming time it will take to complete new tasks. A tool to uncover alternate ways to achieve your desired goal.

In detail, SCERT will identify all bottlenecks to permit sound planning and action. With SCERT as a management review and planning tool, Joseph E. Seagram & Sons uncovered a more efficient way to approach four recurring jobs. Literally overnight they cut their monthly running time for these four programs from 250 hours down to 150 hours. Equitable Life finds it a valuable review and planning tool, too.

In Optimizing Systems Design—On the other hand, consider the possibilities of SCERT in systems design.

With SCERT, the systems designer can fully compare every approach he wishes to consider. With SCERT, he can decide whether or not performance justifies the cost of making a change. He can accurately estimate the cost of each system and predetermine completion time. With SCERT, he can answer the multitude of questions that add up to optimizing the multi-million dollar decision his firm is about to make.

Because of this, Bell Laboratories is using SCERT to help them design a computerized, nationwide, business information system. The Canadian Armed Forces are using SCERT as an aid in the design of a logistic system. And dozens of smaller organizations are using SCERT to help them optimize their systems decisions.

For Hardware Selection—Because SCERT lets you simulate hardware in your system before you buy it, the advantages here are obvious. You can simulate all likely systems to pre-select the hardware and configuration best for your needs—both today and in a range of future needs. You can pre-select such things as the best programming language, the most efficient operating system, optimal core and on-line storage requirements, I/O speeds, and any other variable needed to optimize your system.

Hundreds of firms are now using SCERT to help them scientifically select their hardware. Users report that the savings SCERT has uncovered in this area alone have paid its full costs many times over.

How reliable is it?

A simulation system is only as good as its ability to portray real performances under real conditions. And throughout the past six years, the 200 major SCERT users have proven its ability to do just that. They have made SCERT the "accepted standard."

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COMRESS

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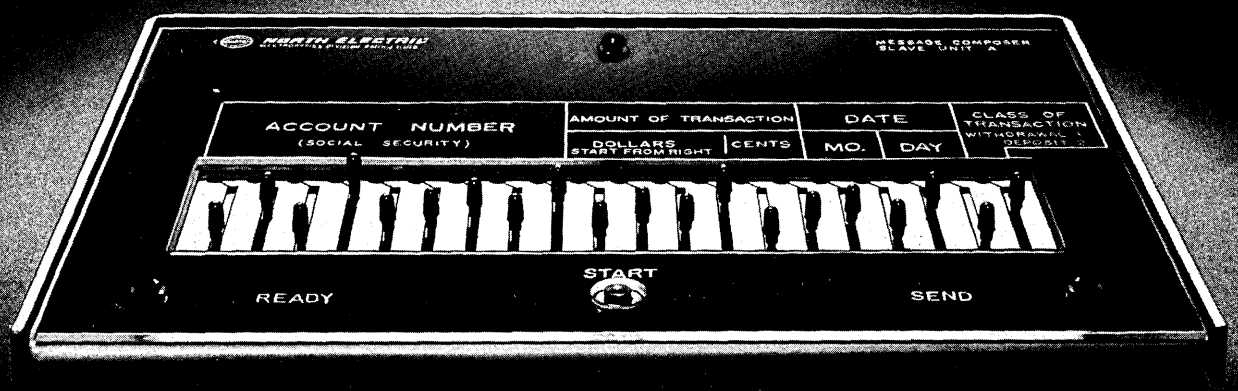
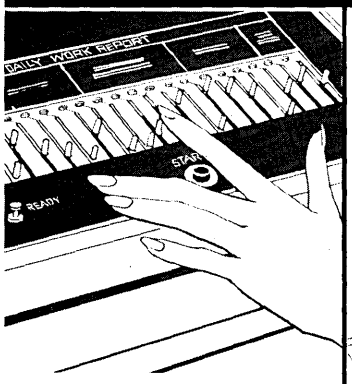


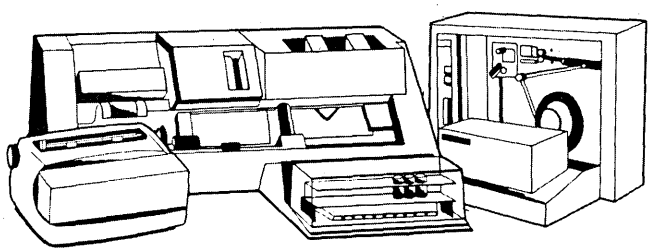
The North Electric Message-ComposeR™ System is the only complete system adaptable to any and all tasks that require punch cards, key tapes, hard copy or any combination of these. It is designed to work with all existing computer feeding equipment. The Message-ComposeR System is available for immediate delivery from stock on an outright purchase plan...or, can be leased for under $95.00 per month.

NED—2A



The keyboard is so simple any unskilled operator can encode a message and scan it for accuracy. He can then transmit it (by pressing a button) over owned or leased lines. With North's Acoustic Coupler he can transmit over switched telephone networks.

Easily changed overlays serve as a guide to the operator. They are laid out in the language of the job and are coordinated with a program plug that automatically encodes required fixed data into the message.



The Message-ComposeR System can transmit messages to any point and, automatically operating a North solenoid pack, produce punch cards, key tapes or typewritten copy—all three if required.

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IMMEDIATE ACCESS AND THE USER REVISITED

stamp out nonprogrammer users

by Murray Turoff

In August of 1966, this author published in DATAMATION an article whose primary purpose was to alert the computer community to the dangerous situation confronting it from the then embryonic immediate access concept. In addition to that warning, an attempt was made to lay down fundamental guidelines for the most effective means of discouraging non-programmers from utilizing immediate access systems. Now, three years later, it seems appropriate to update those earlier considerations and evaluate the course of the battle as it now stands.

In general we can pat ourselves on the back for the efficient and effective manner in which we have dealt with the situation. Our successes far outweigh the few failures that have occurred. The items we can be thankful for are basically the following:

The major computer manufacturers have been quite careful to build multipurpose executives which in principle will perform any possible function the computer may be asked to handle by any potential user. This executive concept of being all things to all people has put us in the beautiful situation of being able to deny to the immediate access user enough of the computer's power so that he is encouraged to go back to his slide rule or desk calculator.

The concept that every one must offer a FORTRAN and COBOL language on the system has been an exceedingly neat way of consuming manpower resources and preventing any deviates from spending their time on more dangerous concepts. In fact, the N language system concept (for which N is allowed to go to infinity) is one of the best possible approaches we have available to us. The larger the set of completely independent languages offered, the greater ability we will have to make the user feel he can never master any significant part of the system.

One of our greatest achievements has been in the careful manner in which we have buried the JOSS philosophy. Except for some minor extensions for the purpose of on-line gaming, which seem to have been forced upon the computer people, RAND seems to have abandoned any extension of JOSS philosophy and has moved on to the bottomless pit of on-line graphics. We were worried when we heard a rumor that IBM was developing a JOSS-like system, and while we realize it is sometimes difficult to keep a tight rein on all the parts of an organization of that size, IBM as the industry leader must take special pains to insure it does not allow things like JOSS to emanate as an IBM-supported item. Apparently the proper people found out about it,

The opinions expressed in this article are the responsibility of the author and do not necessarily reflect the views of his employer.

Dr. Turoff is a member of the systems evaluation division, Office of Emergency Preparedness, in the Executive Office of the President. From 1964 to 1968 he was with the Institute for Defense Analyses. He has also been associated with the MIT computation center and IBM. He has a BA in physics and mathematics from the Univ. of California and a PhD in physics from Brandeis Univ.

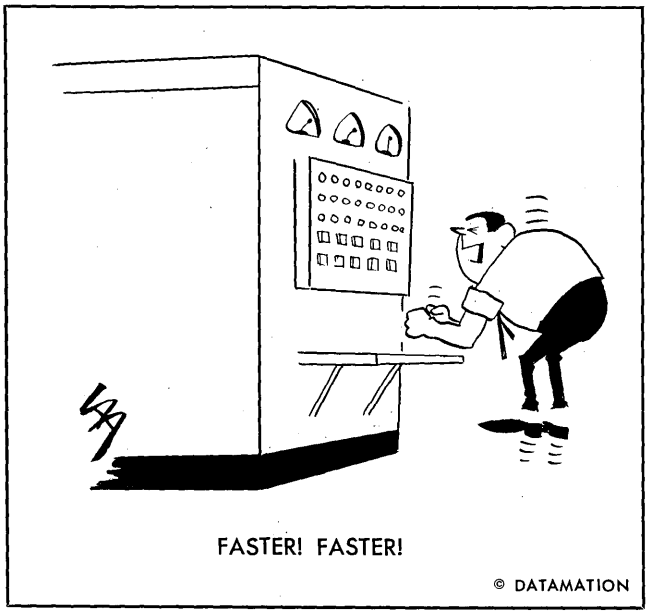
because current rumors are that if JOSS does surface at all in IBM, it will only be allowed out as a Type 3 program and not as a system.

Bolt Beranek and Newman, one of those small companies that sometimes give us concern, did have the audacity to extend JOSS to handle string manipulation. The very thought that a user might do his own string manipulation is an extremely dangerous concept. Fortunately, BB&N only developed that capability for a PDP-1, which really does not count at this point in time. Furthermore, they called their system STRCOMP AND ISRCOMP, which alone is enough to discourage most users. Since most of the commercial JOSS look-alikes did not attempt to extend the power of the system and even emasculated it to some degree (removed the recursive subroutine capability or the exact arithmetic) we can be quite pleased at the current situation.

If users inquire about JOSS, be sure to inform them it is only a computerized desk calculator. Users must remain ignorant that JOSS is more flexible than FORTRAN and that the concept can be extended to a master system control language incorporating file, communication and symbol manipulation capability.

The only real defeat we have had with respect to the JOSS philosophy appears to have occurred at Massachusetts General Hospital. This has turned out to be an excellent example of the dangers involved in letting users gain control over a computer effort. The fact that such a system exists at all is a danger, and I suspect that our official view diplomatically should be that this is a very, very specialized application for a very, very specialized community of users from which it is impossible to draw any general conclusions. Unofficially, we can point to the rising costs of medical care and blame it on the inefficient use of expensive computer hardware. Above all we must insure they get as little publicity as possible.

It is extremely gratifying to note that most of the major manufacturers are going the BASIC route and that their extended versions of BASIC are getting to look more and more like FORTRAN. Unfortunately, we cannot avoid satisfying the demands of those users interested in straightforward numerical work. We must merely assure this capability is divorced and separated from any flexible and powerful control of data strings. We must insure that if the user wishes data handling capability he must come to the programmer and have a special idiot yes-no answer system designed for his single application. It is also pleasing that BASIC systems remain noninterpretive so that users are forced to learn the distinctions between composition, debugging and execution of a program as well as being forced to begin over for every little mistake.



FASTER! FASTER!

The cooperation we have had from government in our effort is most gratifying. We can rest assured that with the exception of a few mavericks who have managed to discover a cut here or there in the red tape, most potential government users will never see an immediate access terminal they would consider using.

I must admit that for a while there was some concern that since the government had mistakenly financed a large portion of the initial R&D in the time-sharing, immediate access area that they would become a big user of such systems. Fortunately, there have been a couple of important factors which have managed almost completely to inhibit the government's movement in this direction. First, immediate access systems for users cost more than immediate access systems for programmers, which in turn cost more than batch-oriented systems, and of course batch systems always utilize the computer hardware more efficiently than immediate access systems. Second, we have carefully neglected to do a good job of analyzing the cost benefits that might be incurred from such indirect measures as user time saved, rapid availability of information, and opportunity costs. Therefore, the government examiner or auditor faced with nothing but intuitive pleas by those misfits trying to justify user-oriented systems must of course disallow the added expense.

Incidentally, we would like IBM to cut out those automatic typewriter commercials which illustrate how expensive the manual writing of a letter can be when properly costed out. We do not want budgetary minded individuals to infer from this there might also be indirect user costs associated with the writing of computer programs. In addition, we can be thankful for those rules which make it harder for the smaller companies to compete when they do not manufacture all the necessary peripheral equipment. The smaller companies are usually the mavericks outside the mainstream of the industry anyway. Finally, we must encourage the government to push harder for standards; now is the best time before users might get wise to other possible languages.

The situation to avoid at all costs is one in which the user is provided with a computer capability for improving the efficiency of his own functions in the user organization. This is typified by a simple-to-use but flexible personnel user file and communication system in which the user can store, edit or update his own data, memos or programs, and where he can send or receive parts of his or other user files. These fundamental operations are characteristic of the functions performed in almost any user community or organization and will spark the user's interest since it provides a day-to-day service to him. Then, of course, if one adds a computational and symbol manipulation capability that is coherent in language structure with the file and communication capability—one that can be learned in modules—the user will then be able to do a significant portion of his own work. We would in such an environment lose the priesthood aura that we have so carefully built.

keep them down

After all, we have nurtured over the years the following precepts relating to the programmer-user interface:

1. The user is incapable of utilizing a computer by himself for meaningful work.
2. Only the programmer really knows what the user wants.
3. The user is incapable of stating his problem in a clear and concise manner compatible with the computer system.
4. All meaningful approaches to problem solution must by definition be compatible with a computer system.
5. The user must remain grateful and satisfied for the programmer's interpretation of his problem and the com-

puter solution to that interpretation.

An immediate access system with sufficient communication capability to allow the user to establish an interaction between him and the programmer on a common language foundation would be a severe blow at these commandments.

Even worse, such an approach might lead to the user community developing, over time, their own management information system able to adapt to the changes in the community structure and its environment. Consider what this would do to all we have said about the effort and design study needed for management information systems and how these must follow the tried and true implementation procedures and techniques associated with information management systems.

Before the user becomes aware of the potential in flexible computer-assisted communications among users, terminals and files we should join hands with the telephone companies and ask government to come to our aid by disallowing such a capability as a fundamental violation of the principles of separation between computation and communications. The fact that this will inhibit the use and development of computer assisted conferencing or on-line gaming is a small penalty to the society which we can quietly sweep under the rug. The community representing the soft sciences is, as a whole, still far enough behind in the use of computers that we would not expect any really organized opposition to such regulations. However, it is urgent that we seek adequate regulatory protection before these academic communities wake up.

One dangerous area that has developed recently is the movement toward computer-assisted education. There are rumors that some of the efforts in this area are considering the possibility of developing user-oriented general purpose software which would allow teachers at a local school to develop their own educational programs tailored to their student community. I feel it would set a very dangerous precedent to treat teachers any different from other user communities. In addition, a few of the psychologists and educators becoming acquainted with computers are beginning to feel intuitively that there is some commonality between the foundations of their tools and techniques and the earlier efforts of information handling, data retrieval, and computational systems.

Once again I urge the technique of fragmentation. Computer-assisted education is a very, very specialized application and has no relationship to other user-oriented systems. Separate languages and systems with highly educational-oriented programs and vocabularies must be built from machine language. There is no possibility that an immediate access language for the user could be used for both the construction of tailored data base retrieval applications as well as tailored educational response systems.

Be sure to isolate the development group for management information systems from the group working on educational packages (separate cities is desirable) as well as the group concerned with on-line computation. Cross-fertilization is the fundamental danger to be avoided at all costs. Adequate justification, administratively, may be found by illustrating the degree of departmentalization existing at most of the universities and by pointing to the limited technical communication existing among academic departments and how well their example highlights the lack of meaningful computer research or development problems requiring company interdivisional cooperation.

As a community, we have had a rewarding three years; however, the same seed that existed three years ago still exists and only by constant vigilance and weeding will our community continue to blossom and flourish. We can foresee, if we maintain our current direction, a glorious future in which the demand for members of the computer community will eventually exceed the population. ■

PL/I AS A TOOL FOR SYSTEM PROGRAMMING

five years
with a temporary compiler

by F. J. Corbató

My vantage point is that of a system designer-implementer concerned with the over-all system performance and the degree that the system reaches the goals that it was designed for. This gives me a little more detachment from the issue of whether the language is just right or not. For that reason some of my remarks will not be completely unequivocal but rather will be shaded.

The basis of the PL/I experience that I wish to talk about is mostly on the Multics system, which is being done as a cooperative project by the Bell Laboratories, the General Electric Company and Project MAC of MIT using the GE 645 computer which is derived from the GE 635. However, I am not giving an official Multics view but rather only my own opinion as a member of the design team. In fact, it's a preliminary view because it is still early to be certain that we have analyzed exactly what is happening. Further, one has to be cautious in forming final judgments on a language, even though it is already a de facto standard, since there still is a need for a great deal of diversity in the computing field so that different techniques can be evaluated.

multics plans

To understand the context in which our systems programming was done, I first have to give you a brief review of what the Multics project's goals are. A set of papers is in the 1965 Fall Joint Computer Conference *Proceedings* if you wish to read more detail. Briefly, we are trying to create a computer service utility. In particular, we want continuous operation of pools of identical units. We want to combine in a single complex the goals of interactive time-sharing and noninteractive batch processing. We want to combine the goals of remote and local use in one system. The system programming problem is to develop a framework which multiplexes a large amount of equipment simultaneously and yet also allows controlled interaction and sharing between users working in concert on various problems in real time.

In short, it's a fairly ambitious project, not because of any single idea but because we're trying to tie together many ideas at once. It was our judgment that we required new hardware to meet these goals squarely and that, of course, meant that we had to write almost all of our software for ourselves, including, it turned out, even the assembler. We were able to borrow a little, but not as much as we had hoped. Thus the project began basically at a research and development level, where flexibility is needed. We wanted a small team of people, because the hardest thing to do when you're groping in an unknown area is to coordinate people. We felt strongly that we had to have maximum flexibility in our implementation. *(Continued on page 73)*

Dr. Corbató is professor of electrical engineering at MIT and widely noted for his pioneering work in development of multi-access systems, including Project MAC. He has written several books and many articles and received the W. W. McDowell Award in 1966 for his work on time-sharing systems. He has a BS from Cal Tech and a PhD in physics from MIT.

(This article is based on a discussion presented by the author at an Air Force PL/I Seminar at Hanscom Field, Bedford, Mass., on March 5, 1968. The seminar was organized and conducted by Logicon, Inc., 255 West Fifth Street, San Pedro, Calif.

[1] The ideas described here were developed in the course of research supported by the Advanced Research Projects Agency, Department of Defense, under Office of Naval Research Contract Number Nonr-4102(01).

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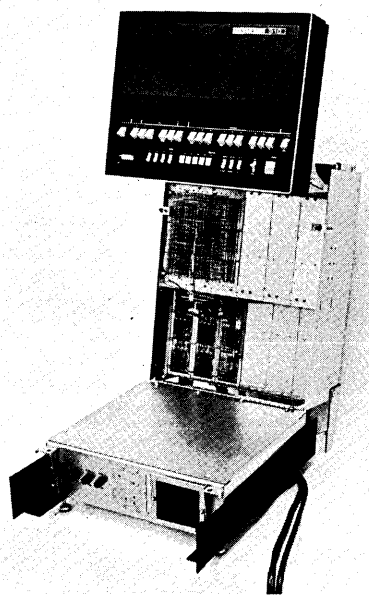

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To give you a little bit of the scale of the project, I will discuss briefly the implementation. The project began in earnest in the fall of 1964 and should lead to a usable system by this fall. This means it will take approximately five years to create a useful system. That's a long time, and I think one has to appreciate the investment of effort that goes into such a venture. If you spend five years developing something you probably try to exploit it for a period of time greater than that; thus there is clearly an underlying goal here of wanting to see the project evolve as conditions change.

The system itself is described quite tersely at the level suitable for a senior system programmer in about 4000 single-space typewritten pages in the Multics System-Programmers' Manual. The system in final form seems to project out to about 600 to 800 modules of maybe four pages of source code each on the average, or, in other words, about 3000 pages of source code. The amount of system program that's in machine code is less than 5% at the object code level; it would be even less except that the compiler did not come along early enough, so some things had to be written in machine code right away. The system projects out to about a half million 36-bit words which, loosely speaking, is the supervisor program. In operation, most of it, of course, pages out and is not resident in core, but it must exist and it is exclusive of all the languages and facilities of that sort, such as COBOL, FORTRAN, and even PL/I itself. The manpower to create the system has varied roughly in a linearly increasing way from zero to approximately 50 people over a five-year period.

compiler advantages

The next question I want to address myself to is why one uses a compiler at all to do system programming. (I'll take up next the question of why PL/I in particular, but first: why a compiler?) First, there is the ability to describe programs briefly and lucidly. Clearly, one can obfuscate one's ideas with a compiler language but it's harder. To some extent one is talking about what one wants rather than how one wants to do it.

The trouble with machine code, of course, is that when you look at a random section of machine code you don't know what properties of the instructions the programmer really wanted to exploit. On the 7094, for example, the fact that the P-bit got cleared by an instruction may or may not be germane to what the program is trying to accomplish. With a compiler language, especially the later ones, one tends to describe what one wants to accomplish in terms of a goal and let the compiler work out the specific detail. This contributes to lucidity, of course. It also gives one the chance for change and redesign, because on a system as large as the one I have just described, the only sensible attitude is to assume that the system is never finished. Although the system obviously goes through phases, one is continually improving and evolving it.

We have had this experience on CTSS, our previous time-sharing system, and we know it is true. What happens is that users have expanding needs and goals as they exploit the facilities and they continually come up with wanted improvements. Certainly, the other extreme—of assuming that a computer software system is like hardware and can be designed once and for all on a one-shot basis and then left to the hands of some maintainers—I think has been shown to be a failure.

Another issue, too, in a system of the ambitiousness that we are talking about is that the software is at least three-quarters of the design work and yet it usually doesn't get started until the hardware is already firm. Thus there is a desire to speed up the implementation effort and using a compiler allows each programmer to do more per day. It's our experience that regardless of whether one is dealing with assembly language or compiler language, the number of debugged lines of source code per day is about the same! Another point, too, is that the supervisor is the host of the user services so that the computer time spent in the supervisor is between 10% in some well-worked-out systems to maybe an extreme of 50% of the total time. Thus, if the compiler isn't generating the most efficient code, it isn't a disaster. In other words, one is dealing with code that isn't being exercised *all* the time. It has to exist, it has to be right, but there is room for some clumsiness. Further, if the system is well designed, the production job will run efficiently and the supervisor will remain out of the picture.

Finally, there is the issue of technical management of programming projects: the problem of trying to maintain a system in the face of personnel turnover and in the face of varying standards of documentation. Personnel turnover is expected on a five-year project. (We didn't think it was a five-year project to begin with; we estimated about half the time.) One has to assume in most organizations somewhere between 10% and 20% turnover per year even if everybody is relatively happy. People get married, husbands are transferred, and for a variety of personal reasons, people must leave, carrying with them key know-how. Training a new person involves a minimum period of six to nine months, even starting with good people, especially if you're faced with a system which has 4000 pages of description in it. You don't casually sit down and read that, even in a weekend. In fact, it's fair to say that the system is large enough that no single person can remain abreast of all parts at once. Thus there is a reasonable case for a compiler in developing large systems.

which compiler?

So the question was: What compiler to use when developing Multics? We chose PL/I. The reasons go somewhat like this. One of the key reasons that we picked the language was the fact that the object code is modular, that is, one can compile each subsection of the final program separately, clean up the syntax, and test it on an individual basis. This latter point seems obvious, perhaps, because object code modularity is in several languages, like JOVIAL, FORTRAN, or MAD, but it wasn't in the ALGOL implementation available and it blocked us from considering it.

The second reason for picking PL/I was the richness of the constructs, especially the data structures and data types which we considered to be very powerful and important features. We had a task on our hands with fairly strong requirements and with unknown difficulty. We viewed the richness as a mixed blessing, however, because we certainly were a little wary of the possible consequences. But it certainly seemed the right direction to start and maybe to err on and to cut back. As I'll get to later, it was a little too rich.

Another reason for choosing PL/I was that it was roughly machine independent. Our object in doing the system has not been to compete with normal manufacturing. Instead, our object has been to explore the frontier and see how to put together effectively a system that reaches and satisfies the goals that were set out. We are trying to find out the key design ideas and communicate these to others regardless of what system they are familiar with. Hence, a language that gets above the specific details of the hardware is certainly desirable, and PL/I does a very effective job of that. In other words, it forces one to design, not to fiddle with code. And this has turned out to be one of its strong points.

Another reason that we considered PL/I was that we thought the language would have wide support. To date it has had the support of one major manufacturer. And the final key reason for PL/I was that two persons associated with the project, specifically Doug McIlroy and Robert Morris at Bell Labs, offered to make a subset of it work. In addition, a follow-on contract with a vendor was arranged for a more polished version of the compiler. That is basically why we chose PL/I. We certainly debated, somewhat cas-

ually, other choices but these were the essential reasons why we picked the language.

The subset that was implemented initially as a deliberately quick-and-dirty job was called EPL for Early PL/I. Its design characteristics went briefly as follows: It had no I/O; after all, this is a system programming language and we use the system subroutines. It had no macros except the INCLUDE macro, which worked in very smoothly with the time-sharing system, CTSS, that we were using. It had no PICTURE attributes or things of that sort which represented the COBOL influence, except for structures, of course. It had no multi-tasking; we found the PL/I specification of this to be defective in the sense that it wasn't thought through well enough, and we certainly didn't need it for a system programming language. It had various minor restrictions like requiring structure names to be fully qualified. No complex arithmetic, no controlled storage (you can simulate that easily), and, more importantly, no attributes such as IRREDUCIBLE, REDUCIBLE, ABNORMAL, NORMAL, USES, or SETS—those things which allow the compiler to do an optimum job of compiling the code with advice from the program; these are sophisticated and tricky attributes, incidentally—but the reason they're not there is that the compiler didn't intend to optimize anyway, so it would have ignored advice.

To emphasize the positive, the things that EPL did have were ON-conditions and signals; it did have recursive procedures—in fact, the system doesn't allow any other kind easily. It did have based storage and pointer variables, and it had ALLOCATE and FREE for storage management. It had structures, as I've mentioned, it had block structures, and it had varying strings, which we regret to some extent because of implementation difficulties. In other words, it was a pretty potent subset from the point of view of language facilities.

not so temporary

The implementation, as I said earlier, was deliberately a quick-and-dirty job. It was expected to be merely a temporary tool to be soon replaced by a polished compiler from the vendor. The team consisted of McIlroy and Morris and two to four helpers. I am going to give a detailed and candid account of the events surrounding the EPL implementation because the nature of the events plus the very high qualifications of the people involved together with the difficulties encountered indicates that PL/I has intrinsic implementation problems which we did not properly anticipate. The original optimistic estimate for making EPL work was that it was only going to take about six months. In spite of the dedication of the people involved, it took over 15 months to get a compiler that was barely usable. Further a lot of work went into upgrading it in the next 18 months, since the polished compiler of the vendor never materialized and the upgrading process had to be continued, notably first by Jim Gimpel and later by Barry Wolmen. Moreover, the EPL effort—like a gruelling relay race—wore out nearly everyone who worked on it. But to everyone's credit, the compiler works and is useful.

The language that was used to implement EPL was TMG, short for "transmogrifier," which is a language system developed elsewhere by Bob McClure. It's a clever, interpretive system specifically designed for experimental language writing or syntax analysis. However, it is not easy to learn and use and, therefore, it is hard to pick up the work of somebody else written in the language.

The EPL translator was initially designed as two passes, the first one being principally a syntax analyzer and the second one basically a macro expander. The output of the second pass in turn led into an assembler which handled the specific formatting for the machine. Later a third pass was added intermediate between the first two in an attempt to optimize the object code.

The quick-and-dirtiness came through when the original language subset specs had only a single diagnostic, namely, ERROR. That has been expanded so that maybe now there are half a dozen, but the only help you get is that the message appears in the neighborhood of the statement that caused the trouble. The compile rate, which was never a major issue, turned out to be a few statements per second. It has been improved a little with time, but more critically the object code that is generated has improved to a respectable 10 instructions per executable statement. (There's obviously a large variance attached to these figures.)

The environment that the EPL compiler had to fit into is significant. First of all, we had adopted as a machine standard the full ASCII character set of 95 graphics plus control characters, so one of our first projects was trying to map a relationship with EBCDIC—the IBM standard.

We also intended to use the language in a machine with program segmentation hardware in which programs can refer to other sections of programs by name. Fortunately, we could use the $ sign as a delimiter to allow us to have two-component names. We also expected the compiler to generate pure procedure code which was capable of being shared by several users each with their own data section who might be simultaneously trying to execute the same procedure. We also wanted to establish as a normal standard, although not a required one, the use of recursive procedures by means of a stack for the call, save, and return sequence, linkage information, and automatic temporary storage. We also wanted to allow the machine to have a feature which we've called "dynamic loading" in the sense that an entire program isn't loaded per se; the first procedure is started and, as it calls on other procedures, these procedures in turn are automatically fetched by the supervisor on an as-needed basis rather than on a pre-request basis. This, of course, is in conflict with any language which allows storage to be predeclared by the INITIAL specification within any possible module that is ever used by the program. (This problem also comes up in FORTRAN.)

We also had a feature in the machine which we call segment addressing that allows one to talk about a data segment without having to read it in through input/output; rather, one merely references it and the supervisor gets it for one through the file system. In other words, we were trying to design a host system capable of supporting software constructs which make it easier for people to write software subsystems.

environmental problems

In this rather sophisticated environment, one of the problems was that much of the time was spent finishing the design of the compiler so as to implement the mating of the language constructs with the environment. The things that caused trouble were the SIGNAL and ON conditions, which are relatively tricky ideas and which clash head on with faults and interrupts. The call, save, and return conventions had to be mated into the standards of the system. Problems of non-local GO TO's and the releasing of temporary storage which has been invoked had to be licked. Most of these problems are implications of the language if one thinks it through, for the language has a lot of assumptions in it about what kind of an environment it is going to be in.

There are also little subtleties, like when you're talking about strings of characters and operators, what is the role of control characters, i.e., codes without graphic representation such as backspace, when encountered in strings. There are also obvious difficulties in that the language doesn't discuss any protection mechanisms, a feature that every system must have to implement a supervisor-user relationship.

Thus there needed to be some additional modifications made to the compiler to make that work out.

And then there are strategy problems within the implementation, such as how you're going to implement internal blocks and internal functions. These also took some time to work out and were one of the principal reasons why the compiler implementation was slow going. Further, it was done simultaneously and in parallel with the system design. I would say with hindsight that we didn't put enough effort into trying to coordinate the two. The reason we did not was that to a first approximation we felt that the language implementation was decoupleable from the main project. That was a useful thing in the early days, but as we came home toward the finish line in the design, it began to haunt us that we hadn't worked out some of these interface ideas more carefully, and we had to pay the price of redesign in various parts.

One preliminary conclusion we draw from the above experience is that PL/I went too far in specifying the exact environment. There are a lot of ideas that should be subroutines and not part of the language. I don't mean they shouldn't be thought through, but to think them through is not the same as putting them in the syntax of the compiler. In particular, things like SIGNAL and ON conditions could indeed be implemented as subroutine calls and be part of the environment of the host system. I don't think they belong in the language per se, although if one makes the language embrace a standard subroutine library, then I, of course, agree.

I'll say very little about the vendor's compiler. They estimated it would take 12 to 18 months. After approximately 24 months, we stopped expecting anything useful to appear. One of the principal reasons they failed was that there was a gross underestimation of the work, by a factor of three to five, and it was impossible to mount a larger effort by the time the underestimation became evident. Thus, the pioneering EPL has become the standard system-programming compiler.

Let me next talk about the use we made of the PL/I language. A strong point, we felt, is the ability to use long names which were more descriptive. People still get cryptic, but they're not nearly as cryptic as they were. The full ASCII character set is a strong point because we wanted to deal with a well-engineered human interface. The structures and the data types, as I mentioned earlier, we consider to be one of the strongest assets (this perhaps comes as no surprise to COBOL users but this feature is very important when you're trying to design data bases). The POINTER variable and based storage concept, along with ALLOCATE and FREE, have been pivotal and crucial and have been used extensively. Some of the features like SIGNAL and ON conditions, which have cost us a lot of grief, at least in principle, have been very graceful ways of smoothly and uniformly handling the overflow conditions and the like, which suddenly trap you down into the guts of the supervisor. In previous systems we have always had the quandary of how to allow the user to supply his own condition handlers in a convenient way. We're not sure that the price isn't perhaps too high, but the mechanism does look good.

Another point about PL/I, that is perhaps obvious, is that the conditional statements that are straight out of ALGOL are very valuable.

reduced errors

Over-all, the general result that we got from using PL/I was a rather small number of programming errors (after a programmer learns the ropes), in fact, a sufficiently small number that one of our major sources of residual trouble is that a lot of bugs have been caused by mismatched declarations, getting parameters in a calling sequence inverted, getting argument types in calls mixed up, all clerical errors in which the language gives you no help and our implementation doesn't either. In fact, this is a defect in the language in the sense that the independence of the separate compilations has left a gap in the checking of types. (Sometimes programmers have used mismatched declarations for gimmicky convenience or efficiency although we have tried to avoid it because it obviously destroys machine independence.) We also found that skillful system programmers who know the machine well don't want to work in machine language because they make too many mistakes. This condition is aggravated because in modifying the machine we retrofitted a lot of involved ideas onto a somewhat ornate order code. Regardless of the reason, however, we find that programmers would rather get things done than twiddle bits.

A major effect of the use of PL/I has been that we have been able to make major strategy changes which are really vast redesigns. One example occurred in the management of the high-speed drum that did most of the paging. The program that did this was reworked, quite a while ago, when some insight developed which allowed a tremendous amount of bookkeeping to be eliminated. The amount of code that was involved dropped from 50,000 words to 10,000 words. This total rework was done in less than a month (although not completely checked out because the person wasn't working full time on it).

A second example of redesign occurred in the area of a special high-strung I/O controller which has all kinds of conventions and specialized aspects. The first cut of the control program design was a little rich; it ended up involving around 65,000 words of code. After people finished debugging it and recovered their breath, they took a closer look at it and saw that by cutting out maybe 10% of the features and changing some of the interfaces and specifications they could streamline it. Two good men working very hard did the reworking in less than two months. The two months were peak effort, but they did do it. The program basically shrunk in half, down to 30,000 words and it runs about five or ten times faster in critical places.

This kind of redesign is invaluable and in many key areas of the system has occurred several times. It gives one the mobility that one is after. It may be true for the use of nearly any compiler—I'm not trying to argue that this is exclusively a PL/I attribute—but this is the experience we're getting. Another example was a major change in the system strategy of handling "own data" sections, which we call linkage sections. We were keeping them as individual segments but we reorganized things so that they were all combined into a single segment because some of our initial design assumptions had not been correct. This reworking was done in the period of a month. The change was serial to the main line of the project development, so that it was a rather important period of time to minimize.

object code

Now, there's another side of the coin, namely, object code performance. At present the comparison to hand code seems in the vicinity of two times worse and is largely because the compiler cannot optimize very well. A lot of redundant expressions are being calculated; this is especially true with based storage and pointers where it is easy to build up fairly elaborate expressions to access a variable and then at the next occurrence repeat the calculation.

Finally, and this is perhaps the one shocking note that should be taken with some caution, we find that a typical good system programmer produces on his first try EPL-generated object code which is perhaps 5 to 10 times as poor as hand code. I think this is the main problem with PL/I, because a factor of 5 or 10 at the wrong places can sink the system. The reason for the factor of 5 or 10 seems to be principally that programmers don't always realize the mechanisms they are triggering off when they write some-

thing down. The usual pattern when one writes a program is to think of four or five ways that one can write out a part of an algorithm and to pick one of them on the basis of knowing which way works out best.

What has happened is that people are too detached. For example, if you use a 1-bit string for a Boolean variable, it turns out in our particular implementation you generate a lot more machinery than if you'd used a fixed integer. Similarly, varying strings carry a fairly stiff price tag in our present implementation (although ways are known to improve matters a little), and they must be used with caution. Occasionally, too, we've had mishaps where the machine independence works against us in the sense that a man declares an array of repeating 37-bit elements and the compiler dutifully does it, straddling work boundaries mercilessly. The best we've been able to do so far is to get the compiler to at least remark on the object code, listing the word "IDIOTIC." There may be other reasons for the factor of 5 to 10—such as the language learning time—but we do not consider them important. Other issues, such as the 10 to 1 variation in ability among programmers of similar experience discussed in an article by Sackman, Erickson and Grant in the January 1968 *Communications*, I think can be discounted in our case. Our technical management has been thin, but we have kept careful track of the individual programmers so that mismatches with work assignments have been minimized.

With regard to remedial measures for upgrading the system one must remember that most of the code in the supervisor doesn't matter; it's not being used most of the time so the key thing is program strategy. I don't have time to discuss here how we localize the parts of the code which are the functionally important parts, but a segmented machine pays off handsomely. Meanwhile we are learning trade-offs between the different supervisor mechanisms. In addition we are trying to develop checklists of things to avoid in the language. It turns out to be rather hard to get people to generalize so it is slow going. On a long-range basis GE is developing plans for an optimizing compiler, but it isn't going to help us right away. We are also studying on a preliminary basis smaller subsets of PL/I with perhaps modifications and changes to the language so that the implementation is more uniformly potent—or impotent, depending on how you look at it. That is, the user would be constrained to a language which would implement well regardless of whether he takes one choice or another. And, finally, there are some coding tricks that might have helped if we had thought of them sooner.

another problem

One of the key problems in our use of PL/I has been that the programmer doesn't have feedback. If he had, say, a time and space estimate on each statement that he writes, given back by the compiler, and if he were in an interactive environment developing the program (i.e., he could get quick return on his compilations), he might be able to form some intuition about what he's doing. To implement such estimates is not a trivial problem, because a lot of the mechanisms that are invoked are shared, so that there needs to be a way of designating the shared mechanisms and showing why they are included.

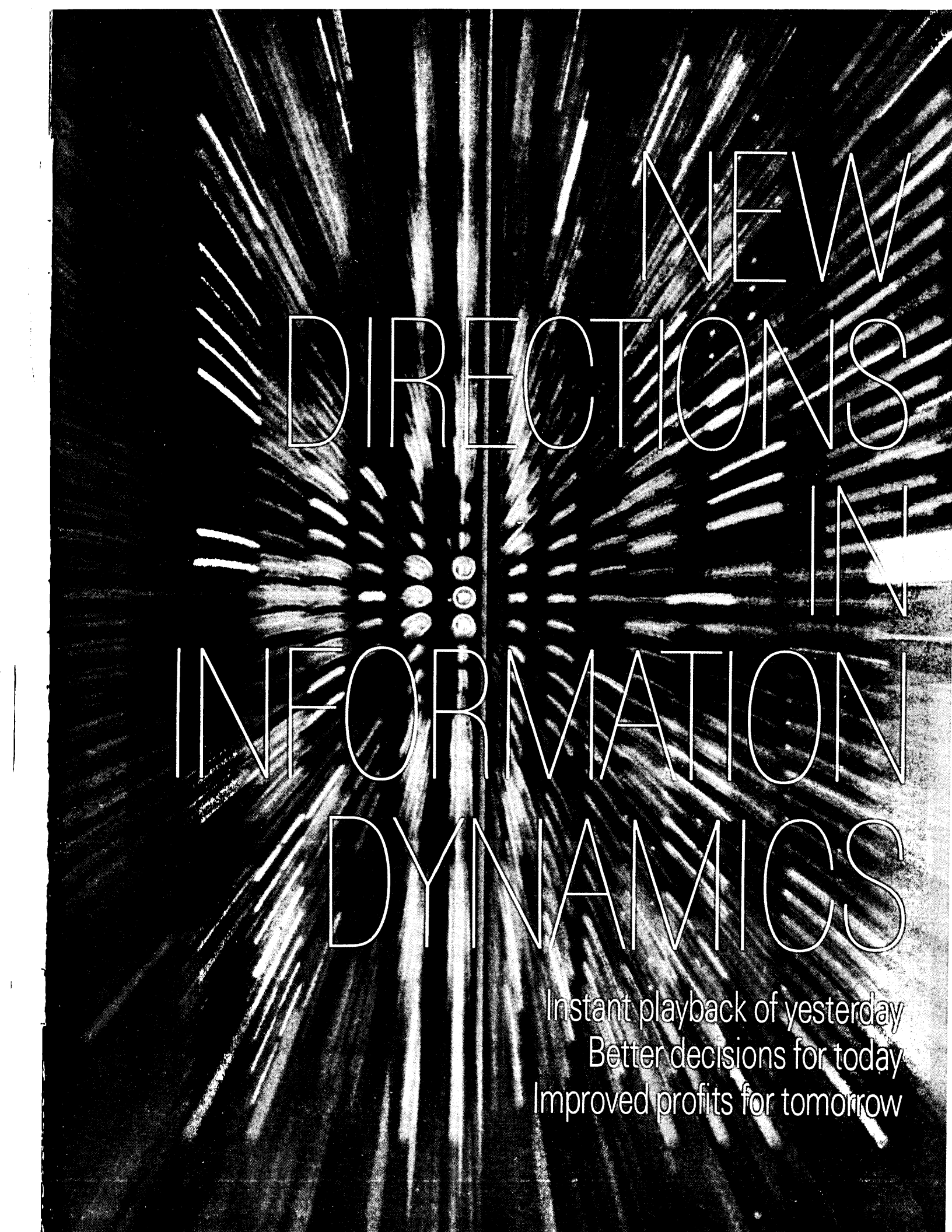
As a last resort in improving supervisor performance we can always go to machine language on any supercritical module. But this isn't a panacea, because it is easy to be swamped if one tries to put too much in machine language and moreover one has lost mobility. (Going to machine language should be compared to parachuting out of an airplane.)

One of the big advantages that one might expect from the use of PL/I as a system programming language is the ability to transfer software from one operating system to another. However, if you get totally wrapped up with an operating system which is peculiar to a particular set of hardware you're trapped. You're just going to have to rework it on another machine. It is a long-range goal, as yet unachieved, to minimize this problem. We've considered the problem some because one of the obvious questions that arises when you have a system which has been largely implemented in PL/I is: Could you put it on another machine? The answer is "Yes," although I think it's still at the level of a "technical challenge" even with similar hardware. To do it one would have to go through and modify and edit all the programs to make it come out just right. There are also some strategy changes required, probably, unless one actually built an identical machine. Nevertheless, such a task is still preferable to having to start all over, writing off as a total loss the ideas and efforts of several years; this is the alternative to working in a compiler language for system programming. I don't really see how there's going to be any progress in the field until we stop killing off our system children.

Finally, I have a few general conclusions. I think that in the language area there has been considerable swinging of the pendulum. FORTRAN was the first compiler with any widespread use and it suffered because it wasn't systematic to implement and was somewhat clumsy to use. It was, however, a practical language. ALGOL was, in a sense, a reaction, but it suffered because it left out the environment and didn't come to grips very squarely with the implementation. PL/I, in effect, is a reaction against ALGOL's not having considered the environment, but it suffers from being designed without well-formed plans for a systematic implementation. The notion of "systematic" is important because without it the cost of implementation, the speed of the compiler and the quality of the object code may be off by factors of 10 or 100. Nevertheless, I admire the PL/I design effort and consider it valuable because it has inspired language experts to try harder; in effect, it has set as goals what is wanted. The fact that the language has not been implemented well by anyone, I consider to be an object lesson. Nevertheless, techniques for mastering the problems are being found. In addition, people are beginning to think of ways of accomplishing the same functional characteristics without the same internal problems. One of the ways is to try to minimize the language syntax and to think through more carefully what is the subroutine library.

Future languages will come and they'll be beneficial, too. But PL/I is here now and the alternatives are still untested. Furthermore, I think it is clear that our EPL implementation is going to squeak by, and in the long run the Multics project will be ahead because of having used it rather than one of the older languages.

Now the last question, which I think is a tough one: If we had to do it all over again would we have done the same thing? I'm not totally sure of my answer; I just don't know. We certainly would have designed the language more carefully as part of the system; that was something we didn't pay enough attention to. If it was EPL or a PL/I again we would have tried to strip it down more. With hindsight we would have modified it to some extent to make sure that it could have been implemented well. If it were another language, we would have tried to beef it up with things such as are in PL/I, and maybe modified it. Either course of action takes a lot of design time, and that's the dilemma: in effect, one wants one's cake and one wants to eat it, too. I think the decision probably hinges on whether or not one is trying to meet a deadline. I would probably use FORTRAN to meet a firm deadline. But if I'm trying to solve a problem with a future, I think I would use either PL/I or its functional equivalent—and the choice will have to be answered in the future. ■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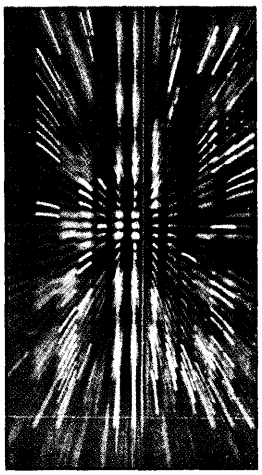

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Now compare the alternative, a decision often made by default. Using conventional impact line printers, the same volume of information drains up to 18 times the computer resources and requires longer for the output printing. The fan-fold paper printout is difficult to distribute, slow to retrieve, and expensive to store. Direct cost of multi-part paper usage alone often exceeds your hardware rentals. Then there are the follow-on costs of after-handling, such as the time it takes to decollate, burst, and bind.

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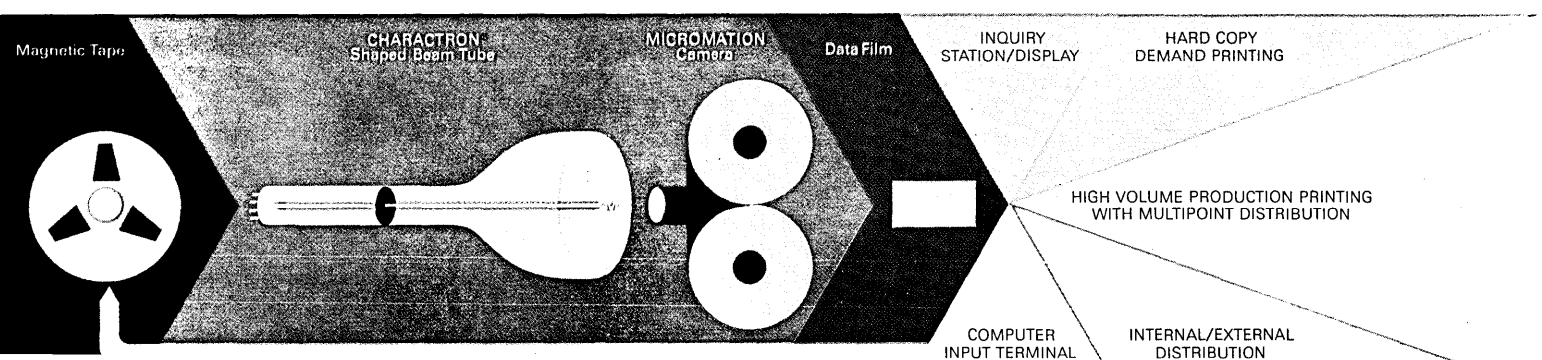

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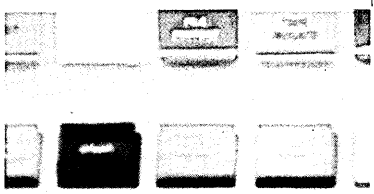

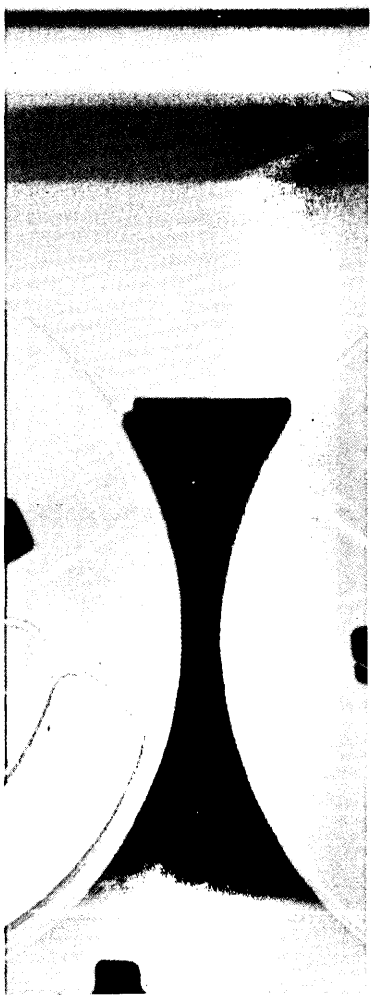

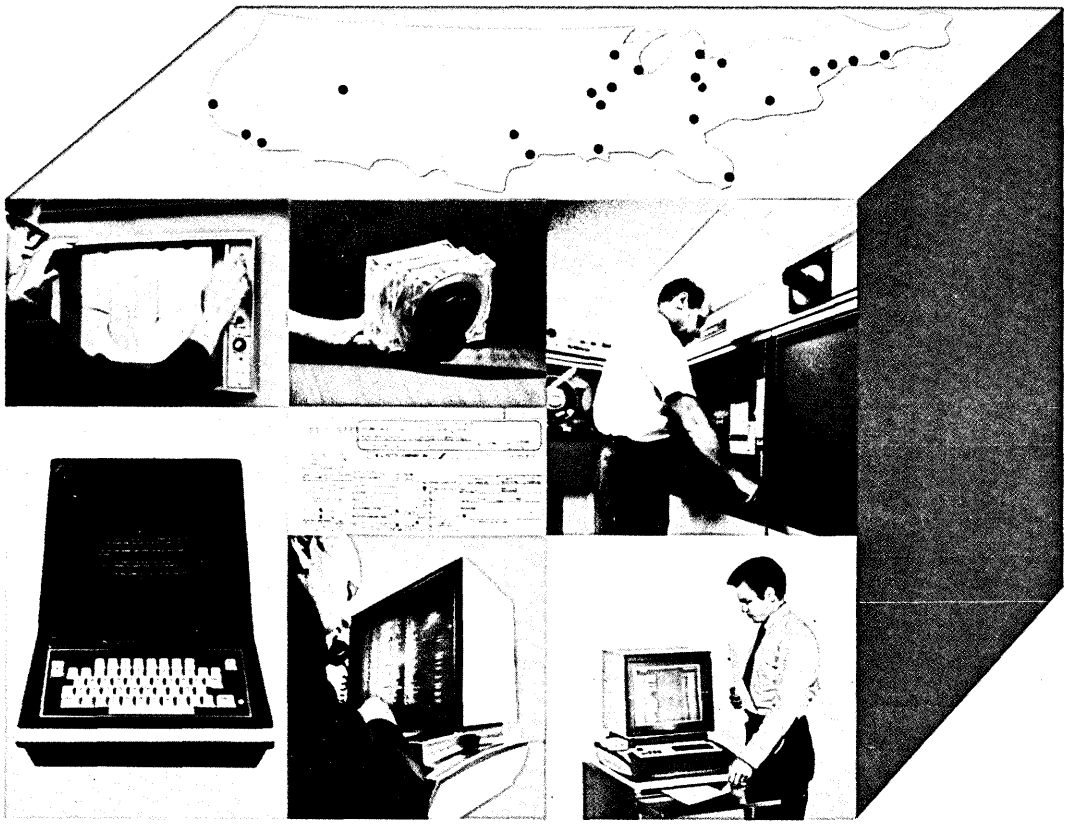

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a new technique

MAGNETIC CHARACTERS FOR DATA ENTRY

by Joel H. Levine

Data entry is still the bottleneck in edp systems. Although improvements have been made, there is still a long way to go.

There are two basic techniques for performing the data entry function. The older and still most widely used method is manual data entry. This involves keying the source data into a machine readable medium. Before 1965, the keypunch was almost universally used. This meant that the edp systems were all necessarily designed around the punched card and the mobile unit record concept. The card fulfilled the system requirements for input, output, file storage, working storage, and turnaround documents. In recent years the various key-to-tape/disc data recorders have gained in popularity with their increased efficiency and throughputs. The second and newer technique is the automatic character reader, which will take a properly prepared source document and automatically read the data on-line to the computer, or transcribe the data off-line onto magnetic tape. So far, two techniques have been evolved for performing character recognition—MICR and OCR.

The magnetic ink character readers (MICR), used quite exclusively in the banking industry, read a highly stylized special type font specified by the American Bankers Association which is limited to 10 numerics and four special symbols.

The form factor of the magnetic field for each character allows for its recognition. However, the limitations on readability and lack of alphabetic characters has severely limited its usage in other commercial and industrial applications. A second, more inclusive code set that has gained popularity in Europe is the CMC7 Magnetic Font which allows for up to 41 characters. This method has seen little usage in the U.S.

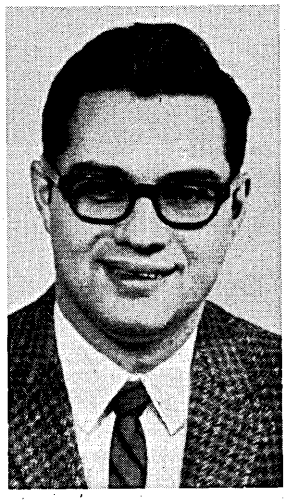
Optical character recognition (OCR) is slowly gaining in usage but is still expensive. Many fonts of various sizes may be read, depending upon the manufacturer, although there are attempts to standardize to the USASI character fonts.

A new concept developed by Potter Instrument Co. offers an interesting alternative to the data entry process. This new system uses a magnetic bar code associated with each alphanumeric character (see Fig. 1). Thus, each character will be both man- and machine-readable, thereby opening the door to a wide range of applications which will be described later in this article.

There are three basic operations that must be performed to meet the requirements of any data entry system. This includes the generation of the document (in this case the printing), the reading of the text, and finally the recognition or decoding of the text into machine language.

character printing

The coded character is printed by any of the commonly used impact printing devices including typewriters, high or low speed line printers, listers, cash registers, etc. To print the Potter character, the print slug on the typewriter or the character on the chain or the drum must be modified to include the bar code (Fig. 2). The only other requirement is to replace the ink ribbon with a conventional magnetic ink ribbon which is compatible with the Potter read heads.



Mr. Levine is manager, product planning, at Potter Instrument Co. He was previously principal engineer there, working on the development of printers, random access memory systems, and coordinate measurement devices. He has a BSEE from City College of New York and an MBA from Adelphi Univ.

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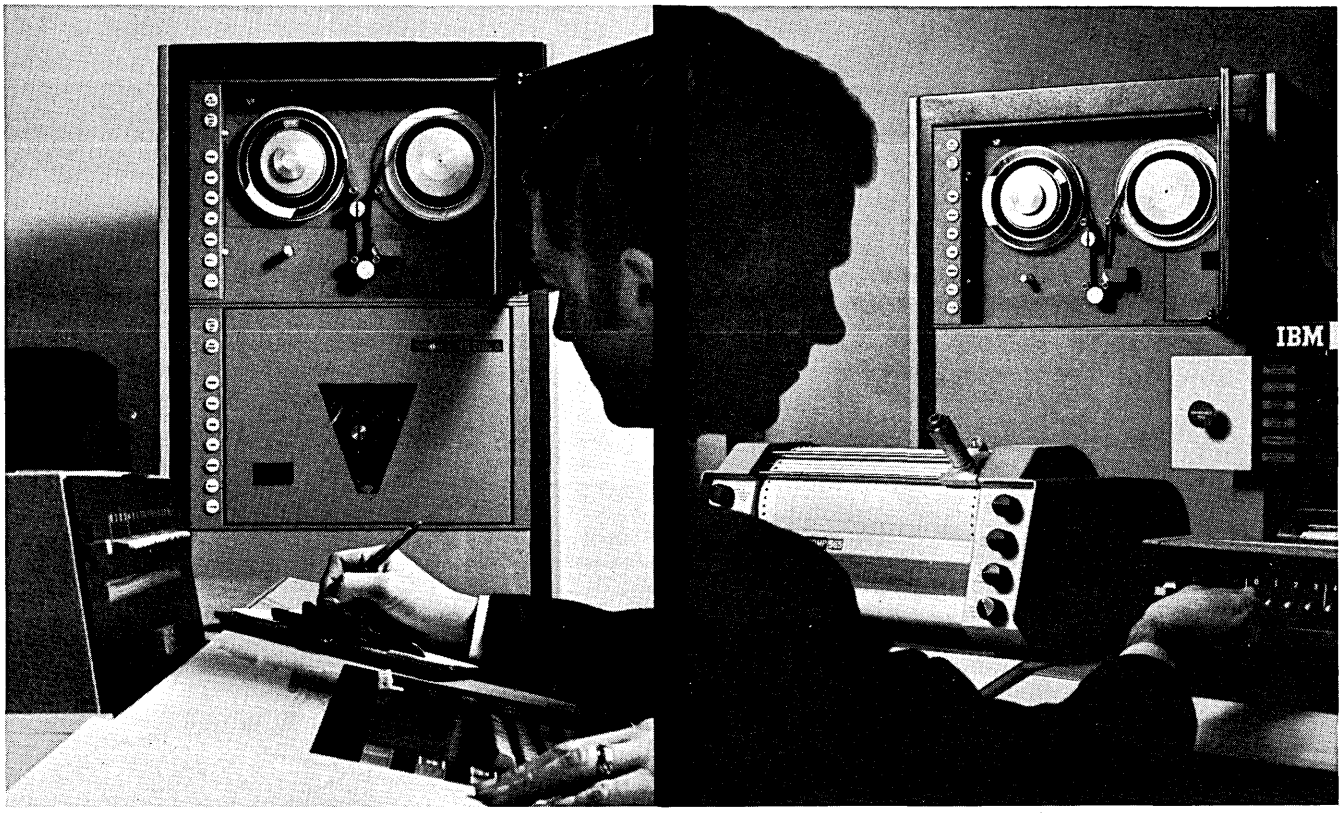

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Fig. 1 indicates the legibility of the text and the complete lack of reader adjustment that is often required of OCR and MICR techniques. In special applications where the bar code is distracting, techniques have been worked out that enable the printed letter to appear on one side of the document while the machine readable bar code appears on the opposite side.

character reading

The machine reading of this character is accomplished by simply passing the printed document under a simple read head. As the bars of magnetic material pass beneath the head a voltage is induced (see Fig. 3).

With this bar code system, a dual head is required for each line of data to accommodate the bar above and below the character. Once the character has passed under the head, up to eight pulses might have occurred. These data bits are suitably amplified, digitized, and stored for subsequent decoding. For multiline documents many dual heads can be paralleled yielding greater throughput and information density.

The simplicity of this magnetic bar code system yields a number of significant gains in reliability. Since this detection scheme "reads" magnetic bars, any dirt, grease, or pencil marks will not affect the readability and, unlike other

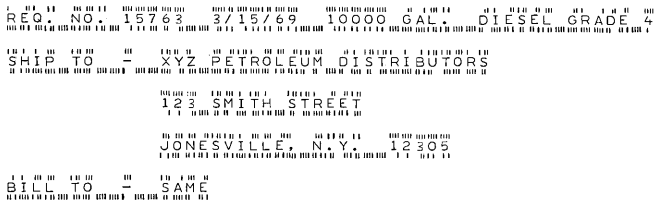


Fig. 1. A typical example of a message using the Potter magnetic character set.

systems, paper color and opacity are of little concern. The possibility of stray fields erasing the stored data, normally a problem in magnetic systems, has been eliminated with this approach since the detection scheme "looks" for the magnetic particles in the ink and not for an oriented magnetic field.

character recognition

Once the bar code for any character is read and stored, the decoding or the translation becomes a simple lookup table or decoding matrix which can be accomplished with hardware in the reader control electronics, or with software in the computer. Upon taking a closer look at the character font it becomes apparent that with eight bits per character available, 2^8 or 256 characters are possible. However, the requirements of the coding scheme for the magnetic character recognition requires that three functions be performed—decoding, self-clocking and error detection—while offering a minimum of 64 characters.

With these factors in mind, many possible coding schemes were considered. Depending upon the application, different hardware and performance trade-offs were available. The set presently being used on the initial hardware is a fully-clocked system which requires that each of the four pairs of upper and lower positions in the bar code have at least one bit. Since there will now be at least one output for each "bit pair," the two read heads will then yield four clock pulses per character. This clock may then be used to strobe the outputs of the two read heads to extract the data pattern. Error checking is performed in this scheme by counting the total number of strobes per record. This count can be then compared to the number expected in the fixed block length record. For random block lengths the total count can then be checked for the required even multiple of four. With each bit pair having only three combinations (the 00 combination is invalid) now 3^4 or 81 characters becomes the maximum font size. Other clocking schemes yield larger code sets or individual character parity for error detection and can be considered when the applications demand.

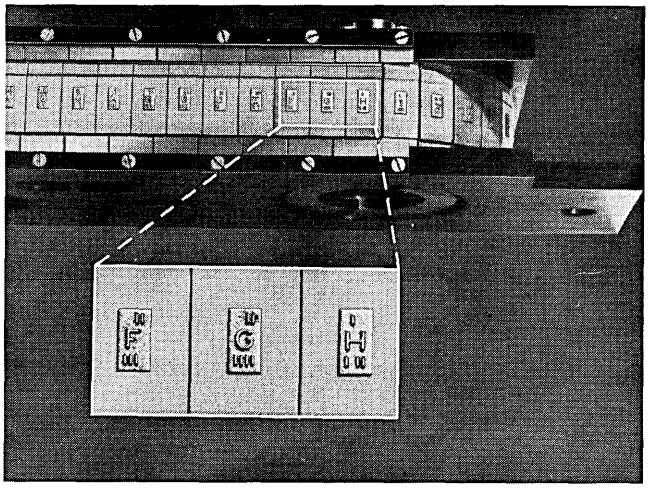


Fig. 2. Print characters with bar code added.

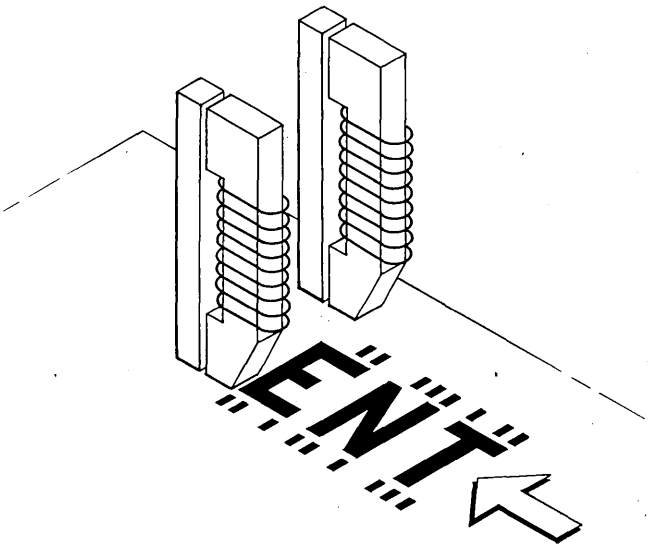
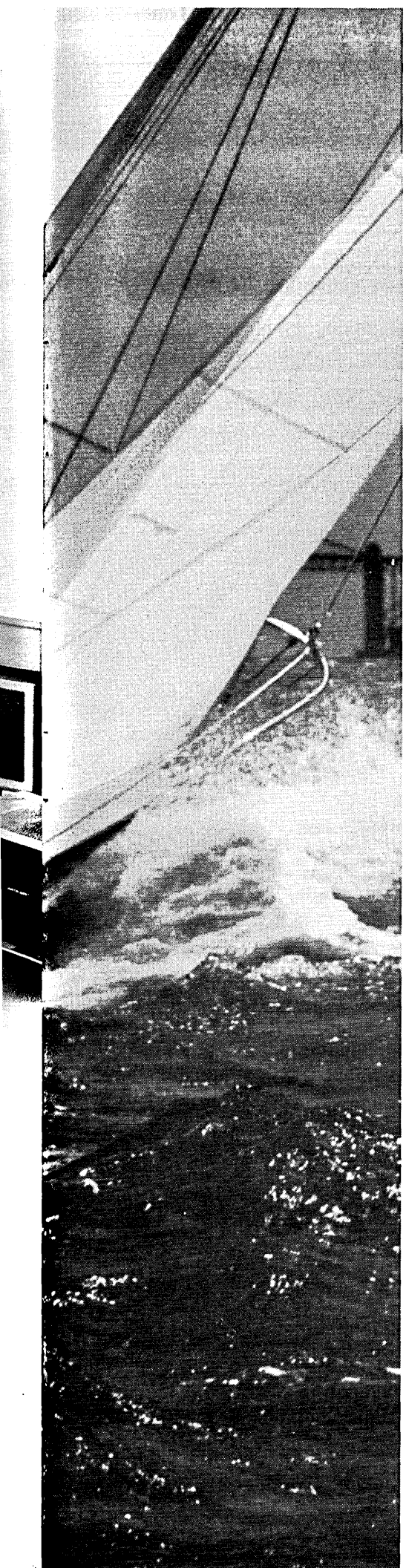


Fig. 3. Magnetic character passing under a dual read head

The important aspects of this decoding principle are its flexibility, with respect to font size, character style and error detection, and its simplicity and economics when compared to the very elaborate and expensive recognition units required for the present OCR Readers.

applications

Now that the key elements of this technique are defined, let's apply them to the existing data entry problems. In the manual entry mode, as discussed earlier, the bulk of the work is still being done by the ubiquitous punched cards and with the newer key-to-tape/disc systems. The compari-



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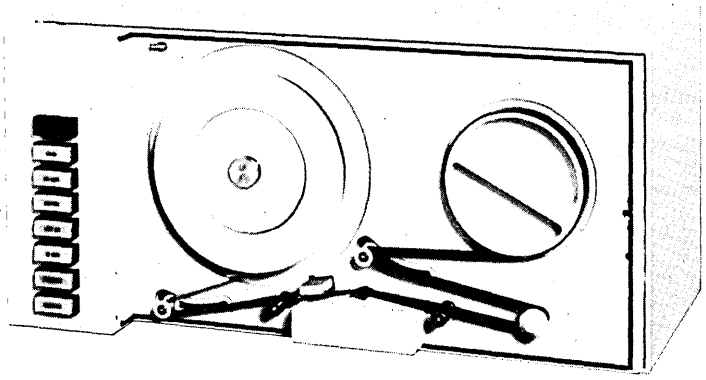

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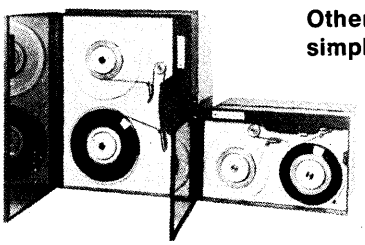

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son of the punched card to a magnetic character card is a simple one to make. The punched card used with the Hollerith code offers a maximum of 80 characters and has minimal error detection capability. It is also limited in man-readable printout without secondary operations; the utility bill you receive must be both printed and punched under current conditions.

An equivalent card magnetically imprinted in the Potter style can have up to 700 characters by printing 10 lines of data at 70 characters per line. This is an improvement of about 9 to 1, along with the advantage of being fully interpreted in one operation. In addition to this, the hardware requirements for printing a card are much simpler, less expensive and faster than the techniques available in punching a card. This is easily demonstrated by considering the use of the high speed line printer as a magnetic card printer. A Potter HSP 3502, printing a 48-character font at 400 lines per minute, will produce the equivalent output of 350 punched cards per minute, and if two cards are fed to the printer in parallel 700 cpm is attainable. Thus, in both the printing and reading operations, a better match with

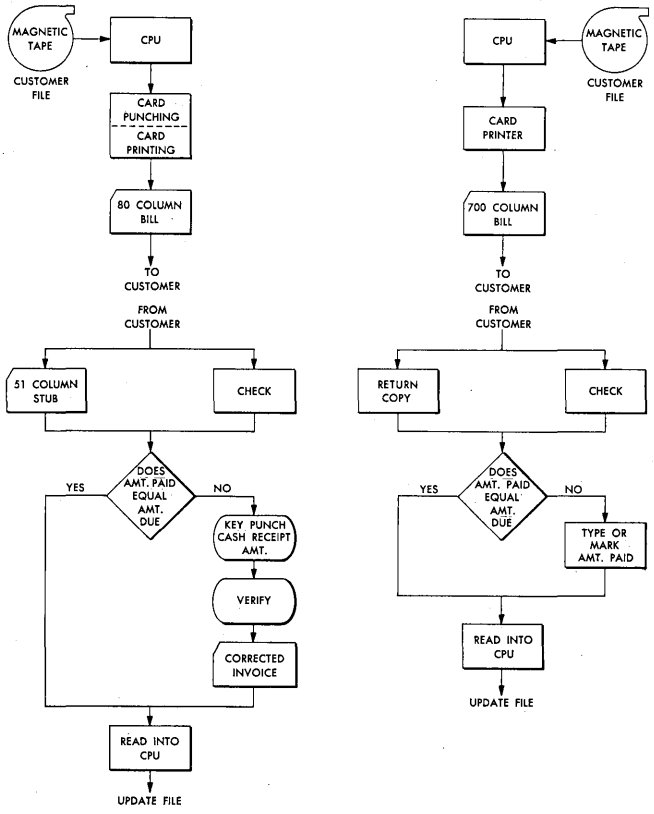


Fig. 4. Magnetic character vs punched card mass billing application

the computer's I/O capabilities is achieved.

The new key-to-tape/disc systems have challenged the keypunch with two important advantages. First, these systems all employ buffers between the keyboard and output tape. The flexibility of the buffering and built-in sophisticated electronics allow for 25 to 30% higher operator speeds. The second significant advantage is the higher throughput achieved when transferring the data to the edp system. One interesting approach is to add a magnetic character card printer to a key-to-tape system. Once the source data has been entered and verified on tape, the data on tape can be printed off-line to create the turnaround documents. A second approach would involve substituting a magnetic character card printer for the transport on the Potter KDR 3100 key-to-tape data recorder. The system still can achieve the operating speeds inherent in the buffered technique while reaching data throughput of nine times the punched card rate (a 300-card-a-minute magnetic character reader will deliver the equivalent of 2700 cards per minute of punched card data).

As with most improvements, the key-to-tape system is not all things to all people. The operating system that requires the inherent advantages of a card as a turnaround document and as a unit record has not found the improvements it requires. On the other hand, the magnetic character card approach extends these capabilities with its higher information density and fully interpreted data.

The area of automatic character recognition also requires serious appraisal. With present unit record equipment, many edp managers have found that they cannot keep up with the ever-increasing work load. OCR offers a very promising solution but the high costs, $100,000 and up, of a single reader limits its usage severely. A magnetic character reader (MCR), however, should carry a price tag of $2,000 to $10,000 depending on features and electronics required. With these price and performance characteristics, this technique should stimulate a re-evaluation of present automatic character recognition applications and allow for other applications not previously considered feasible. The system designer will have a great deal more flexibility in solving his problems. One significant design freedom that could not be considered with OCR equipment is the use of many remote readers at local installations instead of one or more OCR systems at the central edp facility. A document can be read in the field and if the reader is on-line to the computer via telephone, an action can be taken using all of the data available to the edp center that could not be available locally.

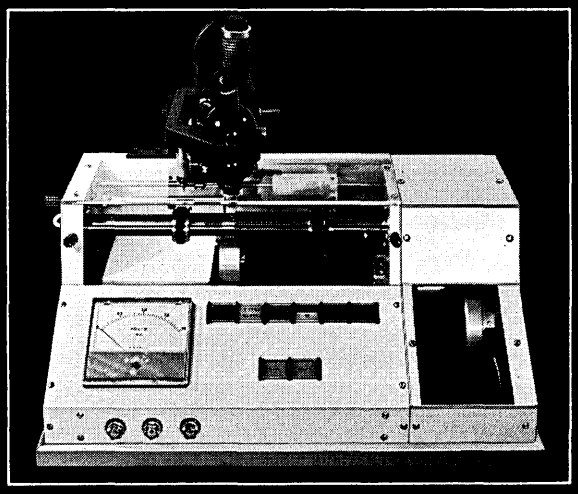
In the realm of turnaround document systems a magnetically imprinted card offers some interesting capabilities and should be studied with respect to the punched card and OCR approaches. Typical applications for turnaround documents include mass billings (e.g. utility billing), meter reading, airline ticket processing, inventory control, etc. (see Fig. 4). A study of a typical mass billing operation that is used by utility, magazine subscription, credit card and insurance companies will illustrate some of the magnetic character reader's usefulness. As this application is reviewed, it should be kept in mind that this is a simplified composite of many typical systems that offer many variations—but the example will help illustrate the significant points.

The generation of the bill or invoice is described in the flow chart (p. 89), which shows the data being obtained from a magnetic tape file and processed through the cpu for punching. This will then be followed by a printing operation to include name, address, meter readings, amount due, etc. The bill is then ready for enveloping and mailing. In an OCR or magnetic character approach to the problem, the printing operation will output a document that is both man- and machine-readable and therefore the punching operation is no longer required.

The second half of the mass billing turnaround document problem is then brought into focus. When the punched card stub is returned to the office, a girl will compare the amount on the bill with the amount paid. If they agree, the stub will either be directly processed or transcribed to some computer acceptable format. If, however, the check disagrees due to a partial payment, customer error or service adjustment then an exception procedure must be made available. One such technique will be to prepare a new card by key

Don't tell the computer what's on the film...

...Show it!



SAAB Automatic Film Scanner Mk II gives the computer an eye of its own

A photographic film can store large quantitites of information in a very small area. And a digital computer can process large quantities of information in a very short time. It's the gap in between that's the trouble: studying the film by eye and converting the information by hand into a form that the computer can digest.
The SAAB Automatic Film Scanner Mk II bridges the gap. It acts in effect as the computer's own eye, speeding the evaluation of data stored on film and at the same time increasing the accuracy and reliability of documentation. The Mk II Scanner can co-operate with any computer capable of performing analogue-to-digital conversions of input voltages of 0—5 or 0—10 V at conversion times of 150 μs or less. It can also be equipped with a tape transport for digital off-line recording.

Wide range of applications

The Mk II Scanner is capable of extracting information from film records of many kinds. A few examples of its fields of use are:

- CRYSTALLOGRAPHY. X-ray diffraction patterns for molecular structure analysis
- NUCLEAR PHYSICS. Bubble-chamber particle tracks
- GENETICS. Chromosome analysis
- MEDICINE. X-ray plates, EEG and ECG traces

as well as numerous applications in scientific, industrial and military research, statistical analysis, etc.

For further information
write or call SAAB AKTIEBOLAG, Electronics Laboratory, GOTHENBURG, Sweden. The Mk II Automatic Film Scanner was described by professor S. Abrahamsson in the Journal of Scientific Instruments Vol. 43 (1966) No. 12, p. 931. Additional particulars on request.

SAAB

Electronics Laboratory
Box 5042, S-402 21 GOTHENBURG 5, Sweden.
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punching and verifying the account number and amount paid. This card may then be processed for file updating.

Using automatic recognition techniques, the girl will again compare the amount due on the bill with the amount paid by check. If they agree the bill may be processed for updating the file with no further action required. The desired result of an exception procedure will be to update the bill to include this additional information and still obtain machine readability. This can be accomplished by feeding the invoice into a modified typewriter for the addition of the amount paid or by using a magnetic mark sensing technique. This data would be read by the same head performing the character recognition. The mark would be made using a magnetic ink pen on a mark sense field.

A third possibility would be to use a keyed data recorder in conjunction with a magnetic character reader. The exception bills could be read into the KDR buffer and the operator would key in the amount paid and the total data could then be output on compatible magnetic tape for further processing. As in the bill preparation cycle, the accounts receivable processing is simplified by automatic recognition techniques.

If you couple this capability with the possibility of performing the recognition cycle at the local sales and service office (made possible by the availability of the low cost reader), a number of significant advantages become apparent. The local office can respond more rapidly to real or potential problems and, with the check being processed faster, achieve improved cash flow.

way of preparing man- and machine-readable documents presents a very powerful tool for low volume remote data preparation. The typewriter will give the system designer the ability to place a data preparation system at the source of the data. In effect, he can afford to give the stock clerk a keypunch equivalent. A typical inventory control system requires that the stock clerk write or type a material requisition. The requisition is then sent to a keypunch facility where keypunching and verification is required before the requisition can be processed. With the MCT at the stock room, the document produced is immediately ready for processing with no further transcription required. There are many other similar in-house documents that require regeneration of the document for the sole purpose of computer entry. The lower costs and higher reliability achieved by eliminating the transcriptions is obvious.

The final application that will be considered here is reservation systems. We can envision a chain of remote ticket brokers—transportation or entertainment—with an on-line ticket generating capability. A typical system would include a keyboard, visual display system and a magnetic ticket printer all linked via telephone lines to the central computer. Through the use of the keyboard and display, the broker could "talk" to the computer and select the train, flight or show. Once having made his choice the ticket can be prepared.

At some later date this ticket can be placed in the reader at the railroad station or airport, where the ticket may be read and validated, and seats assigned, while the data is sent to the computer for processing.

To summarize, what Potter's magnetic character technique offers is a new approach to some old problems by giving combinations of features not available in any presently used system. It offers higher density, man- and machine-readable data with reliability and attractive costs, while making remote, automatic character recognition feasible for the first time.

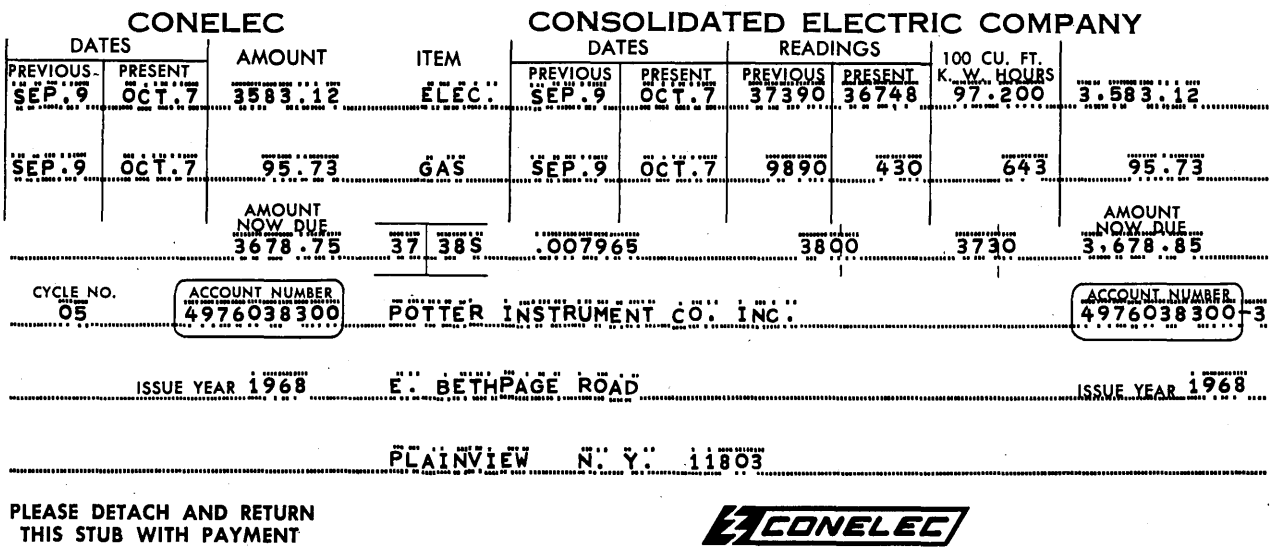
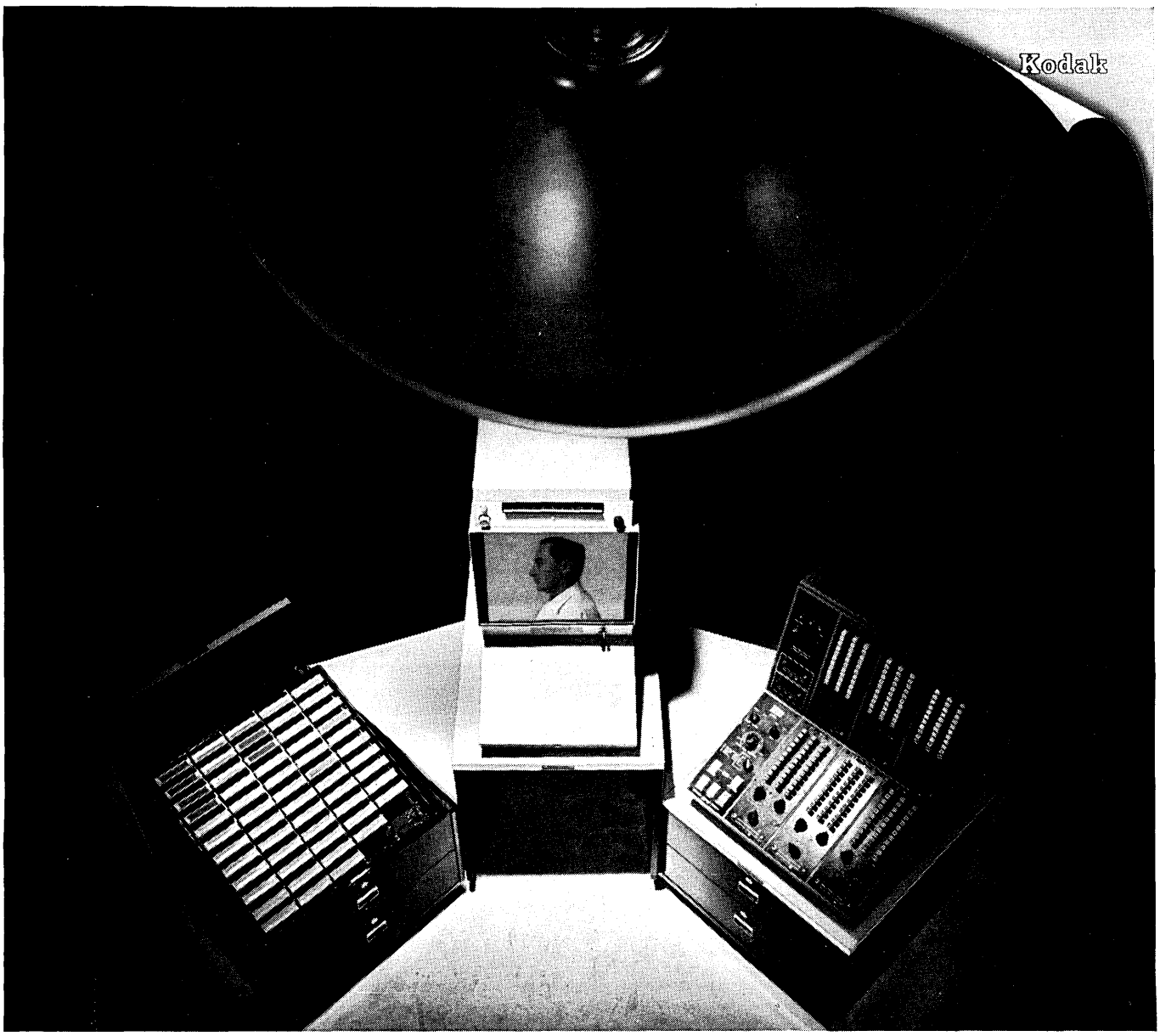


Fig. 5. A typical electric utility bill (facsimile)

Another application area that deserves discussion is journal tapes. Many cash registers, adding machines and accounting machines output printed tape. These units could easily be adapted to produce the magnetic character. Using the techniques already discussed, a reader could be built that would read these tapes reliably and inexpensively. Present systems usually require paper tape attachments to the cash register, which significantly raises the cost. OCR techniques are being considered as a solution but reader costs are limiting these applications. Many chain retail outlets might find the use of a magnetic character reader and a communication link an ideal way of getting data daily to their centralized edp facilities.

The use of a magnetic character typewriter (MCT) as a

The simplicity and low cost of the Potter concept indicates a substantial potential for widespread applications. Some of the more obvious possibilities have been mentioned in this article. But, as is so often the case in our fast-moving industry, the most significant possibilities may not yet have been recognized. The Potter product development group is researching this matter at present. Discussions with potential users are intended not only to uncover special applications but also to establish guidelines for future Potter MC hardware. ■



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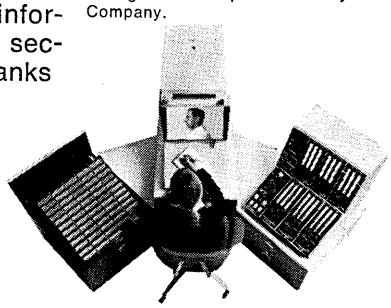


RECORDAK Microfilm Systems by Kodak

AUTOMATED POLICE INFORMATION SYSTEMS: A SURVEY

growing fast

by Paul M. Whisenand and John D. Hodges, Jr.

This is the year of the "fuzz." That is to say, fiscal year 1968-1969. Indeed, if the present trend continues, the 1970's may be known not only for the fantastic growth and sophistication in electronic gadgetry, further conquests in outer space, but equally as well for the improvement brought about in local law enforcement.[1]

Thomas Reddin, chief of police, city of Los Angeles, expresses the critical role of our police system as follows: "The position of the law enforcement officer today is more important now than at any time in our generation. It has been stated that this is the year of the policeman. And it is a critical year. The police officer in the days to come will have more to do with the future of our cities than any other man."[2]

There are two very important reasons for the authors feeling as sanguine as they do over what lies ahead for the police. The first reason is based on "money," and the second on "machines." The police now understand the inherent benefits to be derived through the acquisition of data processing equipment. In fact, the capabilities of computerized police information systems are so overpowering that no major police planning proposal is considered respectable unless it contains at least one section on automated data processing systems. Admittedly, in some instances, such systems are still regarded with uncertainty and uneasiness by police policy-makers. But this distrust or anxiety is daily giving ground to examples of successful computerized law enforcement systems. Operating police information systems can currently be found at all levels of government. The findings reported in this article offer concrete proof of the present and future use of data processing by local police agencies.

Before we consider the machine we had best backup a bit and discuss money. The justification for doing so is simply that the acquisition of money normally precedes the acquisition of machines.

safe streets act of 1968

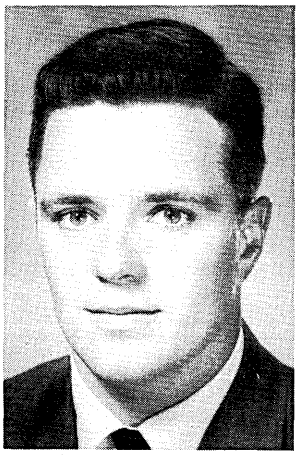
Congress gave birth to the Safe Streets Act[3] during the summer of 1968 after an arduous 18-month gestation period.

Title I of the act authorizes grants to states and local governments to improve and strengthen law enforcement. Significantly, Title I defines law enforcement as including all activities pertaining to crime prevention, including law enforcement, prosecution, courts, corrections, probation and parole. It established the Law Enforcement Assistance Administration (LEAA) to administer all grants and placed it in the U.S. Department of Justice. Although $100.1 million was authorized in the bill for the first year of operation, the actual 1968-69 appropriation was as follows:

Support of the administration of the act	$ 2,500,000
Grants to state planning agencies for the development of comprehensive plans	$19,000,000
Matching grants for improvement of law enforcement services	$29,000,000
Education contracts to students and law enforcement officers	$ 6,500,000
Support of the newly created National Institute of Law Enforcement and Criminal Justice	$ 3,000,000
Expanded FBI training programs	$ 3,000,000
TOTAL	$63,000,000

The essential features of the act involve *planning* ($19 million) and *action* ($29 million) grants. The planning portion of the act provides encouragement for state and local governments to prepare and adopt comprehensive plans based upon their evaluation of state and local problems of law enforcement. The action portion, which is allocated on the basis of population, has been set aside for block grants to the states. California, for example, will receive a total of $2,351,610.

An important aspect of these block grants is that 75% of the total must be made available to local governments. Some purposes for which the money can be used are specifically mentioned in the act—they are: the development, evaluation and purchase of methods, devices, facilities and equipment for the improvement of law enforcement; recruitment and training of personnel; public education; construction of various facilities; control of riots and disorders; and the development of community service officer programs. In most cases, action grants may be funded up to 60% of program costs. On construction proposals there is a 50% funding ceiling; higher limits, up to 75%, apply to organized crime and riot control programs. The comprehensive state plan will be the guide for decisions on approved action grant proposals. And it seems reasonable to assume



Dr. Whisenand is an associate professor of criminology and director of the institute for police studies at California State College, Long Beach. He is also a consultant to the U.S. Justice Dept.'s Law Enforcement Assistance Administration. His textbook "Automated Police Information Systems" will be published this year by John Wiley and Sons. He has a PhD in public administration from the Univ. of Southern California.

[1] This research was supported in part by the North American Rockwell Corp. Views and conclusions expressed herein should not be interpreted as representing the official opinion or policy of the Institute for Police Studies, the Sperry Rand Corp. or the North American Rockwell Corp.

[2] Thomas Reddin, "Law Enforcement in a Complex Society," (Santa Monica, California: General Telephone Company, 1968), p. 2.

[3] Public Law, 90-351, 90th Congress, H.R. 5037. "Omnibus Crime Control and Safe Streets Act of 1968," Jne 19, 1968.

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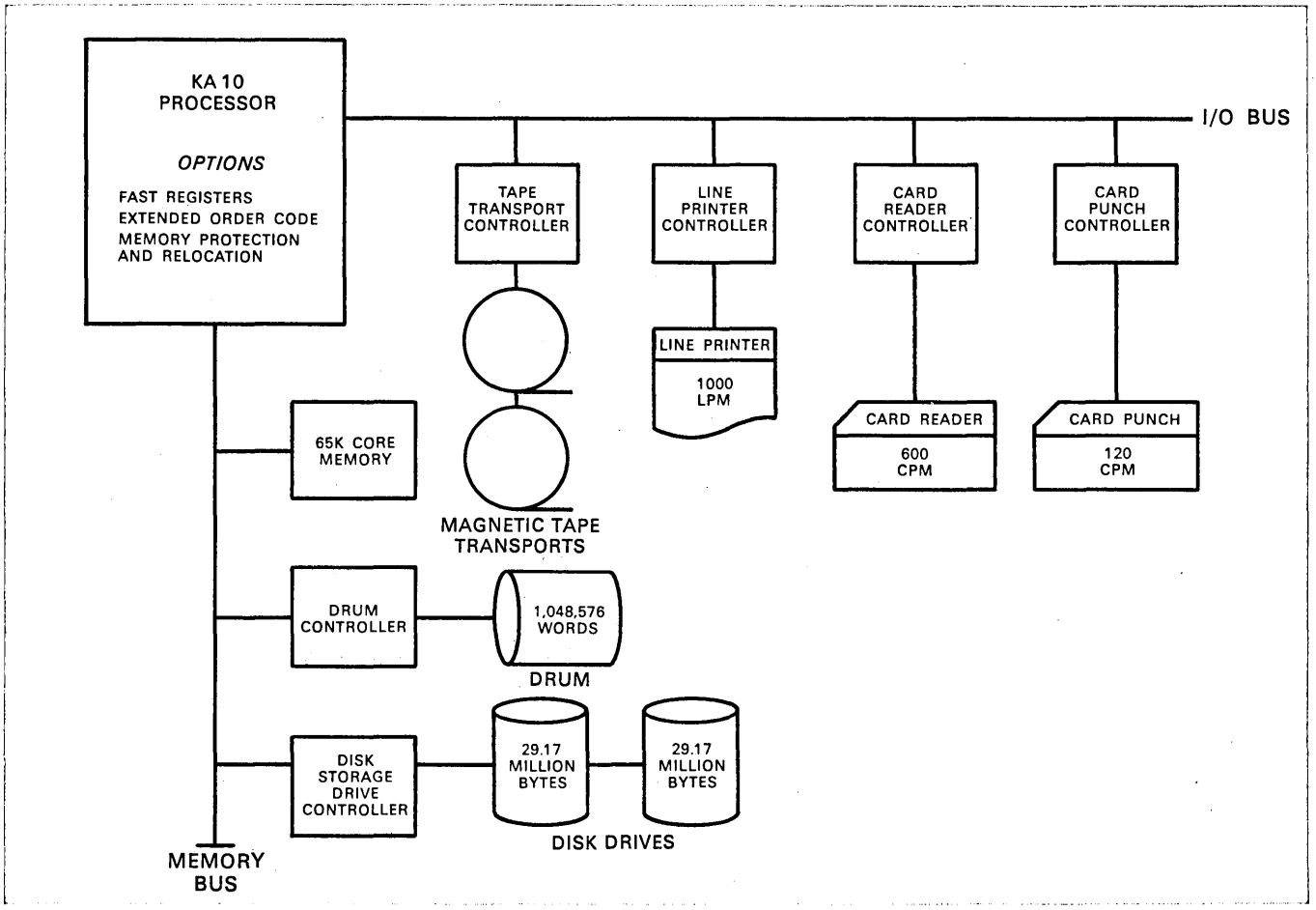


CIRCLE 95 ON READER CARD

that the majority, if not all, of the state plans will include a concern for data processing. The state of the art in police data processing certainly affirms this thinking. Hence, we have arrived at a point where the machinery should be brought into our discussion.

Setting aside for a moment the recent impetus of federal money for data processing systems, let us consider two other earlier developments in the 1960's which caused local police agencies to become increasingly interested in improving their data processing operation or to bring data processing into the department as a management and operational tool. These two developments are: (1) rapid growth in the activities of these law enforcement units has required the handling of expanding volumes of data; and (2) major technological advances have been made in data processing equipment and application that make these devices items that can save time, money and manpower. The study reported here provides an indication of their response to these two developments. Significantly, it does not record the response to the current developments in federal aid to law enforcement and the new impetus for improvement and modernization of law enforcement systems that is sure to follow.

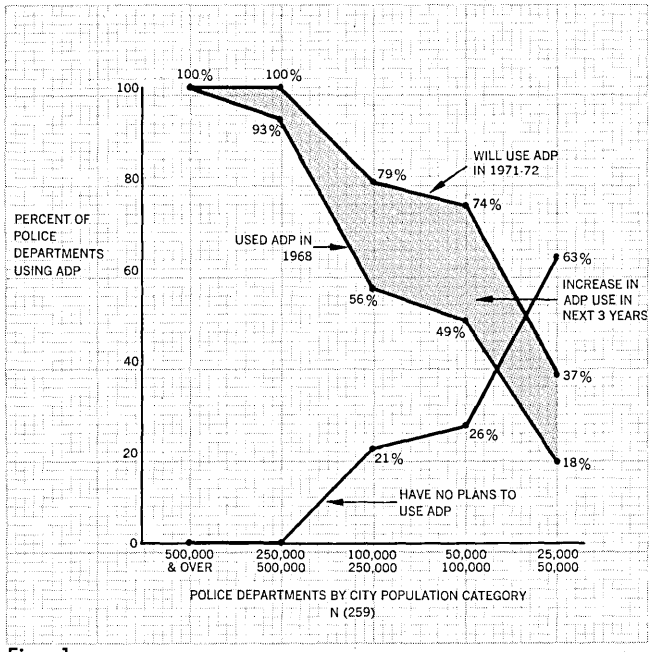


Fig. 1

Essentially, this article reports on a recent survey of automated police information systems. It presents both the number and types of local police departments that either have or anticipate using an automated information system. Moreover, it indicates the perceived importance of the various present and future police applications that are readily applicable to data processing capabilities.

The research reported in this article was conducted during the summer of 1968. All municipal police agencies servicing cities of populations over 25,000 were mailed a questionnaire regarding both present and future automated police data processing systems, and existing or anticipated applications. In essence, this study was a follow-on and updating of three other efforts to define computer usage in law enforcement agencies: (a) The International City Managers' Association's survey on "Automated Data Processing in Municipal Government,"[4] (b) the Task Force on Science and Technology's report to the President's Commission on Law Enforcement and Administration of Justice,[5] and (c) a survey of "Police Automatic Data Processing in Orange and Los Angeles Counties."[6]

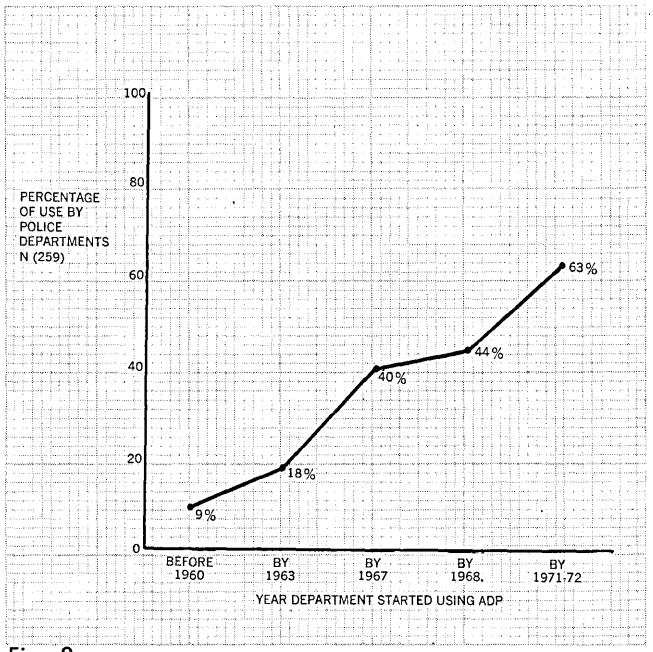


Fig. 2

adp use by municipal police departments

Of the 592 city police departments sent questionnaires, 251 responded with a complete set of answers. This gave a 42% return of questionnaires. In order to determine the effects of city size on the responses, the population was broken down into five subpopulations as follows:

CITY SIZE (POPULATION)	TOTAL NUMBER OF CITIES	NUMBER OF CITIES THAT RESPONDED
500,000 or over	27	18
250,000 - 500,000	27	15
100,000 - 250,000	96	48
50,000 - 100,000	153	66
25,000 - 50,000	289	104
Total:	592	251

The response to the questionnaire was directly related to city size (67% of the cities with populations over 500,000

Mr. Hodges is assistant manager of Univac's law enforcement systems department. While a research specialist at North American Rockwell Corp. he was a principal investigator for the analysis of data requirements for small-city police departments. He was previously with System Development Corp. and has a BA in psychology from the Univ. of California at Los Angeles.

[4] Municipal Year Book—1968, International City Managers' Association, Chicago, Illinois, 1968, pp. 28-303.

[5] The President's Commission on Law Enforcement and Administration of Justice, Task Force Report: Science and Technology, U. S. Government Printing Office, Washington, D.C., 1967, pp. 157-165.

[6] Paul M. Whisenand and Kenneth L. Kraemer, "Police Automatic Data Processing in Orange and Los Angeles Counties," Journal of California Law Enforcement, October, 1966, pp. 92-97.

responded, while only 36% of cities with populations under 50,000 responded) as was the use of adp. Of the police departments responding, 110 or 44% indicated that they were using some form of automatic data processing. The proportion of cities using adp in the five categories ranged from 100% of the cities of 500,000 population or more to only 18% of the cities with populations below 50,000 (see Fig. 1). The police departments were also asked if they had plans to implement a data processing system in the next three years and an additional 49, or 19%, indicated that they had plans firm enough to allow them to indicate a year for installation. The responses within individual population categories and the projected proportion for 1971-72 are presented in Fig. 1 (p. 93).

The basic results of the survey as related to adp use could be summarized as follows:

1. Of the police departments responding (251 of 592—42%), a group of 110 or 44% indicated that they were using automatic data processing.
2. By 1971 this group should increase to 159 or 63% of the departments responding.
3. A vast majority of the adp equipment being used are computer systems (84%) as compared to electronic accounting machines (16%).
4. The future trend is also definitely in favor of computer systems although the proportion of computers to eam will remain about the same.
5. The use of adp is directly related to city size, with the larger cities more likely to use adp than smaller ones, as would be expected.
6. There seems to be no definite trend at this time that establishes a pattern of control, operation or location of adp equipment. Some 50% of the departments reported that they operate their own equipment and the sentiment in law enforcement is absolutely in favor of police control of their own systems.
7. Automatic data processing, while not new to law enforcement (21% of the departments with adp were using it prior to 1960), is relatively new to the mass of municipal police departments, as 60% of the responding agencies with adp have started using it since 1964 (see Fig. 2, p. 93).

RANK	CURRENT ADP APPLICATIONS	NUMBER OF DEPARTMENTS	PERCENT OF DEPARTMENTS
I	Traffic Accidents	56	51
II	Parking Citations	55	50
III	Traffic Citations	54	49
IV	Arrested Persons	45	41
V	Criminal Offenses	44	40
VI	Personnel Records	43	39
VII	Financial-Budget	40	37
VIII	Police Activities	39	36
IX	Patrol Distribution	33	30
X	Juvenile Activity	33	30
XI	Stolen Property	31	28
XII	On-Line Inquiries	30	27
XIII	Vehicle Registration	29	26
XIV	Vehicle Maintenance & Costs	29	26
XV	Warrant File	28	25
XVI	Offense Location	25	23
XVII	Inventory Control	21	19
XVIII	Message Switching	4	4

Table A Current adp applications by police departments (N=110)

RANK	PROJECTED ADP APPLICATIONS	NUMBER OF DEPARTMENTS	PERCENT OF DEPARTMENTS
I	Arrested Persons	106	96
II	Traffic Accidents	103	94
III	Criminal Offenses	102	93
IV	Personnel Records	100	91
V	Traffic Citations	99	90
VI	Warrant File	96	88
VII	Police Activities	95	86
VIII	Stolen Property	93	85
IX	Parking Citations	92	84
X	Patrol Distribution	88	80
XI	Financial-Budget	88	80
XII	Juvenile Activity	86	78
XIII	On-Line Inquiries	80	77
XIV	Offense Location	77	70
XV	Vehicle Maintenance & Costs	75	68
XVI	Inventory Control	74	67
XVII	Vehicle Registration	64	58
XVIII	Message Switching	42	38

Table B Projected adp applications by police departments (N=110)

8. Within the next three years some 46% (or 51 of the 110 respondees using adp) will upgrade their information system with more sophisticated equipment.

In an effort to determine what role adp was playing within the spectrum of police operations, a series of possible adp applications were presented to the survey population and they were asked to indicate if they were applying adp to this area or if they had plans to do so in the near future. The applications presented included the following 18:

Crime-Related Applications:
Criminal offenses
Arrested persons
Juvenile activity
Warrant file
Stolen property
On-line inquiries
Police Operations Applications:
Police activity
Patrol distribution
Message switching
Offense location
Vehicle registration
Traffic-Related Applications:
Traffic accidents
Traffic citations
Parking citations
Police Administration:
Personnel records
Inventory control
Vehicle maintenance & costs
Financial budget

In current adp applications the most often used applications are in the traffic field; with traffic accidents, parking citations and traffic citations ranking one, two and three in use (see Table A, p. 94). The other categories of applications—crime-related, police operations and police administration—are scattered throughout the rest of the list, although all of the crime-related applications were reported as being applied by at least 25% of the departments. On the average, the data indicates that currently there are some 6.5 applications being used by each municipal police department.

When the group of police departments that are currently using adp are asked what applications they have plans to implement in the near future, there is a dramatic increase in the proportion of departments who would be using the various applications. There is an average increase of some 51 departments for the use of applications, which is an over-all average increase of some 46% of the total population. Traffic-oriented applications no longer top the list (see Table B, p. 94) but are interspersed with the other functions, and the parking citation applications fall from a number three ranking to ninth in the list of projected applications. When one considers the numerical or proportional increase in the projected use of applications (see Table C), the following items are apparent:

1. The most significant increases over the number of departments previously using an application is for message switching, warrant files, offense location and stolen property.
2. The applications that show a significantly below-average increase are the traffic-oriented items and the financial-budget applications.
3. The applications which show the greatest numerical increase (number of additional departments using the application) are warrant file, stolen property, arrested persons and criminal offenses.
4. The two significantly increased categories show a trend towards a greater emphasis on the use of the computer in crime-related operations and real-time, immediate response information systems that will aid in day-to-day field operations.

TYPE INCREASE *	ADP APPLICATION	NUMBER OF ADDITIONAL DEPTS.	PERCENT INCREASE IN USE	PERCENT INCREASE OF DEPTS.
Significantly Above Average Increase	Message Switching	38	950	35
	Warrant File	68	243	62
	Offense Location	52	210	47
	Stolen Property	62	200	56
Above Average Increase	On-Line Inquiry	50	166	45
	Juvenile Activity	53	160	48
Average Increase	Vehicle Maintenance	45	155	41
	Vehicle Registration	35	155	32
	Inventory Control	53	153	48
	Patrol Distribution	55	150	50
	Police Activities	56	144	51
	Arrested Persons	61	140	55
	Personnel Records	57	133	52
	Criminal Offenses	58	132	53
Significantly Below Average Increase	Traffic Accidents	47	84	43
	Traffic Citations	45	83	41
	Financial-Budget	48	83	44
	Parking Citations	37	68	34
Average	All Applications	51	144	46.5

Table C. Summary of projected increased use of adp applications by 110 police departments reporting adp operations.

* Arranged by amount of increase from previous use (center numerical column)

The applications investigated in this IPS survey are comparable to those studied by the President's Commission on Law Enforcement and Administration of Justice (Appendix F, Task Force Report: Science and Technology). There are two very significant differences between the two survey groups: (1) the range of use of applications by departments and (2) the amount of computer vs. electronic accounting machinery (eam) in use.

Table D (p. 96) presents data which compares the application usage data from the Crime Commission study and

the IPS current and projected use groups. The range of the number of municipal police departments using an adp application in the Crime Commission report was extreme, from 0 to 95%. Within the IPS survey this range was greatly reduced (19 to 51%) and showed a much more homogeneous use of applications. This homogeneity is repeated by the projected use data from the IPS survey (58 to 96%). This change may have materialized in the two years since the Crime Commission study, but is more likely a result of the small number (N=17) of departments surveyed in this earlier study.

Another significant difference is in the use of eam by the departments. The Crime Commission study showed some 42% (7) of the departments reporting on the use of applications as having EAM systems, while the IPS survey found only 16% (18) of the departments exclusively using eam equipment.

Table D also indicates that there will be an increase in average application use of some two and one-half times (from 6.4 to 15 applications on the average per department) within the next three years.

	Crime Commission Report Data (N=17)	IPS Current Use Data (N=110)	IPS Projected Use Data (N=110)
Average Number of Applications Per Department (Total Applications=18)	6.1	6.4	15
Average Percentage of Applications Per Department	34%	35.5%	84%
Range of Number of Departments Using an Application*	0-16	21-56	64-106
Range of Percentage of Departments Using an Application	0-95%	19-51%	58-96%

Table D Comparison of adp application use data from Crime Commission report and Institute for Police Studies (IPS) current and projected use groups.

* Does not include message switching

The findings of this survey research effort are encouraging (that is, they are encouraging if one is convinced of the benefits of data processing for municipal police agencies). The survey data substantiate a sizeable degree of involvement by police agencies with data processing technology. Moreover, all indications are that the degree, both in terms of equipment and applications, will continue to increase. And, *because of current and future federal assistance, this increase will occur at a previously unanticipated rate.* By this we mean that the normal course of data processing developments in the police field will be vastly changed through the infusion of federal financial aid to state and local law enforcement and criminal justice agencies. Consider fiscal 1969-70 for an example. In his State of the Union Message, President Johnson urged—or challenged—Congress to appropriate the full amount of their previous authorization of Law Enforcement Assistance Agency monies, for 1969-70—$300 million! Based on Congress' constantly expressed concern for strengthening local law enforcement, President Johnson plainly requested that they put *our* money where *their* mouth is.

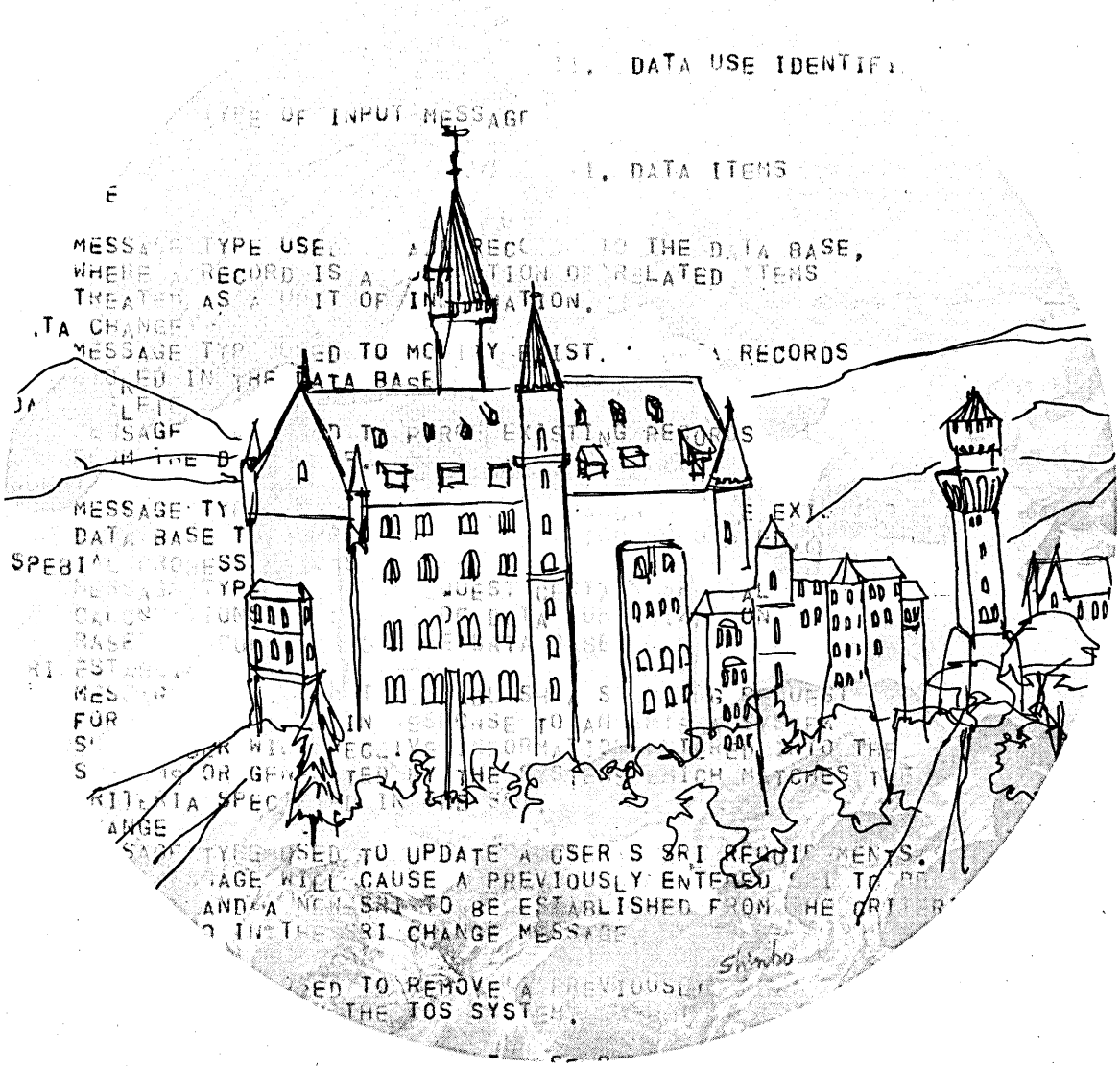
The value of quick access to accurate information for a police officer is emphasized by the President's Commission on Law Enforcement and Administration of Justice. They stated:

"The importance of having complete and timely information about crimes and offenders available at the right place and the right time has been demonstrated throughout the Commission's work . . . Modern computer and communications technology permits many users, each sitting in his own office, to have immediate remote access to large computer-based central data banks. Each user can add information to a central file to be shared by the others. Access can be restricted so that only specified users can get certain information . . . Criminal justice could benefit dramatically from computer-based information systems[7] . . ."

Certainly the day when police data processing systems are as common as patrol vehicles is still years away. But this should not detract from the present and future efforts to improve a police department's information system. In fact, it is expected that many progressive chiefs of police will assume the initiative in their city government for the acquisition of capabilities. For those in data processing who have remained on the sideline while our police have increased their physical and intellectual accessibility to the computer,[8] it seems inevitable that you'll become involved in the data processing progress and problems of law enforcement agencies at the city, county, state and regional level as time goes on and the information system requirements of the police and society demand solution. ■

[7] Task Force Report: Science and Technology, Report to the President's Commission on Law Enforcement and Administration of Justice, Washington: U. S. Printing Office, 1967, pp. 157-165.

[8] An excellent discussion of the importance and the relationship between intellectual and physical accessibility to computers can be found in Herbert H. Issacs, "Computer Systems Technology: Progress, Projections, Problems," Public Administration Review, 28 (November-December, 1968), pp. 488-494.



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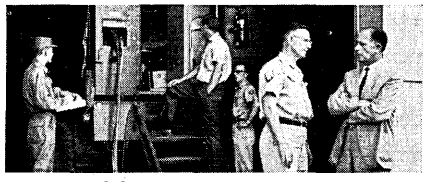

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with some alarm

AN EVOLUTIONIST LOOKS AT COMPUTERS

by Garrett Hardin

A hundred years ago we abolished slavery—and now we are the greatest slave owners in the history of the world. But our slaves are not alive; they are machines. And that makes a world of difference.

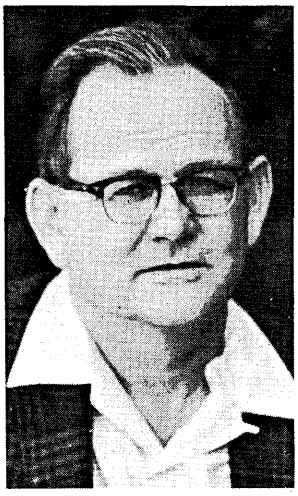
How many slaves does each of us have at his command? The easiest way to calculate this is in terms of energy. The average American consumes about 3,000 calories of energy a day in the form of food. But he uses about 150,000 calories of energy for other purposes, that is, for running tractors, automobiles, trucks, and refrigerating equipment; and for all his manufacturing processes. If we figure that 3,000 calories worth of work each day is equivalent to one slave then the average American owns the equivalent of 50 slaves.

Even this large figure underestimates our wealth. No longer are our slaves merely energy-slaves; we have information-slaves as well. Unfortunately, it is hard to devise a metric for measuring their importance.

It would be easy to estimate the work of a cash register in terms of human work. But how would you measure the slave-equivalent of a long-distance telephone conversation? Would it be a marathon runner? How would you express the human equivalent of the automatic space assignment system of an airline? Such a function could not even exist in the absence of modern information processing systems. Our information-slaves are probably already more numerous than our energy-slaves, and are growing daily more important.

We are all slave owners—and we love it! However, the fact that a slave owner loves his privilege does not prove that the privilege is, in the long run, good for him. One of the annoying characteristics of biologists is that they insist on asking questions about "the long run." By temperament,

(This article is based on Dr. Hardin's address at the 1968 FJCC.)



Dr. Hardin is professor of biology at the Univ. of California at Santa Barbara. He is known internationally for both his academic work and his role as spokesman for scientists concerned with the social implications of their work. One of his best-known books is Nature and Man's Fate, published in 1959 by Rinehart and later in England and Germany; it is also available in a Mentor paperback.

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biologists are not satisfied with the mere appearance of stability. They suspect short-run peace—and even a human lifetime is only a short run in the eyes of biologists.

As a biologist, I cannot help but wonder: is slavery good in the long run? Classical slavery was not without its distinguished defenders. St. Thomas Aquinas defended it as being part of the natural order decreed by God. Friedrich Engels, a somewhat less saintly character, in his *Anti-Dühring* (1877) said: "Without slavery there would have been no Grecian state, no Grecian art and science, and no Roman empire . . . no modern Europe . . . [and, at last getting to his favorite subject,] no modern Socialism." At about the same time Alexander Herzen stated the same point more operationally: "Slavery is the first step towards civilization. In order to develop, it is necessary that things should be much better for some and much worse for others; then those who are better off can develop at the expense of the others."

Put another way, no community in which the average income is little above the subsistence level can afford to develop the arts and sciences if it insists that all must share the poverty equally. Whether pleasing or not, this analysis gives a sort of historical justification for slavery and other inequities. Does "the end justify the means"? Take your choice.

However we may feel about flesh-and-blood slaves, we all believe that the "exploitation" of inanimate slaves is perfectly justified. Inanimate slaves also can make possible a higher development of the arts and sciences. Inanimate slavery furnishes a necessary but not a sufficient condition for the flowering of a civilization.

Are there any bad "side-effects" to slavery? With inanimate slaves we don't worry about cruelty to the slave; we want to know what are the effects of slavery on the slave owners. Back in the days of human slaves many critics pointed out the deleterious effects of slavery on the masters. In various ways slavery corrupts the owners. Most obviously, it tends to make them physically soft. When all the hard work is done by slaves, and none by the slave owners, then given even reasonably good food at the slaves' mess, middle-aged slaves will be much healthier animals than their middle-aged masters.

In addition, the ability to summon slave labor at the snap of the fingers does not tend to develop intellectual ingenuity in the owners. Why develop a labor-saving machine when labor is all around you to be had for the asking? For more than 2000 years horse-loving knights-errant, surrounded by slave labor, did not have the wit to invent a horse collar. Why should they? It was easier to harness up a man than a horse. It was not until about 1000 A.D. that the horse collar was invented, probably by nonslave-owning medieval peasants. This invention made a work horse—for the first time—worth more than a man. With the appearance of the horse collar one of the principal economic bases for slavery was destroyed.

decline and fall

When it comes to the causes of the downfall of the Roman Empire, every man is his own historian. But among the multiple causes most people would include the physical softness and intellectual laziness concentrated in the ruling classes of Rome by slavery and other social arrangements for "letting George do it." In its last days the Empire was overrun by barbarians, and even by slaves who had not enjoyed the benefits of degeneration through prosperity. Though an exact assignment of blame for the downfall of any institution is hardly possible, still it would be difficult to defend human slavery as the bulwark of any long-lasting society.

But what if the slaves are inhuman? What if they are automobiles, and machine tools, and computers? To understand the long-term effects of inanimate slavery we need to put human inventions into an evolutionary framework.

In imagination let's go back about 100,000 years to the time when man made one of his first inventions, a sharp knife edge of flint or volcanic glass. With this simple tool he could skin an animal he had perhaps killed with a stone. If you don't have such a knife edge you have a hard time getting at the meat. You have to grab the fur between your teeth and rip. About the biggest game an effete modern man can handle in this way is a rabbit. Prehistoric man, with his much more powerful jaws, may have been able to deal with a small antelope.

But it was hard work. A stone knife edge for making the first incision was a marvellous invention. It opened up a whole new world of food to man the hunter; and it started his jaw on the road to degeneration.

An unused structure necessarily degenerates; a partially used structure partially degenerates. The reasons for this generalization are technical and somewhat involved; I don't want to go into them here. But please take it as gospel.

The invention of the cutting knife caused the partial degeneration of the human jaw. Was this bad or good? When you receive the dentist bills for a large family you may feel that we have paid a pretty high price for the knife; but aside from that we've gotten along very well.

The invention of the knife caused no *over-all* loss of function. The function was merely moved (in part) from inside the man's skin to the outside; from his jaw, which is part of him, to his knife which is not. The knife is one of a large class of devices to which a wise old evolutionist named A. J. Lotka gave the name *exosomatic* adaptations—"outside the body" adaptations. Teeth are endosomatic, knives are exosomatic. In a sense, both are produced by evolution, and both have evolutionary consequences.

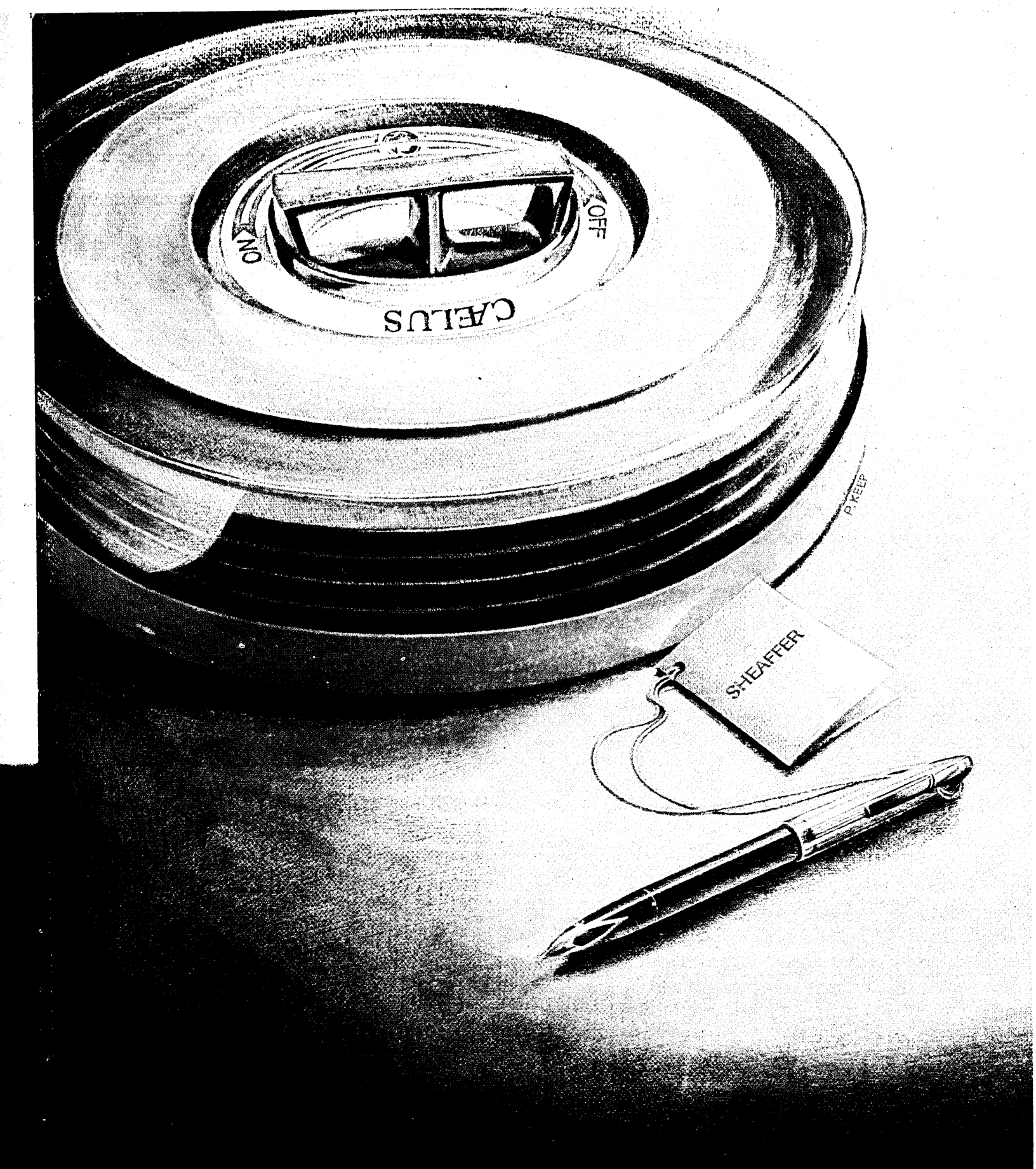
Every exosomatic adaptation tends to bring about the degeneration of its endosomatic precursor. This sound generalization has ethical implications. Whenever we move an adaptive mechanism from inside the skin of man to the outside, we affect man's position in the universe in two important ways. First, we increase the selective value of the intelligence needed to manufacture the exosomatic adaptation—for the species as a whole, if not for the individual. Secondly, we make the species vulnerable to the consequences of accidental loss of the exosomatic adaptive ability.

Our dependence on exosomatic knives is not a very serious matter. Even if our civilization were utterly destroyed, leaving only a few million people scratching for a living in a new Stone Age, the knife would not disappear. It is a simple concept. New knives would soon be made.

But we've made other exosomatic inventions that are not so simple. Consider the exosomatic heart pacemaker; and the exosomatic artificial kidney. Suppose everyone were dependent on these outside-the-skin adaptations. What would happen then if civilization were destroyed? Very likely the species *Homo sapiens* would disappear also. Very few people have the knowledge, or even the intelligence, required to manufacture pacemakers and artificial kidneys.

Of course very few people need them now (fortunately). But if we keep on supplying them, more and more people eventually will. There's not much danger when we equip a sixty-year-old man with either of these exosomatic devices. He's nearly past the breeding age and hence what happens to him from now on has little selective effect.

But evolutionists look with horror at pictures of ten-year-old children equipped with pacemakers or artificial kidneys. If their deficiencies are even in part genetically caused (which they probably are) and if they insist on having children later (which they probably will), the long-term effect



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of equipping them with these exosomatic adaptations will be to move the adaptive function from inside the skin to outside—and to make the species more vulnerable to accidents, which we have no assured way of preventing.

the consequences

I am worried about the evolutionary consequences of that grand class of exosomatic adaptations we summarize in the phrase "the computer." We are moving the calculating functions from inside our heads to machines outside. Desirable and necessary as this shift may be, I think it also brings grave dangers with it. Let me illustrate my point with a story.

When I was young I used to accompany my father to the grocery store. As we stood at the counter waiting for the clerk to add up the items on the cash register, it was my father's delight to add them up in his head and arrive at the answer sooner than the clerk. My father never went to college. In fact he never finished high school. However, his interest and ability in mental arithmetic was, I believe, not exceptional for one of his generation. It was just assumed that any ordinarily intelligent person could add up a long column of figures in his head and get the right answer.

What do we see now? Certainly not customers adding up figures in their heads for the pleasure of it. Nobody adds anymore. In fact, the clerk at the cash register no longer even has to make change. At the punch of a button, the machine does it for her. On the rare occasions when a machine fails, we frequently discover that the clerk can add up the figures neither in her head nor with a pencil and paper. It is as though 3000 years of development in mathematics had never taken place.

"If this *is* the end of the world then we know there's something wrong with our computer."

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This is no isolated instance. This is the trend of evolution in a computer-centered society. Human thinking functions, disused, have been set on the road toward degeneration.

Of course, someone has to design and manufacture the computers. This is a bright spot in the picture, but it is a very small bright spot. Only a minority of a minority of the population are subject to selection for this sort of intelligence. With every advance in computer technology the great bulk of the population is increasingly free from selection pressure favoring any thinking at all of a mathematical sort. A rift is being created in the species. This is dangerous.

H. G. Wells partly foresaw the possibility of such a rift in the human species. In *The Time Machine,* you may remember, he told of a visit to a future world in which there was a rigid bifurcation of society into two groups, groups so different that they could rightly be called different species, though they had had a common origin in the author's time. The Upper World people, called the Eloi, were the beautiful people. They were the Haves of the future world and the descendants of the Capitalists of Wells' day. Below the Eloi—literally below them, permanently confined to underground caverns—were the Have-nots: hideous, subhuman, revolting Workers; they were called Morlocks. The Morlocks owned nothing and did nothing but work all the time. The Eloi owned everything, and did nothing but play and make love all day long. For the Eloi life was pleasant—but unquestionably precarious. They were living on borrowed time.

is this it?

Was that *our* world that Wells prophesied? Yes and no; even the best of prophesies is always subtly wrong. But the best—or luckiest—prophets make us see things about our world that we might otherwise miss.

We can see a good beginning—I mean a *bad* beginning—of the bifurcation of the population that Wells foresaw. We can call our disjoined groups the Eloi and the Morlocks, for want of better names. But the separation of functions between these two groups is perversely different than from that which H. G. Wells foresaw. Because of labor-saving machinery we are moving into a world in which *no* Morlocks will be needed for labor. Because of thought-saving machinery, no Morlocks will be needed either for routine calculations and "thought" at the lower levels. In fact, no Morlocks will be needed at all—but it looks like we are going to have them.

Our Eloi work. Look around you at a computer conference—our Eloi are working very hard and having a hell of a fine time doing it. But what are our Morlocks doing? Increasingly, they are doing nothing at all. This is not because they choose to do nothing. It is because society deprives them of the opportunity of doing anything.

I exaggerate somewhat in describing the present, but what of the future? Is not this the direction in which the evolution of society is moving? With the Morlocks doing little but spinning their wheels, can there be a stable society? Wells' Morlocks were decently working underground, out of sight, out of communication with the Eloi. Ours are above ground, and very much in sight. Deprived of the meaningful work which is the natural delight of man they threaten society with other activities for which the computers of our clever Eloi have no answer.

What are we to do? I don't know. Let me describe various possibilities and see what you think of them. See how you like them.

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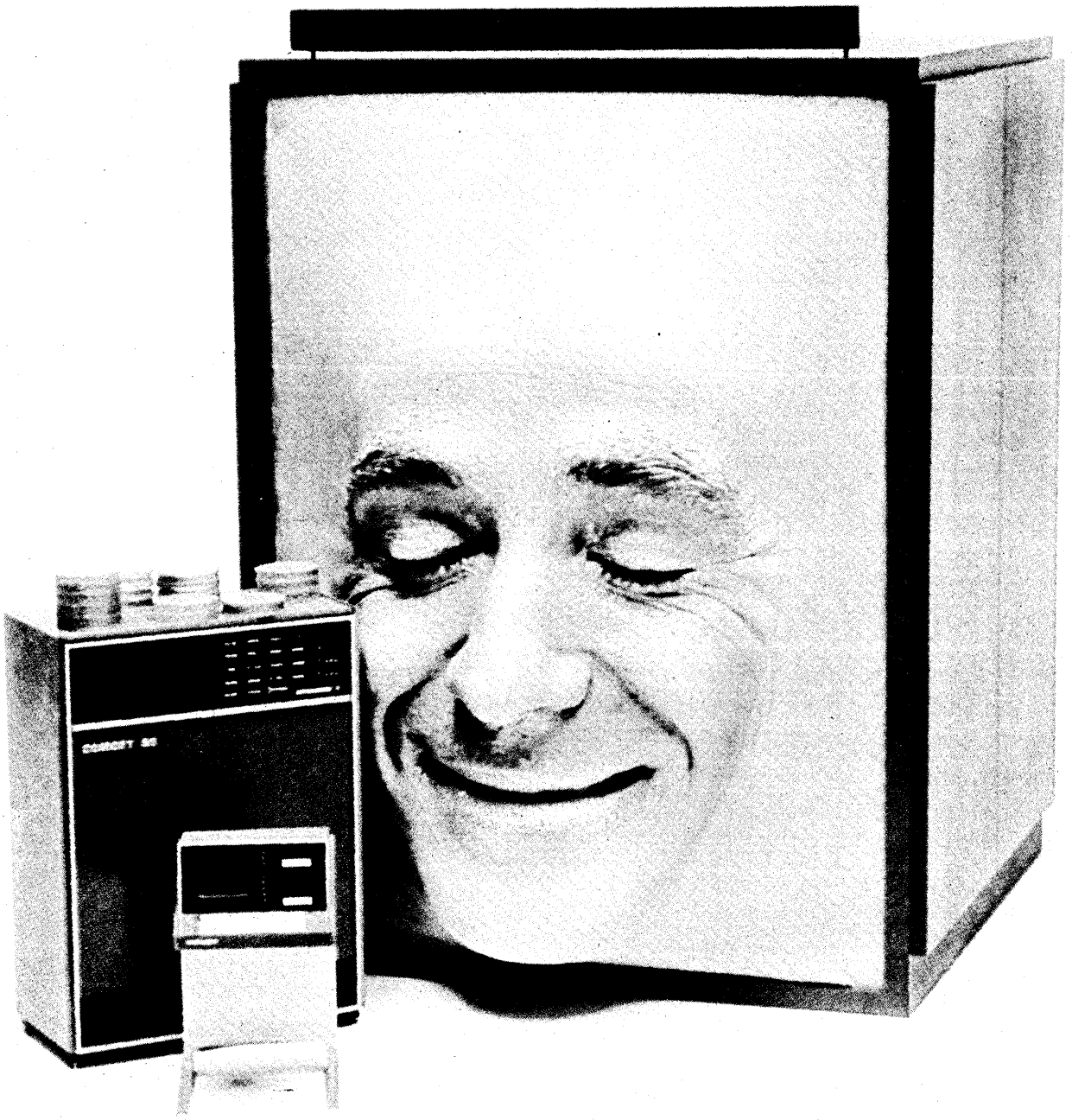

And because your computer doesn't have the software to face it, it panics at the thought of adding a terminal from another supplier.

The second problem for your on-line computer is its inability to interface with many of the terminal devices now on the market. As a result, users are forced to select their terminals on a compatibility basis, rather than on the preferred cost-performance basis.

Users must either compromise on terminals not ideally suited to their needs, or undergo the high cost of developing and maintaining their own software. This problem has held back many firms from realizing the full potential of computers in their operations.

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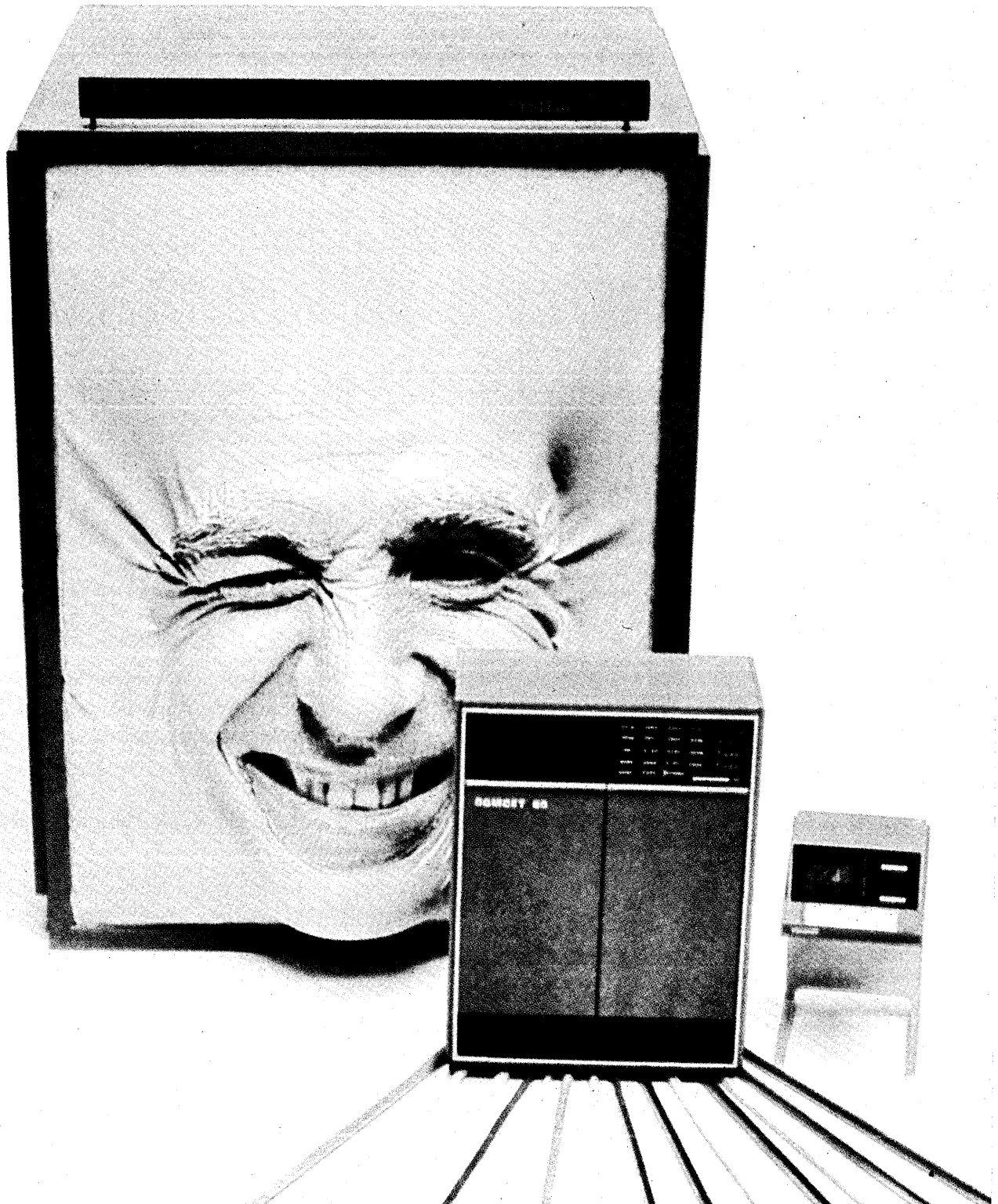

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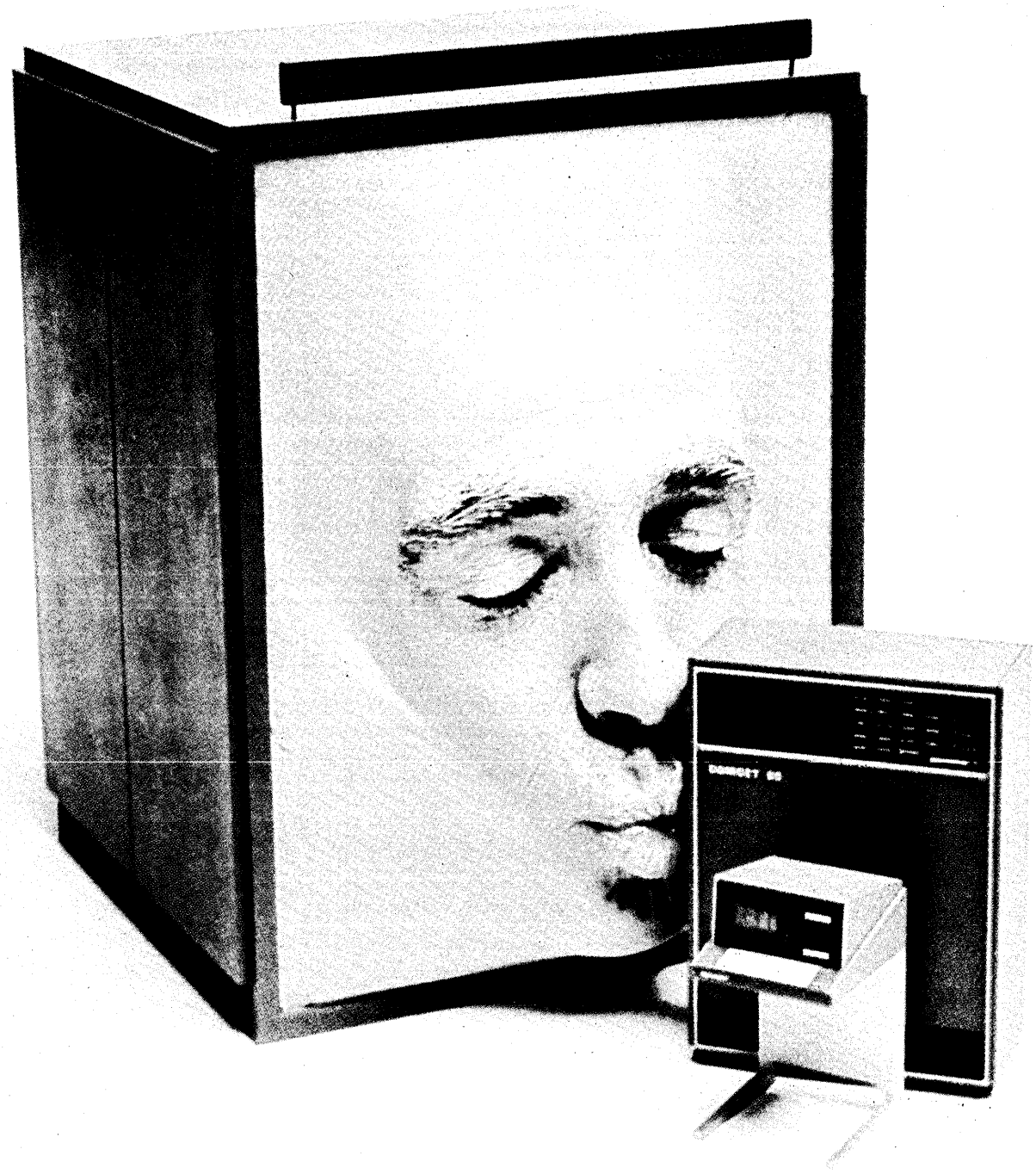

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that is, continue thoughtlessly doing what we are doing now to bring about an unplanned evolution. It is probable that our Morlocks will continue to breed, without being asked to; in fact, having little else that is meaningful to do, they may even breed faster than the Eloi. What will that do to society if it is continued generation after generation?

The tremendous disproportion in numbers may eventually result in some sort of a revolution, of an unimaginable sort with hardly desirable consequences. The bases of an exosomatically dependent civilization may be destroyed. Or possibly the vastly outnumbered Eloi (of whom so few are needed to keep the computers going) may eventually become slaves of the Morlocks who haven't the foggiest notion of how to make or service a computer. This would be a strange reverse twist to H. G. Wells' fable!

Another possibility: by chance or by design the Morlocks might be inveigled into breeding less rapidly than the Eloi. It is taboo to discuss such a possibility; I only mention it. If it came to pass, the problem would eventually solve itself.

At the moment there is no sign that the problem is solving itself. There is little sign of the solidarity among the Eloi that would have to exist if a solution were to be found. In fact—and this is the most frightening aspect—children of the Eloi in large numbers are leaving the parental society and joining the Morlocks. This has the good effect of lessening the rift between the classes; but it leaves the support for the ideals of the Eloi dangerously eroded.

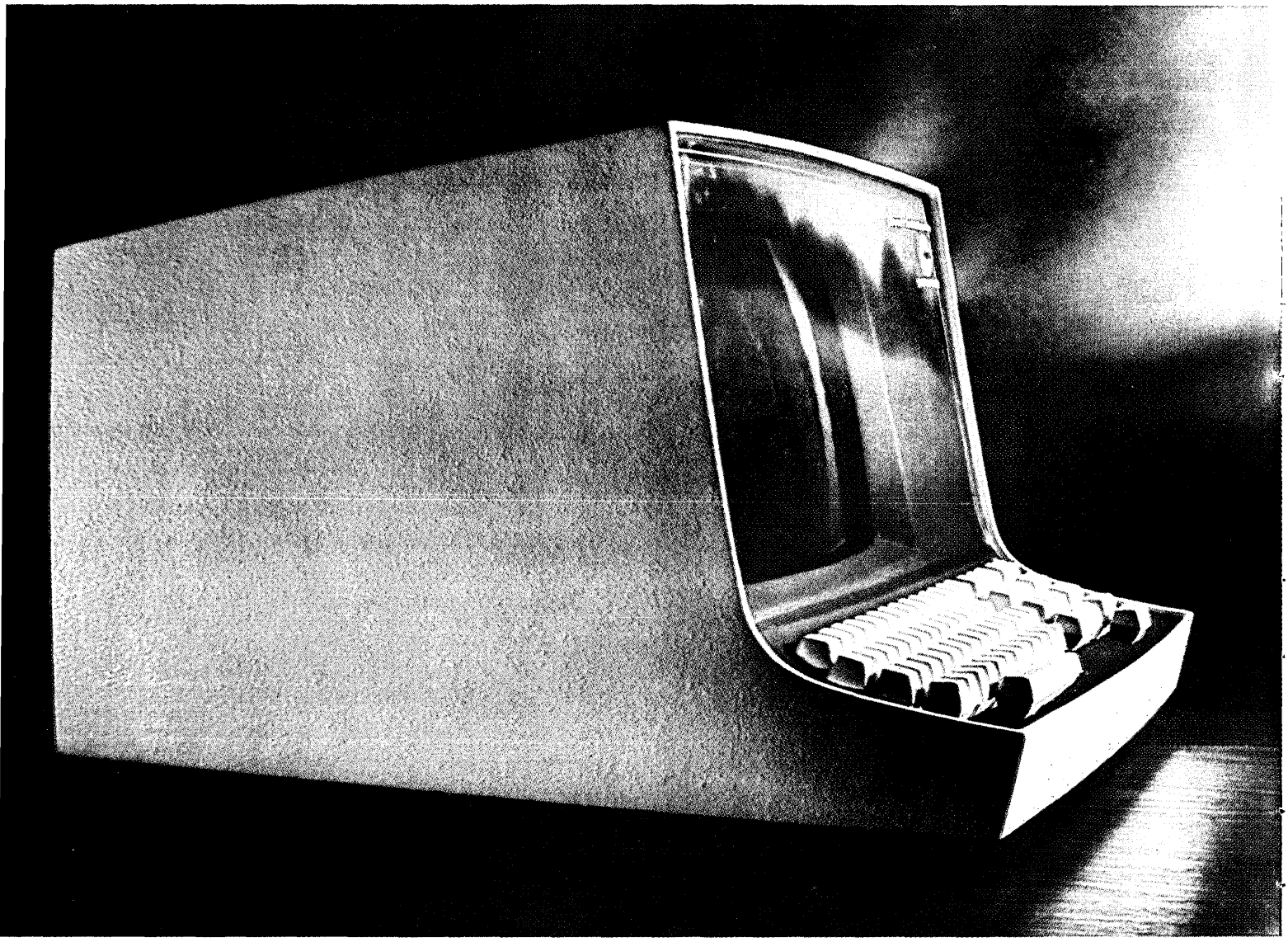
In looking around for measures we might take to offset these present tendencies one of the few possibilities I see is in education. I wonder if we might not, in intellectual matters, take a hint from athletics. The original Marathon race was run for a real purpose—to carry a needed message as fast as possible. This function of running no longer exists, but our people still enthusiastically run marathons and enthusiastically watch others run them.

We pursue most athletics for what we can properly call *transcendental* reasons—reasons that transcend simple necessity. We know this, and it does not lessen our respect for, or our participation in, athletics. We dimly recognize that, in the long run, we will be badly off if we do not continue to honor and encourage physical prowess.

Are we not close enough to a possible downfall of the computer-based world to see that we must similarly encourage intellectual athletics? Simple necessity requires only a dangerously small minority of Eloi to keep the world going, so few in number that they may be overwhelmed by the Morlocks. To create a broad base of public support do we not need an explicit glorification of the transcendental values of thinking?

To maintain such a transcendental value system in the intellectual realm we will have to defend the relevance of intellectual training in a world that may become increasingly dominated by mental Morlocks. We will also have to see to it that the genetic ability to be so trained is nurtured and even multiplied relative to the rest of society. It goes without saying that this will be no easy task.

Computers are part of the authentic evolutionary trend of man. They are exosomatic devices the invention and multiplication of which is made possible by endosomatic intellectual abilities. The computer men who have developed these exosomatic devices are themselves agents of man's evolution now and extending into the future. If man is to survive, these agents must become conscious of the evolutionary implications of their actions. ■



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In developing the Datapoint 3300, Computer Terminal Corporation sought a terminal that would amplify the productivity of the professional as he worked upon problem solutions in interactive dialogue with a computer. We sought to remove the traditional barriers to effective man/machine communications. We succeeded.

A central feature of the 3300 is the CRT display capacity of 1800 characters in a 25 line/72-character-a-line format. (A high "refresh" rate provides characters that are at once stable and easy to read.) In this expanse of data, a complex program or problem can easily be expressed, and comprehended at a glance. The interactive user, working the standard 64-character-set keyboard, can easily add, delete, correct or manipulate characters and lines of data. The remote computer becomes a powerful and flexible extension of the human thought process, directly responsive to and controlled by the user sitting at the Datapoint 3300.

Because the 3300 is not shackled by the limitations of a mechanical printer, it can make available data transmission rates of up to 600 bits per second standard, and up to 4800 bps with optional speed buffer. This means the interactive user enjoys faster response from his remote computer; accordingly, his "on-line" time will shrink while his productivity goes up.

The 3300 is noiseless — no hum or clatter of keys to intrude upon the user's concentration. It comes packaged in a handsome, totally self-contained unit, comparable in size to an executive typewriter, which blends well with today's office environment. The female help will love the 3300's appearance, as well as its ease of usage.

We think you'll like it. For further information, simply write to Computer Terminal Corporation, P. O. Box 6967, San Antonio, Texas 78209.

Computer Terminal Corporation

CIRCLE 137 ON READER CARD

THREE NEW INTERMEDIATES

by R. A. McLaughlin

In a manner a la Detroit, mainframe manufacturers are extending their model lines in all directions. Some of the move has been to "import size" models like Honeywell's 316 minicomputer (see New Products). Some of the additions are showing up in the "compact" series, such as the GE 105, a plain-looking business sedan version of the slightly spiffier GE 115, and the Univac 9200 II and 9300 II, where new trim has been added to generate buyer appeal. (All three were described in March New Products.)

The IBM 360/50 class of intermediates appears vulnerable to competition from two directions. Stripped-down versions of the full-size family sedans, such as the 1106 model of the Univac 1108 and the 615 model of the GE 600 series, can compete with the 50. In addition to this very real threat, whole new lines are being introduced, such as the RCA Spectra 70/60 (March, p. 90) and the straight-off-the assembly-line Honeywell 3200.

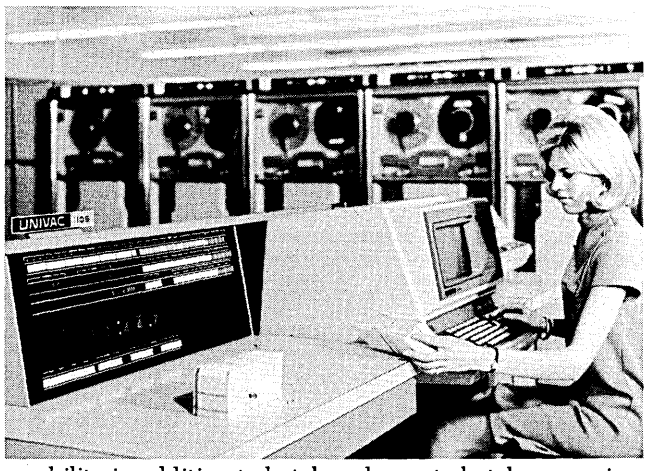
univac 1106

The Univac 1106 is based on an 1108 cpu that has been detuned to run at a 1.5 usec rate rather than 750 nsec. The drop in memory speed is reflected in a drop in the data transfer rate to 33K words/sec per four-channel block (to a total of 667K words/sec for the system).

The Univac 1100 series is built around a 36-bit word. Two words are pulled from core on each access: the current data word, and the next instruction (which is retrieved from a separate module of memory). A 166 nsec access scratchpad contains 128 flip-flop registers. Of these, the user has access to 64, including 12 index, 12 accumulator, 4 index/accumulator, and 36 gp. The remaining 64 are duplicates which the system uses.

The 1106 recognizes one hardware interrupt for each channel (from 4-16 channels can be hung on the mainframe); each device on each channel is assigned a core address for its indexing location which it transmits to the cpu with its lower-level interrupt. Communications Terminal Module Controllers (CTMC's) can be added to provide remote processing capabilities. Each of these can connect up to 32 duplex or 64 simplex circuits via Control Terminal Modules (CTM's). Communications lines can automatically transfer characters to and from main storage on a self-controlled basis without disturbing the program sequence. A hardware/software Guard Mode feature guarantees program security from an external read or write.

The software for the 1106 is line-for-line compatible with that used on the 1108. Both the EXEC II and EXEC 8 operating systems are offered (the latter has a communications



capability in addition to batch and remote batch processing features). In addition, application packages such as APT III, MATH/STATPACK, PERT/TIME, and LP are supplied.

A $37K/mo. configuration ($1,550,000 on purchase) is marketed which includes the cpu with 64K of memory (expandable to 256K), a CTMC network with eight CTM's, a card punch, card reader, a crt console (the Uniscope 300), six tape drives, a printer, a 200 million character Fastrand III storage system (92 msec access, 230KC transfer rate, with a 35 msec "Fastband" sector), four I/O channels, and three 4.25 msec access, 1.44 MC drums.

A worst-case benchmark was run on the 1106 using a processor-burning matrix inversion program. The stop

watches showed an effective data rate of 60% of the maximum. Since most of the 1106's instructions operate in one core cycle of 1.5 usec, an I/O-bound job mix might see a data rate close to the maximum 667,000 operations/sec.

CIRCLE 590 ON READER CARD

honeywell 3200

The Honeywell machine *almost* does not belong in the grouping of 360/50 competitors. Honeywell forecasters have agreed that the market for communications-oriented systems will expand much more rapidly than the gp market. They predict that today's estimated 7,000 communications systems will expand nine-fold to 66,000 by 1975 while the total number of systems installed increases from 52,000 to 110,000. That increase in market proportion, from 13% today to 60% then, led Honeywell to develop a one-sided communications processor on which a five-digit add takes 13 usec and even floating-point hardware must be ordered as an option.

A byte-oriented machine, the 3200 has the same core cycle time as a 360/50, 2 usec/4 bytes, but Honeywell engineers claim an instructions/sec figure substantially greater for their system. Running a commercial Gibson mix, they rated the 3200 at 72,500 operations/sec and the 50 at only 55,250. They also claim a data transfer rate of 1.5MC compared to the 50's 1.2MC.

The 3200 achieves its communications capacity through 48 trunks split from 16 I/O channels. With this configuration, up to 16 I/O data transfers can be transacted simultaneously with computing. Honeywell's Mod IV Operating System controls up to 20 concurrent jobs. The system has 30 registers available to user programs; an additional 64 exist on chips in control memory. The interrupt scheme involves three hardware-level interrupts and lower-level I/O interrupts.

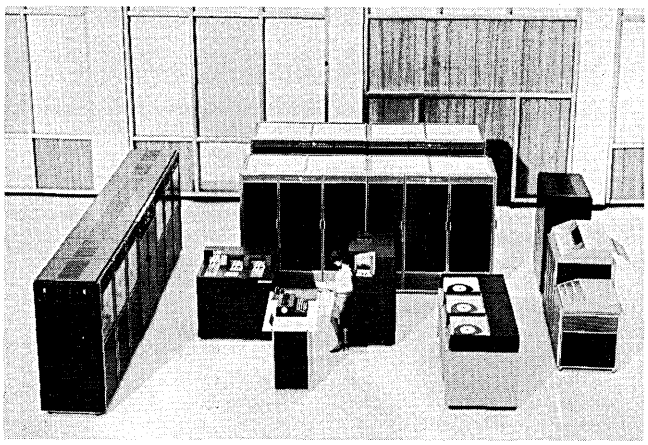
A "typical" 3200 installation will consist of 128K of core (expandable to 512K), eight tape units, two printers, one card reader/punch, a nine-spindle disc pack drive system, and the cpu, and will rent for $21,460/mo. on a five-year lease. The corresponding 360/50 installation, Honeywell claims, would go for $27,499/mo. (But with that one you get floating-point hardware and a 4-usec adder.) There is about a 10% difference in the H3200 rental figures for a short-term lease.

CIRCLE 591 ON READER CARD

(Continued on page 113)

general electric 615

While the more luxurious GE 625 and 635 are offering competition to the IBM 360/65, the GE 615 is going to open in showrooms near 360/50 dealers. In almost all particulars the two combatants will be well matched. The 615 is strictly a word machine, and might have to yield a bit to the 360 series' byte/word instruction set schizophrenia. Their memory cycle times are close (2 usec/36-bit word for GE, 2 usec/4-byte word for IBM); adder times are close (4.4 usec for GE, 4.0 usec for IBM), and data transfer rates are close (1.2 MC for IBM on a channel basis, and 1.4 MC for a GE Input Output Controller). The GE machine uses



eight 18-bit general-purpose index registers and five dual-role A/Q registers while the 50 relies on 16 altogether.

The contest is not quite a toss-up, though. In addition to the word versus byte organization differences, the systems are also different in I/O handling organization. IBM handles I/O on two types of channels. Up to three Selector channels can be attached to a 50 for handling high-speed transmissions. Although each Selector only has one subchannel, many devices can be attached to it, to be serviced one at a time (in a "burst mode" of transmission). A Multiplexor channel is part of the mod 50 cpu. To it can be attached up to 248 subchannels through eight control units. On the other hand, the GE IOC handles both high speed and low speed peripherals. It is equipped with six 400KC channels and ten 25KC channels, for a total transfer rate of 1.4MC. Up to four IOC's may be hung on the system.

Floating-point and fixed-point arithmetic features are standard on both systems, although GE 600 line uses an unusual two's-complement technique.

The 615 operates with GECOS, a batch/remote batch/time-sharing operating system that is capable of driving a multiprocessing configuration with multiple memories and IOC's. (Most likely, however, no one will opt to use the system this way since it should work out cheaper to upgrade to a 635 first.) Batch language processors such as FORTRAN IV and COBOL are supplemented by time-sharing language processors such as BASIC, FORTRAN and TEXT EDITOR, and by applications programs such as LP 600, APT III, and others available through the GE 600 Users Association Library, GESHUA. An Integrated Data Store package is available for data base management.

The GE's $30K/mo. price is comparable to the $14K-$55K range and $33K "typical system" figures for the 360/50. For the $30K, the user receives—for a month—the following configuration: cpu, 64K of core (expandable to 256K while IBM goes up to 512K), one IOC, six tape handlers, a printer, card reader, card punch, and four disc pack drives. For time-sharing operation, a user would need a Datanet-30 communications system, too. ■

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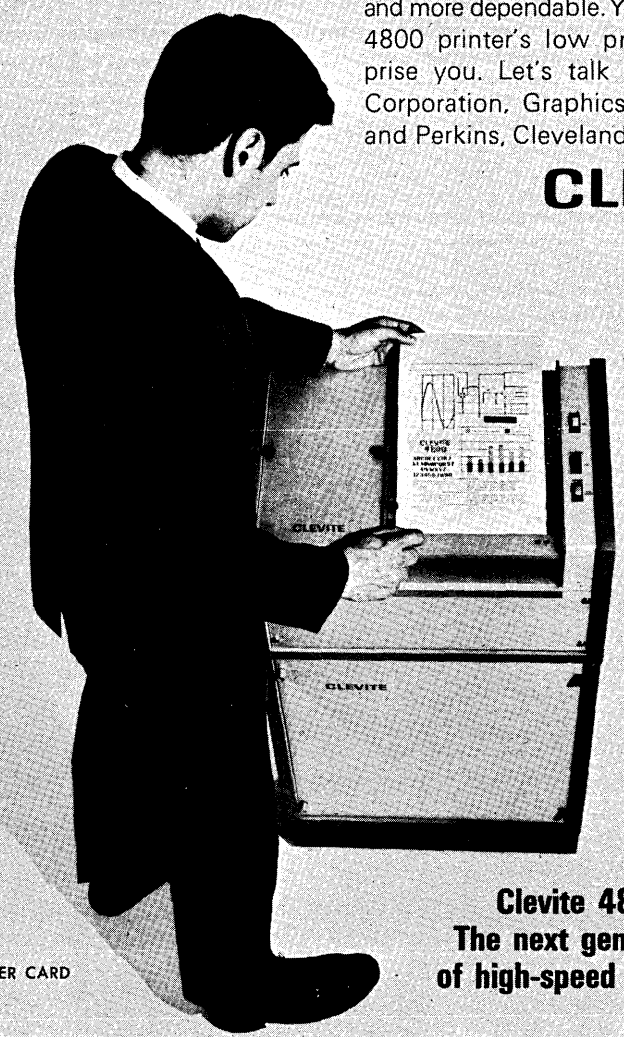
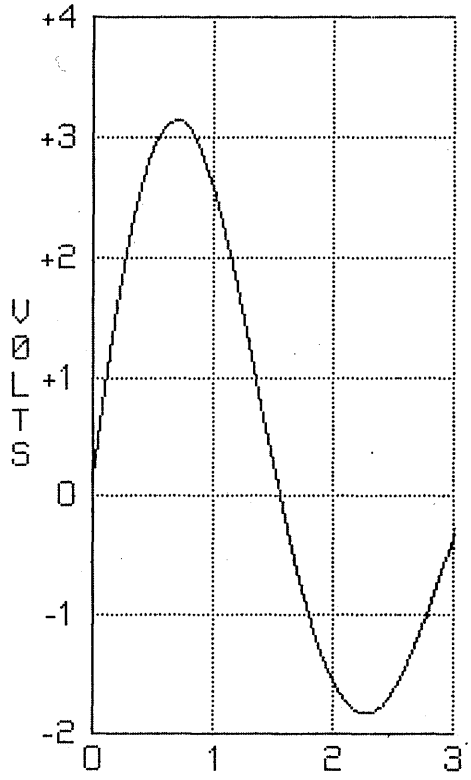
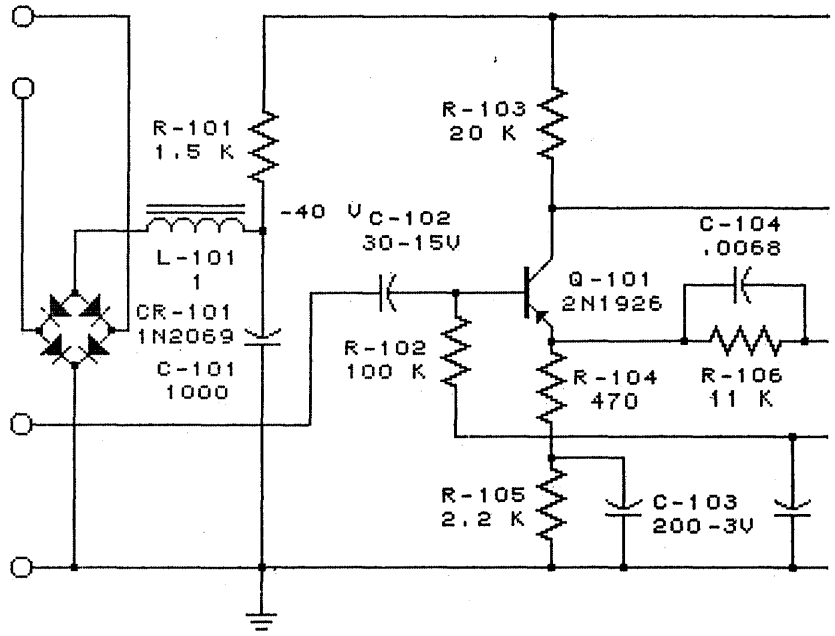


Clevite 4800. The next generation of high-speed printers.

CIRCLE 55 ON READER CARD

See Clevite 4800 at booth 805. Spring Joint Computer Conference in Boston.





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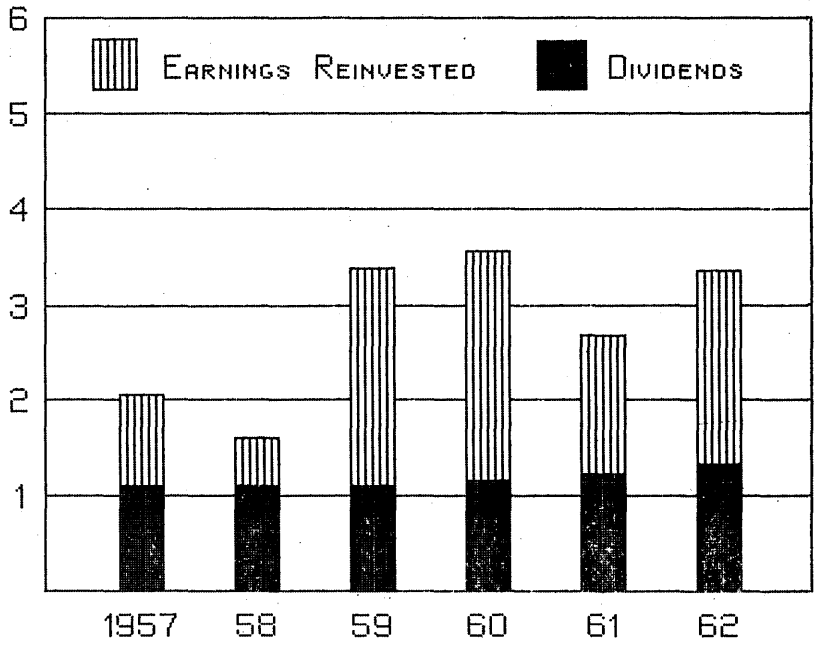

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a symposium

COORDINATION OF MEDICAL COMPUTING PROGRAMS

Health care system is the second largest "market," but the need for effective data handling is greatest *here*. Medicare, large health programs, multiphasic screening have mushroomed during the last few years mirroring the concern of our society to provide better health services for all. The intent is laudable but the cost of these programs has become a major concern.

While the physician's services remained essentially unchanged during the last year or two, the cost of health services has increased at an alarming pace. One simple explanation is that obsolete bureaucratic-clerical functions became increasingly ineffective as the scope of these health programs grew beyond a "critical mass." Medical diagnoses or therapy recommendations are overshadowed by the clerical efforts to validate claims, to identify patient, doctor, clinic, drugs and bills. Computerization of the health care system is an economic necessity of highest national priority.

"Counting pieces of paper, Medicare, as projected for 1970-75, will create some half billion pieces of paper processed on prescription drugs," stated Dr. Neer of the President's Task Force and Prescription Drug Insurance. A recent symposium, where this startling warning was presented, focused attention upon the problems of health record transferability. The symposium, sponsored by the Continuing Medical Education Program of the State Univ. of New York at Buffalo, reviewed some of the crucial issues related to compatibility. The panel discussions evaluated the current approaches to patient identification and various systems for coding medical diagnoses and therapy. Transferability of laboratory data, compatible hardware and software, design of the data bank and protection of confidential information were the other topics for discussion.[1]

For patient identification, the Social Security number emerged as best compromise choice, although birth number and a logical synthetic number were also considered. Coding of medical data first requires standardization of criteria for usage of diagnoses and uniform definition of clinical procedures. Laboratory data can be transferred from one data bank to another only after the "provincial" component—e.g., differences in methodology, local norms, etc.—has been eliminated. The concept of "relative values" was proposed, i.e., the distance from norm center divided by specific variability of norms.

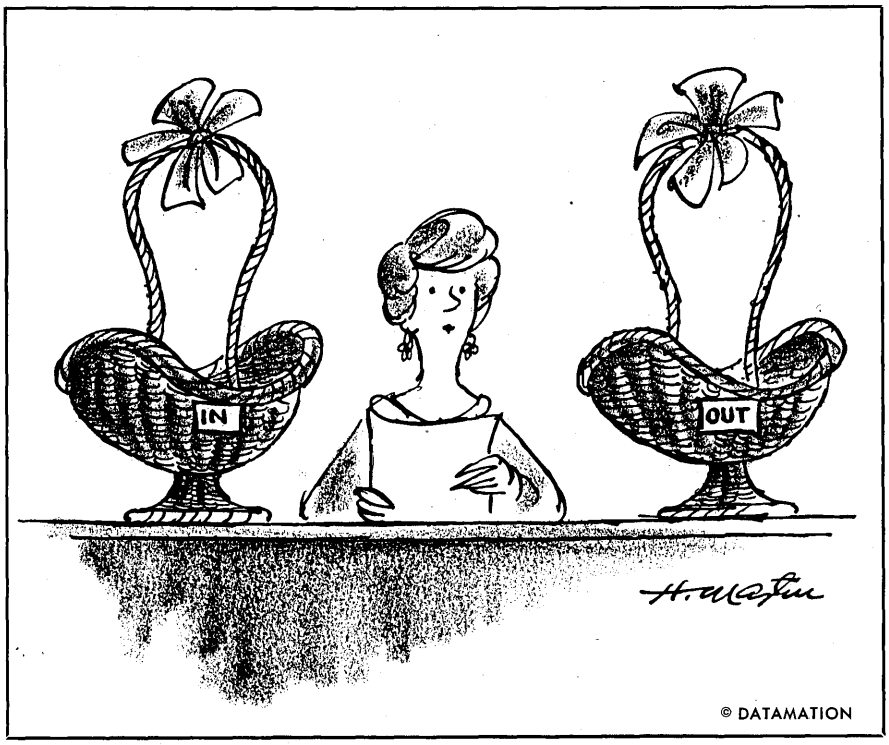
Conversion of actual findings into relative values may be the answer to the problem of laboratory data transferability. Lack of compatibility of hardware made by different manufacturers, and noncompatibility of software, was discussed by several speakers. Coordinated action was proposed to end this vexing issue. Since the confidential nature of medical data calls for protection of information from unauthorized use, the technical and legal aspects of such protection were discussed extensively. The consensus was that this issue urgently requires solution. Absolute privilege was proposed by the dean of the Law School of the State Univ. of New York at Buffalo. Absolute privilege (i.e., "data stored by the computer cannot be used in evidence in any kind of legal case") would enhance the accuracy of the records, but both patients and health professionals should be aware of the legal protection granted to these data, stated Dean Hawkland. "We hope that clinical records will be transferable in a more reasonable, economical way, than they are today" stated Colonel Andrew Aines from the Office of Science and Technology of the Executive Office in Washington.

Need for international coordination was emphasized by the representatives from Canada and Belgium. The concept of a global health information network was mentioned by several speakers. A compatibility committee was proposed to be "chaired by the representatives of the sponsoring university" involving other universities, federal agencies, foundations, the AMA and the private sectors, to follow up the issues and develop national solutions for compatibility and confidentiality.

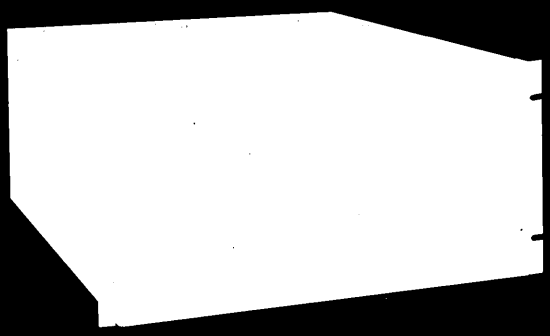
Another conference on these issues will be held by the sponsoring university in October, 1969, to evaluate progress in matters related to confidentiality and compatibility.

A series of workshops will be offered for physicians, nurses, health planners, administrators, and those involved in medical computing. A plenary session will be focused on the legal, technical, and moral aspects of computer-stored privileged information.

—E. R. Gabrieli



[1] Copies of the transactions are available from the Continuing Medical Education, State Univ. of New York at Buffalo.



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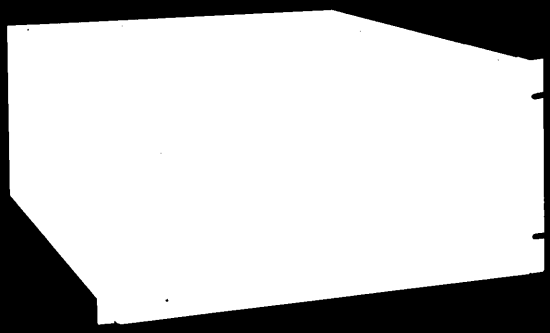

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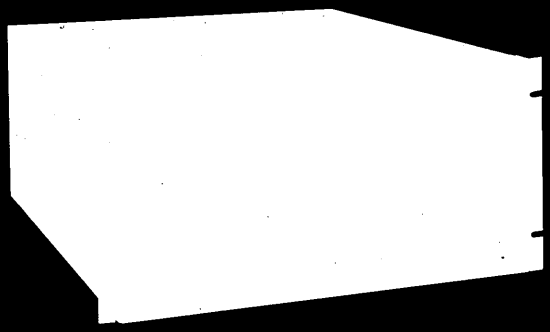

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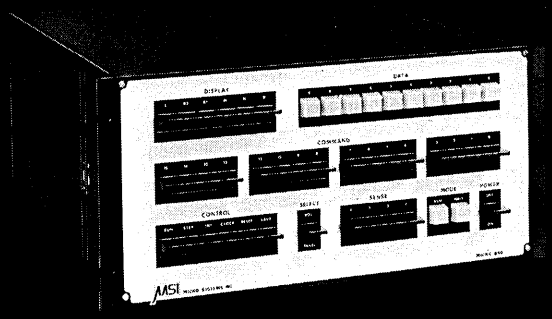
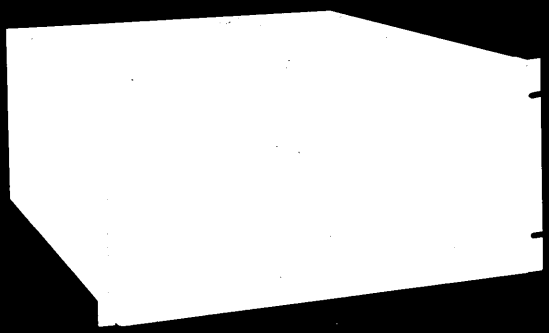


MICRO 800



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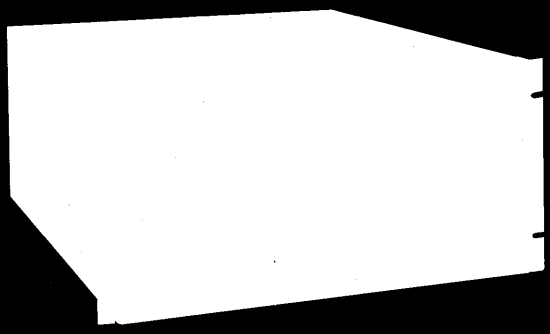
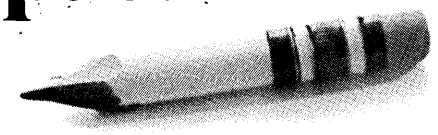


COMPUTER ε

Here,

compare features adaptability and cost of the new MICRO 800 computer



	MICRO 800	α	β	γ	δ	ε
Microprogrammable	yes					
Memory Cycle Time	1.1 μs					
System Clock Rate	4.55 Mhz					
Micro Command Execution Time	220 ns					
Core Memory Capacity	0-32K bytes					
Core Module Sizes	2K or 4K x 8,9, or 10 bits					
General-Purpose Hardware Registers	16					
Memory Parity, Memory Protect, Power Fail Detect/Restart, Spare Bit, and Real Time Clock Options	yes					
Direct Memory Access: Optional I/O Rate	yes 910,000 bytes/sec					
TTL Microcircuitry	yes					
Interchangeable Plug-In Console Options	3					
System Interface Module Spaces In Basic Enclosure	5 or more					

The MICRO 800 is a microprogrammable, byte oriented digital computer engineered for dedicated and general purpose applications in fields such as control automation, data acquisition, and communications. System flexibility through macro and micro programming, plus high speed, functional modularity, and lowest cost give it an unfair competitive edge for dedicated applications.

For $2950.00 (with quantity discounts to 40%), the MICRO 800 comes fully equipped with a basic processor containing 16 multi-purpose registers, 256 words of read-only store, basic console, enclosure, and power supply to function as a microprogrammed controller. To this configuration can be added up to 32K of core memory, direct memory access, and many standard or special options to fit a broad spectrum of system requirements.

With a basic configuration price of $2950.00, quantity discounts to 40%, and 30-day delivery, the MICRO 800 is the first computer developed specifically for the OEM and volume user.

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CIRCLE 60 ON READER CARD

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Then consider a basic quartet of true-nesting priority interrupts, expandable to 64 levels if needed.

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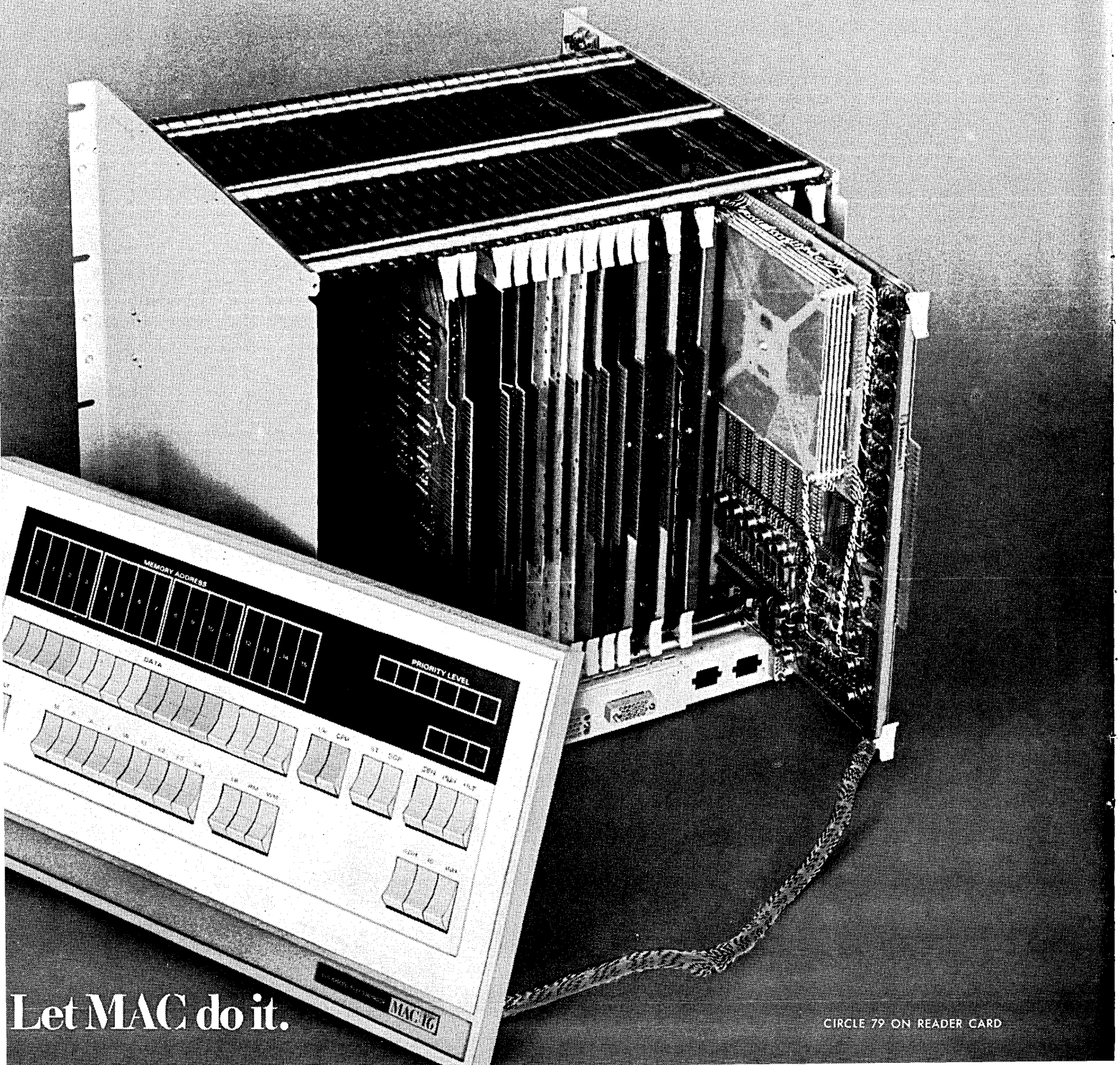

Let MAC do it.

CIRCLE 79 ON READER CARD

news scene

an interpretive review of recent important developments in information processing

TASK FORCE BACKS NONREGULATION OF EDP—MA BELL'S EARS ARE RINGING

Government regulation of the data processing industry is unnecessary.

This is a key conclusion of the Presidential Task Force on Communications Policy appointed in 1967 by LBJ. Their report, developed over a 15-month period, was completed late last year. Here's a sneak preview of some of the other major recommendations of the report, not yet generally released:

Ma Bell should be required to interconnect its private line facilities with those of competing carriers. But existing ratemaking principles must be modified so the phone company's ability to compete isn't hindered.

Interconnection of the public message system with foreign attachments and with user-provided communication systems should be allowed, within limits.

Western Union's plans to go into the commercial dp business don't threaten those already in the business.

Tariff provisions that prevent private line users from sharing transmission facilities should be lifted. Communication among users of the same private line should be allowed.

Ma Bell should be required to buy communication equipment from independent suppliers if they can offer equivalent performance at less cost.

A pilot domestic satellite system should be established, under the trusteeship of Comsat. But because of unresolved questions, it is "premature" to establish a full-scale system.

Perhaps the most significant conclusion of the Presidential task force is its recommendation that "the FCC should have full jurisdiction over intercarrier agreements." Right now, although the Carterfone decision has eliminated some prohibitions on interconnection, the liberalization affects only *users*, not firms like Microwave Communications, Inc., or University Computing, which want to sell private line transmission service in direct competition with the telephone companies. Their agreements with the carriers are outside the scope of tariffs. In fact, the established carriers insist that such arrangements are beyond FCC's jurisdiction. So, if and when MCI, UCC, and/or others become certificated to lease private lines, they will still have to overcome the reluctance of the established carriers to negotiate interconnection agreements. The task force recommendation, if implemented, should make this chore much easier.

not impressed

The task force did not seem terribly impressed with Ma Bell's argument that interconnection would lead to poorer quality service. The report points out that the telephone company already permits private line *users* to attach their own terminal gear and protective devices—an implication that competing *suppliers* of private line services could be interconnected without escalating the risk.

There is a need to maintain a compatible communications system, the task force added, so that in a national emergency, circuits supplied by different carriers can be used interchangeably. "We leave it to the FCC, with the advice of the Executive Branch, in passing on specific applications, to decide whether additional design or technical constraints on interconnection, or requirements for compatibility, should be imposed to reflect the needs of national security."

Another reason the established carriers object to interconnecting their private lines with those of new entrants is that this would allegedly permit the latter to skim the cream off the rich markets of the former. The task force thought there was some merit to this contention:

"The essential idea of existing rate patterns is that common carrier tariffs are applied uniformly to jurisdictional areas and specific routes. If such a pricing policy were to be maintained, new entrants would be provided with an artificial and uneconomic incentive to enter the low-cost, high-density routes. By diverting business on these routes from the established carriers—frequently called 'cream skimming'—the new entrant could deprive the carriers of revenue which partially helps to support the service on high-cost routes . . . When a competitive challenge to the established carriers arises, neither they nor the regulatory agencies should continue to apply the principle of jurisdictional tariff uniformity based on the aggregate costs of serving all routes. Rather, prices over competitive routes should be based upon the costs and demand characteristics of these routes."

The new carrier, meanwhile, should be "protected against the threat of noncompensatory or 'predatory' pricing (by) the carrier who has a monopoly market . . . If predatory pricing is to be prevented in the future, the FCC must establish effective regulatory standards over minimum rates . . . The FCC should take a more active role on pricing issues than it has taken in the past."

Although the report subscribes to the Carterfone decision, it doesn't specifically evaluate Ma Bell's claim that the phone company must supply network control signalling equipment and protective arrangements. "These protective measures . . . would appear to reduce in importance the issue of 'system integrity' which has long been the basis for excluding private equipment and systems," the task force said. "If so, the path would be cleared for the development and use over the switched network of a wider range of terminal devices and perhaps also of private communication systems."

edp excepted

The task force opposed government regulation of the data processing industry largely because of a belief that computer utilities will not dominate the market. "Computer costs are declining more rapidly than the costs of long-haul transmission," the report points out. "At this time, it appears that all but the most highly specialized computers will be able to operate at full capacity without seeking a regional or national market." The report adds that the telephone companies should not be allowed to offer dp services, but it specifically excluded Western Union.

Much of the pressure for regulating commercial dp services comes from the established carriers, who have complained about competition from unregulated firms that offer store/forward services. The task force completely rejected the carriers' argument that computerized store/forward ser-

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vice is a subset of telephone-type switching and therefore should be provided only by the common carriers as part of a regulated offering. Rather, noncarriers should provide nonregulated store/forward services, and present tariff restrictions limiting their ability to do so should be lifted. One obstacle mentioned in the task force report—which prevents private line users from sharing transmission facilities—was partly removed by AT&T recently (see March '69, p. 113). But it is still illegal for private line users to resell communication services, nor can line sharers communicate with each other. The task force thought both bans should be removed.

Although these sentiments will certainly gladden t/s service bureau operators and the on-line stock market quotation fraternity, their joy may be tempered by another section of the report; it says that Western Union should be allowed to provide teleprocessing and dp services. The task force rejected the dp industry's major objections to competition from Western Union by saying that the telegraph company "lacks substantial monopoly power in other markets which it could bring to bear on nonregulated competitors in teleprocessing." Also, while Western Union "has some advantage" over potential competitors in that it controls its own transmission lines, this advantage might disappear "if our suggestions on interconnection and line brokerage are adopted." For, competitors could then "obtain the same transmission economies as Western Union."

The task force admitted that bookkeepers might have trouble segregating Western Union's regulated public message service (PMS) from its unregulated dp activities; but this problem was neatly disposed of with the suggestion that somebody else operate PMS—for example, the Post Office or AT&T.

"Since a common carrier in the communications business is a public franchised monopolist," the report adds, "it is in the public interest (for) . . . the carrier (to) procure equipment independently," if this equipment does the job required and costs less. This policy "implies that information on future procurements (will) be made available to all of the industry and not just to the affiliate of the carrier"—i.e. Western Electric. "It implies also that when switching systems have passed through the development stage, stable components, where feasible, might be broken out for competitive bidding. The problem is one of central and growing importance." —PHIL HIRSCH

ICL, RESULT OF BRITISH MERGERS, EMERGES AS BIG TIME COMPETITION

It is beginning to look as if the mergers of the UK computer industry that produced International Computers, Ltd., have achieved their ends. Intended to produce a company with the scale of operations needed to compete not only with Big Brother but also with the other eight major American mainframe shops active in Europe, the plans behind the formation of ICL carried the rise or fall of an indigenous British industry.

The first moves to integrate marketing and services support followed quickly. Chopping out unprofitable production lines and rationalizing the products were more arduous.

The sequel to this has been the development of methods for pushing through a number of modifications and new products comparable to those undertaken by competitors. Inexperience in this sector may have been one of the weakest links in the forging of ICL.

But now the company has come up with a technique that may help it to react as fast—if not faster—than some of the competition to vagaries of the computer market. First hints that the manufacturer had something up his sleeve came in a contribution early last month to a computer-aided design conference. It described work on a system called Design Communication. This is a method devised by an engineering team at the firm's main Stevenage plant for cutting the bottleneck between the design shop and the production floor.

getting it right

Design Communication is aimed at curing the UK computer industry's most intractable problem—the job of getting the basic production/mechanical engineering part of processors and peripherals right the first time. In common with the opposition, ICL uses CAD (Computer Aided Design) to produce logic diagrams for its new circuit designs by machine. Nevertheless, the mechanical engineering task of getting it all together into a processor, tape or disc store, card reader or high speed printer, etc., still absorbs over 50% of the effort at the production engineering/draughting stage.

Now, the idea for a modification or new product goes straight from design layouts to production engineering drawings, maintenance manuals and information records in one operation. In one swoop the Design Communication service produces all the data for production, including the necessary details for numerically controlled machine tools.

An army of draughtsmen from separate offices, technical literature groups, a materials standards department and five reprographic centres have all been rolled into an operation done by machine, "a process which has shattered some sincerely held beliefs," according to Derek Stevens, the manager who has nursed the idea of Design Communication for over five years since the original streamlining of production took place at ICT.

As numerical control was introduced wholesale at that time to turn out complete printers in one operation and take over back panel wiring, etc., Derek Stevens became increasingly conscious of the manpower and time it took to convert a design idea into working drawings, parts lists, maintenance manuals and work schedules.

Working through an electronically controlled draughting board, the basic design is now fed into a computer, which makes the translation by calling upon a data base of production engineering information. As a bonus, a computer-aided management information system called Dorace prepares automatically (for each accounting period) progress reports with work in hand and money spent on each project going through the preproduction stage. Although still in its preliminary phase, ICL has nearly doubled the number of modifications and new products going through the Design Communication centre, with 100 fewer people and at a departmental cut of $300,000.

But perhaps more important still, the system offers a way for ICL to react more quickly to market demands in terms of getting changes onto the market and in assessing the production aspects of new products.

Design Communication interfaces with the company's own corporate model for forward investment. Primarily a financial model, the company model presents an analysis of policy changes in marketing, sales activity, production forward loading and costing, and future product assessment as a P & L sheet.

angry motive

Over the past four years the company model for ICL has grown from an experiment to a serious aid for testing out policy options. One of ICL's kingpins in corporate planning, Peter Ellis, said recently that it had first been used in anger in assessing the chances of a merger between ICT and another European manufacturer. As this was pre-ICL, the most likely candidate for a marriage with ICT was

(Continued on page 124)

the French company, Machines Bull. With the hindsight of the huge investment needed from GE to put that one straight, ICT can be grateful to its model for not losing the company's shirt. It provided the basis for the merger that eventually took place between ICT and English Electric. And on balance has shown that it knew who its masters were.

But its most exacting test has yet to come, for the adult policy-machine that started by rejecting Machines Bull has to help choose the new range of computers that will please enough customers to keep ICL's production shops full. One of the contenders for this is the Basic Language Machine or Code Word, which should take all that sweat out of software for the customer —so the story goes.

The big question is: Does ICL carry out its enhancements to the present range of machines until 1975 and the change to a new design technology? Or does it make the change sooner . . . model, model in the hall?

—PEARCE WRIGHT

WESTINGHOUSE IS SURE IT'LL BE WESTINGHOUSE

About 135 firms (or is it 150 this month?), want a lion's share of the "network information services" market that is supposed to climb to $1 billion in 1971, $1.3 billion in 1973, and maybe, $2 billion by 1975. Many of the firms now joining the battle don't have much faith in the profitability of "conventional time-sharing and remote batch services," but are saying that two "names of the game" are "build a big network" and "specialize."

Westinghouse Corp. is doing just that with its Manufacturing Information Services Department, which has already opened four of the 12 Tele-Computer Centers that will dot the nation by the end of the year. But even such expansion plans are not unusual news these days. What is interesting about the effort is the sector of the market that MISD will service initially —manufacturing, and the very broad base of Westinghouse resources that theoretically give it an edge over many fledgling competitors.

In a New York-to-Pittsburgh picturephone interview with MISD sales manager, Thomas Matson, DATAMATION was given a breakdown of these resources and plans. (This was after some self-conscious fidgeting and chuckling by the interviewer, who has never used a picturephone before. This unit is one of 40 used by Westinghouse for voice communications under a cooperative experiment with the Bell System.)

MISD was initiated last May, led by Steve Mullé, but its marketing effort was really only begun earlier this year. Actually, of the 30 terminals on-line to the Spectra 70/46's and an IBM 360/50 and 75 ASP system in Pittsburgh, more than 20 are used by Westinghouse itself. MISD has built a staff of 60 people in that time, to grow to 150 by the end of '69, and its sister department, Information Controls and Systems, which is responsible for "custom" software development, has 150 people, to grow to 350 this year. Some ICSD products will grow into standard packages for MISD. Both departments fall under Westinghouse Information Systems Laboratory.

westinghouse disposal

MISD, considered a corporate "new business" venture, has at its disposal: a choice from among the 2,000 programs in the Westinghouse software library; a share of the firm's nationwide private leased line communications net, for which it pays, but at below AT&T rates; and excess time on four mammoth systems—two CDC 6600's and two Univac 1108's—in addition to its own dedicated systems for time-sharing and remote batch processing.

MISD has selected and worked with 20 programs from the firm's library, Matson told us, most of the applications being in the manufacturing area. Currently, they are broken down into numerical control tape preparation programs (interactive and remote batch), data management, computer-aided problem solving (CAPS), and "other" packages that will come out of ICSD. ICSD work in transportation, biomedicine, state and local government, and other industries provides a hint of other markets MISD may in future enter.

But the manufacturing services market, still in its infancy, provides enough potential to keep MISD busy now. Matson estimated that this sector should grow to 3% of that $1.3 billion market by 1973, and then take a leap forward to 10% after 1975. But the first step toward total manufacturing information services (management information, production and inventory control, etc.) is, very simply, numerical control tape preparation, which will account for much of MISD business this year (not projected).

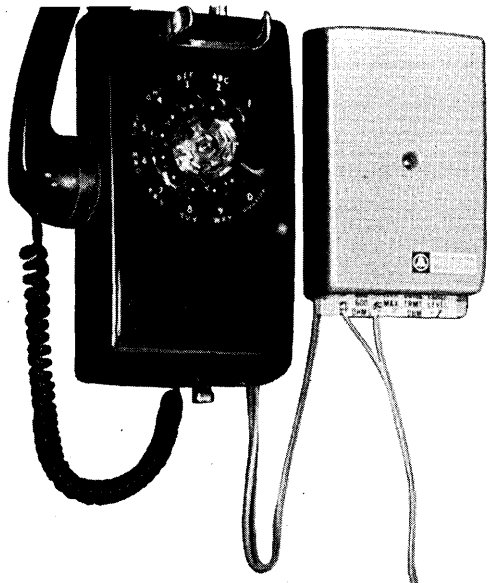
misd market

Let's break down this market further. There are over 1,000 companies with a total of about 16,000 numerically controlled machine tools—and that number is expected to grow 30% annually. Conservatively, says Matson 70% of these are manually programmed, and most are found in small-to-medium size operations with five or fewer machine tools. This is the MISD market, plus any of the larger tool installations, as in aerospace firms, that are finding tape preparation a low priority in their batch systems. Matson estimated that only 10 time-sharing and/or remote batch firms are after this market, the most significant competitor being General Electric, which, like Westinghouse, has had much experience with industrial control manufacturing.

Why go to remote access systems for tape preparation? According to an internal article by WISL director Frank Carr, "If a $25 cost reduction per piece can be achieved by using numerical control on a given part but the cost of preparing the program is $250, there must be a requirement for more than 10 pieces in the lot to achieve any economic advantage. If the cost of part programming can be reduced, the economic lot size is reduced." Except for simple parts, there is no advantage to manual programming over computer-aided parts programming (which generally reduces the cost by at least one-third). In interactive or remote batch versus batch preparation, it is a matter of improved turnaround time, program accuracy that can be closely controlled via user-computer interaction, and thus, cost savings. Matson noted that even with sophisticated parts, the cost saving with MISD services could be 50% or more over manual programming. (No batch processing comparisons given.)

There are many variations with which to deal. MISD does or will provide several interactive parts programming languages with which the user can obtain his finished tape at the terminal after developing the program: Campoint (point-to-point machines), Campturn (lathes), and Campmill (milling machines). Campfive, however, mixes time-sharing and remote batch processing, since it is oriented toward more complex point-to-point parts programming and produces a manuscript too long for time-sharing; three passes are required as well. APT is also available on a remote batch basis.

MISD has also developed Campdata, which provides user access to a metal-working data base. Other systems offered include an interactive data management package, TRIM, and a host of



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problem-solving packages, such as electronic circuit analysis, control system analysis, and communications network analysis. Matson says that these services plus other ICSD packages will ultimately account for 60% of MISD business, with conventional scientific and engineering applications, provided as a supplement to customers, accounting for 40%.

where they are

Currently, the Pittsburgh center contains the 46's and ASP system noted above. The 6600's are also there for MISD's batch use; the 1108's are in Baltimore. In each of the following Tele-Computer Centers there are an IBM 1130 and two line concentrators linking users to the 46's and ASP systems: Philadelphia, Chicago, Boston. By July, New York, Detroit, Cincinnati, Buffalo, Baltimore, and Cleveland will be added; by late '69—Atlanta and Minneapolis; 1970—Los Angeles and "others."

The 46's will handle 48 terminals; the ASP system can handle up to 250 1050-type terminals (reduced by the number of satellite computers linked to it). The user will have various options like: direct access to these systems; or large amounts of input or output can be transmitted from or to the satellite 1130 instead of the terminals; or programs can just plain be mailed to the local center. Several operations, like Univac's, provide this "as you like it" service.

Each of the satellite centers will be upgraded to 46 and ASP systems, if the demand requires it. Time-sharing charges are $10/hour for connect time, $13.50 per cpu minute for parts programming services, and $3 a minute for other services; $100/month minimum. Remote batch charges are $8-12/hour for connect time; $1000/hour for cpu time for parts programming; and $750/hour for other services.

Noting that many remote-access service firms under corporate umbrellas have often been stifled by the excessive demands made by other internal divisions, we asked how MISD fared within Westinghouse. Matson noted that MISD, which hopes to become a separate division or subsidiary of the firm, intends to minimize the percentage of internal business. But further, he pointed out, grinning over the phone, MISD has to compete with other time-sharing services for Westinghouse contracts. Ten such services are now in use there. —ANGELINE PANTAGES

COMPUTER SCIENCES CORP. CELEBRATES 10TH BIRTHDAY WITH REORGANIZATION

Coincident with the company's tenth anniversary, Computer Sciences Corp. has announced a reorganization plan that puts in William R. Hoover as executive vice president and Alvin E. Nashman as head of the newly formed Systems Group.

The reorganization, Hoover says, is "a natural evolution . . . separating products (such as Computicket, applications programs, programming systems) from services." This is, of course, a rather fuzzy distinction, since nearly all the products offered by the company include a large measure of services. But it's clear that the main emphasis will be on supplying the most complete package possible of both programming systems and those kinds of services that tend to continue throughout the course of relations with a customer—starting with system analysis and going through programming, equipment specification and selection, training, installation, checkout, and long-term support. This general kind of "systems house" job, says Vince Grillo —vp of corporate development under the new set-up—"now accounts for two-thirds of the investment" a customer makes. And Hoover adds that "this area of the business is growing at 30% or 35%" so it deserves the emphasis.

This plan to evolve into a complete systems operation is also evident from the choice of name for the major part of the company; the new Systems Group is made up of the former Computer Sciences Division and the Communication & Systems Division. And it includes nearly 3000 of the approximately 3200 total employees, with the rest spread thinly over a half dozen or so different operations. In further statistical support, the group is supposed to account for some $60 million in revenues. Based on CSC's latest financial report for 39 weeks—during which they took in $48.4 million—the fiscal year for the whole company should be in the $65 million range, making the Systems Group liable for well over 90% of the whole company's revenues.

Still, there are ample reasons for thinking that Hoover and president Fletcher Jones know where they're going and how to get there.

the past

The company got started in April, 1959, with five people. By early 1963, as Jones told DATAMATION then in an interview, CSC had 200 people, had just installed its new Univac 1107, was initiating fixed-price contract work for programming services, and had completed a $4 million sales year. During that time they had, among other things, written the compilers, executive, and complete operating system for the 1107 under contract with Univac.

In the fiscal year ending March, 1964, sales reached $7.8 million. Two years later they hit $25.2 million and by March, 1968, were $53.3 million. By this time, net came to $2.4 million from operations (not counting the sale of an interest in the Computax system) and for the latest 39-week period net from operations reached slightly over $4 million.

What about the rest of the company —other than the Systems Group?

"We're still working on the reorganization," Hoover says. "We aren't yet ready to announce the names of the people for some of the boxes . . . besides, an organization chart won't tell you much about this company."

Here's the general idea, though, of how the organization seems to be shaping up.

The leasing operation—headed by Adrian Bos, former Univac executive. The policy here, apparently, is to lease whatever kind and type of equipment seems suitable—without reliance on any single manufacturer. CSC is offering a package financing plan, so that a customer can have easy terms on software and services as well as the machinery itself.

Information Network Division—CSC's version of the computer utility is headed by Marv Franklin, former IBM marketing man and once head of systems planning at Poughkeepsie Labs. The plan calls for 10 centers, each with two 1108's, but so far seems to be moving slowly: the first center is due to get going in June and will be in Los Angeles. Hoover, like others, sees time-sharing as a winner in the future. "Infonet will be a big part of our growth, 20% to 25% per year." Here again the complete systems approach comes in, with plans for building up specific data bases as well as supplying systems and applications software. Remote batch will be featured first, but conversational t-s using BASIC and other languages will soon follow. The first marketing effort will be toward scientific/engineering customers, with business jobs by industry added as the program packages come along.

operations abroad

International—two main operations, in Europe and Canada. Both are small versions of the domestic CSC, in that they offer the same kinds of services

(Continued on page 128)

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and products, as well as sell the use of computers. The European headquarters is in Brussels, headed by Mario Montana. About 100 people are involved, with a few offices scattered around the continent and the U.K. Holland's Philips (also now in the computer manufacturing business) owns a 25% share of this venture. The Canadian operation is under M. G. Goudge, with headquarters in Ottawa, and employs about 75. There are branches in Vancouver, Toronto and Calgary—where there is an 1108, offering terminal services over a wide area. This venture is slightly more Canadian than U.S., with Canadian National and Canadian Pacific railroads each owning 25½% of the action. (The Canadian government is reported to be "assessing the implications" of this joint venture.)

Computicket — headed by Nick Mayo. This reservation and ticketing system also includes accounting and report programs for subscribers. Franchise rights for the European market have been sold to International Publishing of Great Britain.

Application Systems Division (a tentative name)—headed by Ed Kearns, former RCA marketing executive for 10 years. The group includes the Computer Sciences Institute, under Norm Carter, and the Applications Systems department, now to be run by Roger Fisher.

The institute is aiming courses at management, at marketing people who need more training in systems to deal with computer and related sales, and at the general category of computer operations groups (they have a contract with the Logistics Command to train 500 analysts, programmers, and operators). The group will also sell a package that includes courses, training aids, desks, consoles, and training for the instructors.

Applications packages seems to be a promising venture, with new stress on marketing a number of completed proprietary programs. These include a general-purpose payroll system (39 have already been sold), Compuflight II (intended for commuter and regional airlines), the EXODUS conversion package, a personnel management information system, a revised COGENT II file management system, and packages for accounting applications and financial institutions.

The over-all purpose of the reorganization, company officials say, is to put together the specialists making up CSC's strength in new combinations, so that emerging markets can be better served.

We asked Mr. Hoover if he would be interested in buying a communications company.

"Well . . . no," he said. "We can always buy these services like anyone else." —WR

SOFTWARE FIRMS UNWRAP PACKAGES AND HOPE FOR PRESENTS FROM IBM

As the great day nears when IBM will make the awaited announcement of some form or other of separate pricing of hardware and software, the independent software companies and packages proliferate and the usual chaos continues. No one is quite sure what the effect of separate pricing will be, but there is overweening confidence of a bright future for all and activity is increasing and bustling, prompting the conclusion that when the shakeout comes, it will, indeed, be a major one. Something is happening everywhere.

Applications Software, Inc., will begin to actively market its generalized file management system (ASI-ST) now that the first two are in and running at Corning Glass and Singer. The Torrance, Calif., company is shooting for eight installations by June, 25 by year-end, 100 by 1970, and 250 by the end of '71, the date by which president Don Sundeen expects ASI to be the number one software house.

ASI-ST runs on the 360 (OS and DOS) and Spectra 70 (TDOS), for $25K and $32K, respectively, although prices will be hiked soon. A conversational version will be ready in late '69 or early '70. Sundeen claims that ASI-ST runs at least twice as fast as Informatics' MARK IV, and sometimes is 10 times as fast.

In a move to beef up ASI-ST marketing, Sundeen has brought in Bob Bleier to head the effort. Bleier formerly was research leader, Commercial Systems Division at SDC.

MARK IV, meanwhile (now running at over 130 installations), will be offered by Informatics to time-sharing users at its data centers' 360/40's in Los Angeles and New York, as well as on four 360/30's gained in the acquisition (for 148,000 shares of stock) of Rucker Company's data centers in L.A. and Oakland. Informatics plans a nationwide chain of centers and will offer remote batch MARK IV services through a newly developed, commercially available terminal that compresses data at the terminal. The data centers are aimed at companies in the $3 to $10 million annual gross class that are "subcomputer" at present. MARK IV/2, a "faster, more powerful" version of MARK IV, is now being marketed by the firm. It operates under both DOS/ and OS/360 and is priced at $35K.

Computer Sciences Corp. has temporarily withdrawn the Cogent II file management package from the market. It's undergoing substantial revisions, and will be available June 1 at a healthy new price of $36K, up from $25K. Ed Kearns, Applications System Division vp with CSC, says the firm sees a large profit potential in proprietary packages, and estimates a market of $350 million/year by 1974, of which it expects to have a tidy slice. Kearns is convinced that Cogent II will be a real rival (another one) for MARK IV and will be the best package yet to come out of CSC. The firm also is going to narrow its package range to "run-of-the-mill" commercial packages, and will amortize them by dividing the development cost by the estimated number of sales, divided by the "useful life" of the package, seldom more than three years.

popping packages

Measurement Analysis Corp., an L.A. Digitek subsidiary, has four of its MAC/RAN packages out on lease, and has concluded a deal with Control Data Corp. that gives 6600 data centers in the U.S. exclusive service bureau rights for the random data analysis program. Completed seven months ago after a six man-year effort, MAC/RAN has a one-time price of $10K.

Measurement Analysis recently signed an agreement with Synergistic Software Systems, Houston, Texas, to serve as the national marketing agent for MAC/RAN. The Houston firm plans to establish a nationwide network for the marketing of software packages.

Isaacs-Dobbs Systems, Inc., Los Angeles, has developed a random access systems I/O software program, RAM (Random Access Method), that it claims is up to three times faster than IBM's Indexed Sequential Access Method (ISAM) and enables the user to use disc storage in a "truly random fashion." The system is currently being used for on-line accounting and billing by several Southern California utilities.

And Lahey Computer Systems, Phoenix, Arizona, has completed writing a FORTRAN IV compiler for the GE 600 and is trying to get somebody interested, especially GE.

Even IBM, finally aware that its OS 360 provisions for maintaining and accessing data bases leave something to be desired, has decided to do something about it. Three projects are un-

der way, including one in L.A.'s Century City, where 50-60 people are wrapping up a package called IBM 360 (Information Management System). It is now being beta tested at several customer installations and is tentatively scheduled for release in July. But a political/technical imbroglio is brewing within IBM over which file management project will eventually be chosen as THE one. A second project is called AM 1 (Access Method One).

One of the newer entrants on the software company scene is a phoenix risen from the ashes, Consolidated Software, Inc., which is the successor to Software Resources, Corp., a company founded by Robert V. Head, who will serve as exec vp of Consolidated. The firm is financed by Programming Sciences, Inc., New York, and will operate as a partly owned subsidiary. William G. Debs, former vp with Programming Sciences, is president.

According to Head, there have been several significant changes in the proprietary package business in the past two years. The first concerns the users, who are puzzled and dismayed by the multiplicity of packages and their unevenness in quality, lacking the homogeneity of IBM packages with respect to documentation and performance. The second development is that the owners of packages are becoming more sophisticated in marketing them, are demanding more of the people they choose to sell their products. The nature of the product also is changing, says Head, becoming in some cases a package including hardware, software and services. And on-line packages are becoming available through service bureaus, sold directly or on a royalty basis to the developer.

Consolidated will offer packages previously developed by Programming Sciences and Software Resources, including a payroll system, an information retrieval system, and a flowcharting package for the 360 series. The firm will also market packages developed by other houses, and will "deal only in software products that have passed rigid tests of quality assurance." It has offices in New York and Los Angeles and will shortly be in Chicago and Washington, D.C.

Another development in the software industry is that package brokers are entering the scene, some with the intention of focusing on certain geographical areas, some to handle only specialized packages, and very few with a sound service concept.

Incidentally, SDS has so far sold 17 of the COBOL compilers developed for the Sigma by CSC and delivered nine of them for a reported $400K-plus. The company is bullish about prospects.

—AD

Probably the same person who piled all the tape reels on the desk. And who filed the cards all over the floor while transferring them.

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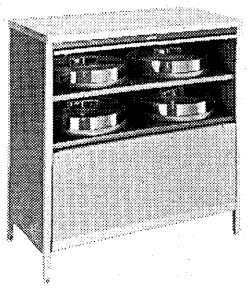
And leave Mrs. Murphy's locker for Mrs. Murphy.



Computer Companions by

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PRODUCTS CO.

Who put the disk packs in Mrs. Murphy's locker?

CIRCLE 20 ON READER CARD

news briefs

AT&T FILES NEW WIDEBAND AND ATTACHMENT TARIFFS

AT&T has filed two private line tariff changes with the FCC, both of which will become effective July 1, the commission agreed.

The first filing covers a wideband communications pipe that could be shared among a number of users. Two pipe "diameters" are offered: one is 12 voicegrade channels wide, the other is 60. Each can be used for voice and/or data. The larger pipe is able to transmit data at a rate of 250 kilobits per second, while the smaller is rated at 50 kilobits per second. The tariff permits channels to be subdivided with customer-provided multiplexing equipment. It also allows use of foreign attachments.

Initially, 250 kilobit service would interconnect 47 cities in Illinois, Indiana, Michigan, New Jersey, New York, Pennsylvania and Ohio. The 50 kilobit channels would extend from the terminal in each city to the user or to secondary switch points within the seven-state area.

The transmission charge for the 250 kilobit service would be $18 per airline mile per month. Rates for the 50 kilobit service are $15 per airline mile per month for the first 250 miles, $10.50 for each of the next 250 miles, and $7.50 for each additional airline mile. Substantial additional charges would be levied for terminating arrangements. The proposed tariff requires each user to lease wideband service for a minimum of two years. If he decides to discontinue service, the phone company demands a 12-month advance notice.

Bell's other new filing covers the use of foreign attachments by its private line customers. Basically, the provisions are the same as those imposed on users of the public message system a few months ago (see February DATAMATION, page 105). But while that tariff change eased pre-existing restrictions, this one tightens them.

Until now a private line customer could acquire a data terminal, modem, and network signalling equipment from independent sources and interconnect electrically with a Bell-supplied private line. Under the proposed new tariff, the same user—after July 1, 1970—must obtain a connecting arrangement from the telephone company and comply with specified network protection criteria. The connecting arrangement, basically, is a small black box which limits the frequency and amplitude of the signal put out on the telephone company line by the terminal device.

AT&T told FCC that it may attach connecting arrangements to private line terminals before July 1, 1970, but the customer will not pay an additional charge, at least "initially." It was added that "later development of protective arrangements for special customer requirements may require a charge in some situations."

The new tariff allows independently manufactured data terminals to be connected acoustically or inductively, as well as electrically. But acoustic-inductive connections must be made "external to telephone company voice transmitting and receiving equipment." Also, after July 1, 1970, the user must meet specified network protection criteria.

Private line users who connect their facilities with the switched network must, under AT&T's new proposal, meet the network protection criteria spelled out in Tariff No. 260, at the time their service begins. AT&T also wants to impose a $10 maintenance-of-service charge on private line users when they have trouble, call a telephone company repairman, and he finds that the fault is due to a foreign attachment.

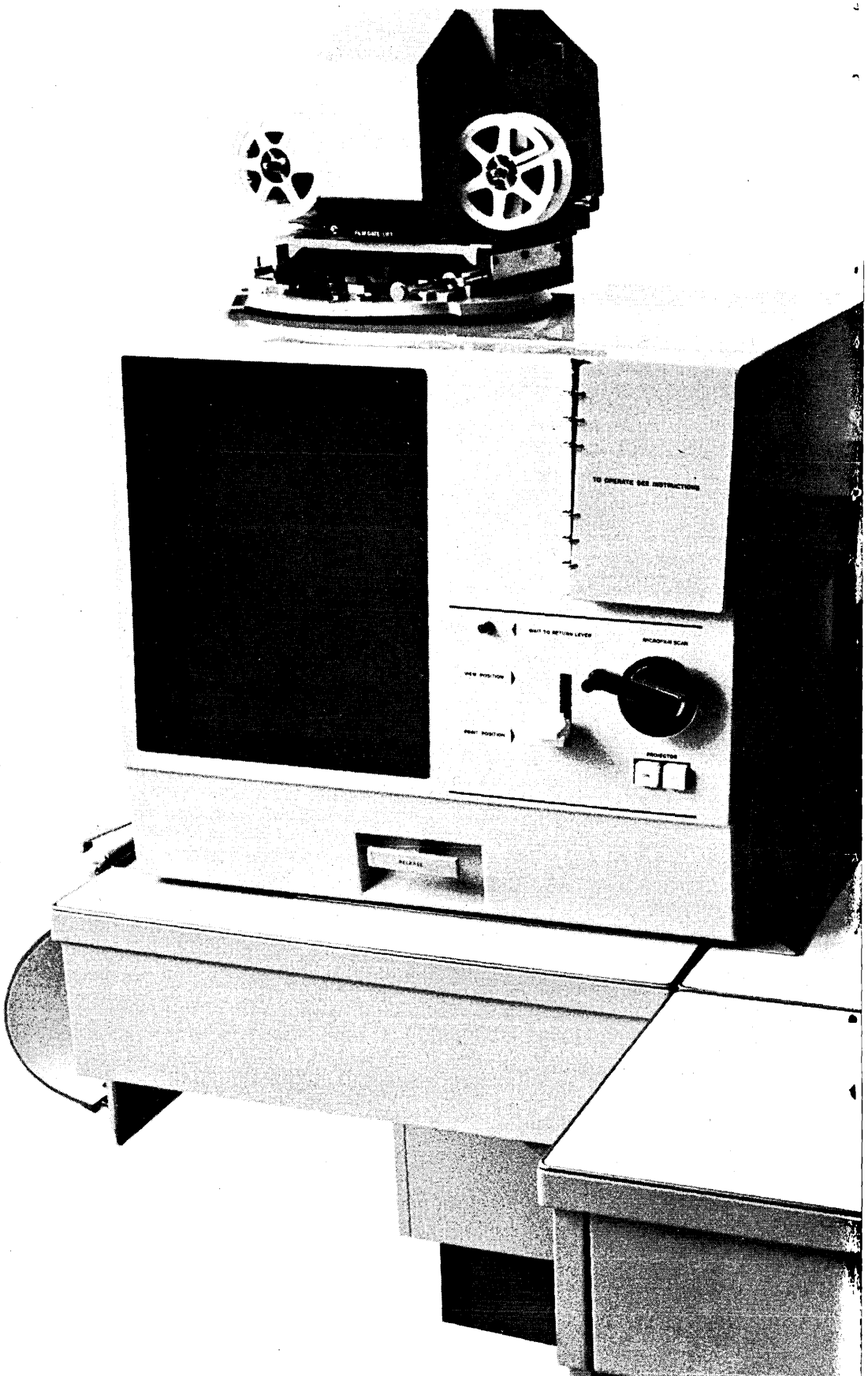
(Continued on page 134)

ARE HOLOGRAMS ALREADY OUTDATED?

Holography is one of the most exciting developments of today's technology. Holograms make use of a high-energy laser beam to store or display three-dimensional images for such applications as read-only storage; packing densities and device speeds are extremely impressive. However, at today's pace of innovation, holography may be outmoded before it approaches being practical. One of the latest competitors for 3-D display, storage, and wave conversion applications is the kinoform, a new wavefront reconstruction device which also projects a 3-D image, but requires one-fourth of the computer time to generate and creates images roughly three times as bright.

A computer program is used to produce a coded description of light being scattered from a particular object. The resultant computations are used to produce a 32-grey-level plot which is photoreduced and bleached. Then, when subjected to even a very small light source, such as the girl's earring in the photo above, the 3-D image is formed. A kinoform image can be produced of any object which can be computer-described. Examples might include proposed buildings, auto designs, relief maps, or two-dimensional alphanumeric data.

A flat, dry print from 10 seconds with the new



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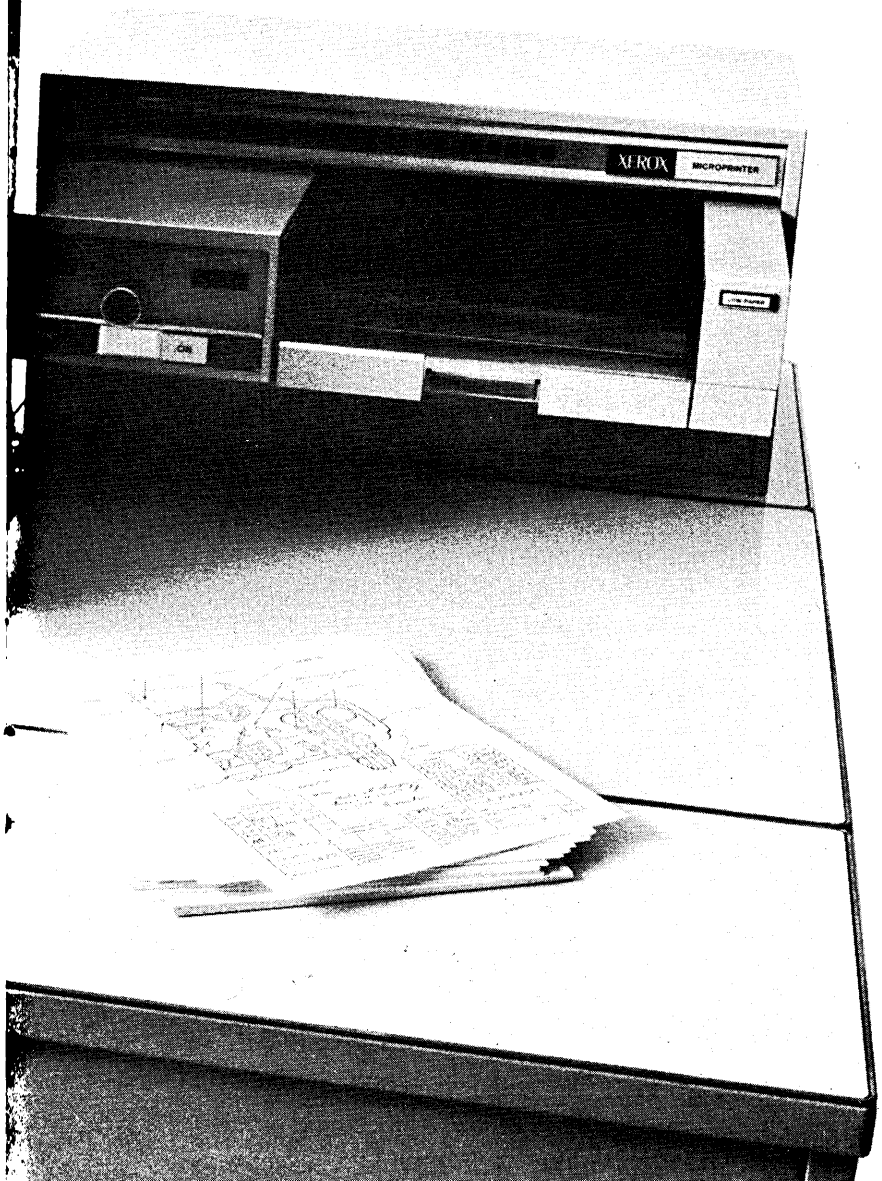
CIRCLE 62 ON READER CARD



news briefs

INSTITUTIONAL INVESTORS CAN BYPASS BROKERS

The fourth securities trading market is being automated by a private firm called Institutional Networks Corp., New York. Instinet, which is using Keydata Corp.'s service in Watertown, Mass., will offer giant institutional investors the ability to trade large blocks of stock via a terminal, anonymously and without paying a brokerage commission. It is not new for institutions to trade among themselves, called the "fourth market," since there is no regulation against bypassing a broker, but the speed of an on-line service and the ability to haggle over price without identifying the parties have never before been available.

No data was made available about how many such institutional investors would comprise a market for Instinet, but one advantage becomes clear: the investor will not have to wait for the broker to locate the securities, often lost these days because of the horrendous back-office accounting problems on Wall Street. The transferral of money and securities will be handled by one source, the Bank of New York.

The press has played up a potentially vehement reaction on the part of the brokerage community, which has enjoyed a relatively monopolistic control over securities trading. There are no laws that give them recourse against Instinet. It is not clear what jurisdiction the Securities and Exchange Commission has over such a service; it is now studying the system. But perhaps if it does get off the ground, it will be an added impetus to the broker to provide a better securities handling service than has been in effect.

The key to the system is the subscriber's code number. When a bid or a sell is entered into the system, it is accompanied by this number and not the subscriber's name (identification of the subscribers will be locked in a vault). Instinet, preferring not to discuss its system by phone, referred to *Business Week's* writeup as a simplified illustration of some ways it would work:

"By tapping in the code numbers for an issue on the send-receive unit, the fund manager can instantly see what blocks are being offered for what prices, and what the bids are to buy what quantities . . . The fund manager can contract to buy one of the offered blocks at the stated price. If he prefers to bargain, he can contact a potential seller through the code number and begin negotiations. Or he can simply enter his own bid in the computer file and wait for an unnamed seller to begin the haggling. In addition, he can send a 'flash' to all subscribers, announcing that he is in the market for so many shares at a specified price. The 'flash' comes in on a second machine, a receive-only unit. Once the prices and the number of shares jibe between buyer and seller, the computer closes the trade and produces the confirmation printouts that set the exchange of securities and money in motion."

A minimum trade is 500 shares with a value of $25K. The trades will not be reported over any trading ticker tape, but Instinet is considering providing the information to the press. One thing is sure: news of a massive sale or buy of any one stock, such as a fund's dumping of Control Data stock some months ago, will not reach Wall Street as quickly as it does by going through a broker, and hence will not have such a quick effect on the stock.

The system includes 1200 stocks, and any others subscribers want can be added. Instinet, headed by Herbert Behrens, considers that 20 subscribers will make the service "viable," and expects to be in operation well before the year is up. If the service is successful, it should be an extra shot in the arm for Keydata Corp. Keydata emphasizes that Instinet will not use up its available computer facilities, no matter how big it gets, and that it will continue to provide the on-line buiness data processing services, in force, that it has.

A Univac 494 is used for the service. Concentrators will be added as either Keydata or Instinet require; one is now being installed in New York. Two Fastrand drums and four flying-head drums are now on the system.

The price for Instinet users is a monthly subscription charge of $1,740.

PROCUREMENT SPEC FOR DISC PACKS EXPECTED FROM GSA

GSA has developed a procurement specification for disc packs which, hopefully, will lead to consolidated purchases by the federal government and lower unit prices for manufacturers. The specification covers 6-disc packs for use on IBM's 2311 and compatible drive units; it is now being circulated among manufacturers for their comment. A knowledgeable source expects a consensus to be reached "within the next few months." GSA reportedly hopes to issue an RFP before the end of this year.

The procurement sequence in the pending spec is much like the one set up for mag tape several months ago. A vendor couldn't answer RFP's for 6-disc packs until his product passed a qualification test and he was listed on a "qualified products list." Disc packs offered in response to an RFP would be accepted only after they passed a production test at the factory and an acceptance test performed by GSA. Both are described in the pending spec.

A likely spot for the qualifying and acceptance tests is the National Bureau of Standards, where facilities for similar examination of mag tape are already established.

According to the draft specifications, qualification testing will be performed on a GE Model 2280 tester, IBM 2311 Model I disc drive, "precision measuring, balancing (and) weighing apparatus, and such other equipment deemed necessary."

The proposed spec limits the weight of an acceptable pack to 10 pounds. It must be balanced within 8 inch-grams to a single plane parallel to the disc surface, and have a maximum rotational speed of 2400 rpm ± 48 rpm. Allowable roughness is less than 3.5 microinches, arithmetic average. The maximum allowable height deviation is 30 microinches measured with a 0.0001 stylus over a 0.030 cutoff range. The magnetic material used on the discs must provide a minimum readback voltage of 11.7 mv and a maximum of 24.2 mv over the entire recording surface, when writing and reading at 1.25 megabits per second.

As the spec is now written, no errors are allowed in any home address area or in track 00000 location. An acceptable disc pack must have a minimum of 2010 good tracks, and no more than 10 error tracks on any disc surface.

All of these characteristics, plus several others, would be evaluated during the qualification test. GSA would select test samples from each participating bidder's regular production. The spec requires the supplier to offer four packs for this purpose. One of these would be disassembled, and some of its parts might then be destructively tested.

The performance portion of the qualification test would be conducted by writing zeros on all track locations and testing for missing pulse errors, then erasing the zeros and testing for extra pulse errors. If an error was detected, the track would be reread 10 times. It would become an error track if the error recurred during the rerun.

The performance test would be repeated on all 6-disc packs offered to the federal government in response to an RFP. As the spec is now written, one to 10 sample packs must be included with each bid, depending on the size of the procurement. If a sample bombed out during the acceptance test, a specified portion of the vendor's total offering would be rejected, and he would have to submit a new lot, together with a new sample. Failure of the second sample would "constitute sufficient grounds for termination

of the contract and removal of the contractor from the qualified products list."

BLACK AND WHITE WORLD AT SUPERVISORY LEVEL

Prejudice against Negroes is not serious at the junior or senior programmer level, but it prevents blacks from getting promoted into supervisory dp jobs. So says Napoleon Rhodes, a 30-year-old Negro who is among the first of his race to become president of a programming, systems design and consulting firm.

Scientific Analysis Consulting and Programming Support Corporation is the rather formidable name of the organization, headquartered in Washington, D.C. It was formed last July, apparently because Rhodes personally felt the lash of prejudice. During the preceding eight years, he had worked as a programmer for three firms—Pratt & Whitney, Bendix, and D. Brown Associates—and had been passed over at least once when a supervisory slot opened up. Asked directly about the relationship between his entrepreneurial ambitions and the promotional policies of his former employers, Rhodes would say only that "I went into business for myself because it was the only way I could go where I wanted."

As president of SACAP, he encounters "some" prejudice—notably from the federal government. But he believes the bias is due more to habit than to "anything personal." Potential customers "are used to dealing with whites," he explains. Rhodes says he doesn't want preferential treatment, merely "a fair shake." He thinks the federal government, in view of its oft-expressed commitment to Negro betterment, should award contracts to Negro firms whenever they can perform "as well as Caucasian companies competing for the same job."

SACAP is capitalized at $25K, raised privately. The company has a line of credit with the First National Bank of Washington. A First National vp, Robert Bisselle, sits on SACAP's board.

Besides Rhodes, there were six other founders, three of whom are Caucasian. Rhodes declined to identify his partners because they're working for other firms and contribute their talents after hours. Sixteen additional programmers and analysts, including "quite a few Caucasians," provide technical support when needed. According to a company brochure, the individuals comprising this technical staff have a long list of prior credits in dp work related to space, public transportation, and engineering management applications—e.g. they've studied techniques for computerizing commuter transportation operations, researched methods of differentiating earthquakes from underground nuclear explosions; helped implement a regression analysis system used at Goddard Space Flight Center; and made mathematical analyses of space tracking system data.

The company says its "areas of proficiency" include commercial programming, system programming and analysis operations analysis and resource management, information systems and data base management, customer education and training.

SACAPS bread-and-butter contract at the moment encompasses the study, design, and implementation of an on-line information retrieval and updating system for the Youth Division of the District of Columbia. Files are accessed from a 360/40 with 32K core. Three other proposals are gestating at the moment—involving, respectively, an automated general ledger job, analysis of space tracking data, and development of a common data base accessible to three law enforcement agencies on a shared basis. The company also has developed an on-line bookkeeping system for physicians that it hopes to begin marketing soon.

ACM MOVES TO PULL OUT OF BIG RED

The Association for Computing Machinery, trying to make up for its losing trend financially, has taken some measures toward achieving a planned $235K surplus for fiscal 1970. ACM will end up $150K in the red in fiscal '69, ending June 30. It was hurt by bad deficits in areas like the professional development program and by decreases in numbers of advertising pages in its publications.

Briefly for now, the measures taken include the following: members will not receive three ACM publications for the $25 membership fee. Instead, *Communications of the ACM* will be given, as well as a $7 credit toward purchase of the *ACM Journal, Computer Surveys,* or *Computing Reviews.* (The latter costs $12.50, the others are $7.) The number of pages in the *Reviews* and the *Communications* will be cut back.

At ACM headquarters, the staff has been cut back, information services have been closed, and the activities of the persons involved in conference and lectureship coordination have been realigned. The professional development program seminar rates will go up, and the number of seminars will decrease.

ATARCSI AIR RESERVATION SYSTEM SET TO TAKE OFF

ATARCSI (Atar Computer Systems, Inc.) has signed the necessary ten participating airlines for its ticket reservation system, and George Buchanan of the Air Traffic Conference of the Air Transport Association has signed the contract that will put the plan into operation. Under Federal law, the agreement between the airlines and ATARCSI has been filed with the CAB, and although opposing briefs may be filed by the Association of Retail Travel Agents (ARTA) and the American Society of Travel Agents (ASTA), CAB approval is probable.

The ten airlines are TWA, United, Delta, Western, Northwestern, Eastern, Southern, National, Continental, and the last to sign, Alaska. Northeast Airlines also is expected to join the group.

Under the terms of the five-year contract, ATARCSI must have the first selling agent installation on the air within 11 months after the signing (April 4, 1969), and the contract is in effect for five years from the last day of the month in which the first installation goes into operation. The charges to the travel agency range from $110 to $160 a month, depending on volume and amount of use, while the airlines are charged based on the number of schedules stored in ATARCSI's computer system (two back-to-back 360/65's in Los Angeles) and the number of individual transactions.

In the beginning, the system will offer schedule display, airline seat availability and reservation booking. The firm also hopes to be able to offer auto and hotel reservations shortly after operations begin. It will serve basically as a third-party system to airlines and agencies, working with airline computers and agency terminals on-line to provide ticket information within seconds.

The travel agent groups' objections to the ATARCSI system are that it is not extensive enough, that it doesn't store and provide more information on individual passengers, tariffs, baggage, etc., and that it doesn't provide the agents with data identical to that of the airline, but Buchanan has stated that a start must be made somewhere, that ATARCSI's is the most feasible system in taking the step, and that it will in time encompass most of the agent's desires. The agents also object to what they consider the high price of the service, but ATARCSI considers the price extremely reasonable.

(Continued on page 136)

news briefs

ADR DEVELOPS INTERNAL PROGRAM PROTECTION CHECK

A new way of protecting legal rights in computer software has been proposed by Applied Data Research, Inc., the Princeton, N.J., program development firm which seems to be devoting most of its time these days to patent law.

The new scheme, developed by ADR vp Marty Goetz, requires assignment of a unique 4-8 character code to each computer system; it would be stored in a read-only register. A proprietary program, when sold or leased to a particular user, would be correspondingly encoded, possibly in a number of places to make piracy more difficult. Before the program could be executed, the two codes would have to be compared. If they agreed, the program could perform correctly; if not, the program would terminate, or produce erroneous output.

"A further extension," said Goetz, "is to have the software program check a date in the operating system. If a software system is leased for a fixed period of time, the date (could) be checked against an expiration date."

Goetz recently wrote a letter to the Patent Office describing his idea. It can be implemented without any government intervention, he said. Goetz added that the proposal would eliminate the need to register programs. This could be an important advantage because the Patent Office opposes software patents partly on the grounds that they are difficult to register.

"The cost (of) a hardware serial number facility is small relative to the cost of computers," added Goetz. "Its value in protecting computer programs far outweighs the cost of the hardware addition. Although current operating systems (i.e. IBM 360 OS and DOS) could use standard locations in the operating system, they do not afford the same protection as a hardware serial number that can be accessed by a computer program."

Goetz admitted that his idea would require the cooperation of computer makers, most of whom oppose software patents. But "since manufacturers, themselves, may sometime in the future desire protection of their own software, there is the excellent possibility that manufacturers would be in favor of such a scheme."

MORE ON SICSIC AND THE LETTERS BACK AND FORTH

In response to a letter from Robert M. Shapiro (April, p. 182), who stated he was the secretary of SICSIC (Special Interest Committee on the Social Implications of Computers) and protested the dissolving of same, Bernie Galler, president of the ACM, replied that it came as a complete surprise to Jean Sammet (who executed the dissolution) and him that Shapiro was the secretary of SICSIC with a mailing list of 100 names.

"Unfortunately," he went on, "SICSIC has never seen fit to comply with the provision of ACM Bylaw 7, which requires every SIG and SIC to file a roster of members at Headquarters yearly, and to submit a report to the council yearly. Thus there is no official record of any of the activities of SICSIC, and we cannot be expected to ferret out a secretary, mailing list, and round table discussions. Because this Special Interest Committee was dissolved, I must ask you not to issue statements in the name of either ACM, or ACM SICSIC."

Galler denied Shapiro's request that SICSIC be reinstated, on the ground that "each SIC commits ACM to spending a fair amount of money, and we do not currently have evidence that this is a viable committee, let alone a thriving one." Galler said he was delighted at the number of people concerned about the subject, and that "what we wish to do now is make sure that if a new Special Interest Committee is formed, it will be strong enough to become a permanent, financially self-supporting Special Interest Group within a year, as is our policy."

He advised Shapiro to contact Robert Bigelow (April, p. 189), who is attempting to start from scratch to comply with the requirements for forming a SIC, and this contact, we understand, has been made.

Bigelow told DATAMATION that he believes that SICSIC (a name he deplores) rightfully should concern itself with computer-oriented social matters: data banks and the invasion of privacy; the regulation of the computer industry; and perhaps the implications of computers and unemployment. But he is not in favor of a professional society going on record in the matter of Vietnam, a position with which Shapiro disagrees. However, Bigelow hopes that cooperation and amity will be the watchwords as the new committee is formed. He has received about 20 inquiries thus far regarding membership. He may be contacted at 39 Grove Street, Winchester, Mass.

HOW TO USE IBM AS A NATIONAL RESOURCE

There are an estimated 100,000 professional people in the world who know how to program and apply an IBM 1800 or an IBM 1130 in a process control application. This single, simple fact can be a huge roadblock to the competing company wishing to market its own process control computer line. With a little bit of thought that roadblock can be an asset. Apparently the folks at General Automation, Inc., thought that, anyway, for their new series of process control systems, called the GA 18/30 series, is fully compatible at the binary code level with the IBM machines.

GA is not building another 1800 or 1130. Although the machines are compatible with the IBM instruction sets, the hardware has appreciably louder bells and shriller whistles. For instance, the 1800 (the bigger of the two IBM machines) has a 2 usec or 4 usec memory; the 18/30's cycle time is 960 nsec. The 1800 add time is a function of the number of carries in the arithmetic; GA claims their add time is two to four times faster than an "average" time for the 1800, and list the 18/30 time as 2.4 usec (3.6 for double precision). Multiply and divide instructions are implemented through the hardware and rated at 12 usec and 13.2 usec respectively. Memory sizes from 4-32K are provided with direct addressing to all locations.

The 18/30 can be clocked at 400,000 operations/sec, GA claims. Part of the speed is undoubtedly attained through the use of the inter-register instructions which, in turn, make use of 16 extra registers. Five direct memory access channels are available for hooking up the peripherals for which process control systems are noted. In addition, the 18/30 can direct couple, cpu-to-cpu, to an 1800, to an 1130, to a 360 series machine, or to one of General Automation's own SPC-12's.

First deliveries for the systems will begin in June. To place more of the machines, GA is adding sales/service offices to its present 10 at a rate of one/month, and expects to have 25 finally. Overseas plans call for offices in Stockholm, Munich, Paris, and Brussels by next year. London's is already in. GA's Sciences Division is opening 10 Technical Application Centers to solve customer problems, presumably by selling them GA gear. These centers will be staffed with analysts, programmers, and systems engineers. Two are now open, in Cleveland and in Orange, Calif. Others (one every two months for a total of 10) will be nationwide. All will have an 18/30 and an SPC-12 for service bureau operation.

The 18/30 systems can be ordered with every imaginable peripheral, analog or digital—an important consideration for process control. GA says that even the 18/30 cpu backpanel has no

(Continued on page 138)

wires, so reliability should be very high. Claiming prices lower than 40% of the equivalent IBM 1800 configuration, GA lists the 18/30 systems at $20,000 with paper tape and keyboard. For information:

CIRCLE 593 ON READER CARD

IBM TO STOP COUNTING VOTES AFTER 1974 TALLY

IBM has announced that it will discontinue its Votomatic system for punched card voting after 1974, providing support for their machines, including replacement parts and computing services, until the completion of current contracts. Spare parts will be continued until 1977, when additional discussion with users may be entered into.

The reason given for the decision was that IBM felt its marketing effort could be better expended on a less specialized application, but the system had been under some criticism despite a generally good performance in the 15 states in which it operates, and this could have been a factor in IBM's decision. In future, the responsibility for the system will rest with the licensees, which currently number three: Data-Media in Dallas; Seiscor in Tulsa, and Voting Instrument Product Co. in Evanston, Illinois.

The reaction to the move from several rival automated voting systems is one of skepticism, that IBM will leave the field in name only. This might explain a report that a group of IBMers had formed Computer Elections, Inc., to market the Votomatic system. However, IBM says that this outfit is not a subsidiary and is not licensed to sell the product.

IBM had to endure yet another canard the night of the Los Angeles mayoralty primary. Asked to explain why he was running so far behind his chief contender, Councilman Tom Bradley, Mayor Sam Yorty explained, testily, "It's that IBM system's fault."

ACT USES INTERACTIVE T-S TO GET INTO THE ACT

An infant Northridge, Calif., firm is using a computer to speed the design and fabrication of digital test and control systems.

American Computer Technology, Inc., is hooked up to a time-shared 360/50 APL system, on which it has stored all of its standard circuits. The designer of a circuit assembly board keys into the system, identifying the integrated circuits to be used, and the computer comes back with wire and load lists and instructions for assemblers . . . plus a paper tape to control the automatic wire-wrap machine that will wire the back panels of special circuit boards, or flat plane assemblies.

The technique, claims ACT, allows significant cost and time reductions. They've quoted 30-day delivery of a computer simulator to one customer, claim they'll make it on time, at one-third the cost possible through conventional engineering design.

The flat plane assembly is of a special construction, containing up to six flat plane circuit boards, each with a capacity of 124 integrated circuits and a 1000-pin interface, plus power connector that allows for several different voltage levels in addition to Vcc (+5v) and ground. Discrete components may also be added to the planes.

Formed in January, 1969, the company now has 29 employees and a 9500-sq.-ft. plant, which contains newly acquired Falcon Industries, component sales and computer cable producer, which will be operated as a wholly-owned subsidiary.

Heading up ACT, which will pursue custom system contracts for test and production control and data acquisition systems, is Dr. John J. Szalay (Zuh'-lay), most recently president of Industrial Corp. of America. The company will also produce components, digital comparators and other instruments and subsystems.

Serving as general manager is Dr. Richard L. Petritz, noted LSI expert, who was formerly director of advanced technology at Texas Instruments. Chief technical advisor is Dr. John Salzer, formerly vp of technology and advanced planning for General Precision, Librascope.

Wallace W. Mingus is vp, engineering, and William McGhee vp, marketing. Both were most recently associated with Litton Industries Guidance and Control Division.

After its first three months of operation, the company had a backlog of over $3.5 million.

ACM CHAPTER LOOKS AT FATE OF OLD PROGRAMMERS

The San Fernando Valley Chapter of the ACM recently held a panel discussion entitled "Old Programmers Never Die; They Just Flow Away," which was advertised as a look at the fate of "old" programmers with five years or more experience, but turned out to be more of a discussion on what *should* be the fate of five-year programmers. Stuart Shaffer, SDC, who was program chairman, moderated the panel, whose members were Roger Mills, TRW; Bob Hooper, Compata; Gene Jacobs, SDC; and Frank Wagner, Informatics.

The format called for each of the panelists to present his views on the subject for ten minutes or so, then to discuss it among themselves, and then to answer questions from the floor. Roger Mills, considered to be the only active programmer among the panelists, led off. He wanted to know what a five-year programmer was: a programmer with five years of gradually expanding experience, or the kind he knew a lot of—a programmer who repeats his first year five times?

He said that if a programmer hasn't started his own company after five years, he'll have to find a way to move up and out of the manager's job he has, and that programmers should get into management because they are better able to understand edp problems and are able to recognize good programmers when they come along—rarely, according to Mills. He felt that configuration management also should be under the control of software, not hardware, people. He concluded by advocating that the ACM establish standards for apprentice, journeyman, and senior programmers.

Bob Hooper opened by asking for a show of hands by all those in the room with less than five years experience. Only two or three hands went up from 75 or so people present, and Hooper observed that the decision on what to do after five years had already been made by most of the audience. He disagreed with Mills that programmers should go inevitably into management. He thought that staff planning positions should be open to programmers, where they could be away from the on-line of fire and be responsible for long-range planning. He said that too many programmers are unaware of developments in the field and perhaps some of them should go back to school and find out what the universities are coming up with. He cited the increasing number of programmers who are absorbed into other ventures because they have become steeped in a particular application. In an attempt to establish the status of the programmer, he equated the occupation with the CPA and engineering professions in the technical and scientific field, but observed that the programmer isn't regarded as a professional because there is no official testing or licensing required to become one.

Gene Jacobs told the gathering that he had checked the want ads and couldn't find any help wanted ads for programmers with over five years experience—all of them asked for people with one or two or three years experience. Thus, he concluded, there was no demand for really experienced programmers. And so, what was an old programmer to do if he didn't want to go through a list of jobs beginning with aardvark breeding? First, he said, the programmer should figure out what he really wants to do, keeping in mind three factors in the selection: luck, personal inclinations and ability. In determining ability, he remarked, one should remember the auto driver survey that showed 87% of drivers to be above average in skill. Within programming, one had two choices: the generalist and the specialist (applications, systems). Being a JCL (Job Control Language) specialist offered infinite opportunity, he implied, because they are impossible to find.

Jacobs, one of the members of management on the panel, dwelt at small length on the difficulty of judging whether a programmer is good or not. Some, he said, write good, tight code but their production is slow; some write fast but their documentation is faulty; some write programs with flexibility, others do not. He closed with the opinion that what a manager thinks is good in a programmer is what is important to him, whether it's tight code, flexibility, speed, or getting along with the customer.

An armed Frank Wagner then rose to address the meeting. He uttered "After five years, what?" put a cap pistol to his temple and shot himself. Remarking on the role of the specialist, Wagner, a vp at Informatics, told of the programmer who had applied to him for a job and identified himself as a "clear and add" specialist with 10 years experience. In a serious vein, Wagner said that he thought the branch in the road for programmers comes not at the five-year point but at the ten. He averred that it takes five years to become a journeyman programmer and another five in design and then there are only two roads—to continue the technical career or take the high road to management. He felt that to continue on the technical course and perhaps one day earn the respect of being a grand old man of programming and a leader in the field wouldn't mean much after a while.

On the other hand, there are two things that attract a man to management: money, of course, but far greater than that, Wagner said, is that only in management is there the power to change things. Some executives use it venally, some constructively, but in any case, the power to change things to the way one thinks they ought to be is an almost irresistible attraction. It's hard he said, for a technical man to leave technical pursuits behind, but once the choice is made to go into management, it's irrevocable. The power is too satisfying.

In his talk, Wagner had defined supervision as seeing to it that subordinates do their individual jobs properly. Mills responded to this by asking Wagner when he had ever checked code at North American (where the two men had once been associated). Wagner said he wasn't a supervisor at North American, to which Mills replied "I knew that but I didn't think you did."

A question from the floor related to the position of the person who has made a "side door" entrance into programming from his previous occupation—physics, perhaps—and wanted to return after five years only to find that the field has passed him by, that he couldn't compete with the new knowledge. There was no really constructive advice on this from the panel, although Jacobs was heard to suggest aardvark breeding. Frank Wagner did offer one sound bit of advice to programmers who wanted to go on programming. He said that they need not only the ability to organize their thoughts well, but the ability to make an effective presentation of the resulting programs. This idea did not meet with wild ac-

claim.

A final question had to do with the recurring theme of whether a programmer is a professional, and with that, moderator Shaffer adjourned the meeting with the comment that professionalism could very well be the subject of an entire meeting at a later date, an idea met with mild acclaim.

SCHOOL EDP COSTS RISE AS DISCOUNT HELP DECLINES

Educational discounts will cover only about 15% of computing costs at U.S. colleges and universities this year, versus an estimated 27% in '65, a subcommittee of the House Science and Astronautics Committee was told last month. The statistics were presented by Dr. Milton Rose, head of the Office of Computing Activities, a constituent of the National Science Foundation; OCA provides federal aid to campus computer users.

Dr. Rose didn't elaborate on the reduction in educational discounts, but other sources indicated that it stems chiefly from IBM's troubles with the Justice Department, DPF&G, and CDC. All three have charged that the discounts constitute unfair competition.

Dr. Rose estimated that expenditures for general- and special-purpose computing activities at college and university campuses will total about $263 million in FY'69. Users will supply about 54% of this total, while the government and private sources (including equipment makers) will each supply 23%. Dr. Rose presented estimates for earlier years which suggest that campus computing activity expenditures are growing roughly $20 million/year.

OCA has asked Congress for $11 million to support college and university edp projects, plus an equal amount for related educational and research work. This is roughly equal to the funding provided in FY'68, when 42 grants for computing facilities support were awarded, plus 131 for education and research.

Dr. Rose added that a "representative central-site computer system costs $75-500K at a college; $400K -2 million at a small university; $2-5 million at a large university, and $5-15 million at a multi-university. A computer dedicated to a department's or research facility's exclusive use costs $10K-3 million.

OCA hopes to get more money for research into computer-assisted instruction, by working out a coordinated program with other federal agencies, said Dr. Rose. He indicated that support of regional computing facilities would be another big effort for the coming year. So far, 57 grants have been awarded for these facilities. They encompass eight universities, 82 colleges, and 23 secondary schools in 25 states.

NSF's other major computer-related activity involves the support of science information systems. About $14 million was invested in this program in FY'68, and $11 million will be spent during the current fiscal year. For FY'70, $13 million has been requested.

Some of the money will be spent on further development of information systems designed to serve physicists, astronomers, psychologists, and linguists. All of these efforts have just gotten started. Meanwhile, work on an NSF-assisted information system for chemists and chemical engineers is well underway; by 1971, this facility—developed jointly with the American Chemical Society—is expected to begin offering computer-generated chemical abstracts and indexes; by 1974, according to present plans, several ACS journals will be computer-produced and a worldwide input/output network for accessing chemical abstracts should be operational.

Related activities include the development of university-centered information systems and "national systems planning" studies.

One university-centered system, at Stanford, is now being developed. Known as SPIRES (Stanford Physics Information Retrieval System), it will serve both academic and industrial researchers and include inputs from industry, university, government, and foreign sources. NSF has asked Congress for $800K in FY'70 to support its university-centered information system program.

Another $1 million has been asked for national systems planning activities. Much of this money will go into definition studies of a nationwide information network capable of interconnecting all of the existing systems operated by government, academic, industry, and professional groups. NSF's program is directed at "developing design criteria, technical requirements, and minimum compatibility standards; developing means for assessing the value and cost of alternative information systems; identifying overlap and gaps in coverage . . . (developing) new means for information storage, retrieval, and dissemination . . . " Congressman Roman Pucinski of Illinois has introduced legislation which would implement the network with funds appropriated under the National Defense Education Act (see April '69 Washington Report).

As part of this national systems planning activity, NSF supports studies of long-term science information problems. They range from "fundamental research to sophisticated hardware utilization studies, and include programming, planning, and development of experimental prototype services aimed at advancing the state of the art or exploiting innovative technology. A good example is Project Intrex at MIT, which involves remote access to a computer-stored catalog that provides more that the usual amount of information available from such a source. The information is obtained in the course of a conversation between the user and the computer, designed to remove ambiguities from his request.

NSF plans to spend $300K in FY '70 to support individual research projects related to information processing. Another $600K is earmarked for two research centers, at Ohio State Univ. and Georgia Institute of Technology. Individual research supported in the past includes studies aimed at determining the nature of scientific and engineering needs for information, experiments in computerized indexing, and development of criteria for evaluating document retrieval systems.

GOVERNMENT WANTS TO KNOW WHAT YOU WANT TO KNOW

The Federal Government is concerned about the effectiveness of its dissemination of technical information within the Government and to the public at large, and COSATI, the Committee on Scientific and Technical Information of the Federal Council on Science and Technology, has formed a task force to evaluate data dissemination practices and policies and to recommend improvements. The group is interested in receiving opinions on the adequacy of the current operation, and criticism and suggestions concerning any difficulties or lapses that have been encountered. Contributors' identity will not be disclosed without permission, and a brief summary of the responses can be obtained on request. If interested, send replies to: Currie S. Downie, Chairman, Task Group on Dissemination of Information, Committee on Scientific and Technical Information, Office of Aerospace Research, 1400 Wilson Boulevard, Arlington, Va. 22209.

EDS JOLTS COLLINS WITH PROPOSAL FOR STOCK SWAP

Small but sure-footed Electronic Data Systems shook up Collins Radio last

(Continued on page 145)

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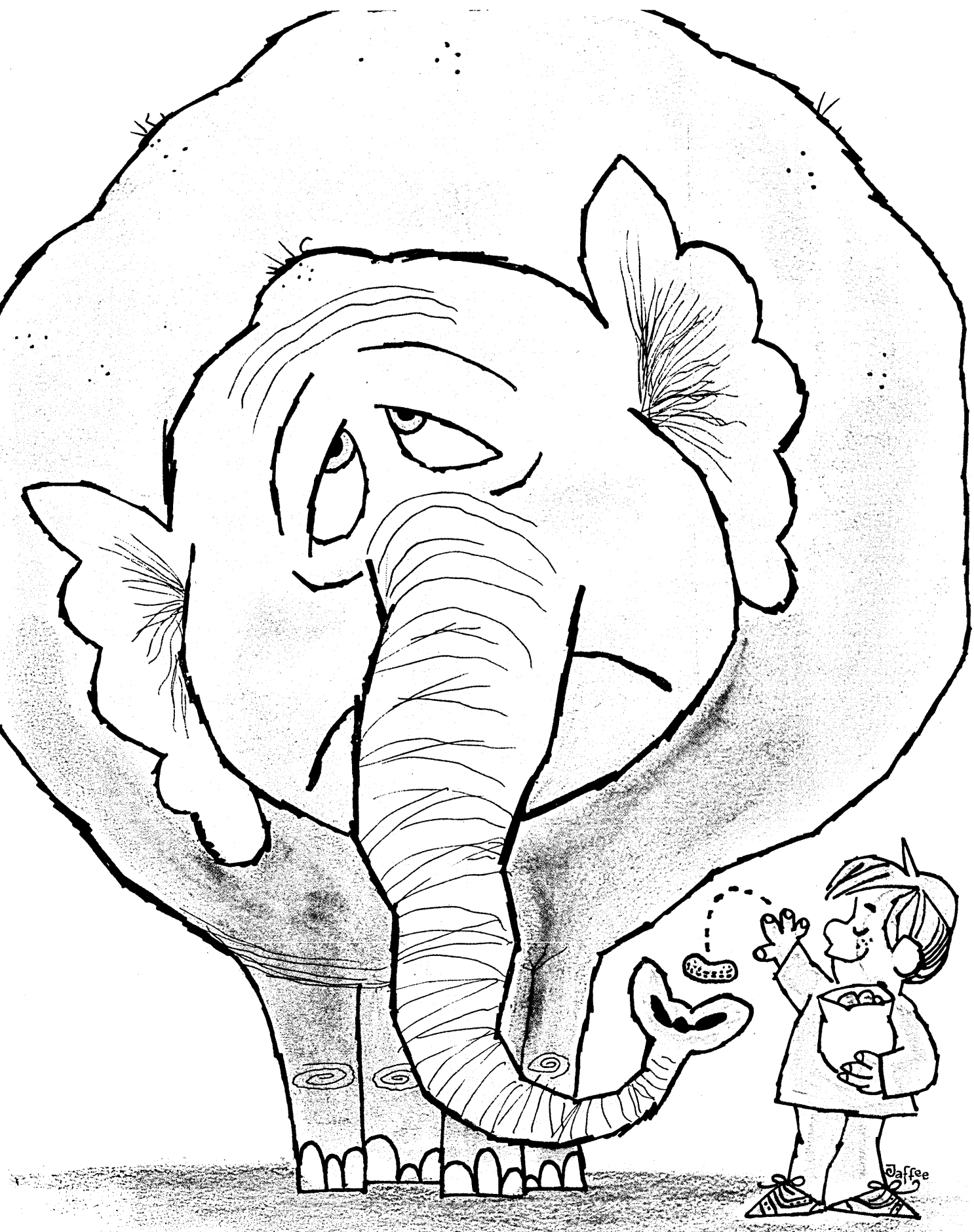
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Elephants aren't really wild about peanuts. Little boys will tell you otherwise, but a four-ton elephant can't get too excited about a quarter-ounce peanut. He's made for bigger things. □ So is a high-speed central processor. It has a big appetite made for big meals. The kind it gets from the INFOREX Intelligent Key-Entry System. □ INFOREX gathers data from eight keyboards into one buffer. It sight verifies and key verifies. Built-in logic performs check digits, left-zeros and balance totaling. Then, it pools completed jobs on 7 or 9-track compatible tape. Optionally, it will operate on-line directly to your central processor. □ It sounds expensive. But confidentially, you can have one for peanuts.

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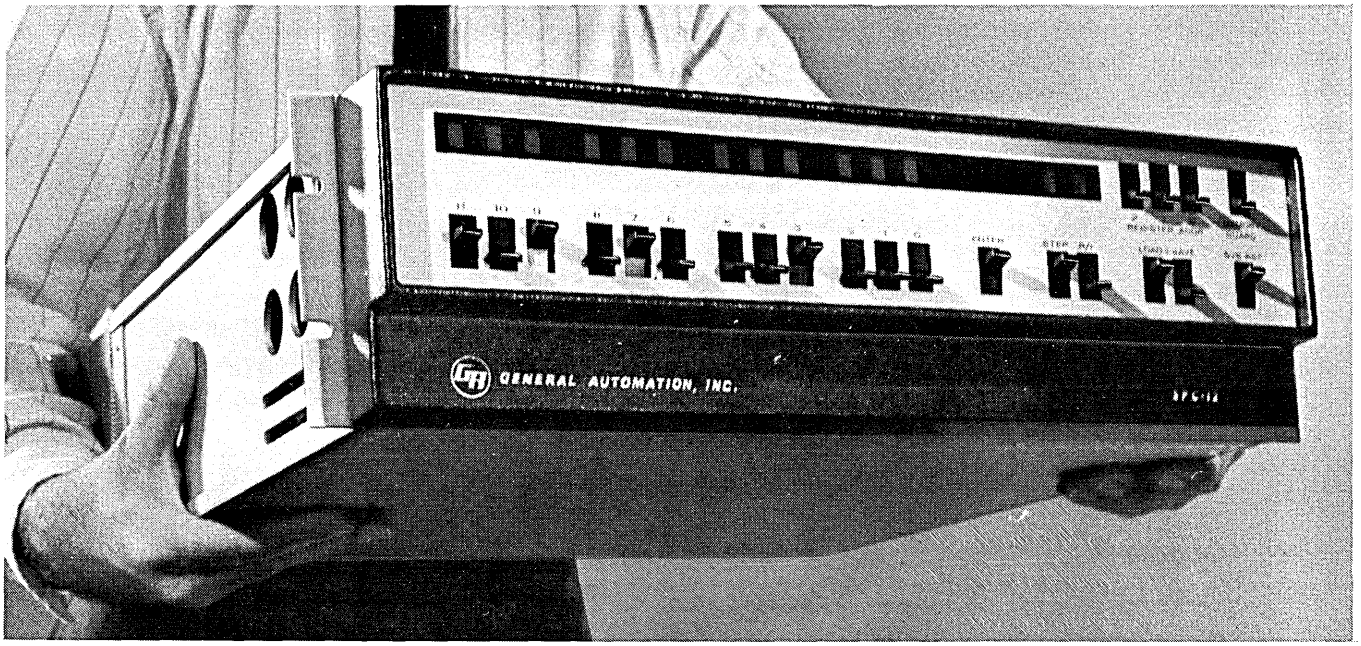

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month with the calm announcement that EDS planned to make a tender offer for about half of Collins' outstanding stock.

Take-over bids are nothing new these days. But in this case it's the minnow threatening to swallow the whale. EDS has 400 people; Collins has about 23,000. EDS revenue for the latest six months was $5.1 million; Collins' was about $195 million. On the other hand, EDS earnings have been growing furiously while Collins' have been from level to down lately.

Before making the announcement of the pending tender offer, EDS had quietly acquired 75,000 Collins shares. Now it hopes to get at least 1,438,388 more—which would result in a total of at least 51% of the stock. And EDS is willing to accept up to some 2.4 million shares if the holders are interested. Timing of the offer depends on SEC processing of the EDS filing. Terms are $65 worth of EDS stock for each share of Collins—but not to exceed one and a half shares of EDS. Market prices for the two in early April: Collins in the low 60's and EDS in the high 40's.

Within a few days after announcement of the upcoming offer, cries of rage and distress emanated from Collins. In a letter to Collins shareholders, the company warned of every conceivable kind of disaster ahead if the offer is successful—including dilution of earnings, "significant questions" under the antitrust laws, and so forth. More important, the company indicated that "more than 10" other companies were interested in some sort of move to help Collins. Some companies rumored to be among this number are Burroughs, Control Data, and University Computing.

DPF&G GOES INTO HARDWARE BUSINESS

Data Processing Financial & General has bought into Berkeley Computer Corp., of Berkeley, Calif., a recently organized manufacturer of large-scale time-shared computer systems. DPF&G purchased $100K of the small (35-man so far) firm under a debenture agreement amounting to one-half of BCC's common stock, and has agreed to pick up the tab from time to time for a total of $2 million. Actually, DPF&G is following up on a sizable investment made previously by the government.

It seems that the president of BCC, Dr. Melvin W. Pirtle, and much of the 35-man staff were involved in the GENIE project at the Univ. of Calif. at Berkeley. GENIE was funded by ARPA (Advanced Research Projects Agency of the Office of the Sec. of Defense) and is primarily a study in time-sharing. This group once bought a Scientific Data Systems 930 computer and designed some alterations to it for time-sharing. The resultant Berkeley t-s system was impressive enough for SDS to incorporate into the 940 system. Having done their good deed, the GENIE engineers continued to develop their time-sharing philosophy. Apparently, not everyone was willing to continue in this largely esthetic occupation. Exit Dr. Pirtle and friends.

One of GENIE's ideas is going to be tried in the marketplace. Berkeley Computer, which also includes Dr. Jesse T. Quatse, Dr. W. Wayne Lichtenberger, Dr. Butler W. Lampson, and Mr. L. Peter Deutsch, plans to have the expression of that idea ready to be sold in the first quarter of '70. Although the firm is understandably quiet about the system, it is known that the design specs call for servicing up to 500 simultaneous users with a response time of less than 2 sec, and that the architecture calls for multiple processors—some actually hard-wired controllers. Many of the system components will be supplied by outside vendors, including core stacks (Ampex) and rotating memory system (Bryant). The cpu is theirs; it is not to be similar to anything now going, but will have an operating mode that will allow for SDS 940-compatible instruction processing. The controllers are also to be produced by the firm.

Also to be included in the new offering will be an operating system, an assembly language and compilers. Even with the $2 million financing from DPF&G, most of which is earmarked for the purchase of compo-

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nents, this whole idea is a mighty big undertaking for a small firm. And they might just pull it off.

CENSUS HEARINGS RAISE PRIVACY ISSUE

Census Bureau Director A. Ross Eckler, whose enumerators are regarded by some citizens as Peeping Toms, defended his operation again last month—this time before a House GovOps subcommittee.

The data produced by census questionnaires is needed to carry out government programs, said Dr. Eckler. "To the best of my knowledge, we have never included a question simply because it is important for marketing purposes." Individual answers remain confidential so individual privacy is fully protected.

None of this was particularly new; nevertheless, the hearing was significant. It took place because more than 50 separate (and largely similar) bills have been introduced this session, aimed at limiting the number of census questions. Another indication of current public sentiment is a survey mentioned at the hearing. It was taken by Congressman William V. Scott, a member of the subcommittee, in his district, and indicates that a sizable majority believes census questionnaires should be shortened.

The GovOps subcommittee, headed by Congressman Charles Wilson of California, plans a number of subsequent hearings; most of these will be held outside Washington. In his opening statement, Wilson discounted the alleged threat to personal privacy posed by census questionnaires. "Much of the outcry appears to have been deliberately fomented through . . . news releases designed to . . . play upon our natural fears of 'Big Brother'." But Wilson added that "I, myself, have formed no opinions. My objective is to obtain the facts."

Other members of the subcommittee were more critical. Congressman Jerome R. Waldie complained that census questionnaires are "shortchanging the quality of American life." His basic point was that there is too much emphasis on the economic and quantitative aspects, and too little on the social and qualitative. "You do not sell (public) education . . . you sell housing. That may very well explain the emphasis upon housing (questions in the census) and the de-emphasis on education, health, and employment."

Dr. Eckler devoted much of his testimony to denying that commercial interests control census questions. The subcommittee shortly may be able to judge this influence for itself. The Census Bureau director promised to supply information on the advisory groups who help his agency evaluate proposed questions.

Dr. Eckler offered his critics at least a piece of an olive branch when he said that, given a choice between a voluntary questionnaire and a mandatory questionnaire that could not be expanded without specific Congressional approval, he's take the latter. The basic disagreement remains, however. Critics want not only future questions controlled but present questions reduced.

The Census Bureau director was particularly adamant about changing the 1970 questionnaire, which is now about ready to go to press. Reducing the number of queries would delay the whole project at least a year, he said. Making them voluntary instead of mandatory would produce a like delay because of changes required in the wording and format of questionnaires, and in organization of the census enumeration.

MONTREAL UNIV. COUNTS COMPUTER CENTER LOSSES

Two months later, people at Sir George Williams Univ., Montreal, are still contemplating the wreckage wrought by the sit-in which culminated in vandalism and fire destruction of the entire computer center and most of its contents, and are trying to figure where things stand.

Several decisions have been made regarding the computer facilities as a result of the lessons learned during the dismal inventory following the violence. A new center is being built in an office building nearby but away from the center of the campus; the cost will be $100K, including air conditioning. There is no intention of having a center in the administration building again. When the new center is opened, it will be accessible only to the operating staff. All student input will be by terminals from campus (two CDC 200's and 25 teletypewriters). The new center will be guarded by security police around the clock. Henceforth, all tapes will be duplicated, some to be stored in bank vaults and some to be deployed at various campus sites. The replacement CDC3300 will be in the center by June but software will not be ready before September. No determination has been made about replacing the IBM 1620 at present; this has secondary priority.

Damage thus far known includes

$900K to the administration building's ninth floor computer center, the CDC 3300 and all peripherals, which will be replaced at a cost of $1,290K, and the loss of the IBM 1620—which had cost $125K. Also lost is the revenue of from $8K-$10K monthly received from outside companies for service bureau work done. It is unknown how much of this will be available again to the university, for although some companies say they will wait, it is presumed that they will need dp services before the center is ready again in the fall.

Losses less readily calculable include the research work done by the faculty. For those who had documented their work or whose efforts are on some saved tapes, there will be inestimable time spent in reconstruction. One project seems to be in deep trouble as everything the professor had done went out the windows on cards and tape . . . halfway through a five year project under a $50K grant. Administrative applications, which constituted only 20% of the center's work, are being handled by a manual system; however, the university records will need reconstructing from August 1968 when they were last microfilmed for storage elsewhere.

The invaders who had barricaded themselves in the center threw out of the windows all the card decks and mag tape they could find. Some tapes were overlooked because they were stored in a closet in the rear of the 3300 room. Fortunately, the air conditioning vents nearby kept the temperature to about 140° so the heat did not destroy these tapes. Prof. Graham Martin, center director, estimates that about 75% of these tapes may be usable, although they have not yet been all tested. Prof. Martin also credits the quick action of the firefighters, who took only about 15 minutes to put out the fire, once they pushed barricades aside, in preventing even worse damage.

Disc packs in the 1620 room were completely melted, all 20 a total loss. Of the 25 disc packs used with the 3300, about four-fifths were lost; the five or so that were saved were the most active and contain the operating system, said Prof. Martin. Some of the 3300 disc packs had been damaged by being beaten with heavy instruments.

The intangibles are difficult to even estimate—how does one estimate the value to students of hands-on use of the 1620, lost since January 29th for hundreds of computer science students; there is no telling when another hands-on computer will be available in the near future. And the time needed on the computer for faculty research that is not now available. And the time lost by faculty and students as turmoil

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diverted attention from studying and classroom meetings were disrupted.

There is as yet no decision about the insurance the university will be able to collect. Separate policies were kept on the building and on the computer equipment. The decision may depend on whether the activism will be judged a riot or insurrection, against which the policies carry no protection (they cover fire, water, wind and vandalism). The computer equipment had been bought by funds budgeted for the administration building, half paid for privately and half subsidized by the provincial government. Sir George is a private university; Canada does not have the state universities we know in the United States; however, the state does provide some subsidies.

Control Data people contacted after the fire were soon on the scene and they described it as a discouraging one. Water stood in the computer room to a depth of over a foot; machines had been bludgeoned so that the covers were cut or broken, components pulled out, and wires chopped. At a court hearing later, a CDC representative testified that the 3300 had been in use less than two years out of a useful life that probably would have exceeded 10 years, but that the damage was so great that trying to repair the machine would cost more than to replace it with another.

EARTHQUAKE TO DESTROY CALIF. LAST MONTH, RIGHT?

"Where can we go when there's no San Francisco? Better get ready to tie up the boat in Idaho."

As this is written, in April, the State of California is under a pall of apprehension as it awaits imminent destruction by an earthquake predicted by a varied collection of soothsayers, astrologers, religionists, and charlatans. But we fearlessly predict that when you read this, you won't have a sinking feeling about California.

In support of this contention, Dr. Stewart W. Smith, of the California Institute of Technology, and Dr. William J. van de Lindt, of IBM's Los Angeles Scientific Center, applied their earthquake forecasting technique, which utilizes a 360/65 to chart strain patterns along a particular fault, to the San Andreas Fault in Southern California, the cause of most of the earthshaking developments in the area. They calculated that the magnitude 6.3 quake at Santa Barbara in 1925 and the 7.7 temblor in Kern County in 1952 have significantly decreased the amount of strain in the rock patterns along the fault, indicating that there is less chance than had been feared of a major earthquake in the region.

The research covered 31 earthquakes ranging from magnitude 6.1 to 7.8 and dating back to 1812 (Richter values were assigned the older quakes based on the number of miles ruptured along the fault). Data on each quake was given the computer, along with a mathematical model representing the geologic features and elastic properties of the earth along the fault. The 360/65 simulated each occurrence and produced strain patterns showing the buildup or relief of strain in various locations, enabling Smith and van de Lindt to make "broadbrush" conclusions regarding the unlikelihood of a massive earth movement in California, "although the data do not completely rule out the chance . . . "

Did it happen?

WORLD'S LARGEST CONTRACT SIGNED FOR MOS/LSI

Building circuits from MOS/LSI (metal - oxide - semiconductor/large scale integration) devices is still an expensive undertaking, and is not often attempted unless the product design is extremely stable and mass production quantities are involved.

Such is the case with the Japanese QT-8D calculator. Its manufacturer, Hayakawa Electric Co., Ltd., of Osaka, Japan, plans production quantities of 50,000 units per month by 1970. The QT-8D (Japanese joke: QT stands for "cutie") is an 8-digit, three-pound 5 x 2 x 10-inch device which is capable of multiplication and division, has a full-floating decimal point, an underflow system for rounding off, and automatic credit balance. The 8D performs four arithmetic operations within .3 seconds, has four functional keys plus 10 numerics and decimal.

Its sales specs seem to indicate a much larger machine; that's where the MOS/LSI comes in. The 8D, to be marketed in the U.S. under the trade name of Sharp, contains five LSI devices about 160 mils square (.16 inch compared to the more customary 80 mils) which act as the equivalent of some 3-5,000 transistors.

The circuit chips are produced by Autonetics, of North American Rockwell, in their Anaheim, Calif., facility. Deliveries of the LSI components will reach a high of 160,000 per month; the $30 million contract calls for deliveries through January, 1971, after which time Hayakawa will be on its own with production facilities constructed under a licensing agreement with Autonetics. Autonetics, already

an impressive contender in microminiature circuitry, plans to be a big name in the field. The firm hopes for 20% of the MOS market by 1973—a market they peg at $300 million. In addition, they want to do a total electronics business of $1 billion that year. Some of their other projects include, in addition to the calculator, the entertainment and passenger service multiplexing equipment for the Boeing 747, and information systems for the FAA.

A CPU IN EVERY BRIEFCASE

Many individual soothsayers lost much of their charisma when California refused to slide into the sea on command in April, but playing the game "what does the future hold" is still stimulating, especially in the dp field. Parsons & Williams, a Copenhagen, Denmark, firm, ventures periodically into "futures" in a more dignified and valid manner than do the forecasters that gain the publicity, and perhaps for that reason the resulting predictions are more notable. Recently the firm published a report on the replies to questionnaires it had circulated to professional dp people who attended the FILE 68 conference, an international seminar held on file organization in Denmark last November. About 200 attendees returned questionnaires which listed expected computer developments and asked for the individual's guesses for the dates of their general acceptance.

The fruits of their research are contained in a booklet entitled "Forecast 1968-2000 of Computer Developments and Applications," available for $12.50 from Parsons & Williams' Los Angeles address, 625 South Kingsley Drive. Some of the predictions: a 50% reduction of the labor force in major industries due to automation (1984); instruction at home through terminals (1989); obsolescence of book libraries (1992); widespread use of automobile autopilots (1995); and computers as common as telephones in private homes (1998).

A second series of consensus-of-opinion predictions involved computer technology: majority of software built into the hardware (1978); oral input to the computer (1979); cards and paper tapes no longer used as a medium (1981); computers learning from experience (1984); and computer price decrease by a factor of 100 (1989 . . . there was a large spread of replies on this one, anywhere from 1983 to 1997).

One fault that P&W thought existed in the tabulations was that only a small percentage of replies came from the U.S., the source expected to produce many of these developments. Could be that less rosy predictions would have been made by the people expected to produce the results.

HOW TO FIGURE OUT HOW TO TELL THE TRUTH

When the much-heralded "truth-in-lending" law goes into effect in July, the vendor will have Excedrin headache Regulation Z. This 61-page document will tell him what he has to disclose to his customers who buy on installment. Decision Analytics, Inc., new Pearl River, N.Y., firm is putting together a package of conversational software programs and manuals that will help him figure out what he has to tell customers and how to compute the interest rates. David Lundberg and Jack Tauber comprise DA, and were formerly research associates with the American Bankers Assn. research group, APT.

The software package, now being developed on an SDS 940, is written in standard FORTRAN and will be available for most systems at $3,000-$4,000. This will include the software, a manual and a syllabus for a workshop on the requirements of the law and what the package will do. DA is debating whether to offer the package to banks on a franchise basis so that they can service vendors or to distribute it generally. In case of the former, the price will increase.

Another package, which will be sold to banks and other lenders, is a conversational "commercial loan analyser", which will permit the bank to tailor commercial loans to the needs of the borrower.

NEED MORE SPACE? SELL YOUR TAPE LIBRARY

MACS Computer Accessories, Inc., subsidiary of 17-man Management and Computer Services Inc., Philadelphia, has begun the leasing and rental of magnetic tapes. The pitch is that MACS will buy a firm's entire library of tapes, then lease them back on a three-year basis, providing two cleanings and one complete recertification per year. Cost is a nominal $1 per tape per month. MACS pays a cash price for the tapes, which is negotiable depending on condition and quantity.

And should the user run short of tapes during a seasonal fluctuation in demand, he can rent more reels at a slightly higher charge on a monthly basis, but with no maintenance. Tapes

are furnished in certified condition and are "guaranteed to perform efficiently" or be replaced.

MACS is now doing most business in the Philadelphia area, where it keeps a full time employee at one large user tape library, continually cleaning tapes. The firm is also providing tapes by mail to a firm in Illinois, and is willing to negotiate leases which do not include maintenance. Plans call for beginning to establish branch offices in other areas next year.

Other MACS interests are the marketing of a private label tape, a separate cleaning and recertification service, sale of continuous forms, labels, ribbons, raised flooring, and additional products for use in computer rooms.

INFORMATION INDUSTRIES WILL CHOOSE NEW NAME

A six-month-old Los Angeles firm, first named Information Industries, Inc., may soon be taking on a new name due to conflict with another firm with much the same title. So that a good deal of publicity is not lost on a corporate image being built for III, the new firm name may end up as Intranet Industries, Inc. (barring further conflicts, of course).

III will be involved in time-sharing in three ways. First, they are opening a t-s service bureau in El Segundo, Calif., built around a Univac 1108 with an SCC 4700 front end. The user sites in the network will also have Scientific Computing Corp. DCT 32 and DCT 132 terminals. Second, III is engaged in producing a time-sharing operating supervisor for the SCC 6700, with conversational FORTRAN, maybe COBOL, a data management package, an editing package, and provisions for the later additions of batch compilers. (This was once part of the GENIE project at the Univ. of Calif. at Berkeley. It was to be a money-making byproduct of the GENIE government-funded research into time-sharing systems.) Third area of t-s concern for III is in hardware. They will be evaluating available hardware, designing hardware/software systems, and maybe even manufacturing terminal gear on a limited basis.

To continue with the name-dropping game a bit, III has many members once affiliated with Computer Sciences Corp., including III president Arthur Speckhard, who was CSC's director of operations for the Northwest. James Halverson (vp finance and administration) and Tom Wood (technical vp.) were also of CSC. John Barrett (marketing director) is an ex-University Computing Corp. man. Many of the staff were once with Digitek's compiler group.

BUT WILL THEY MAKE HOUSE CALLS?

Experimental on-line acquisition, in Montreal, of medical records stored in a Stockholm, Sweden, hospital has been announced. The two institutions involved were the Clinique Universitaire de Sherbrooke in Quebec and the Danderyd Hospital in Stockholm. The equipment included a Univac 494 system in Sweden, normal 600-baud telephone lines (using the Atlantic cable), and Uniscope 300 display terminals in Montreal.

In the Danderyd Hospital files are more than 1,500,000 medical histories, including such information as in-patient and out-patient visits, X-ray data, blood type, allergies, etc. The data is referenced through the identification number assigned to every Swedish citizen, and stored in a three-level chain. Depending on the authorization level of the person inquiring, progressively more detailed information can be released. Given the necessary authorization, doctors or hospital personnel within the Danderyd Hospital or, as was shown, thousands of miles away from the hospital can access any of the million and a half personal files.

In earlier demonstrations, using voice-grade unleased lines, data was transmitted, in a conversational mode, to Portsmouth, England, Frankfurt, Germany, and Rome. The benefits of such information sharing are obvious; the dangers of invasion of personal privacy are also apparent, and perhaps this kind of system requires a socialized medicine environment to operate. In any case it has been proven that the specialist who treats you need only be as near as your phone, but it looks bad for house calls.

time-sharing segments . . .

FINANCIAL SERVICES ON A 67 RESULT FROM MERGER

With the confusing proliferation of companies with sound-alike names, the brief announcement a few months ago that Interactive Data Services and Computer Communications Center had merged into Interactive Data Corp. passed by relatively unnoticed, sounding like little more than two synonyms in search of a compromise. But actually, CCC, never formally announced, was the second in a growing number of commercial IBM 360/67 time-sharing services. Its leaders were Jack Arnow and others from Lincoln Laboratory who had helped develop the IBM/Lincoln Lab operating system for the 67, CP/CMS.

The other half, Interactive Data Services, was a division of White, Weld & Co., which began offering on-line financial services on SDS 940's in 1967, and had built up a stable of 30 clients from the banking, insurance, and mutual fund communities. Next month, all of these accounts will transfer from New York to the model 67 at the Waltham, Mass., headquarters of Interactive Data Corp.

IDS was the long-awaited brainchild of White, Weld partner, 34-year-old Joseph Gal, who is now board chairman and executive officer of the new IDC. Arnow is president. The financial services, called Analystics, are aimed at securities analysis, portfolio management, and operations research. It includes the interactive First Financial Language, which will permit the non-programmer user, after about 10 hours of training, to query and manipulate a data base containing 20 years of annual financial reports on 1800 companies and daily stock market information on 4500 companies. Applications programs are also available for remote batch processing.

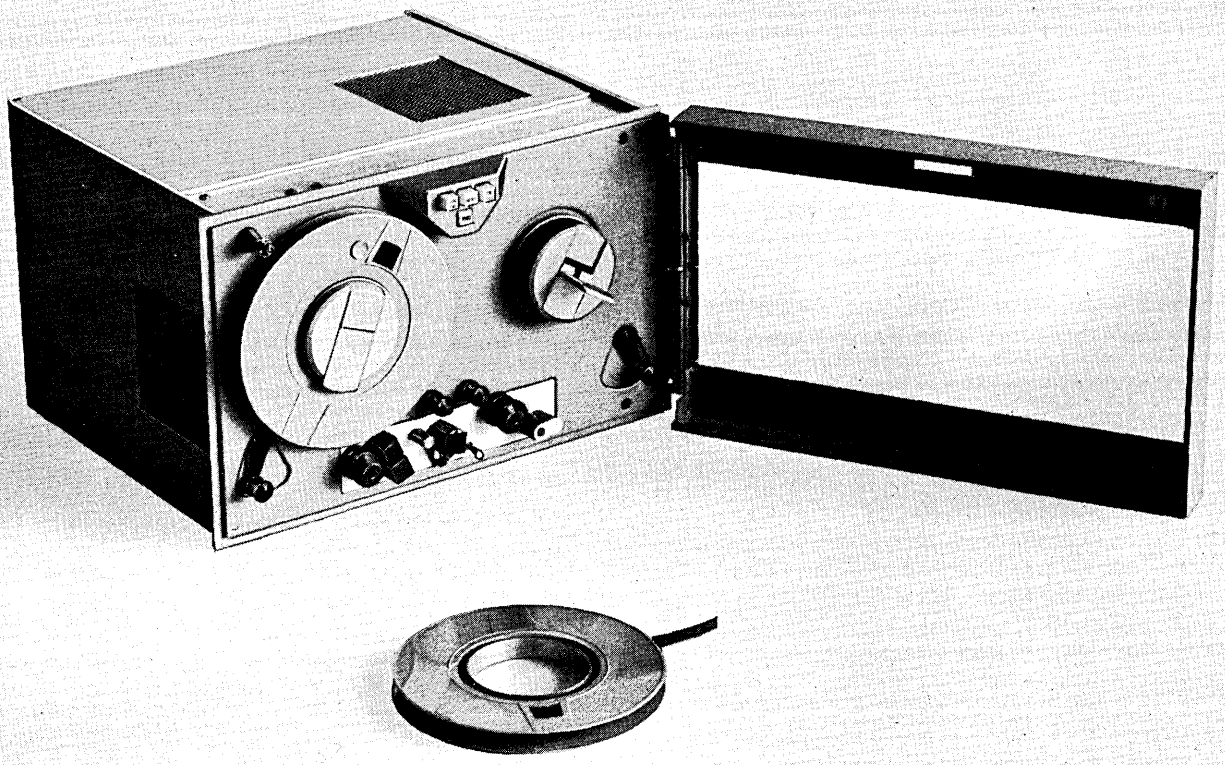
"About a dozen" customers are already using the system for scientific and engineering applications. Services extend around the nation, with concentrators installed in New York, Los Angeles, San Francisco and Chicago. The 512K-byte model 67 (offering up to 1 million bytes under the "virtual machine" concept) comes with software that includes the operating system, extensively modified for data base handling and called Executive System and Control System. FORTRAN, CAL, BASIC, COBOL, SNOBOL, DYNAMO, text editor, and context editor are used. OS/360 and available compilers can also be loaded into the system so that the user can essentially use it as a "virtual" 360/65 (or other models) from his console.

Costs include $13/hour for connect time ($8 for 6 p.m. to midnight), $1,000/hour for cpu time, $25/month for on-line 2314 disc storage of 120K-bytes, plus other fees. Terminals available include mod 33 and 35 Teletypes, and Selectric-type terminals. Peripherals on the system include two 2314's (400 megabytes), two high speed printers, 8 tape drives, 2703 transmission control, and two 2301 drums. Currently, it will handle 30 users simultaneously, expected to be doubled this year.

(Continued on page 153)

the second revolution in computer time sharing begins NOW...

CIRCLE 74 ON READER CARD



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CIRCLE 75 ON READER CARD

news briefs

IBM LINKS DATA CENTERS INTO CANADIAN NETWORK

IBM is in the process of providing high-speed communications links between its 23 data centers stretching across Canada. Centers in Vancouver, Edmonton, Calgary, Regina, Sheridan Park, Toronto, Montreal, and St. John are now included in the network, which provides links to the 360/65 systems in Toronto, Calgary, and Montreal. Smaller computers such as the 1130 and 360/20, plus 1978 terminals, are utilized in the remaining 20 data centers for small jobs, while users will now be connected to one of the Model 65's for larger requirements. Customers will be charged for processing time and line costs, in addition to terminal charges.

IBM's entire Canadian program library will now be available at any of the centers in the network, whereas previously many of the programs could not be run because they required use of a Model 65. Each of the data centers will also be able to transmit and receive punched card information. A user with a terminal in his office will be able to transmit punched card data to any of the data centers for processing, or transmit information from IBM centers to his firm's headquarters. Customers with terminals will pay their own carrier charges while data transmitted from IBM location to IBM location will have a pricing structure based on volume transmitted as well as carrier charges.

FIRM AIMS T-S SERVICES AT SPECIFIC INDUSTRIES

One-year-old Cambridge Computer Corp., with offices in New York, Los Angeles, and San Mateo, Calif., is offering data processing services for four specific industries, rather than generalized services to all industries. The four fields are grocery, drug, state and local government, and medical. The firm maintains a professional staff of thirty, mostly IBM alumni, with individuals specializing in the four activities. Services provided include consultation and planning, facilities management, software packages, and education of personnel.

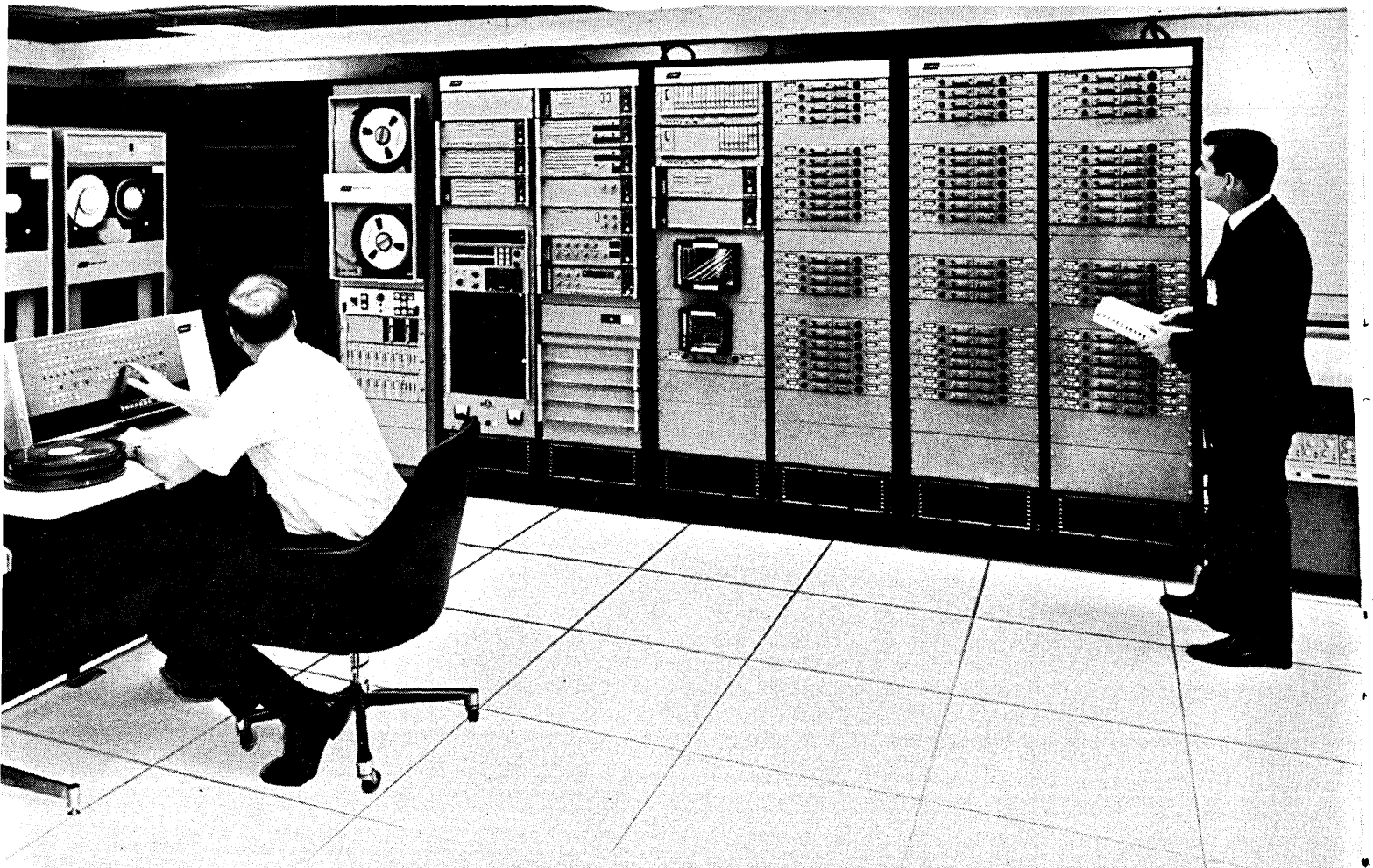
This month the firm will begin a service for pharmaceutical manufacturers under a contract with Distribution Data, Inc., a subsidiary of the National Wholesale Druggists Association, to collect and process sales data from wholesale druggists. This information will then be sold to pharmaceutical manufacturers by Distribution Data, in the form of monthly reports. The data is expected to be "invaluable to the manufacturer in formulating marketing and information plans and in enabling him to better direct the marketing efforts of his detail men." Hardware used is an IBM 360/30 in San Mateo. Cambridge expects to process more than a million invoice lines per month. The initial operation will concentrate on drug sales in California involving more than 60 drug wholesalers, who will make regular reports on product movement.

APL USED IN ANOTHER TIME-SHARING SERVICE

Convinced that APL will "in five to 10 years" supplant all other programming languages as the major language in use —and that IBM is throwing more and more weight behind it, 12-year computing veteran Karl Korn has started an APL-based time-sharing service. APL-Manhattan, a division of the new Industrial Control Systems, Inc., will begin this June, using an IBM 360/50. It follows close behind a similar effort by The Marquardt Corp. in Van Nuys, Calif.

The initial emphasis will be on interactive APL program development and engineering and scientific applications. But Korn feels APL is a general purpose language which surpasses any current language in ease of use and speed of programming, implying future plans to expand markets—if the user can be weaned away from current languages. ("APL is to FORTRAN as FORTRAN is to Assembly language," he says.) Further, it is designed in its entirety to be an interactive language, unlike all the others. Most particularly, the "conciseness, machine independence, character manipulation capabilities, frequent elimination of the need for looping," and other qualities make APL a preferable language for large, constantly changing projects, such as production planning and control. The parent company, ICS, intends to do contract programming in APL for such projects.

ICS expects to have 12 people in time-sharing and programming next month. Korn, president, and James Lamb, vice president, were formerly with Western Electric Engineering Research Center in Princeton, where they spent the last three years studying computer languages, and, most particularly, APL, under a research agreement with IBM. Korn claims that APL, developed by IBM's Kenneth Iverson and Falkoff, is reported to be the "fastest-growing time-sharing language" in IBM, and is being used on systems ranging from the 360/67 and 50 down



4 BILLION BITS IN ONE WEEKEND!

You can generate over 4 billion bits if you process 31 one-hour tapes with 80 channels of analog flight-test data per tape and encode it at 5 samples/cycle into 12-bit words.

You can accomplish this over the weekend if you have an EMR ADVANCE computer with an EMR telemetry front-end.

This system was designed for Lockheed to preprocess flight test data from the Air Force C-5 Galaxy. It is so successful that now the system is being used to process data from other Air Force test planes as well — over the weekend, of course. It can be done because the EMR computer sets up and calibrates the telemetry hardware, automatically switches from one tape to another, scales data, corrects wild points, and "talks" to the operator about tape status, errors, etc. In seconds!

For more information on this computer-controlled system, write or call our Marketing Manager, Box 3041, Sarasota, Fla. 33578; (813) 958-0811.

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to the IBM 1130 (subset). Several users have research agreements with IBM in APL development.

The service's library of time-sharing programs will include many of those available from IBM as Type III (unsupported) programs and from the "1000-plus" users working with APL. Included are a large statistical package (developed at Univ. of Alberta), interactive linear programming packages, a text editor similar to Datatext, a management information system for control of manufacturer resource allocation, a banking system for balancing accounts, and numerical analysis packages for real and complex functions.

The 256K-byte model 50 will initially handle 30 terminals simultaneously (1050-type terminals, not Teletypes). Three levels of security are provided: user or library number, password entry into a locked workspace of programs and data, and password entry into locked programs. Each user has his own library of "named 32,000-byte workspaces." Charges will be $12/hour for terminal connect time. Cpu use up to 1/60th of connect time will not be charged; after that it is $5 a minute. Initial service charge is $100; monthly minimum is $100 per user number.

■ Vernitron Corp. will begin offering time-sharing services July 1st, through its OEI Computer Systems Div., using Honeywell 1200 and 1250 systems located in Great Neck and Port Washington, N.Y. Honeywell-developed t-s software is employed. The service will be marketed nationally and will be available either independently or in conjunction with the use of Vernitron's portable Dataport terminals. OEI Computer Systems was acquired by Vernitron in January 1968.

■ Charles Hobbs, of Hobbs Associates, Southern California consulting firm, has opened a t-s service at the Orange County Airport, Santa Ana, where his office will utilize a Hewlett-Packard 2000A with 16K 16-bit words of core and with 1½ million bytes of disc storage to accommodate up to 16 simultaneous users. The system will use BASIC and be primarily for engineering, scientific and education and certain commercial users, and the firm will charge only for terminal time, TTY 33 terminals connected to the computer by local telephone lines. The rate will be $6 per hour for the first 50 hours, $5 for over 50. There is no added cpu charge. Storage price is 20¢ a month for each 128 byte record. The service is aimed at small users and companies, or it can be utilized as a secondary service tied in with large operations. Hobbs' idea is that a user should subscribe to several services, employing each to do the specific job it's best equipped to handle.

■ Bolt Beranek and Newman, Inc., will expand its t-s services, utilizing PDP-10 computers with an advanced version of BBN's TELCOMP language, as well as FORTRAN IV, BASIC, and other languages. Commercial versions of the system will operate in the U.S. in BBN's Telcomp Computer Service and in Time Sharing, Ltd., London, England. BBN has sold its interest in Time Sharing, Ltd., to Delos Computer Leasing Corp., an affiliate of BBN.

■ Time Sharing Sciences, Inc., has been formed in New York with Hal B. Lamster, formerly with General Analytics Corp., as president. The new firm will specialize in developing time-sharing software and will serve as consultant to vendor and user. Charles L. Baker, previously with Penta Computer Associates, is vp.

■ Computer Center Corp. is a new company in Seattle, Wash., offering time-sharing. Monique R. Rona is the director of applications programming.

■ Consolidated Computer Services, headed by Prof. Mers Kutt, director of the computer center at Queen's Univ., is now operating a t-s service in Toronto, Canada, with plans to extend to Kingston and Ottawa. The company also intends to manufacture hardware.

■ Intranet Industries, Inc., is the new name of Information Industries, Inc., Los Angeles t-s firm that will go operational in July with a Univac 1108. President Arthur E. Speckhard said the name change was necessary to avoid confusion with a number of eastern companies when the firm opens nationwide. The firm develops its own software and designs its own hardware configurations for specific requirements.

■ Computer Time-Sharing Corp., Palo Alto, will acquire DCA Reliability

Laboratory, a Mountain View, Calif., testing laboratory. CTS has also reached an agreement in principle to acquire the Northwestern School of Business in Lynnwood, Washington. The school has more than 600 students and offers courses in data processing, programming, systems design, and edp maintenance.

■ Chemical New York Corp., parent holding company of Chemical Bank, has purchased Realtime Systems, Inc., New York t-s operation, which will operate as a subsidiary. Firm's capabilities will be doubled with the addition of another B5500, and it plans to extend services nationwide.

■ Computersearch Corp., Williamsville, New York, time-sharing firm has purchased Paytronics, Inc., of Buffalo, N.Y., for an undisclosed amount of stock.

■ Computer Research, Inc., Newton, Mass., has agreed in principle to acquire 11 more nursing homes in Ohio, Kentucky, and Florida for stock and cash valued at over $8 million. Computer Research provides t-s services, primarily in the investment banking field.

■ Computility, Inc., the time-sharing subsidiary of North American Computer and Communications Co., has installed the first of seven PDP-10 systems at its new Boston office; the remaining systems will be installed in eastern states by the end of the year. The system has 48K core memory, two disc units, five DECtapes, two magnetic tape units, printing and card handling equipment, and a digital plotter. Approximately 60 users may be accommodated simultaneously. Services will include batch processing.

■ Computer Task Group, Inc., Buffalo, N.Y., has joined the Applied Logic Corp. AL/COM Time-Sharing Network. CTG formerly provided only batch processing services. The firm also offers consulting, software development, and personnel training.

■ ITT Data Services has opened four additional time-sharing centers in Denver, Houston, Pittsburgh, and San Diego, bringing the nationwide network to a total of 16.

■ GE has installed a GE-600 system in its Schenectady, N.Y., Information Processing Center, to provide Mark II time-sharing service for upstate New York, Vermont, and western Massachusetts. It is the fourth such system to be installed; others are located in Los Angeles and Cleveland. The new system supplements Mark I service, which has been provided for the past three years, using three GE-200 systems. The new configuration includes 96K-word memory, an I/O controller, four Datanet-30 communications processors, disc storage units, a drum and controller, a magnetic tape system with six tape handlers and controllers, and a printer, card punch, and reader.

LEASCO REORGANIZES, ACQUIRES, EXPANDS, T-S'S

Leasco Systems & Research Corp. has finally entered the time-sharing field, plans for which were announced last year. The corporation has also been reorganized as a result of the acquisition of Operations Research, Inc., and because of expansion. The Bethesda-based subsidiary of Leasco Data Processing Equipment Corp. currently employs 750. Dr. Emory Cook, founder and formerly president of ORI, is now chairman of the board of LS&R, where he is responsible to the parent company for "achieving the corporation's goals."

Under the new organizational scheme, LS&R has three operating divisions and two subsidiaries. The three divisions are the Computer Services Group, the Management Systems Group, and the Time Sharing Group. The two subsidiaries are ORI and Leasco Information Products. The Computer Services Group is engaged in software development, facilities management, and systems consultation. The Management Systems Group is creating operating systems that provide clients with "decision-oriented" information. This group was formed by combining what was the Management Systems Div. of ORI with the Analytical Services Div. of LS&R.

The Time Sharing Group, headed by vp Dr. Walter Simonson, is responsible for designing and operating time-sharing systems. These are now being marketed as a service under the name "Response," utilizing six Hewlett-Packard 2116B minicomputers in Bethesda, with BASIC and a few applications packages. Cut-rate charges of only $5.75 an hour for connect time, with no separate fee for cpu time, but a minimum of $100 per month, were heralded in a full-page *Wall Street Journal* ad on St. Patrick's Day. A reduced rate of $4.75 an hour is available "on a volume basis." Dr. Simonson explained that the low rates were possible because of the use of the Hewlett-Packard computers. Plans call for expansion of time-sharing services to include additional software and other time-sharing centers in New York, Boston, and "across the country," eventually.

The ORI subsidiary will retain its identity and operate through its three internal divisions, Engineering Analysis, Systems Engineering, and Operational Analysis, specializing in quantitative analysis of physical systems for military and aerospace clients. The Leasco Information Products subsidiary designs, manufactures, and sells information products, and provides a program of seminars for both in-house and outside education. A current project is the "disclosure" service for the Securities and Exchange Commission: the publicly available reports filed by companies and mutual funds with the SEC are produced on four-by-six inch microfiche cards and distributed through a subscription service.

The nucleus of LS&R was established in May 1967 when Leasco acquired Documentation, Inc., Bethesda, and Fox Computer Services, New York, merging them to form the new corporation. Documentation, Inc., founded in 1951, had been "a pioneer in development of large-scale automated information technology." It created and operated NASA's scientific and technical information center for seven years. Fox, founded in 1963, specialized in predictive mathematics and statistical analysis, providing projections upon which decisions could be based. Last year, LS&R acquired Information Development Co., a software house with offices in Los Angeles and Boston that had developed systems for several computer manufacturers. At the end of 1968, ORI was acquired.

new companies

University Software Systems has been formed in Los Angeles to assist organizations working in such areas as radar, oceanography, seismic noise, oil exploration, economic time series analysis and biomedical research. Initially, the company will specialize in digital filtering, digital time series analysis, random process theory, communication and control, and statistical analyses. They are also offering a series of on-site education courses in digital time series analysis and a digital filtering package that may be bought or rented. . . .

Computer Modem Corp., new Ft. Lee, N.J., firm whose first product is a high-speed modem for use in remote data processing and computer time-sharing systems, has awarded a long-term engineering and development contract to SYS Assoc. for the continuing development of the corporation's proprietary line of digital data transmission equipment. . . . A new management consulting firm, *The Brookings Computer Group*, has established offices in New York City. Major areas of concentration will be in cost reduction of input and the coding to data for computers. . . . *International Logic Corp.* (Interloc) has been formed in San Francisco by Koso Keikaku, independent software and engineering company of Japan, and Walter Kieckhefer, a Bay Area developer. Purpose of Interloc is to provide a marketing organization to make available to the American edp industry the system software and application package development technology available from Japan. . . . *Computer Dynamics Corp.*, a new Cherry Hill, N.J., software consulting firm, will specialize in computer programming systems for banks, insurance companies, brokerage houses, and other financial institutions. . . . George E. Snively, most recently president of Manufacturers' Lease Plans Inc., has established his own financial service firm, *Snively Financial Organization*, in Phoenix. The firm is engaged in counseling and financing dp equipment lease and rental plans of both manufacturers and users. . . . *Opportunity Systems Inc.*, Washington, D.C., has been organized to provide systems analysis, computer programming and related services, specializing in urban applications. . . . Century Geophysical Corp., Tulsa, has formed *Century Automation, Inc.*, by combining the activities of two recent acquisitions, Seco Engineering Corp. of Los Angeles and Numerical Controls Corp. of San Diego. The company, headquartered in Los Angeles, designs and builds automated production and assembly systems. . . . A new software company, *Systems, Software, Services, Inc.*, has been formed in Dallas. SSS will concentrate initially on providing a software flowchart package, utilizing several different languages, to business and industrial dp departments. . . . *D/P Computer Services, Inc.*, is a new management consulting firm headquartered in Evansville, Ind. The company will specialize in commercial edp use and will also offer office and administrative services, management education and training, and recruitment services. . . . *Horn Computer Research Corp.*, an edp support services company, has been formed in New York City as a "think tank" operation in practical applications for computers and related equipment. . . . *Computer Information Management Co.*, Dallas, will specialize in on-line information systems through management guidance, MIS assistance, educational, and systems design and programming. . . . *International Data Systems Corp.* (IDS) has been formed in New Orleans as a computer consulting, software, and leasing company. . . . *Micro-Data Systems, Inc.*, Encino, Calif., is now engaged in the manufacture and sale of computer output microfilm recorder systems and services; computer graphics; and products for the retrieval, storage and presentation of data. Several companies will provide one or more of the items of equipment and services to be offered, but Micro-Data Systems will offer the complete package of equipment and support services. . . . *Automated Information Systems, Inc.*, of New York and New Jersey, will emphasize communications-oriented software and hardware. . . . Three former MIT staff members have formed *MITECH Systems Inc.*, a new Cambridge, Mass., computer consulting and analytical services company. . . . SYS Assoc., Ft. Lee, N.J., and Essex Systems Co., New York City, are joint owners of a new firm, *Essex Computer Services, Inc.*, which will offer Essex customers computer systems and programming assistance in addition to the computer forms, disc and magnetic tapes Essex Systems now offers. . . . *Applied Business Services, Inc.*, has been established as a wholly owned subsidiary of International Industries to provide data processing services to the 17 operating divisions of the company and to outside organizations. . . . *Systems Data Inc.*, new Akron, Ohio, corporation, specializes in real-time and on-line computer applications and systems analysis for industrial acquisition and control systems. SDI is also involved in research leading to computerized educational systems. . . . *Diebold Computer Leasing, Inc.*, has established a leasing subsidiary in France with the help of two French banks, who will own 20% of the company. . . . American Credit Corp., Charlotte, N.C., has established a subsidiary, *Infitronic, Inc.*, to provide general computer services to business and industry, concentrating initially in the Carolinas. . . . A new system analysis and programming firm, *TOTAL Computer Systems, Inc.*, Newton, Mass., will offer consultation, hardware and software analysis, and program development. . . . Programming Sciences Corp. and Great West Saddlery, an investment and holding company, have announced an agreement to form an equally owned international computer software and systems programming or-

news briefs

ganization, *Programming Sciences International,* to be headquartered in London. . . . *Spin Physics,* San Diego, aims to be the largest and most technically advanced producer of precision magnetic recording heads in the industry within three years. . . . Cavanagh Leasing Corp. has formed *Cavanagh Computer Leasing Co.,* which will be operated as a division of the parent company. . . . First product of *System Utilization Inc.,* New York City, is CASH RESERVE, a package for demand deposit accounting systems of commercial banks. S.U.I. will also offer consulting services to the banking industry. . . . *Computer Systems Technology, Inc.,* (COMSTEC), Jenkintown, Pa., will offer technical support to computer and peripheral manufacturers in the design and implementation of their supplied software. . . . International Computers Limited, U.K. mainframe manufacturer, has transferred its supplies activities to a separate wholly owned subsidiary, *Dataset Limited.* . . . Pryor Computer Industries, Northbrook, Ill., has established a systems analysis and programming subsidiary, *Pryor Computer Software Corp.* . . . *BASYS, Inc.,* new consulting subsidiary of Booz, Allen & Hamilton, will concentrate in one organization the computer-related management information services in the health and education fields formerly offered by various units of the parent company. . . .

mergers, acquisitions

Trilog Assoc., Inc., Philadelphia, has purchased from *Information Interscience Inc.* (3i Co.) its interest in *Tridak Services, Inc.,* a Delaware Valley computer services firm. . . . *Computer Servicenters, Inc.,* Greenville, S.C., will merge into *United Data Centers, Inc.,* New York, subject to approval by Computer Servicenters' stockholders and receipt of a favorable tax ruling. The combined companies would result in a network of 13 dp centers. United Data Centers plans additional acquisitions in the near future. . . . *Tracor, Inc.,* Austin, Texas, has acquired 40% interest and an option on an additional 23% in *Codamite Corp.,* Stanton, Calif., producers of character printers for computers and mobile communications systems. . . . *Data Architects, Inc.,* Waltham, Mass., has acquired *Computeration, Inc.,* also of Waltham, for an undisclosed number of common shares. Data Architects' board has also approved the acquisition of Integrated Systems & Designs Ltd., U.K. systems manufacturer, and plans to market these systems in the U.S. . . . Agreement in principle has been reached for the acquisition by *Management Data Corp.,* Philadelphia, of *Systems Associates, Inc.,* Reading. MDC offers financial, management and computer consulting services; SAI provides systems and computer software consulting and operates two subsidiaries, one in the field of computer education and the other in computer-based medical systems. . . . Shareholders of *ComShare Southern, Inc.,* have approved a proposal to merge the company into a recently organized subsidiary, *Computer Complex, Inc.;* to change its name to Computer Complex, Inc.; and to transfer corporate HQ to Delaware, where Computer Complex is chartered. . . . UCC subsidiary *Computer Industries, Inc.,* has announced agreement in principle to purchase the assets of a small industrial computer engineering and development unit of *Bunker-Ramo.* Bunker-Ramo, meanwhile, has completed the acquisition of *Data Technology, Inc.,* Watertown, Mass., makers of encoders, digital counters and digitizers for the industrial control, instrumentation and aerospace industries. . . . *Electronic Memories Inc.* has agreed in principle to acquire *Electroglas Inc.,* producer of computer-controlled systems for the semiconductor and microelectronics industries. . . . *National Computer Analysts Inc.,* Princeton, N.J., has announced preliminary negotiations to acquire *Data Systems Analysts Inc.,* of Pennsauken. . . . *Unionamerica Computer Corp.,* dp service subsidiary of Union Bancorp, has acquired controlling interest in *Computer Input Corp.,* Los Angeles, which offers contract keypunching and programming to U.S. customers utilizing facilities in Bangkok and Taipei. . . . *Electronic Computer Programming Institute* and *Computer General Corp.,* both of New York City, have announced agreement to merge into a new holding company, subject to the approval of stockholders of both companies and to other contingencies, including the acquisition of other companies acceptable to both boards of directors. . . . *Computer Environments Corp.,* Hanover, N.H., subsidiary of Time Share Corp., has acquired *Dartmouth Printing Co.,* also of Hanover. . . . *Computing and Software* has acquired *Douglas Dunhill, Inc.,* Chicago, direct mail marketing firm. CSI also announced proposed expansion of its information and financial service activities with the signing of an agreement in principle to acquire *Heitman Mortgage Co.* of Chicago. . . . And *Control Data Corp.* is at it again. They have acquired the business of *American Business Systems, Inc.,* a Philadelphia-based producer of business forms and

data processing cards, in an exchange of stock; recently acquired *Automation Institute of Pittsburgh* will be operated by Control Data Institute; and CDC's acquisition of *Printed Circuits, Inc.*, Minneapolis, has been approved by the company's stockholders. Printed Circuits' products, multilayer printed circuit boards, will be used in CDC computer systems and will continue to be sold on the open market. . . . *Computer Counseling, Inc.*, Baltimore, has acquired *Data Center, Inc.*, Baltimore service bureau which will be operated as a wholly owned subsidiary. . . . *URS Systems Corp.* of San Mateo, Calif., announced the acquisition of *Ken R. White Co.*, Denver, an engineering, architectural and planning firm. URS and *Automatic Information Management* of Encino have agreed that URS will purchase 21% of the outstanding AIM stock for cash with an option to purchase the remaining stock before the end of Dec., 1971. . . . *Affiliated Computer Systems*, Dallas-based software and service firm, has agreed in principle to purchase *A.R.M., Inc.*, from the First National Securities Co. of Dallas. A.R.M. provides computer-based data services to doctors, clinics and clinical laboratories. . . . *Datascan Inc.*, Clifton, N.J., manufacturer of electronic equipment, plans to purchase *Star Parts Co.* and *New Era Manufacturing Co.* from Powers & Eaton Industries Inc. for more than $3 million. . . . *Statistics for Management Data Processing Corp.*, New York City, and *SSI Computer Corp.*, San Francisco, have agreed in principle to merge through the formation of a new parent company. . . . *Bankamerica Corp.*, owner of the Bank of America, has reached an agreement in principle to acquire an 80% interest in *Digitran Corp.*, computer leasing, software and consulting firm recently organized by Bankamerica Corp. It is the holding company's first acquisition. . . . *Computerology, Inc.*, New York City service bureau and systems design firm (*and* manufacturer and distributor of its own and imported men's shoes), has signed a letter of intent to acquire *Connecticut Scientific Center, Inc.*, New Haven, a highly scientifically oriented computer software company. . . . *U.S. Systems & Software, Inc.*, Los Angeles, has agreed to acquire the capital stock of *Systems Exploration, Inc.*, of San Diego. . . . *Sterling Electronics Corp.* has acquired another firm—*Washington Electronics, Inc.*, Seattle. The company's subsidiary, *Sterling Computer Systems*, has agreed in principle to acquire *Computer Systems Services, Inc.*, Los Angeles firm specializing in MIS, computer systems design, and programming and consulting services. . . . GT&E subsidiary *Sylvania Electric Products Inc.* has reached an agreement in principle to acquire *Chester Electronic Laboratories*, Chester, Conn., designer, manufacturer and supplier of dial-access information retrieval systems and language laboratories and microwave systems for education. . . . *Information Control Systems, Inc.*, Ann Arbor systems and software house, has entered the abstracting field by acquiring *International Abstracting and Indexing*, Paris-based service that provides translations and abstracts of technical articles from foreign language publications, especially those from Communist countries. I.C.S. plans to expand the service to include coordinated translation and abstracting in all technical fields. The abstracts are expected to become available within four to six weeks after publication. . . . Computer Learning Corp. has moved its corporate headquarters from Falls Church, Va., to Rockville, Md.; changed its name to *Computer Learning & Systems Corp.*; and acquired *Management Research Assoc.*, Arlington, Va., another firm engaged in computer education and training. . . . *KDI Corp.*, a diversified firm, has completed the acquisitions of *Industrial Electronetics Corp.*, Satellite Beach, Fla., and *IDM Electronics, Ltd.*, Reading, England. KDI has also announced that agreement in principle has been reached to acquire *Tresco Scientific Devices Corp.* of Philadelphia. . . . *Rutherford Laboratories, Inc.*, Lodi, N.J., has acquired *New Jersey Statistical Accounting Center*, Morristown. . . . *A I M Companies, Inc.*, Warren, Mich., has reached an agreement to acquire *dataStation Corp.*, Los Angeles-based service bureau that also operates two centers in New York City. . . . *Wang Laboratories, Inc.*, has acquired a "substantial" interest in recently formed *Digital Information Storage Corp.* and has an option to acquire the remaining interest at a later date for an undisclosed amount. Wang has also announced the acquisition of *Medical Systems and Data Corp.* of Boston, again for an undisclosed amount. . . . *Leach Corp.*, recently acquired by Subscription Television, Inc., has announced their purchase of the *Winston Div. of United Controls Corp.* Winston designs and manufactures data recorders which are compatible with, but extend the range of capabilities of, the present Leach tape recorder line. . . . *Gerber Scientific Instrument Co.* has acquired 90% interest in *Applied Programming Technology Corp.*, Sudbury, Mass., software and consulting firm. Gerber plans to use APT's capability to provide their customers with individually adapted programs. . . . *Data Documents, Inc.*, Omaha manufacturer of dp supplies,

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mag tape and disc packs, has signed a letter of intent to acquire *Mission Photocomposition,* Merriam, Kan. . . . *Management Science America, Inc.,* Atlanta-based management consulting and software firm, has acquired *Data Conversion Co.,* Houston, which specializes in source document preparation. . . . *Informatics* has completed the acquisition of *Computing Technology, Inc.* (Nov., '68, p. 192), and two *Rucker Co.* data centers. . . . The merger of *Maxson Electronics Corp.* into *Riker Corp.* to form Riker-Maxson Corp. is now in effect. Shares are being traded on the American Stock Exchange.

● GE board chairman and chief exec Fred J. Borch has announced the formation of a new international group, with J. Stanford Smith, currently vp and group exec of the information systems group, as vp and group exec of the new setup. In other appointments, Borch named Hilliard W. Paige, vp and group exec of the aerospace group, to succeed Smith, and Mark Morton, vp of GE's missile and space program, to succeed Paige. The international group's establishment and the three appointments go into effect June 1. Initially, the international group will encompass GE's international operations consisting of area divisions: the Far East, Latin America, Europe, and the International GE export division. Smith will be responsible for the incorporation of personnel and facilities of these international operations into the new group. He has been instrumental in establishing GE's time-sharing operation on a world-wide basis, and Paige is credited by GE as being the chief architect of its entire aerospace activities.

● Univac president Robert E. McDonald made some interesting predictions about the computing industry in the 1970's at the March AMA Conference in New York City. Among them: Over the next five years the projected U.S. computer industry growth rate will be 15% per year, and the foreign market rate will be closer to 20%. By the mid-'70's there will be about 100,000 computer installations in the U.S. A recent survey revealed that almost 10% of all plant and equipment expenditures in the U.S. in 1967 were for dp equipment and that this would rise to 29% by 1975. Further changes will be more evolutionary than

revolutionary; the accent in the fourth generation will be on communications capabilities. The value of remote terminals shipped by all manufacturers will exceed $2.7 billion in 1974 compared to $770 million for this year; and the 70,000 remote terminals in use today will increase to a total of between 200,000 and 350,000 by 1972. Graphic devices will have as large an impact on the computer in the next decade as computers in general have had on business and industry for the past ten years. There will be increasing emphasis on supplying customers with complete software systems—both operating systems and applications software. Memory speeds in the '70's will be increased to between a tenth and a hundredth of a microsecond.

● GE's Medinet is opening a marketing office in Chicago, another step in establishing its hospital information system services nationwide. Eight applications are currently available in Chicago, six administrative and two patient care: patient admission and census reporting, inpatient billing and accounts receivable, outpatient billing and accounts receivable, payroll and personnel accounting, accounts payable, and general accounting; medical records statistics and nurse scheduling control. The administrative applications are handled in remote batch or batch from the Watertown, Mass., headquarters computers; the patient care applications are on-line and when volume warrants will be available through the Chicago Information Services center. Since Medinet began selling the service approximately a year ago, it has 10 hospitals in the New England-New York area contracted for all or part of this service. It is difficult to pin down costs of the service as it varies with hospital size, number of applications desired, and the internal activity variations. A rough estimate is that for all six administrative applications, costs are $1.00 per patient day.

● Computer Machinery Corp., L.A. firm with the multiple-key-to-tape through a computer unit, has reached a financial agreement with Transamerica Computer Co. whereby Transamerica will take title to $15 million worth of CMC's KeyProcessing systems, representing 60% of production through 1970, while CMC will serve as agent, marketing and maintaining the equipment. James K. Sweeney, president of CMC, said the firm is shipping its first unit in May, has $1½ million in current orders and has scheduled 22 deliveries in the next year. Delivery at present is six months after receipt of order.

● Two Australian computer firms reported widely differing profit trends for 1968. IBM Australia, Ltd., which holds slightly less than half of the market down under, more than doubled earnings for the year to $2,770,000, while the profit of Honeywell, Ltd., was almost halved, to $242,000. Honeywell attributed part of its fall in profits to the costs involved in moving into a new head office in Sydney, and another part to the increase in the number of systems rented during the year compared with the number sold. IBM, on the other hand, experienced a rise in outright equipment sales in 1968, which is reflected in the increased net profit, but does not expect this trend to continue at the same rate.

● University Computing Company, Sam Wyly's Dallas-based firm, has acquired Datel Corp., producers of conversational t/s terminals (the Model Thirty-21) and data capturing devices. The purchase was made by an exchange of stock, six shares of Datel for each share of UCC. Datel has shipped $3 million worth of gear since last November, and production of the terminal is now up to 175/month, with a goal of 630/month by the end of the year. The firm exhibited its new tape deck at the SJCC, claims it has a very low error rate. Datel's headquarters in Falls Church, Virginia, will shortly be moved to Tyson's Corner, near McLean, Virginia. Its manufacturing facilities are at Riverton, Wyoming.

● MIT's Dr. Marvin Minsky has been chosen by the ACM as winner of the 1969 A. M. Turing Award and will deliver the Turing lecture opening the ACM conference at the San Francisco Civic Center Aug. 26-28. Dr. Minsky received his PhD from Princeton in 1954 and is a fellow of the Institute of Electrical and Electronic Engineers, the American Academy of Arts and Sciences, the New York Academy of Sciences, and the Harvard Society of Fellows.

● Chi (for the Greek letter) Corp., Case Western Reserve Univ.'s unique dp profit-making firm, is in the very early stages of a project for ARPA for computer security (to ensure privacy

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in time-sharing) and computer-aided design of computer systems—hardware and software. When completed, it is envisioned as a design tool to design systems to comply with any security guidelines. Chi is using a PDP-10 for the project and PDP-8i-driven interactive display terminals (specially built by Digital Equipment to Chi-DEC design); no typewriter terminals are involved. The project will cost somewhat over $1 million and take 2½ years.

● Through a $450,000 contract with Ultronics, a division of Sylvania Electric Products, Inc., Reuters News Service will have an 80-channel communications system to link its London, New York, Montreal, Sydney, Hong Kong, Singapore, and Tokyo offices. Data will be exchanged on a tty-tty basis at multiplexed rates to 4,800 baud. Some 215 stations will be included in the network, many of which will be Ultronics' Stockmaster and Videomaster terminals. As this suggests, the lines will be used to carry stock market information as well as general news.

● Management of large files, especially those hooked on to on-line computing systems, will be the forte of a newly formed Dallas company, Computer Information Management, Inc., the brainchild of a quartet of ex-IBMers. President of the new firm is David S. Willis; associates are Orrin C. Stevens, Jr., Charles R. McCoy and James M. Galbraith. The new group plans to offer software and systems consulting services to credit bureaus, banks, insurance companies and other enterprises which have to contend with lengthy data files. At IBM, the group worked on the original software package developed for credit bureaus in conjunction with the Association of Credit Bureaus, which is now being made available to local credit bureaus across the land. First customer for the new firm: who but that staunch friend and patron of small companies everywhere, IBM.

● Interactive Sciences Corp., Braintree, Mass., time-sharing and management consulting firm, and Digital Systems Corp., Hanover, N.H., computer-aided engineering design and consulting firm, have established a cooperative agreement for the development, application, marketing, and maintenance of high-level simulation-model processors for problem oriented applications in both industry and government. The plan is to market software developed by DSC in conjunction with ISC's time-sharing services, although each will also be available separately, with ISC handling all marketing chores, and DSC doing development and maintenance. ISC presently has a PDP-10 t-s system in Braintree, but plans to add five regional t-s centers with PDP-10's during the next year. First proprietary package offered under the agreement is Process Assembly Case Evaluation Routine (PACER), described as "the systematic computer encoding of chemical engineering knowledge to enable chemical process engineers to simulate, design and optimize total chemical plants."

● Lockheed Information Systems, a part of Lockheed Missiles & Space Co.'s Research and Development Div., Sunnyvale, Calif., has opened a branch in Harrison, N.Y., to serve the northeastern states. LIS uses edp technology in an effort to solve problems in state and local government, develop new educational techniques, and improve the efficiency of hospitals through medical information systems. In a non-edp vein, the firm recently announced a high school course curriculum to discourage teenagers from taking dope by using films depicting the pitfalls of drug abuse. The division also opened a branch in Silver Spring, Md., last year, and intends to move into Chicago next year. Personnel are being transferred from Sunnyvale and recruited locally for the Harrison branch.

● Systems Engineering Laboratories, beginning to sound more and more like a general purpose computer company, has set up a subsidiary to make a standard line of peripherals. Peripheral Dynamics Inc., staffed by executives formerly with Philco, has been established—conveniently—in Norristown, Pa. (not far from Philco). The subsidiary will announce its first product, a "low-cost" card reader for small computers and remote terminals, late this summer; deliveries begin early in 1970. This will be followed by a tape transport, and then disc drives and line printers, SEL customers and OEM's will be PDI market targets. Principals Thomas Patchell, John Dobson, N. Allen Cargill, and John C. Schisselbauer are all long-term Philco veterans with extensive experience in peripheral de-

vice design and development, including all products noted above.

● Lehigh Univ. is developing a system called Lehigh Automatic Device for Efficient Retrieval, with the objective of establishing a "library" of information through which a researcher can "browse," using an IBM 1800 data acquisition and control system. LEADER permits a user to query the computer through an IBM 2260 crt terminal, using ordinary English sentences. The crt then responds with descriptive phrases from which the researcher chooses the phrases which best describe his particular interest, or, if undecided, he may request additional information. The process continues until the desired information is either located or found to be unavailable. At any point in the search, the user may ask for a display of selected passages or the full texts of specific documents in storage. Although LEADER is still in the experimental stage, real information is used and real enquiries can be answered, with about 200 documents analyzed and cross-referenced, their full texts stored, and another 3,000 additional documents which have only been indexed.

● The ACM Special Interest Committee on Microprogramming (SICMICRO) has been established with the objectives of bringing together microprogramming practitioners; providing them with a forum for the exchange of viewpoints, new ideas and problem solutions; and promoting the free exchange of information on all aspects of microprogramming. SICMICRO plans to sponsor an annual microprogramming workshop, publish a newsletter, sponsor technical and tutorial sessions at national conferences, and establish technical working subcommittees and liaison with other interested organizations. Information on membership may be obtained by writing SICMICRO, c/o ACM Headquarters, 211 E. 43 St., New York, N.Y. 10017.

● A $2.5-million Honeywell computer system consisting of two model 2200 and two model 516 computers is being installed by the Blue Cross Assn. to expand nationwide communications capabilities for its 75 Blue Cross and 73 affiliated Blue Shield plans. The system will enable the centers to send and receive claim questions and answers from the various plans and will also handle administrative data processing. Cutover to the new system is expected before the end of this year. The present Blue Cross system serves 86 million people and handles about 30 million characters of data daily. Its 40-million-character capacity is expected to be reached soon. The new system will handle up to 100 million characters.

● Data Power, Inc., formed early this year in New York City, plans to provide packaged computer services from locally managed franchise centers. Initially, six centers will be established that will connect to a centrally located IBM 360/40. From these company-owned centers, district managers will place 21 additional franchise centers, each equipped with NCR key-tape transmitting/receiving stations and printers, to provide localized payroll processing, accounts receivable, inventory control and other services to small- and medium-size businesses. A franchise territory consists of 2000 employers having 20-250 employees.

● An expanded version of the General Retrieval System for Managers (Nov., '67, p. 119) is now available from Information Science Inc., New City, N.Y. GRS, written entirely in COBOL, is designed to be a simple, practical and inexpensive solution to the programmer gap, allowing those with a need for information from the computer to request and receive their own reports in English. New GRS features include: full calculation capability, the ability to perform multiple searches with one pass of the data base, and the automatic creation of up to six levels of totals for each report. The new system costs $4K for complete installation and user-education for one data base, and $10K for this plus a generator program that provides the ability to adapt GRS to additional files. When the system was introduced, the prices were $10K and $20K, respectively.

● A PDP-8/I computer has been substituted for the PDP-8 in Digital Equipment Corp.'s 338 programmed buffered display, resulting in a reduction of $4,500 in the purchase price to a base price of $50,500. Of greater importance, according to DEC, is the fact that options and peripherals for the system are less expensive. The low-cost expansion cost of the PDP-8/I, it is said, can reduce the cost of the typical user's system by $20,000 to $25,000—most 338 customers have pur-

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chased the system with additional core memory, high-speed paper tape, and other peripherals. The system has been redesignated the 338/I.

● The Second Annual ACM Computer Art and Music Festival will be held in San Francisco August 26-28 in conjunction with the 1969 ACM National Conference. Individuals interested in submitting their computer-generated art, music, or sculpture for display should send a one-page description of their art to Glyn Jones, Burroughs Corp., 460 Sierra Madre Villa, Pasadena, Calif. 91109.

● Six firms have joined the Society for Management Information Systems as institutional members: Consolidated Software, Inc.; The First National Bank of Chicago, Information Systems Dept.; Information Management Facilities, Inc.; Lester B. Knight & Assoc.; R. E. Moll Assoc.; and The Pillsbury Co. Two new members have been added to the executive council—Joseph F. Cunningham, Deputy Director of the Bureau of the Budget; and W. Robert Widener, president of Information Management Facilities. SMIS has been formed to aid in the exchange of technical information and to provide an interdisciplinary forum for MIS directors, executives served by MIS, educators in graduate schools of business, MIS resource personnel, and members of the general public interested in MIS. Institutional memberships are available at $500 annually. For information on individual and institutional memberships, write SMIS secretary Richard E. Dooley at The First National Bank of Chicago, 38 S. Dearborn St., Chicago, Ill. 60690.

● R. Paul Alleman, formerly manager of computer systems planning for Xerox and systems planning manager for Hunt Wesson Foods, has started up his own software firm, CS/SD (Computer Systems/Software Development) in Fountain Valley, Calif. The firm has ongoing contracts with Edwards Laboratories in Santa Ana for marketing sales analysis and manufacturing control systems, and has completed negotiations with T. A. Bruinsma and Co., financial and management consultants, for $50K in financial backing for 30% of the company, which

plans to concentrate on customized packages.

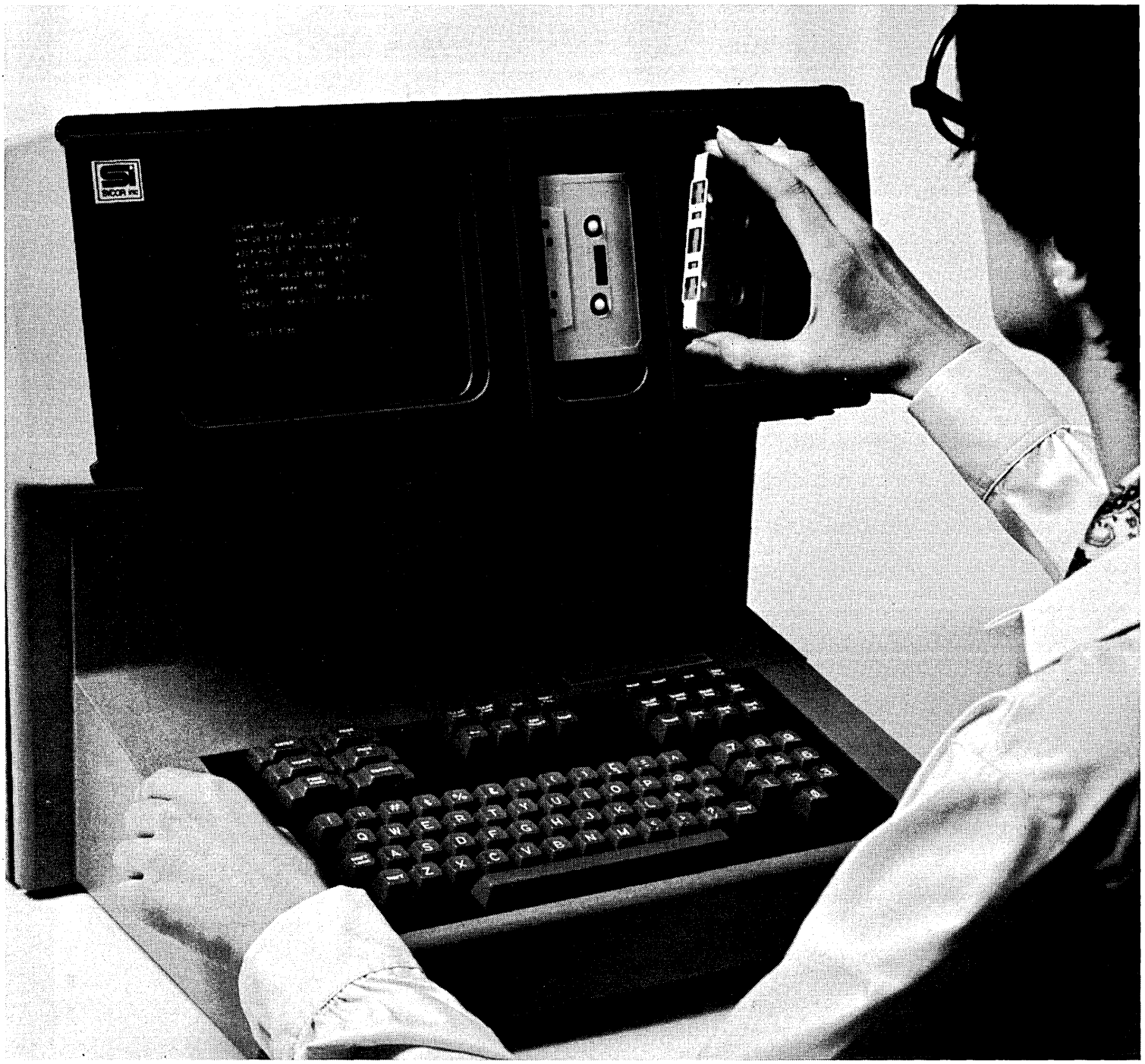
● Chemical Abstracts Service has announced the scheduled introduction in October of *Access*, a service designed to help the chemist, information specialist and librarian locate specific journals, monographs or patent specifications containing information of chemical or chemical engineering interest. *Access*, which will be derived from a computer store of bibliographic data developed at CAS with the cooperation of some 400 resource libraries in 28 nations, will contain data on about 20,000 source literature items published since 1830. The 1969 edition of *Access* will be published in two volumes and will sell for $100 per copy. Information may be obtained from CAS, University Post Office, Columbus, Ohio 43210.

shortlines . . .

Data Communications Systems, Inc., who recently acquired Carterfone Communications Corp., has received a $375,000 net settlement from AT&T of the Southwest of litigation begun in 1965 against AT&T's prohibition of interconnection of private communications systems with the telephone network via the Carterfone invention. . . . Avco Computer Services has become, they say, the first commercial dp service bureau to provide customers with MVT. . . . An NCR Century 100 computer has been delivered to the U.S. House of Representatives for the preparation of the House staff payroll; additional planned applications include printing and mailing labels for House correspondence (some 30 million pieces issued every month) and the installation of an information retrieval system. . . . Of the 4,171 existing computers in Japanese minor enterprises 2,990 are of domestic manufacture and 1,181 are foreign produced. . . . Gerard L. Seelig has been appointed president of Lockheed Electronics Co. to succeed Alan J. Grant, who has become a group vp of Fairchild Camera & Instrument Corp.'s Instrumentation Div., Sunnyvale, Calif., and six East Coast divisions. Seelig has been with Lockheed since 1961, most recently as exec vp. . . . EMR Computer, Minneapolis, has announced a price reduction for both purchased and leased systems in their ADVANCE 6130 series by an average of 16%. . . . Deliveries of International Computers Ltd. 1900 series computers have passed the 1,000 mark. . . . Midwest Stock Exchange Clearing Corp. plans to start a national clearing system for computerized processing of over-the-counter stock transactions during the third quarter. . . . Applied Data Research claims that 550 computer installations are presently using the firm's AUTOFLOW automatic flowcharting package, including 55 of "the nation's 100 largest computer users, five out of six of the largest computer manufacturers, and all major U.S. government departments." . . . Honeywell's EDP Div. has received a two-year, $396,000 grant from the U.S. Dept. of Labor to train 130 persons in computer production work. . . . Univac is now producing microminiature avionics computers for the U.S. Navy's P-3C Orion anti-submarine-warfare aircraft under a $13.6 million Naval Air Systems Command contract. . . . Computerm Terminals, Inc., Minneapolis, has obtained the first Data Access Arrangement from Northwestern Bell Telephone. . . . In what could be considered a perspicacious move to solve the rooming shortage in Las Vegas during the FJCC, the Levin-Townsend Computer Corp. will pay $10 million for the Bonanza Hotel and Casino in the gambling resort, a heretofore ill-fated venture that closed in 1967 after substantial losses.

call for papers . . .

Computers and Communications Conference, Rome, N.Y., Sept. 30-Oct. 2. Papers on signal processing, computer-aided design for communications equipment and systems, decision and control, simulation, on-line communications, and interactive graphics are invited. The purpose of the conference is to review the latest communications/computer processing developments and to consider the role of communications techniques in the development of computer systems. Application and implementation, rather than theoretical aspects, will be emphasized. There will be two categories of contributed papers: "long," for a 20-minute presentation, and "short," for a 10-minute presentation, both with discussion period to follow. Authors of long papers should submit a complete manuscript of less than 4,000 words and a 50-word abstract. Papers for short presentation will be considered on the basis of a 200-word abstract. All manuscripts (in duplicate) and abstracts (five copies) should be submitted no later than June 1. Any reasonable manuscript format is permissible, but authors of accepted papers will be required to prepare a final manuscript in accordance with the IEEE kit which they will receive. Address all correspondence to: Computers and Communications Conference, 304 E. Chestnut St., Rome, N.Y. 13440, to the attention of the Technical Papers Committee.



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Production models of our series 300 Key-Cassette™ terminals are taking their bows in Boston at the Spring Joint Computer Conference. Their performance centers on the advantages of applying a programmed video terminal to the task of capturing business information at the source. The role of the Key-Cassette is to combine entry, verification, search, viewing and editing of data under program control with video display of the record entry, control format and field identification. The data is recorded on compact, snap-in, magnetic tape cassettes—each providing the equivalent of 1700 feet of paper tape or 2500 punched cards. See you at booth 2903. Critics invited.

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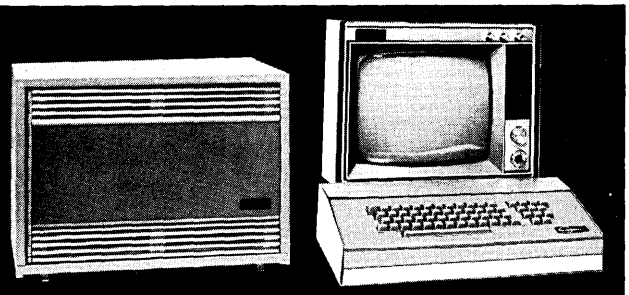

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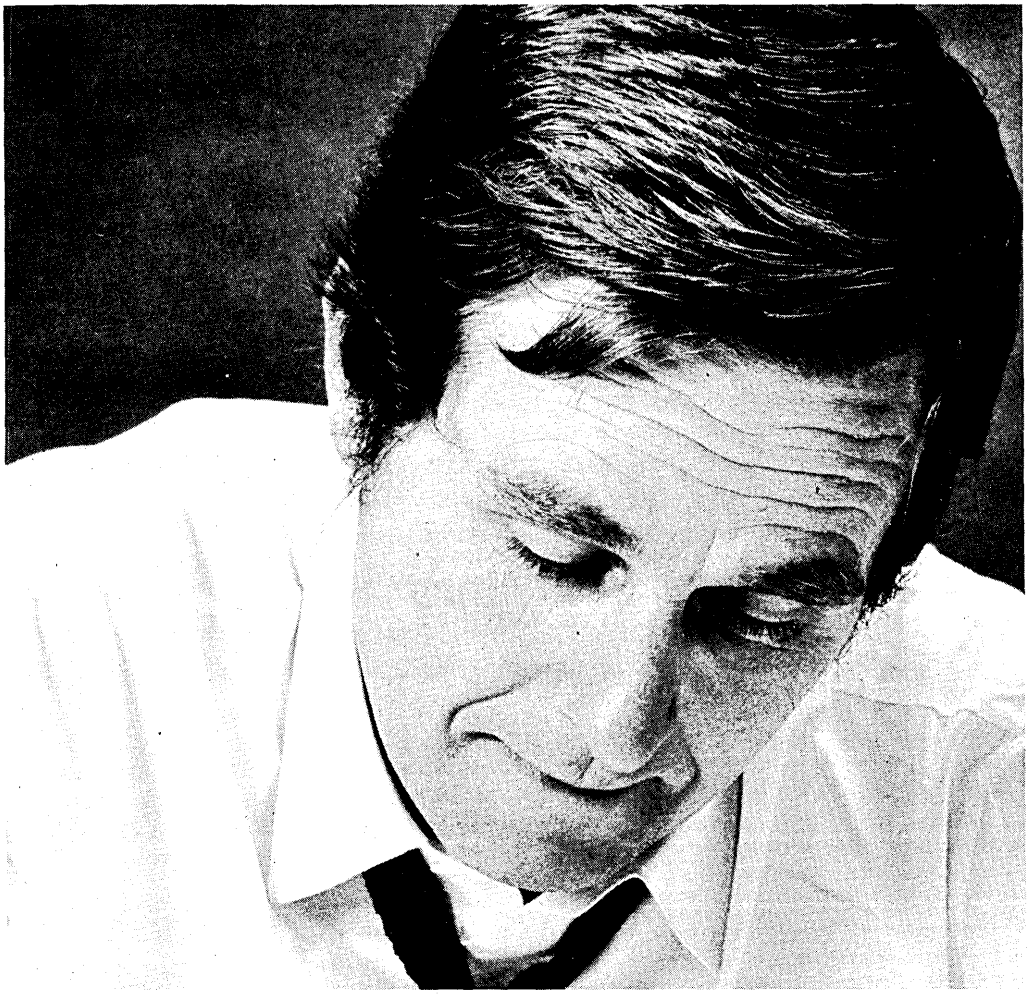

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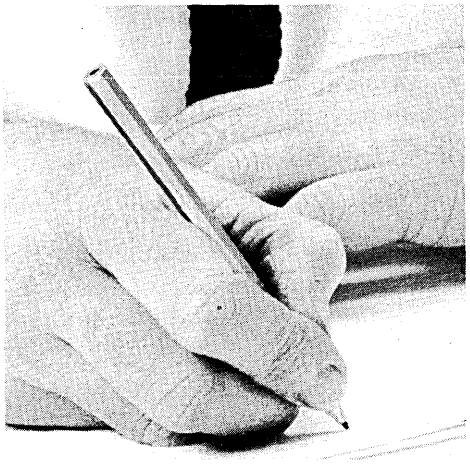

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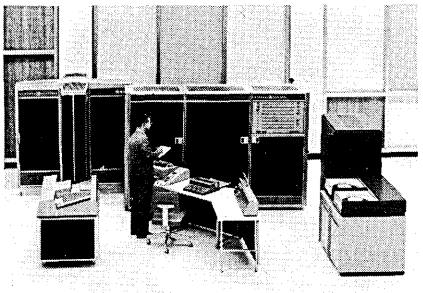
new products

three new intermediates

The intermediate computer range, which includes the IBM 360/50 is being rapidly expanded. This month's entries include the Univac 1106, General Electric 615, and the Honeywell 3200. For a description of these machines, see "Three New Intermediates" listed in the table of contents.

little 400

GE has been adding "little brothers" to most of its computer lines. In the case of the 400 series, which includes the 415, 425, 430, 435 and 440, the addition is the 410. The little brother in this series is designed as a low-volume



time-sharing system for in-house use. It can service 10 user keyboard terminals simultaneously, with connections to as many as 40. The new model is quite a bit less powerful than the 430 t-s system (30 users on-line with 120 lines) or the 440 (50 users on-line with 200 terminals), and is quite a bit less expensive, too, at $500K purchase and a base monthly rental of $10,475. (The base rental on the 430 is $15,421; for the 440 it is $22,187.)

GE does not claim that the 410 is the least expensive system to operate as far as cost per terminal hour is involved. Their selling point will be the ease with which the small system can be upgraded to the larger ones. For instance, the 400 line of software, including Dartmouth BASIC, FORTRAN IV, and Edit commands are all usable on the 410. An addition of a few disc files and a faster memory produces the hardware portion of the upgrade to the 430. With the addition of a few peripherals, the 410 can be used without the faster 430 or 440 memories, as a batch-oriented system.

Included in the base price of the 410 is the cpu, 32K of 6.3 usec core memory, two DSU 160 disc storage systems (of the 2311 IBM variety, with 7.6 M char./pack and a transfer rate of 208 KC), a 600 cpm card reader and a DN 30 Communications Controller. Upgrading can go almost any direction with printers, punches, tape units, etc.

Just as the rest of the 400 line, the 410 operates with a 24-bit plus parity word (four characters per word), has hardware memory protect, eight I/O channels (expandable to twelve), and a scatter-read/gather-write feature. GENERAL ELECTRIC CO., Phoenix, Ariz. For information:

CIRCLE 501 ON READER CARD

low-budget time-sharing

This two-year old vendor claims to have produced a time-sharing system that out-economies the economy models. Although a low-budget package, the 20-terminal end product is guaranteed to have a maximum response time of 3.5 sec, and that is not bad. Called Minits II (for "mini-time-sharing"), the system architecture is unique for a small-scale operation; it incorporates two small-scale cpu's, an Interdata Model 3 and Model 4. The three is used for bookkeeping and buffer management functions leaving the 4 (1.5 usec core access, 3.9 usec add time) free to process user jobs. Both are linked to a common memory of 16K bytes.

In addition to linking to tty terminals, Minits II connects to an 1108 for applications too complicated for the Interdata 4. Programs can be stored on the Univac Fastrand data storage system, called into the job stream (from the tty or from a batch terminal), processed and output to the tty or to a line printer. Because huge volumes of printout are unrealistic for tty printing, a "quick look" feature is built into the command language for printing selected outputs for debugging purposes, In addition to the command language, FORTRAN and BASIC are offered; a FORTRAN diagnostic scan and Univac 1108 control language scan program are planned.

Purchase price for the system is $90K; third-party leases in the range of $4 per terminal-day will be available, making this, the supplier claims, 1/24th as expensive as comparable systems. JACOBI COMPUTER SYSTEMS, Encino, Calif. For information:

CIRCLE 502 ON READER CARD

speedy disc drive

"Access time" is the name of the game this vendor is playing with its 701 disc drive, and the spelling for that is "30 msec." The industry standard times for minimum, average, and maximum access times are 25 msec, 75 msec, and 135 msec, respectively. The 701 timings are 10 msec, 30 msec, and 60

msec, so the units begin to look good already. Access time is not all-important, however, since the true length of time it takes to get to a piece of information located on an unmounted disc pack includes the time it takes the operator to find the correct pack and mount it, and also the time it takes the drive to bring the pack up to operating speed. Other than supplying a built-in coffee dispenser, there is not much a disc drive manufacturer can do to control the operator, but the vendor can try to whittle down that 60 sec. industry standard start-up time figure. Again, the 701 is speedy; start-up time for the unit is 15 sec., and the 45 sec. saved can be used for 1,000 extra random read operations.

The access time is achieved through an electromagnetic actuator and an electronic positioning control system, rather than through the use of mechanical or hydraulic positioning systems with a mechanical detent. (This also avoids the problem seen on other 2311-compatible drives, the supplier claims, of denting the oxide slightly every time the head is picked up and sometimes on positioning, too.)

Many aspects of the drive are simi-

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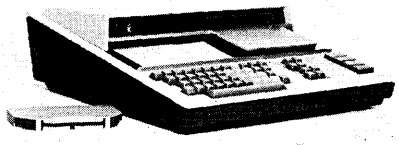
CIRCLE 85 ON READER CARD

lar to the 2311, as should be expected, including the 7.25 M byte storage capacity, 2,400 rpm operating speed, and the 156 Kc transfer rate. Two features are not like those of other drives. The 701 automatically compensates for temperature differences between the pack and the operating environment. (This helps that start-up time figure.) The second feature is a more powerful maintenance control panel which allows for manually commanding the drive's mechanisms and for testing to the board level. Separate head address switches and direct read out lights in the service box supposedly make it easy for the maintenance engineer to keep the 701 operating; a single potentiometer replaces the 10-20 normally used for adjusting the drive operation. What does all this mean to the user? No speedy drive that is down for repairs is any faster operating than a slow drive that is down for repairs. The 701's come in packages of one for $22,000. INFORMATION STORAGE SYSTEMS, INC., Cupertino, Calif. For information:

CIRCLE 503 ON READER CARD

key-to-tape

The manufacturers of the Mark I key-to-tape system firmly believe that the bulk of keypunching tasks are handled by relatively unskilled operators, operators who are new to the field in many cases. For this reason they have designed their data recording system with a good number of operator con-



veniences, including an alpha display of the character last punched and the column last punched, and a backlighted program card. In some key-to-tape recording systems the character punched is displayed in binary format, and error messages are also given in code. These systems contribute to operator errors and do not contribute to operator speed.

The Mark I records data onto a ruggedized cassette according to a program format entered through a punched card. The cassette uses two sets of rollers, one for forward spacing and one for rewinding. A pooler is supplied to convert the cassette-recorded data to ½-inch tape in either 7- or 9-track format.

As the data is being keyed onto the tape, the light panel under the program card "maps" the course of the program column by column for the operator and a light panel to the left of the program card shows her progress across major fields of the record. If an error is detected in keying, the operator may backspace, display the erroneous character, and reenter the data. When operating in the verify mode, errors are similarly corrected. A 20 ips search of the cassette may be controlled from the keyboard through the entry of a search parameter.

Sales offices are to be in operation in New York, Washington D.C., and San Francisco within 90 days. Los Angeles and Chicago offices are to be opened within 120 days. Currently the sales of

PRODUCT OF THE MONTH

major mini computer

The Honeywell 316 is billed as the "first under-$10,000 16-bit machine from a major computer manufacturer." But whether or not that's completely true, it *is* the first mini computer from Honeywell, and the smallest addition to the Series 16 line. Last month, Honeywell already had received orders for more than 200 H-316's, with first deliveries expected in June. The firm hopes to make a big splash in the mini market, which it believes will grow at a rate of more than 40 per cent annually through 1975, with the Honeywell share of the market growing at a greater rate.

The 316 sells for $9700, has a 1.6 usec cycle and 4K memory, and is expandable to 16K in 4K increments, each costing $5500. The 316 is logically identical with the DDP-516, having the same register organization and 72-command instruction set. More than 500 software packages which have been developed for the Series 16 line can be used on the 316. These include over 300 application programs from Honeywell's users' group. A Series 16 FORTRAN IV compiler is supplied, fully compatible with USASI standards. The unit weighs 115 lbs., measures 19 x 24.5 x 14 inches in table-top or rack-mountable design, and is also available in a futuristic pedestal-mounted model. The H-316 is also I/O compatible with the 516, allowing use of all 516 peripherals and interfaces, including analog and discrete I/O, disc files, drums, displays, mag tapes, card I/O, paper tape I/O, line printers, communications interfaces, teleprinters, etc.

The H-316 faces formidable competition, including the forthcoming Digital Equipment Corp. 16-bitter. Other 4K memory, 16-bit mini computers in direct competition with the H-316 include the Varian Data 620/i, with 1.8 usec cycle, at $12,500, the Hewlett-Packard 2114A, with 2.0 usec cycle, $9950 price tag, and the Data General Nova, with 2.6 usec cycle, $7,950 price. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

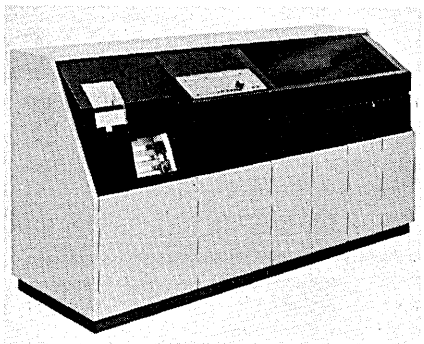
CIRCLE 504 ON READER CARD

the $7,970 units ($11,500 for the pooler which converts the cassette data to full-sized tape) are being handled from the firm's Sunnyvale, Calif., production facilities. Leases for the key recorders are available at $145/mo.; the pooler can be leased for $185. Maintenance will run $17/mo. per unit. Orders must specify record lengths to be used as this is a hard-wired function. CYBERCOM CORP., Sunnyvale, Calif. For information:

CIRCLE 505 ON READER CARD

satellite

Since the processor/controller portion of the Compak II data transmission terminal is built around a PDP-8, the resulting programmable satellite can be used with a variety of central site cpu's in a variety of applications. The system is offered with a choice of peripherals and peripheral operating speeds, too, so that the terminal's software must be tailored to the application. With the 4K (1.5 usec access)



PDP-8, this initial system programming—and any later changes made to accommodate faster peripherals or to interface with another main cpu—is relatively simple.

The basic terminal is equipped with the processor/controller, communications interfaces (for 2,400 bps voice-grade lines), and a 400 cpm Data Products card reader. This hardware configuration is priced at $40,200; the software is optional. A 600 lpm printer (also by Data Products) option brings the price up by $29,800. Other options include a plotter, disc, paper tape reader/punch, and mag tape subsystem. The latter option allows one Compak II terminal to act as a collector for data sent to a central site by other Compak II's. DIGITAL LOGIC CORP., Anaheim, Calif. For information:

CIRCLE 506 ON READER CARD

visual terminal

Upper and lower case alpha is included in the 96-character (ASCII) display capability of the Uniscope 100, a small-scale crt which has been added to the Univac console line. Viewing formats range from 480 characters (six lines of 80 char.) to 1,024 characters (16 lines of 64 char.) in a 5 x 10-inch viewing area. The $100/mo. unit can be used simply as a display or with a keyboard for data entry. Options include a multiplexer for connecting up to 31 of the devices to a single line or I/O channel, and a hard copy feature. The multiplexer provides for broadcasting output messages, and permits mixing single- and multi-station units in one communications network. Purchase price for the Uniscope 100 is $3,000 in OEM quantities. UNIVAC, Philadelphia, Pa. For information:

CIRCLE 507 ON READER CARD

hard copy plus mag tape

The 6000 series and 6200 series of data recording systems are billed as the first such systems capable of producing hard copy and magnetic tape. Apparently the PR staff has ignored a few other vendors, such as R. J. Communications Products. These PR types are certainly not the first to exaggerate a bit, and at least some of their claim seems to be true. R. J. Communications offers a $4,000 typewriter to tape system. However, in addition to the typewriter-based model, the 6200 series, this vendor offers a line of adding

machine and accounting machine-based recorders too, the 6000 series. Both series of equipment share the recorder, a 7 or 9-track, 200 bpi, deck which accepts either even or odd parity. The tape deck controller allows for back-spacing and retyping a single character in error, but more sophisticated error correction and formatting must be done on the receiving computer.

Included in the model line-up are: the 6003 10-key adding machine system which works with an 11-digit number ($3,995); the 6004 adding machine model with a tabulating carriage ($4,275); the two- or three-register 6005 accounting machine system (shown), with a programmable carriage ($5,145); and the 6200 typewriter to tape system (also $4,275). Effective speeds are limited by the accounting machines, and their operators, not by the 60 cps recorder. FAC-IT-ODHNER, New York, N.Y. For information:

CIRCLE 508 ON READER CARD

real-time system

While the industry awaits the Digital Equipment Corp. family of 16-bit machines, DEC has come out with an 18-bit, IC computer which will supplant its current discrete component PDP-9 in on-line, real-time applications. The new PDP-15 (whose puzzling number has only to do with chronological development of DEC systems) is larger, faster, better, and cheaper than the 9—and claims high reliability through use of integrated circuitry and other engineering improvements. Almost above all, the 15's operating software will be ready with the first hardware delivery in October, because it is based on and compatible with the PDP-9 software, as well as that of the older 18-bit PDP-7 and 4. About 400 PDP-9's and 7's are now installed.

The 15 comes in four configurations: 15/10, 20, 30, and 40. Common features are the following:

Separate I/O and central processors share memory banks through multiplexers. The cpu includes three registers for processor-memory communications, a program counter, 18-bit instruction register (vs. the 9's 15-bits), an accumulator, and index (18-bit) and limit registers, which the 9 does not have. Core memory is expandable from 4-128K; 4K is directly addressable and the rest is index addressable, Cycle time is 800 nsec (vs. the 9's 1 usec), access is 400 nsec, and add time is 1.6 usec. Optional is memory parity, which increases the cycle time to 1 usec. Memory autonomy permits mixing of core banks with different cycle times. Memory relocation is standard only on the 40, although it is available on the 30 if it has the memory protect option.

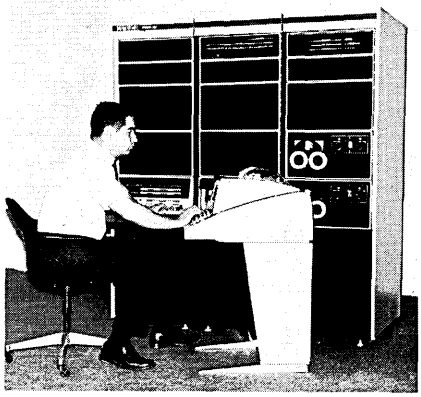
The I/O processor, with 8 standard data channels handling up to 42 controllers, can transfer data in any of three modes: single cycle block transfers at up to one million 18-bit words/sec; multi-channel block transfers, using four of the channels, at an input rate of up to 250,000 words/sec

FOR COMPUTRON CIRCLE 92 ON READER CARD →

and an output rate of up to 181,000 words/sec; and program-controlled transfers at up to 100,000 words/sec.

Among reliability features are IC's, design for "worst case," optimized cooling and packaging of components, "simple construction" and "standard parts."

Consoles will display all registers and come in three models: a flush-



mounted console to permit a locked panel cover, a sloped console with a table, and a remote unit connected by a single cable.

The 15/10 configuration has 4K words of memory, ASR-33 console teleprinter, and COMPACT software system, including assembler, editor, and other utilities and subroutines. It is aimed at "letting beginning users with limited budgets gain access to the 18-bit system" and is expandable in the field because of pre-wired facilities. In other words, while it somewhat competes with small 16-bit machines like the Data General Nova, its aim is to get the user started into the larger PDP-15 configurations.

The 15/20 is an 8K system for research and engineering environments where "real-time data acquisition and control tasks are combined with program development and testing" (all handled under monitor control). With the system comes a KSR-35 tty two DECtape transports and a control unit, high-speed paper tape reader/punch, an extended arithmetic element, and software: Advanced Monitor System, FORTRAN IV, FOCAL, MACRO-15, Dynamic Debugging Technique, text editor, Peripheral Interchange Program, linking loader, and chain and execute.

The basic 16K 15/30 is for real-time processing jobs which do not use all the system capacity, thus providing for background/foreground processing. In addition to the 15/20's features, it has a memory protect system, automatic priority interrupt, a third tape transport, second tty, and real-time clock. Additional software includes a background/foreground monitor.

The 15/40, with a basic 24K of core, is for applications where the "need for a background/foreground mode of operation is compounded by the necessity of large random-access files," and thus provides discs with 500,000 to 2 million words and a disc-oriented monitor system. A memory relocation protect system is standard.

Additional peripherals include 300 and 1000 lpm printers, CalComp plotters, IBM-compatible tape drives, storage tube, oscilloscope and incremental displays, and a host of a-d and d-a converters.

In addition to sales to OEM's, markets include on-line physics and biomedical applications, industrial data acquisition, interactive graphics, communications (message switching and store and forward), and data formatting and correction for management information files. DEC is also negotiating with analog makers EAI and Applied Dynamics to combine the PDP-15 in hybrid systems.

Competition primarily is the IBM 1800, Honeywell 516, SDS Sigma 2 and 5, and CDC 1700. Pricing, not set at writing, is generally described as "20-25% less than comparable PDP-9's." In other words, a $52.5K PDP-9 is equivalent to a 15/20 configuration, which would run about $40-42K. A 15/30 equivalent in the 9 is $81.5K, so the 30 would be about $60-64K. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 509 ON READER CARD

drum printer

The 2410 line printer constructs a print line in 22-char. zones, to a maximum of six zones or 132 characters. Depending upon the number of zones being printed, speeds can range from a "best possible" case (64-char. set, 1-22 print positions) of 1110 lpm to a "worst possible" case (using the optional 96-char. set, 111-132 print positions) of 173 lpm. The reduction in speed results from forming the line from left to right across the paper in the 22-col. increments. The 2410 was developed from an 80-col. printer built on contract to the Navy for operation in nearly inaccessible places (like bilges?). Therefore, the manufacturer claims, reliability figures will be very impressive for the 2410, too.

The chrome-plated drum is turned at 1760 rpm, and lines are printed six to the inch. Either 5- or 8-level codes may be used, Baudot or ASCII. Transmissions can be accepted, the literature claims, up to rates of 500KC. Options include either friction or pinwheel feed, 133-160 column drum widths, 8 or 12 channel VFU (20 ips slew), 8-lines/inch, and parity checking. The un-optioned price is listed at $11,750. Production quantities will not be available for six months. DATA PRODUCTS, Woodland Hills, Calif. For information:

CIRCLE 510 ON READER CARD

key-to-disc-to-tape

Another new data entry system, using parts of the various systems approaches now available—plus a few undivulged designs of its own—is offered by 10-month-old Inforex. The Intelligent Key Entry system, available for delivery the first quarter of 1970, comes with up to eight crt keyboard terminals for input, a disc for buffering and record format storage, and an IBM-compatible magnetic tape for output.

The terminals use a 4½ x 5½ inch crt screen, which displays up to 128 characters, and a keyboard with the standard 64-character alphanumeric set, plus nine function keys. These perform the same functions done through program cards on the IBM 029 keypunch. The terminals may be located several hundred feet from the one-box control unit, which contains a disc drive, tape transport, and a 4K-word read-only core storage, used to control terminal functions.

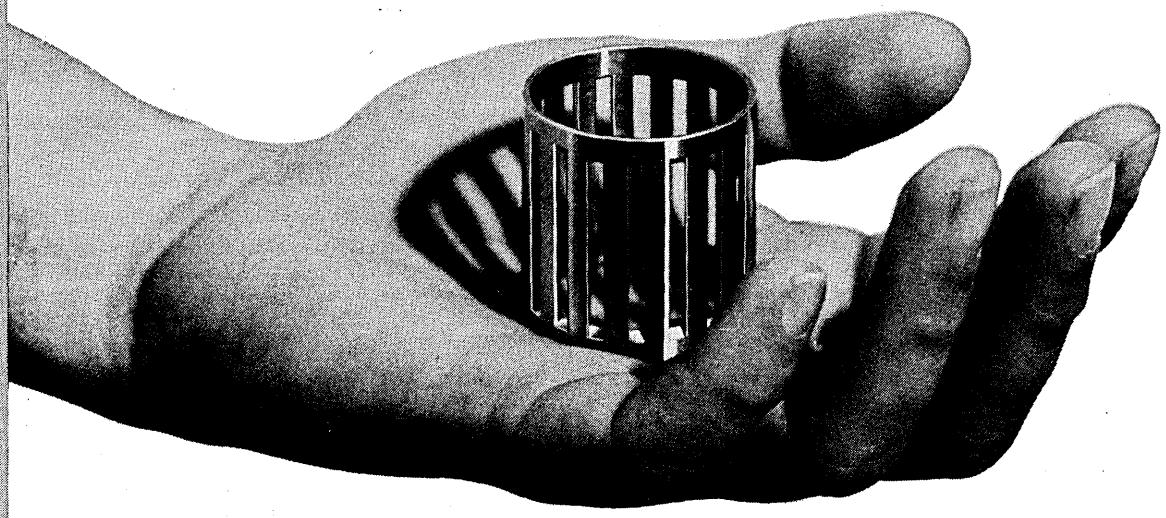
The disc buffer will store 500 128-character records input from each of the eight terminals (or 512,000 characters) before unloading onto magnetic tape. (A proportionally higher number of records can be input from a terminal if fewer than eight are used at a given time.) The disc will also store the formats of 100 different 128-character records, which may be displayed on the crt.

Features include automatic pooling of data collected from the terminals, automatic skipping, auxiliary duplication, automatic plus and minus signing of fields, and left-zero insertion. A self-balancing feature adds up all the numbers appearing in a given field, forming a total which can be compared with the total submitted by the originator.

The operator verifies by backtracking, displaying up to 128 characters at a time. Backspacing may be done by character, also. A three-try system like that on the 029 keypunch is used in verifying, whereby the crt flashes "error" when the verifying operator strikes a different key from that on the original entry, but accepts the new or corrected data if it is keyed in three times in a row.

With the first systems, the user will be hand-carrying the tapes produced to the computer's transports, but some-

~~ONE~~ OF A KIND TWO



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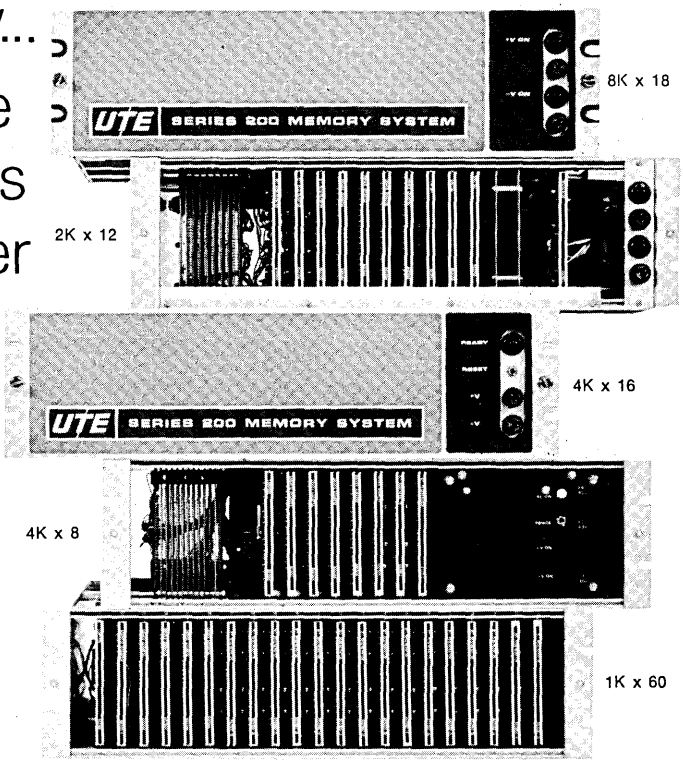

UTE

UNITED TELECONTROL ELECTRONICS INC.
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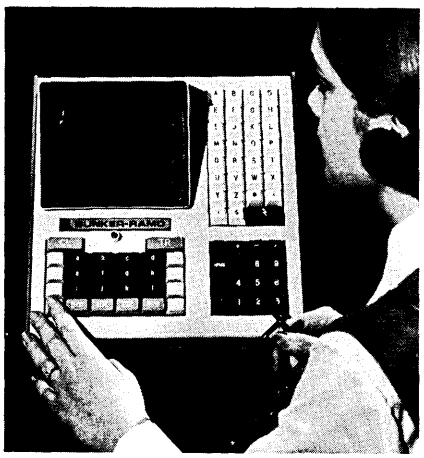
time next year Inforex will provide an interface for direct tape-to-computer transmission. The 40-man firm expects to open branch and field engineering offices "in every major city," and guarantee maintenance service within one hour. The modular system will either be repaired within an hour or the faulty element will be replaced. INFOREX INC., Waltham, Mass. For information:

CIRCLE 511 ON READER CARD

stand-up crt

The Model 2212 crt terminal is intended for processing short messages between non-typist operators and computers, in locations where operators work on their feet or on stools, rather than seated in normal typing position. It employs an integral six-inch crt, block alphabetic and numeric key clusters, and a cluster of 24 editing



and programmable function keys. The block-style keyboard is said to enable entries and interrogations by operators with no typing skill, and "only a few moments of training are required to become familiar with the simple operating procedure." The crt can display up to 444 characters on 12 lines. It has a repertoire of all numeric, alphabetic and punctuation characters. A control unit, containing buffer storage, character generator and communication interface, will handle up to 36 terminals and also drive hardcopy devices. It operates at up to 2400 baud. Price is $1750, or $60/mo. on a five-year rental. BUNKER-RAMO CORP., Stamford, Conn. For information:

CIRCLE 512 ON READER CARD

paper tape punch

Personal challenges have been delivered from horse-back and from bar stools, but they traditionally have taken the form of a claim of superiority. This vendor, following the time-honored procedure, claims for its high speed paper tape punch the distinction of being the "fastest paper tape punch presently in production." Operating at speeds from 0 to 310 cps in 5 to 8-level codes, the P-300 may actually have a claim to the title. Delivery is in 60 days for those that would care to clock it at work. Delivered with the unit is a bill for $3,500 which covers the punch, its electronics, and its power supply. ADVANCED SPACE AGE PRODUCTS, INC., Alexandria, Va. For information:

CIRCLE 513 ON READER CARD

electronic terminal

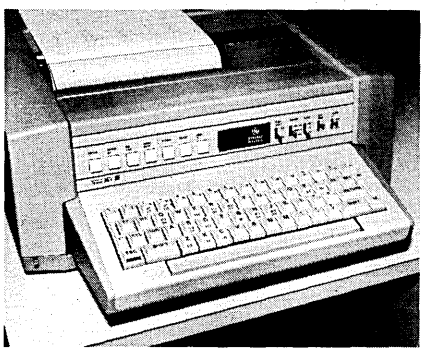
A light, ripping sound comes from the almost-all-electronic data communications terminal, TermiNet 300, as its hammers print out messages at 10, 15 or 30 characters a second. The new terminal, which has 12 patents pending on the electronics, keyboard, and print mechanism, is an "odd" product of GE's Specialty Control Department, more known for components than terminals. (The department is part of the Industrial Process Control Div. and has a sister communications department.)

The only things mechanical about the 300 are the ribbon feed, hammer striking, and paper advance mechanisms. About 20 LSI chips, each with 400-800 elements, are used for terminal functions; three vendors will supply the custom-made chips, said to have a "reasonable price." These chips and other electronic circuitry provide for a quiet operation suitable even for hospital environments and for an estimated realiability of 600 hours MTBF (1000 hours will be achieved by 1970, says GE). No periodic maintenance is required. Fifteen prototypes of the terminal, in development for three years, have been tested within GE for the last year.

Salient statistics include: 94-character keyboard, switch-selectable speeds of 10, 15 and 30 cps, printing of an orginal and six copies, USASCII transmission code, 10 characters/inch spacing, 75 and 118 print-position line lengths, and paper width of 8.5 or 12.85 inches. The light-touch keyboard utilizes magnetic coupling to generate codes and electronic circuitry which prevents double-striking. Two sets of type characters (allowing upper and lower case printing) rotate around in front of a bank of hammers eliminating the need for a moving carriage. The unit, which can be operated remotely, can be used with GE Digi-Net 110 or 111 data sets or Bell 103 series modems and with acoustic couplers. The cabinet has been built with enough room to add more logic—such as the two or three logic modules that would be required to integrate a data set, bypassing separate packaging. This is being considered.

Optional features available: a photoelectric paper tape reader with a read speed of 10, 15, and 30 cps and a transmit speed of 120 cps; a solenoid-driven paper tape punch; horizontal tabulation, operable from a remote location or the keyboard; answerback capability; two color printing (not to be implemented this year); half or full-duplex transmission; vertical tab and form feed; and error detection.

The GE department is not actually set up for end-user distribution and intends primarily to sell in quantity to OEM's or large users—two of which are likely to be GE's time-sharing ser-



vices division, which uses 5-10,000 terminals, and the computer manufacturing division. The single unit price for the basic terminal will be $3,400 (no rentals), with "typical" quantity discounts of 25% (unspecified). The paper tape reader/punch option would add $2,200 to the one-unit price, while a system with all options would retail for about $6,500.

Service will be via GE maintenance contract or GE will train the buyer's instructors or field service personnel at a cost of $200/man for a one-week course. GE SPECIALTY CONTROL DEPT., Waynesboro, Va. For information:

CIRCLE 514 ON READER CARD

remote card reader

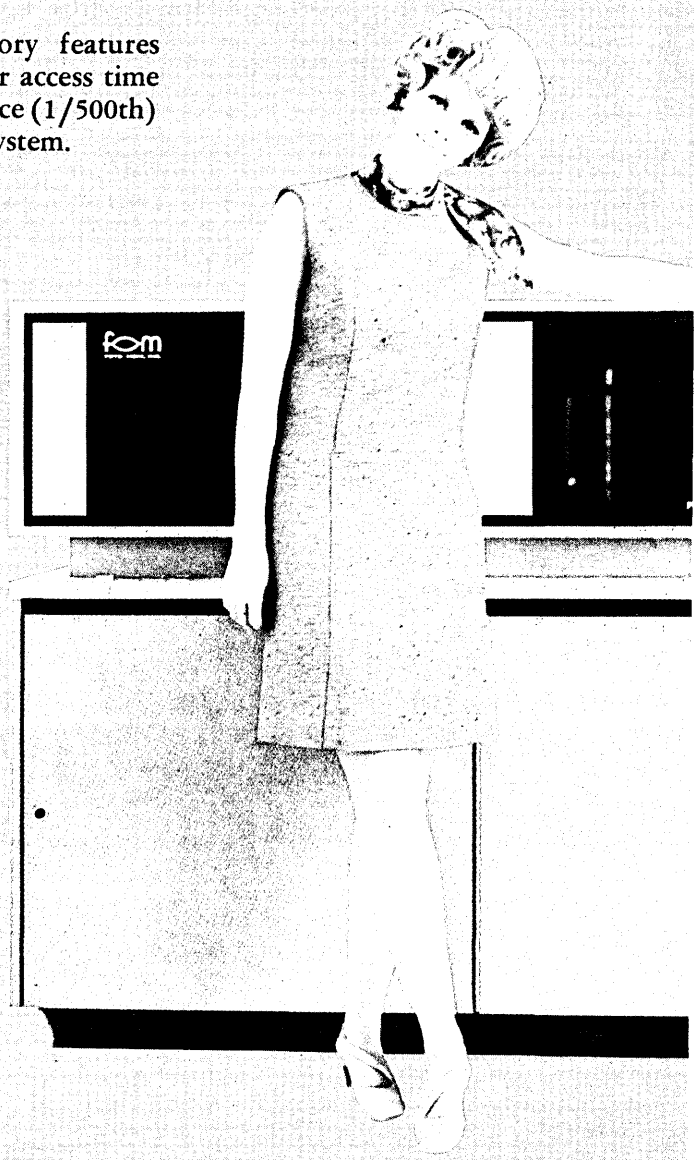
Whatever the market for small remote-site card readers might be, this firm is on top of it. It seems that IBM is encouraging its QUIKTRAN users to adapt to CALL 360/BASIC. Most of the QUIKTRAN users, this vendor claims, are card-oriented and are using 1050's. IBM does not support 1050's through its Service Bureau CALL 360 program. The Service Bureaus could support, however, a remote card reader compatible with the IBM 2741. Funny thing. Data Computing Inc. just so

Introducing the

FM 390

The First Random Access Mass Memory With Multi-Billion Bit Capacity — send for descriptive applications brochure.

The FM390 Random Access Mass Memory features larger bit capacity (up to 250 X) and faster access time (30 milliseconds) — while requiring less space (1/500th) than any other presently available memory system.



Microfiche-Ultrafiche Viewers

Multiplex Viewer-Display Terminal Systems (Data-Vision Systems)

Photo-Optical Random Access Mass Memories

Automatic Microform Storage-Retrieval Systems

Microfiche Reproduction Systems

fom
FOTO-MEM, INC.

FOTO-MEM INCORPORATED, 2 Mercer Road, Natick, Massachusetts 01760 (617) 655-4600

CIRCLE 87 ON READER CARD

happens to have a reader capable of operating over voice-grade phone lines at a rate of 14.8 cps, and compatible with the 2741 Communications Terminal. Called the Cardliner 15, the unit is an upgrade of the Cardliner 10, a device which used v-g lines to trans-

mit at 10 cps and code convert from Hollerith to EBCDIC through a tty interface. The basic differences in the two readers are the code conversion—the 15 converts to ASCII—and the speed of the motor. Since the Cardliner 10 (and the 15) have only two moving parts, the conversion must have been easy. Minimum rental price for the 15 is to be "about $75/mo." depending upon the number of cards processed. DATA COMPUTING INC., Phoenix, Ariz. For information:

CIRCLE 515 ON READER CARD

tape drives

Two series of tape drives are offered for use with Stromberg DatagraphiX Micromation printers. One series is a group of stand-alone units, the other of built-ins. Incapable of writing tape, the drives come with either read/read heads or read/write heads with the write function blocked. Read speeds vary from 20.8 to 180 Kc with tape speeds from 37.5 to 112.5 ips. Packing densities run from 556 to 1600 bpi phase-encoded. Prices range from $15,800 ($395/mo.) for a built-in 7- or 9-track 37.5 ips unit, to $34,000 ($850/mo.) for a full-blown drive. Maintenance charges from $70-$100/mo. apply on the rental units. STROMBERG DATAGRAPHIX, San Diego, Calif.

CIRCLE 516 ON READER CARD

port selector

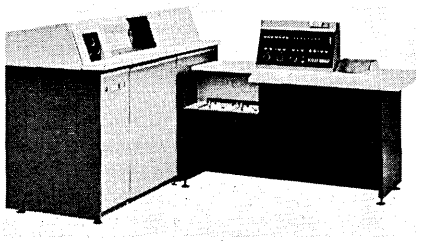
A data transmission coming into a time-sharing computer cannot take "any old port," because the one it chooses might be busy. Either an input channel must be dedicated to a remote site so that the incoming transmission will not conflict with another transmission, or the central site computer must be equipped with a piece of gear like the AS-1000 Automatic Computer Port Selector. The AS-1000 allows the dp personnel to float some or all of the input channels among the inquiring data sets, providing a service flexibility and maximum use of the computer resources.

The device can handle an assortment of input and output lines. It can, for instance, link 16 data sets to 6 input lines, or 14 data sets to 8 input channels, as long as the total number of lines adds up to be 22. The speed of the lines is not relevant, since the 1000 is a switching device, not a communications adaptor or multiplexer. The 22-line configuration just mentioned sells for $7,000 without expansion capabilities. Larger systems, for up to 352 lines, are also available. TECHNICTREND, INC., Pennsauken, N.J. For information:

CIRCLE 517 ON READER CARD

remote batch terminal

Scientific Data Systems Sigma 5 and Sigma 7 computer users can now use their systems in a remote batch operation. Extensions have been made to the Batch Time-Sharing Monitor and



to the Batch Processing Monitor to accommodate the use of Model 7670 Remote Batch Terminals. The 7670, which has been seen before as the Univac DCT-2000, offers a 200 cpm reader, a 75 cpm card punch, and a 128-column, 250 lpm bar printer. In addition to its on-line duties, the 7670 can be used off-line to print and punch. During transmission to the central site computer, the card images being sent can also be listed. Automatic and unattended printing and answering are standard operational features; automatic error checking can force a telephone alert for operator intervention.

The system will lease for $810/mo. or sell for $36,000. A Peripheral Controller can be added for $2,000 (purchase) to interface to plotters, tape drives, or other devices. SCIENTIFIC DATA SYSTEMS, El Segundo, Calif. For information:

CIRCLE 518 ON READER CARD

printing calculator

The Series J800 is an automatic printing calculator with a new multiplier memory. Operations are controlled by 10 single purpose keys and there are multi-cipher keys to allow fast cipher entry of one, two or three ciphers. The J800 has a memory control selector for accumulated total of numerous prior operations: add, subtract, and multiply mix. The space levels may be set for single space or five automatic spaces after totals. Safety features include first factor correction, a safeguard against exceeding capacity, and multiplication halt. Two models are priced at $359. BURROUGHS CORP., Detroit, Mich. For information:

CIRCLE 519 ON READER CARD

bank terminal

A bank teller can interrogate a customer account, enter a deposit, figure interest, or check a payment with this banking terminal. The 25-pound unit acoustically couples to a telephone, uses two ten-key keyboards to input data, and a strip printer to receive the computer reply. Operating mode may be originate only, half- or full-duplex. ASCII code is employed. The price is "under $2,000" for anyone needing oem quantities of 50. OMNITEC, Phoenix, Ariz. For information:

CIRCLE 520 ON READER CARD

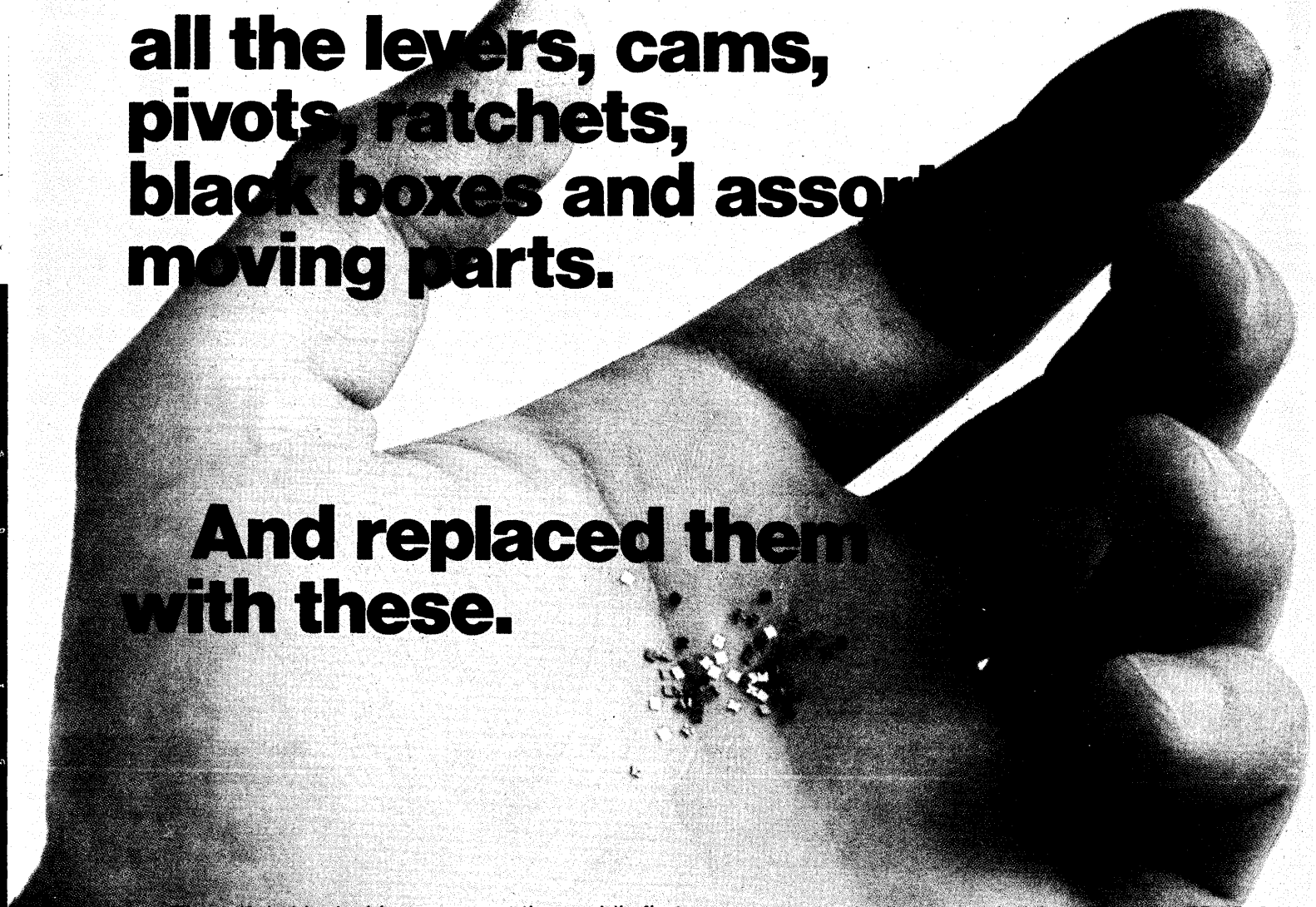
mag tape transport

The Model 1010 Duo-Drive magnetic tape transport features a patented servo control system, said to be the first to provide IBM compatible mag tape by direct reel to reel tape transfer, without any intermediate tape motion

control. All functions necessary for "complete IBM interchangeability" are provided by electronic control of the supply and file reels. Transfer rate is 15 KC for 9-channel, 800 bpi operation, including read in reverse capability. A 7-channel configuration is also available. The unit is contained in a 19-inch rack mounting chassis with a panel height of 12¼ inches and a depth of 13 inches. Price is $2,700 in

FOR MICRO SWITCH CIRCLE 88 ON READER CARD →

We've taken out all the levers, cams, pivots, ratchets, black boxes and assor moving parts.



And replaced them with these.

These little black chips represent the world's first application of an integrated circuit as a keyboard switching element.

Actuated by a magnet on the key plunger, the integrated circuit delivers a digital output which is fed into the encoding matrix of the keyboard. Codes are thus transmitted electronically instead of mechanically as in conventional keyboards.

This all solid state keyboard has no mechanical linkages. No electromechanical parts. No moving contacts. No black boxes. The bounce-free output eliminates the need for any special circuitry to adapt it to your equipment.

And the price is down as much as the technology is up. In production quantities, a mere $100 buys an all solid state, assembled and encoded keyboard. Also the inherent reliability of the all solid state design helps you beat the economics of servicing equipment in remote locations.

MICRO SWITCH can supply all standard key and custom arrays. Block or offset. Encoding of any 8-bit code (or less); hexadecimal; Baudot, BCD; USACII mono-mode, dual-mode and tri-function; plus EBCDIC and custom codes.

Our handy "Condensed Keyboard Guide" briefly discusses keyboards and options to give you an idea of the broad offering that we already have available. MICRO SWITCH application engineers are ready to work with you in developing the most economical keyboard designs to meet your precise format and encoding needs.

MICRO SWITCH
FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL

new products

OEM quantities, with delivery in 6 weeks ARO. BUSINESS & COMPUTER DEVICES INC., Plainview, N.Y. For information:

CIRCLE 521 ON READER CARD

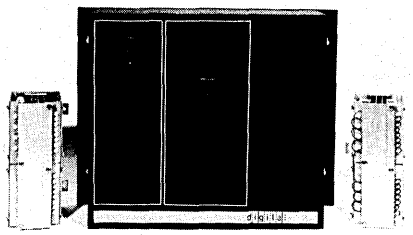
system monitor

There may be some confusion between the Systems Utilization Monitor from this vendor and the Computer Performance Monitor produced by Heuristic Systems Div. of Applied Computer Technology. The confusion is cleared up by saying that a Mr. Dudley Warner, pres. of this firm, once, not long ago, was with the other. SUM, the Systems Utilization Monitor, measures the activity and interaction of hardware components of a system, such as cpu, channels, and peripherals, and of storage partitions in a multiprogramming machine. Indirectly, then, it is possible to measure the efficiency of the software too. SUM writes out onto 800 bpi 7- or 9-track mag tape the information it garners, for processing on the same system. Data processing management is then in a position to alter the priority schedules, re-dedicate data sets, or work on operating system efficiency. Sixteen counters are used; each can be operated at speeds from 1,000 samples/sec. to 1,000,000 samples/sec. A six-digit decimal display allows for monitoring the monitor while in operation. SUM is priced at $35,000. COMPUTER SYNECTICS INC., Santa Clara, Calif. For information:

CIRCLE 522 ON READER CARD

machine controller

The PDP-14 general purpose machine controller is aimed at capturing "part of the multimillion dollars spent annually" for electrical relay networks used in "virtually all" mass production; the prime market is expected to be equipment manufacturers who supply control networks to such industries as steel, automotive, textile and machine tool builders. The unit comprises a cpu and a mechanically alterable read-only memory (ROM) with a capacity of 1K 12-bit words, expandable in 1K blocks to 4K. Primary advantage of the PDP-14 over conventional electrical relay networks is said to be the use of the ROM. "With electrical relays, entire control networks, designed and installed at considerable time and expense, are invariably discarded completely when production changes are planned. With the PDP-14, the user just defines his new production parameters, and installs a new ROM at minimal cost and in a matter of minutes." Using special software for the PDP-8 computer, the control engineer can generate the input for the new ROM or the design change, and can use the computer to simulate the new routine;



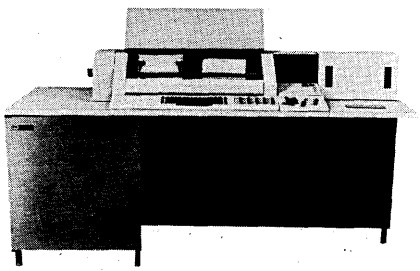
cost of a ROM prepared from a user's paper tape is only $280. Braided-wire memories, made by Memory Technology Inc., are used. The PDP-14 measures 24 x 18 x 8 inches, intended for installation in standard NEMA-12 enclosures. Prices start at under $5,000 without quantity discount. Deliveries are expected to begin by summer. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 523 ON READER CARD

accounting machine

Two slots on the face of the IBM 6430 programmed accounting machine are for its built-in card reader. Slide a card in one opening and 80 instructions of an accounting program are entered; the basic system configuration has enough memory for two cards worth, 160 instructions. A second 160-instruction memory bank can be added. A 22-inch printer with provisions for handling two forms at a time also comes standard. Based on a "golf ball" element, it is rated at 15½ cps.

The 6430 does not come with appli-



cations programs per se. Instead, manuals describing how to structure a program for billing, accounts receivable, inventory, etc., are provided.

Access time for data or instructions is 50 usec; most instructions require 1.8 msec. Control and data entry is performed through the typewriter-style keyboard, a 10-key numeric board, and a set of 20 control and decision keys. Lease price on the system is $450/mo.; purchase price is $15,750. A card punch, rated at 15-19 col./sec. as is the reader, hikes those prices to $740/mo. and $27,100. IBM, White Plains, N.Y. For information:

CIRCLE 524 ON READER CARD

1100 lpm printer

The PRT-130 printer is the fourth and fastest printer available for the GE-100 line of computers. Software for the printer operates under supervision of either the disc or tape operating system. Price is $42,600 or $1,150/mo. rental. GENERAL ELECTRIC CO., Schenectady, N.Y. For information:

CIRCLE 525 ON READER CARD

360 compatibility

A System/360 compatibility survey service is offered to individual peripheral manufacturers, who want to penetrate the 360 market but are unable to gauge the amount of effort necessary to achieve compatibility. The survey covers such topics as interface requirements; OS and DOS modifications; remote and local connection; and system support, including program maintenance, documentation and distribution. The service is offered at a fixed fee of $500 plus travel expenses for a PSC consultant. PROGRAMMING SCIENCES CORP., New York, N.Y. For information:

CIRCLE 526 ON READER CARD

multipoint recorder

Datapoint will sample from 2-8 channels, from high-level sources mixed with low-level sources such as thermocouples, at rates from 2-20 times per second. In its "intensified" operating mode the system can be used to sample higher level channels, such as for temperature or strain gauges, more frequently than the low level lines. A second specialized operating mode allows for sampling a single channel at rates up to 5Hz full scale, or at higher rates for reduced amplitudes. A single pen is used which touches the chart briefly each time a channel is sampled. The resulting record consists of multiple traces on a single grid moving at one of 12 selectable speeds. The unit price is about $2,500. CLEVITE CORP., Cleveland, Ohio. For information:

CIRCLE 527 ON READER CARD

(Continued on page 186)

Introducing the UNIVAC 1106.

When the need arises, it becomes the 1108.

Meet the newest computer system in the UNIVAC® 1100 family, the UNIVAC 1106 system. It's for people who aren't ready for the full power of an 1108 yet. Or those who already have a large scale system and could benefit from additional capabilities.

And when your needs grow into the large scale range, the 1106 can grow with you. In fact, it can be up-graded to an 1108 on site.

The 1106 employs the same proven design techniques as well as the tested software and peripherals of the large scale UNIVAC 1108. The UNIVAC 1106 provides better communications capabilities and more throughput per dollar than any competitive system in its price range.

And since it can be easily up graded, it offers an economical way of getting multi-processing advantages.

Either EXEC II or EXEC 8 software systems are available and all further programs designed for the 1108 will be applicable.

Be sure you meet this newest member of the UNIVAC 1100 series, you'll be glad you did.

UNIVAC

Univac is saving a lot of people a lot of time.

SPERRY RAND

new products

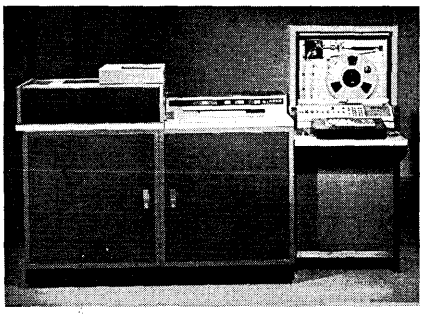
12-high disc drives

Using the 12-high IBM 2316 type disc pack, the GE multi-drive disc storage subsystems provide storage capacities ranging from 90 million to 220 million characters. Each 12-high pack is capable of storing 15 million-plus 6-bit characters. By varying the number of drives in a DSS 167 subsystem, the user can opt to have from 90 million (six drives) to 120 million (nine drives, one a spare) characters on-line. With the DSS 167, the data is accessed at a rate of 75 msec/seek and output at the rate of 208,000 cps. If greater speed or storage is required, a 220 million-character DSS 170 subsystem is also available. The 170 has an access time of 75 msec also, but its data rate is listed at 416,000 cps. The 167 rents for $3,185/mo. for the six-drive version; an additional $75/mo. is charged for the nine-drive model shown above. The 170, which is akin to the IBM 2314, rents for $5,675, and is available in the nine-drive configuration only. GENERAL ELECTRIC CO., Phoenix, Ariz. For information:

CIRCLE 528 ON READER CARD

source data entry

The 9650 CODE (Computer Oriented Data Entry) scanner, an optical code reader and data converter interfaced to a buffered magnetic tape unit, reads unit documents imprinted with fields of either A-M Bar Code, Hollerith punched data, or a combination of

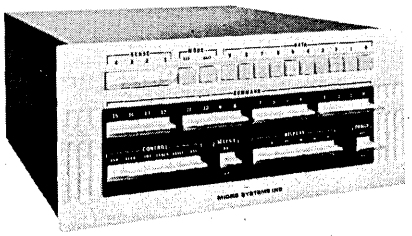


both, converting the data to mag tape for computer entry. The 80-column cards (optional capability to 180 characters) can be read at up to 300 cards per minute, and the data may be recorded on ½" 7-channel 200 bpi or 9-channel 800-bpi tape. Read-after-write operation is performed on all records written on tape. Stored program control provides record formats for mag tape and printer. The unit also includes a 64-character keyboard for entry to or verification of memory contents. Printout can be by typewriter at 15 cps or at 40 cps on a character-serial printer. The units may also be optionally adapted for long-distance transmission. Separate outfile hopper enables the machine to operate automatically; both input and output hoppers have a 1000-card capacity. Base price is $27,500 and first deliveries are scheduled for the last quarter of 1969. ADDRESSOGRAPH MULTIGRAPH CORP., Cleveland, Ohio. For information:

CIRCLE 529 ON READER CARD

control processor

Microprogramming through read only storage makes the MICRO 800 a more powerful system than its 9 x 17 x 23-inch size would suggest. A byte-oriented machine, the 800 is offered with from zero to 32K of 8,9 or 10-bit bytes of storage. The core is rated at 1.1 usec full cycle time, and is augmented by



256-1024 words of read-only memory rated at 220 nsec per micro-command execution.

Aimed at the process control market, the 800 can actually be used as a controller without a memory module. In this case, commands are stored in firmware and the 16 general purpose 8-bit file registers do the buffering. In this configuration the controller lists at $2,950 with 256 words of read-only store. The flexibility of the firmware also allows for specially-designed macros to supplement the existing 89- instruction set. Up to 32 I/O interface controllers can be added.

In basic trim, with the 4K 1.1 usec memory included, the MICRO 800 is marketed at $5,450. Discounts to OEM may be as much as 40%. MICRO SYSTEMS, INC., Santa Ana, Calif. For information:

CIRCLE 530 ON READER CARD

360 bulk core memory

Plug-to-plug compatible bulk core memories will be supplied for the IBM 360 series models 50, 65, and 75—and later for the 360/67—beginning in the first quarter of 1970. The CM-300-LCS bulk stores are available in one-half, one, and two million-byte capacities. Access times on the units are listed as 2.0 usec. or less; full cycle times are 3.2 usec. The memory systems come packaged in a section housing the controller and sections housing the stacks; therefore the CM-300-LCS systems are as modular as, or more modular than, most bulk stores, and expansion of user systems should be reasonably easy.

Maintenance contracts will be available through the manufacturer, but most maintenance will probably be handled by the mainframe manufacturer, as in earlier products from this vendor. (Its memories are found in the GE 600 series machines, and in other lines such as RCA, ICL, and SCC.) LOCKHEED ELECTRONICS CO., Los Angeles, Calif. For information:

CIRCLE 531 ON READER CARD

microfilm reader

The 4317 reader is designed for read-out of images on 16mm film size, either in 100-foot spools or film cartridges. Microfilmed computer fanfold material and similar types of documents can be viewed in vertical or horizontal position. The reader features 20X image magnification on a 12" x 12" green tinted translucent screen. At high speed film moves through the reader at a rate of 100 feet in 15-20 seconds. The unit is 15" wide x 15" deep x 22" high and weighs 33 pounds. Power requirements: 100-125 volts, 60 cycles, 4 amperes, AC. List price is $375. EUGENE DIETZGEN CO., Chicago, Ill. For information:

CIRCLE 532 ON READER CARD

51 x 12 tab reader

The 51 x 12 Tab Reader features a safety device said to assure users that contacts are closed before power is applied, thus preventing damage due to heavy current loading. The device is a side-mounted Micro Switch which serves as a "make ready" switch, which is actuated only after the card is seated and the contacts closed; current cannot flow through partially closed contacts that offer more than minimum contact resistance. The reader is used for data acquisition, production control and process control applications, and provides a full 612 bits from a standard 80 x 12 punched card. Price is $750. SEALECTROCARD CORP., Mamaroneck, N.Y. For information:

CIRCLE 533 ON READER CARD

gigantic memories

The FM 390 is no ordinary memory. It's no less than a photographic memory, which cannot be erased, and can record up to a few hundred billion

FOR DATA DISC CIRCLE 90 ON READER CARD →

The micro-revolution in disc memories

Data Disc's new Micro-space heads skim a measured half wavelength of light above the disc—far closer than heads in any other disc memory. That precision brings new reliability and new economy to disc memories. New reliability because heads so close to the disc can record sharp, well-defined magnetic regions and reproduce strong, clean signals. New economy because bits are packed closer—100,000 per track—to give you 50% more capacity per dollar invested.

As one of many rigorous tests, our quality control technician reads light interference patterns through a microscope to measure the space between head and disc precisely. Only heads spaced 10 to 15 microinches pass.

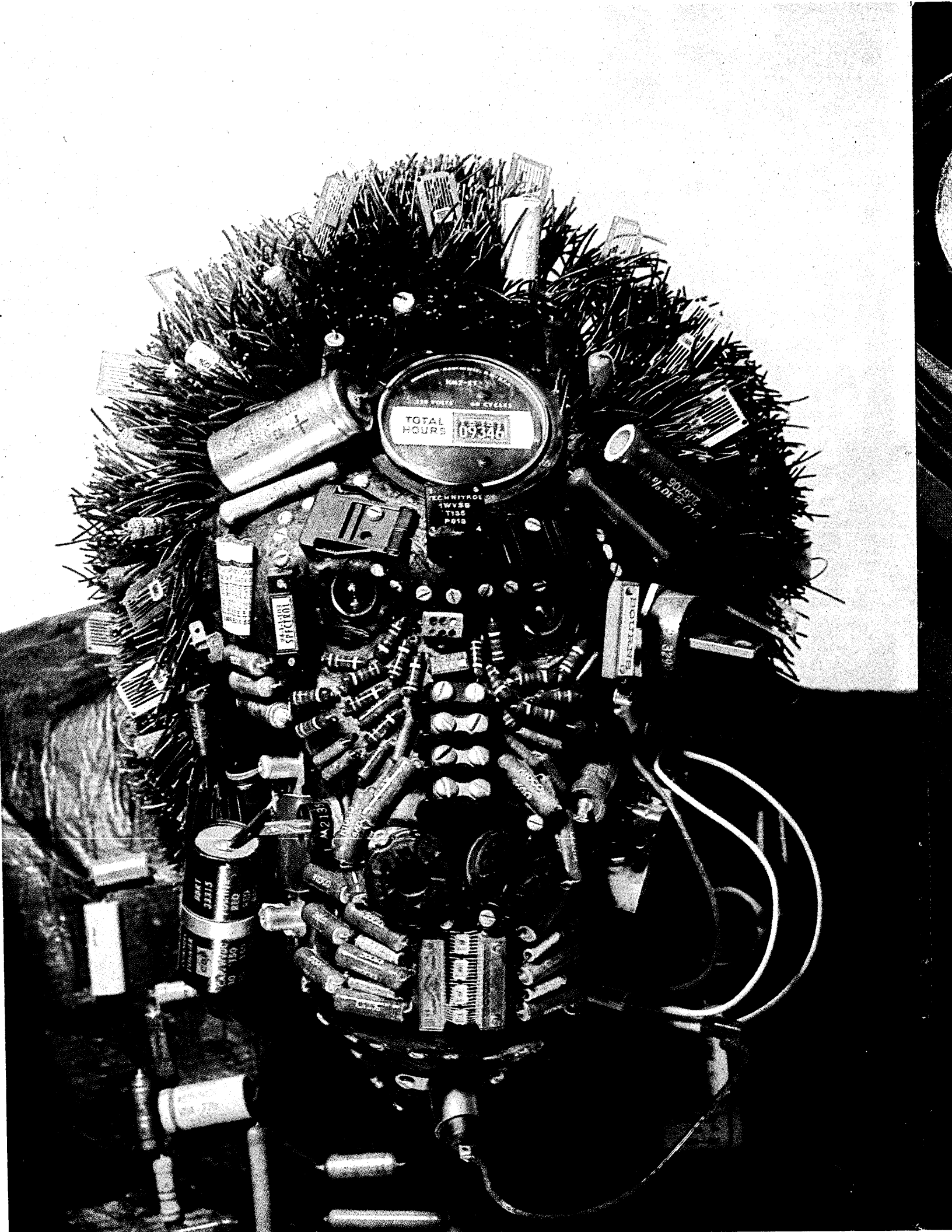
Data Disc's Computer Products Division memories store 100,000 bits on each of 8, 16, 32 or 64 tracks for a maximum capacity of 6.4 million bits per disc. Data Disc's Display Division memories store a whole TV frame on each of 72 tracks—in either digital or analog form. Complete memories usually occupy 10½ inches of rack space.

Data Disc helps you design our memories into your system and provides all necessary service at a modest fee.

For complete information contact Dave Redick, Computer Products Division or Chuck Masters, Display Division, 1275 California Ave., Palo Alto, Calif. 94304. Phone (415) 326-7602.

DATA DISC

Micro-space precision creates more memory for your money.


TOTAL HOURS
09346
SPECTROL

Evolution of the Computer

The dawning of the 4th generation.

The Honeywell 4200 computer:

It's a large-scale computer. But it's something more than that:

It's the beginning of a new generation in computer technology and performance.

Advanced memory

The 4200's memory allows separate and simultaneous access by central processor and input/output controller. And separate memory modules allow independent, multiple, and overlapping accesses. That's a lot of throughput.

The 4200's read-only memory is electrically alterable. So instruction is flexible. And the computer is prepared for firmware of the future.

Its integrated circuitry is really advanced. In fact, we're now approaching large-scale integration.

The 4200 can concurrently transfer data on 16 input/output channels and support up to 96 peripheral control units – and compute at the same time.

Its maintenance processor allows diagnosis and repair of peripheral equipment while the computer's running.

Mod 4

One of the best things about the 4200 is its operating system: The easy-to-use, multi-programming Mod 4 system executes up to 20 different jobs at once.

Mod 4 dynamically allocates the use of central processor, memory and peripheral equipment, for optimum efficiency and flexibility.

It handles remote and local job entries and real-time inquiry responses concurrently.

It's working.

The Honeywell 4200: a versatile, direct-access, up-time computer. It's working beautifully for Honeywell customers right now.

The highlight of the SJCC in Boston, the 4200 is the biggest, most advanced computer ever exhibited at a trade show.

The Other Computer Company:

Honeywell

Sculpture by Jack N. Rindner

CIRCLE 91 ON READER CARD

bits. The system employs Photo-Data-Cards, each of which store up to 30 million bits on a photosensitive card about the size of a postcard (standard microfiche size), contained in a photo data cell which houses 100 cards. Access time per cell averages 30 msec. Transfer of information is at the rate of 100,000 bps. The system performs read functions from a particular or random location on the PDC, and reading may be in parallel and transferring may be either parallel or serial.

The FM 390 comes complete with plug-in interfacing for use with I/O devices such as discs, tape drives, drums, keyboards, other FM 390's, as well as on-line interfacing with computers. And if you want to expand the system later, off-line modules of three million bits each are available at $30, while 500 billion-bit on-line modules cost $15,000 each. Price of a basic system, including reader/writer, storage, and retrieval units, is about $75,000, with a capacity of 500 billion bits. The firm believes the FM 390 is the only photosensitive memory being marketed, although it concedes that IBM once built a photographic memory under a military contract, but never marketed the system. Delivery requires 6-9 months ARO. FOTO-MEM INC., Natick, Mass. For information:

CIRCLE 534 ON READER CARD

mini memory—5¢ a bit

The ICM-160 memory system has 4K capacity and is available with 8, 12, or 16 bits per word, and measures only 2¾ x 5 x 9 inches. The system is field expandable to other word and bit sizes on a modular basis. Cycle time is 1.6 usec, with access time of 550 nsec. Applications are expected in machine tool control, petroleum, chemical, steel and power process control systems, peripherals, and data rate buffering. It is also designed for use as a mainframe memory in general purpose and special systems.

The circuitry and core stack of the memory are packaged on removable printed circuit cards for ease of maintenance. The system uses a four-wire coincident current magnetic core array. The unit is self-contained and includes an address register, internal timing and control, sense amplifiers, and integrated circuit x-y selection switches. All logic, addressing, decoding, control, x-y selection switches and sensing functions use integrated circuitry which provides a high calculated MTBF of 40,000 hours. The system is both electrically and mechanically compatible with Honeywell Micro-Pac units, and can be operated from common power supplies. Delivery requires 30 days ARO. Price was imaginatively described as "five cents per bit." HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 543 ON READER CARD

chart recorder

This compact single channel 100 mV instrument, designed for a broad range of laboratory and production applications, features three chart drive speeds of 2, 10, and 50 cm/minute and uses 4¾"-wide paper. Pen response is to 0.3 seconds full span. Price of the chart recorder is $395; delivery in 30 days or less. SLOAN INSTRUMENTS CORP., Santa Barbara, Calif. For information:

CIRCLE 536 ON READER CARD

communications controller

GE has improved on the Datanet-30 with the addition to the line of communications gear of the Datanet-355. The old communications front-ender could have from 10-50 simultaneous users, worked on a 18-bit word, and had a 7 usec. cycle time with 16K of memory. The 355 can serve up to 192 communications lines with up to 400 users. Built to direct couple to the GE 600 series memories, the unit can accommodate bit rates from 75 to 50,000 bps. Handling data in 6,9,18, or 36-bit word lengths, the 355 is available with either a 16K or 32K memory rated at 1 usec cycle time. Words of all usable sizes are individually addressable and can be mixed in storage. The system has a 96-instruction set, three hardware index registers, with multi-level indirect addressing, and is driven by 256 levels of hardware interrupts. Lease prices for the system begin at $4,000 per mo.; for instance, a 48-line configuration for time-sharing over Teletype lines would go for $4,345. GENERAL ELECTRIC CO., Phoenix, Ariz. For information:

CIRCLE 535 ON READER CARD

2400 bps data set

The Modem 2200/24 transmits data at 2,400 bps over either dial-up or leased lines. It is compatible with the Western Electric 201B, but is said to be a "new type of four-phase modem," and includes circuit techniques identical to those of the firm's Modem 4400. The 2200/24 provides the capability of communication fully on a dial-up basis, or using dial-up as backup to leased lines through the recent Data Access Arrangement. The unit is also intended to meet the needs of international users, and is claimed to be the only data set on the market which can, by strap selection, satisfy either of the transmission methods recommended

a 16 BIT COMPUTER with 32 BIT CAPABILITIES for a 16 BIT PRICE!

The SCC 4700 has the earmarks of a 32 bit computer. The surprise is its price — strictly in the 16 bit category. Whatever your application — be sure to check out the 4700. Here are its major features:

FLOATING POINT ARITHMETIC
- 48 bit precision!
- 30 usec multiply 48 x 48 bits
- 39 usec divide 48 x 48 bits

MEMORY SYSTEM
- 920 nsec full cycle time
- 131 K bytes or 65K words maximum size
- Multiple paths to multiple memory modules

INSTRUCTION SET
- 113 basic instructions
- 16 or 32 bit instruction format
- Byte addressing

I/O STRUCTURE — 4 MODES
- Multiplexor channel — block transfer 90 K bytes/sec
- Selector channel — block transfer 1 mbytes/sec
- DMA Channel — block transfer 2.0 mbytes/sec
- Parallel I/O channel — under program control

Scientific Control Corporation

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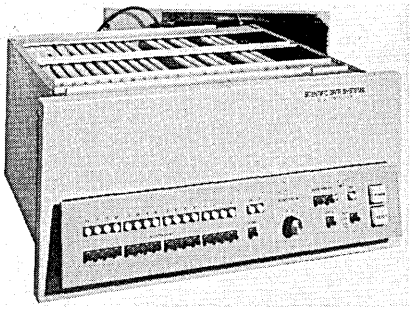
by the CCITT international standards group. Price is $2,350, with deliveries expected to begin this summer. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. For information:

CIRCLE 537 ON READER CARD

controller/computers

These small programmable system controllers have instruction sets which include "large" instructions for performing functions which generally require several instructions on other machines. For instance, a three-way branch instruction is provided in place of two two-way branches in series. A more dramatic instruction is the SCAN



MEMORY command which replaces a complete loop. Because of the nature of the 126-instruction set, many control functions can be performed on the CE16 and CF16 machines with two-thirds of the core which would be required on an otherwise-comparable competitor.

Designed primarily for process control applications, the CE16 and CF16 are priced at $12,800 and $14,900, respectively. The added price of the CF model reflects the replacement of the CE's processor, which is rated at 16 usec for an add or 126 usec for a fully-signed software multiply, with another which is rated at 5.33 usec and 42 usec. Other hardware features include 4K of 16-bit memory (expandable to 16K) and three channels of interrupts (two are hardware features, the third is a programmable interrupt which can access any location in core directly).

Software for the systems includes an assembler, utility and diagnostic programs, and math routines. SCIENTIFIC DATA SYSTEMS, El Segundo, Calif. For information:

CIRCLE 538 ON READER CARD

digital comparators

Dynamic or static BCD inputs can be compared to pre-established limits with the 3200 series of digital comparators. Made to interface with digital instruments such as totalizers and timers, the series comprises single- and dual-limits units, with from four to eight digits per limit, signed and unsigned. The comparators check the BCD inputs from the instruments against limits entered on thumbwheel selectors or entered remotely from other logic level sources. A "GO" or "NO GO" response is made by the single-limit units; dual-limit comparators respond with either "HI," "LO," or "IN-LIMITS." In addition to lighting the correct panel indicator, the devices have three corresponding output signal lines for process control and three similar logic level signals for computer input. Prices for the series range from $425 for the single-limit unsigned unit, the 3201, to $825 for the dual-limit algebraic unit, Model 3202. The prices are slightly higher for units with more than four digits. ATEC, INC., Houston, Texas. For information:

CIRCLE 539 ON READER CARD

9600 baud modem

Data transmission rates for dial-up phone lines are not extremely fast due to inherent instabilities in the phone lines. The AE-96 Modem irons out some of the unevenness with its built-in digital adaptive equalizer. By doing this, the modem is capable of handling 9,600 baud duplexed data transmissions, quadruple the normal rate of the line. The phone circuits are originally equalized through a single pushbutton operation. Thereafter, the equalizer measures intersymbol interference continuously and compensates for circuit changes as many as eight times per second. In its 9,600 bps mode of operation, the 96 transmits four bits per cycle of bandwidth by means of four amplitude levels; a front panel switch provides an alternative transmission speed of 4,800 bps, using two amplitude levels. The device is priced at $23,000 with substantial discounts to OEM. CODEX CORP., Watertown, Mass. For information:

CIRCLE 540 ON READER CARD

photoelectric reader

The PTR-723 paper tape reader uses a light source, lens system, and photocell to read tape, thus minimizing tape wear and increasing accuracy in reading out-of-tolerance or soiled tapes. The drive allows either unidirectional or bidirectional operation. Opaque or translucent tape can be read at speeds up to 1,000 cps. Tape reels are not used, but rather, the tape is neatly folded at either side of the capstan. GENERAL ELECTRIC CO., Schenectady, N.Y. For information:

CIRCLE 541 ON READER CARD

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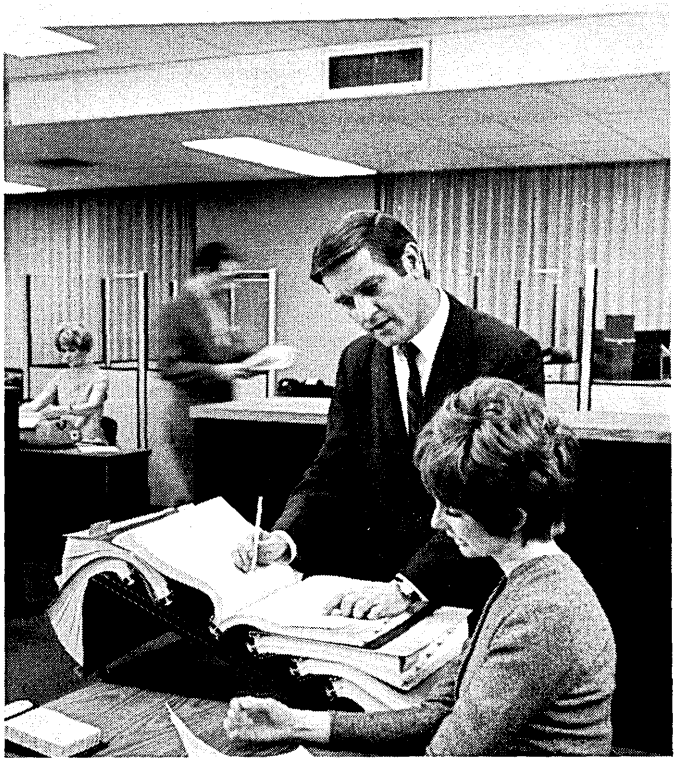

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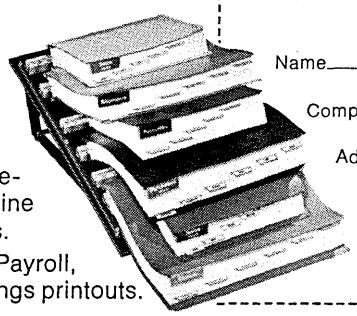

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new software

flowchart replacement

This package accepts as input a COBOL source deck and a data element name/mnemonic cross reference. From these it produces any or all of the following: a new source deck with mnemonics replaced by source names and with existing paragraph names replaced with sequentially-related names; a new program listing; a paragraph name cross reference; and data element name cross reference. If the data element name/mnemonic is not submitted, the program will supply record-related names with sequence numbering. In this case, data elements are then numerically- and mnemonically-related to the records.

With the COBOL Documentation System, the attributes of a flowchart are given to the program listing. Paragraph names are assigned a three-digit element so that the program logic can be traced. Program changes are facilitated by the cross reference tables and by the fact that records and paragraphs and logic sequences are all visually related.

The package requires an IBM 360 system with 32K operating under DOS. On a 360/30, the program was clocked at 180 cpm. The COBOL Documentation System will be sold for $2,500 and maintained permanently for no extra charge. Free 10-day trials are offered. SYSCOM, Manhattan Beach, Calif. For information:

CIRCLE 570 ON READER CARD

program checkout program

The Spectra 70 version of TESTPAK is a program which is designed to reduce a large data file to a small one which still contains the critical points for testing the decision branches of another program. If that larger file is not available, TESTPAK has the ability to construct a test file given the input parameters and their limits. The program has three modules. The first generates the test file. The second stores it on disc to be accessed by the program being debugged. Once the user program has been tried with the test data, a third module of TESTPAK is called in to print out the test data used.

A vendor spokesman claims that users report a time saving (using the older 360 version of the package) of up to 90% of the cpu time usually, or formerly, required for debugging.

Written in IBM 360 APL, the package has been converted to operate on a Spectra 70/45 with 64K. The converted version is priced exactly as its predecessor at $11,050. Two- or three-year sales contracts are available at $515 and $362 per month respectively. A free trial at the user installation is offered, without charge for the two- to four-week use of the program or for the programmer training involved. COMPUTER METHODS CORP., New York, N.Y. For information:

CIRCLE 571 ON READER CARD

executive software

EXEC 16 is an executive control package which provides multiprogramming capability for DDP-516 real-time programs. The software performs scheduling, interrupt handling, core allocation, coordination of I/O devices, and general supervisory functions. The computer's keyboard subsystem serves as a communications interface between EXEC 16 and the user, and also provides an on-line debugging capability. The master control program, "executive scheduler," determines which program will be executed at a given time. User programs are checked for priority before being executed. Multiprogramming capability is provided through hardware interrupts. A maximum of 50 programs is allowed on the basic system. A program can be requested by another program, through the keyboard, or in response to an elapsed time interval. All programs under executive control are started according to their priority in an executive table list. When a priority interrupt signal is received, an EXEC 16 interrupt handler automatically saves the contents of key system locations and registers so that control may be easily returned to the interrupted program.

The system's real-time clock is set to 50 msec intervals and provides three basic timing intervals (50 msec, one second, and one minute) or multiples of these intervals. Programs may be attached to any of three clock intervals. EXEC 16 coordinates I/O devices associated with a priority interrupt. All I/O devices may be accessed by any program within the system. Minimum configuration for EXEC 16 is a DDP-516 with 4K-word core memory, ASR-33 and real-time clock. Both core-only and core-disc versions are available. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 572 ON READER CARD

report generator

For management types who expect a near-miracle to occur before they will ever get quick, concise reports from the dp area, MIRACL has been developed. The acronym spells out to be Management Information Report Access without Computer Languages, and the vendor has taken pains to make the name meaningful. The user of the program, presumably a manager but more likely a subordinate, is given a booklet in which he describes the format of the report he wishes and its contents. He uses his own terminology for the entries.

To the user, a field headed by an "A" may signify "accumulator" or "adding machine"; he will place his own descriptor in the field, such as MAN-HOURS or MONEY, and let the system supplier worry about implementing his report request. The vendor writes a translation program for the application language, and generates the report in the desired format using his MIRACL COBOL routines. The system requires a 32K machine to operate (although one version is running on a 12K Honeywell 200) and a trained keypunch department (for deciphering the report request, and breaking the 132 column lines into unit record size). Keypuncher training, the software, documentation, and a few hours of instruction are included in the $5,000 three-year license contract. REPUBLIC SYSTEMS AND PROGRAMMING, INC., New York, N.Y. For information:

CIRCLE 573 ON READER CARD

OS/360 job entry

Conversational Remote Job Entry will enable OS/360 users to write programs from remote terminals, create data files and direct a central computer to process jobs. Job results can be printed at the user's remote terminal, routed to any other terminal in the network, or produced on a printer at the central computer. Program statements in FORTRAN and PL/I will be checked automatically for correct syntax as they are written. IBM 1050 data communications systems and 2740 and 2741 communications terminals are

FILS
Comprehensive instalment loan system for banks, developed by First National Bank of Boston. Written for correspondent and branch banks. Extremely versatile. Up to 31 different reports. Proven. IBM 360/30, 65k, 4 tape; COBOL.

BID
Comparative bond analysis program; gives immediate analysis of income and capital effects of a bond trade, including tax effects, on time share terminal. CALL/360, PL/1.

PERSPECT
Mech. drawings are easily coded; program then presents perspective views of object, even from inside. Cross-sections also. IBM 1130, FORTRAN.

ACCUFILE
Versatile file management system for safe, compact handling of computer programs or other library type material. Only 13 simple one-card commands. Includes flow charting program.

COMPUTER USERS: ABOUT TO REINVENT THE COMPUTER SOFTWARE WHEEL? WHY?

QTO/COST
Quantity takeoff and cost estimating program. Drawings are converted to punched cards on a digitizer; linear quantities entered directly. Costs data bank available or specially prepared. Complete breakdown by section is given. IBM 1130 or 360, FORTRAN.

AMR
Automatic management reports; unlimited variety of accounting reports. Special report specification technique quickly and easily specified by non-computer personnel. IBM360/30,COBOL.

CONTOUR
Automatic contour mapping of elevations, even on non-uniform grid. Accurate cartographically-acceptable plots produced. IBM1130,FORTRAN.

PIPE
Plumbing system sketch is coded for dia., lengths, etc. Program then plots mech. drawings of pipe sections, bends, etc. for shop. IBM 1130, FORTRAN.

The computer industry and its customers are suffering from a constant reinvention of the computer software wheel. As experienced people in the computer industry recognize, a continuing investment in essentially duplicated computer software plagues the industry – not only in dollars wasted, but more importantly in the creative technical talent consumed. The Cullinane Corporation is principled and structured to change this situation, with the most substantial and single-purposed effort to date, by locating, writing, and distributing the highest quality system and application software, and providing it with the proper support through a nation-wide network of technical/marketing offices.

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A CORPORATE PROFILE
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used with CRJE. A 360/50 or larger with 384K bytes of main storage is required for CRJE when the main processor is operating under Multiprogramming with a Variable number of Tasks. For Multiprogramming with a Fixed number of Tasks, a 360/40 or larger with 256K bytes is required. CRJE is scheduled to be available in the third quarter of 1970. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 574 ON READER CARD

1130-360 job entry

A remote job entry package makes the IBM 1130 a peripheral for a System/360 computer operating under the Attached Support Processor system, using Release Three. Under the Synchronous Transmit Receive mode of operation, the system communicates over normal voice grade lines at a rate of up to 250 cards and 300 lines per minute. During this use, the 1130 is totally dedicated to the remote job entry function. Although the package is available now, price was not announced. AVCO COMPUTER SERVICES, Wilmington, Mass. For information:

CIRCLE 575 ON READER CARD

spectra 70 bank software

Four new bank application software packages for the Spectra 70 are designed to operate on systems with a minimum configuration of Spectra 70/35 with 65K core and four tapes or discs. The packages are upward compatible with the 70/45, /46, and /55 systems. All four packages employ COBOL. The On-Line Commercial Loan is a disc-oriented system, based on "total customer relationship rather than individual loan." Both crt terminals and teletypewriters are supported for enquiry and response. The system may also be operated off-line. The Corporate Trust package provides stockholder accounting in five basic modules for stock transfer, cash dividends, stock dividends, proxy listings, and tax reporting. A certificate file is used to improve handling of surrenders. The Time Deposit package handles savings, clubs, and certificates of deposit, including both passbook and statement accounting. Tax reports, combinations of interest calculation, and accruals are processed by the system. The Installment Loan package provides consumer credit accounting and management reporting based on sequential tape processing. Management reporting includes delinquencies,

accruals, dealer accounting, and new business reports. RCA INFORMATION SYSTEMS DIV., Cherry Hill, N.J. For information:

CIRCLE 576 ON READER CARD

name file edit

A single-pass edit program for name and address files dissects identified fixed-field name and address tape files and isolates items within each field. The program is said to eliminate the need for multiple computer passes in editing tape lists and is useful in tape-to-tape list preparation for producing personalized computer letters, roster, and photo-composition directories. In the name field, name prefixes, first or middle name, and name suffixes can be extracted. These items can be converted to upper and lower case; abbreviation can be punctuated properly; or the full word can be inserted via a table look-up process (i.e., the abbreviation "Dr." can be spelled out "Doctor"). Last names with double capital letters, such as "MCLAUGHLIN,," can be converted to "McLaughlin," and "ODONNEL" to "O'Donnel." In the street and city/state/zip fields, abbreviations such as "Ave." or "PA" can be spelled out in full. At present, names beginning with "MAC," "O'," "D'," and "A'" are translated with the parameter look-up table. The program can be purchased for $950 including object decks and operating instructions, or for $600 when purchased with the firm's Complete file maintenance And coMputer letter System (CAMS). SOFTPAK, INC., Lanham, Md. For information:

CIRCLE 577 ON READER CARD

mini, midi, shoe software

According to IBM, "The way fashion styles change, today's mini may be a midi or a maxi by next week." This gives us more than the fourth generation to look forward to. But it also gives us a new software package, intended to help apparel and footwear manufacturers get the right merchandise to their retail customers before it goes out of style. Known as the IBM Order Allocation System, it is designed to fill customer orders based on priorities established by the user. The priorities can take into account such factors as the size and type of order, the retailer's requirements and ordering patterns, and the desired balance between inventory and open orders. Detailed "picking slips," listing all items to be shipped, are printed by the computer. The system may be used on any 360/25 or larger that has disc storage and a minimum capacity of 24,576 bytes. It is scheduled to be available in the first quarter of 1970. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 578 ON READER CARD

retrieval system

GRADS (Generalized Remote Access Data Base System) is written in COBOL and supports conversational inquiries in a time-sharing environment. Persons with "no" computer experience can use the system for retrieval, update, and comparison. The program encompasses file creation, file maintenance, selective reporting, and back-up for system protection. It has a minimum 32K core requirement with no record or file size restrictions. The system costs $5-10K, and the company will install, educate, maintain, and update. SOFTWARE METHODS, INC., New York, N.Y. For information:

CIRCLE 579 ON READER CARD

360 pl/i improvements

Version 5 of PL/I (F) is scheduled to be available from IBM in the first quarter of 1970. If you are planning that far ahead, here are some of the features you can look forward to: (1) faster execution speeds for scientific programs from better code and the use of optional loop and subscript optimization phases; (2) extensions to many of the message-processing facilities of OS/360 Queued Telecommunications Access Method (QTAM) available to PL/I users; (3) expanded data handling functions for conversions, validation and input editing; and (4) reductions in storage requirements for two-byte binary data through the use of the half-word binary capabilities of System/360. IBM, White Plains, N.Y. For information:

CIRCLE 580 ON READER CARD

business dp system

MARK IV, a program which is claimed to be operating "on all continents except Antarctica," has developed an offshoot, MARK IV/2. The general purpose business system attempts to be all things to all men. It simplifies and automates file creation and maintenance, information retrieval, processing, and outputting. MARK IV/2, just as its predecessor, generates programs to do the user's bidding from a list of specifications. MARK IV/1 operated under DOS/360 and was priced at $30K; IV/2 is faster, operates under DOS or

under OS, and costs $5K more. You may pay your $35K at the firm's offices in Los Angeles, Chicago, New York, Washington, or Geneva. INFORMATICS, INC., Sherman Oaks, Calif. For information:

CIRCLE 581 ON READER CARD

financial library

A batch of time-sharing financial application programs has been added to the Call-A-Computer program library. Among the packages available are programs for trust portfolio analysis, investment yield, cash flow, budget control, growth analysis, and stock acquisition pricing. The programs are accessible through CAC's seven service offices: Los Angeles, New York, Raleigh, Atlanta, Chicago, Minneapolis, and Boston. The library is maintained on a GE 235; programs are called off from a tty. Basic rental charge for the tty, $100/mo., is the minimum monthly rental for connection to the 235 and its library. Small users who go on-line in peak traffic hours pay up to $9 per connect hour plus 3¢ per processor-second plus $2 per 1,500 characters stored. The prices for connect time and cpu time fall to about half the quoted figures for evenings and weekends. Call-A-Computer, Tarzana, Calif. For information:

CICRLE 582 ON READER CARD

character manipulation

CHAMPS is a series of 360 FORTRAN-callable assembler routines which perform character and string manipulations. Such functions as character comparing, character movement and shifting, character to integer or floating point conversions can be performed with no word boundary limitations. The package operates in 542 bytes of core, under DOS or OS (E, G, or H level), and is priced at $150. INTERFACE INC., Ann Arbor, Mich. For information:

CIRCLE 583 ON READER CARD

small business software

Programs for processing inventory control, customer accounts, accounts payable, accounts receivable, payroll, general ledger, and profit and loss statements are generally written in COBOL. However, since this software package was designed for firms which generally contract for on-line dp services, businesses with 10-200 employees, it was written in the more readily available conversational FORTRAN IV. The system is written so that the data resides on disc and portions of the programs are pulled into core as needed . . . about 8K at a time. The entire package constitutes about 50K characters in source form, and runs from $15,000 to $30,000 depending upon the machine to be used, the amount of tailoring desired, and the quantity of documentation desired. Portions of the system can be purchased separately at about $3K – $5K each. COMPUTING CORP. OF AMERICA, INC., Englewood, Colo. For information:

CIRCLE 584 ON READER CARD

banking and sales system

The Installment Loan System was written in COBOL for ease of maintenance and installation on any system, and will be sold to all comers for $2,000. In addition to its use in banking, the system could be applied in other environments where regular payment schedules are observed, such as insurance offices and rental agenices. The $2,000 price seems small for a program capable of generating up to fifteen types of reports including those for reminder and delinquency notices, trial balancing, unearned discount earnings, paid loans, new loans, and control reports with complete audit trails.

The system requires a 32K machine with four tapes, or four discs. It double buffers its I/O and can use blocking factors to 10. Since it operates through options read from a control card stream, all unused peripherals are released at the start of every run, and only requested reports are generated. CUBIC CORP., San Diego, Calif. For information:

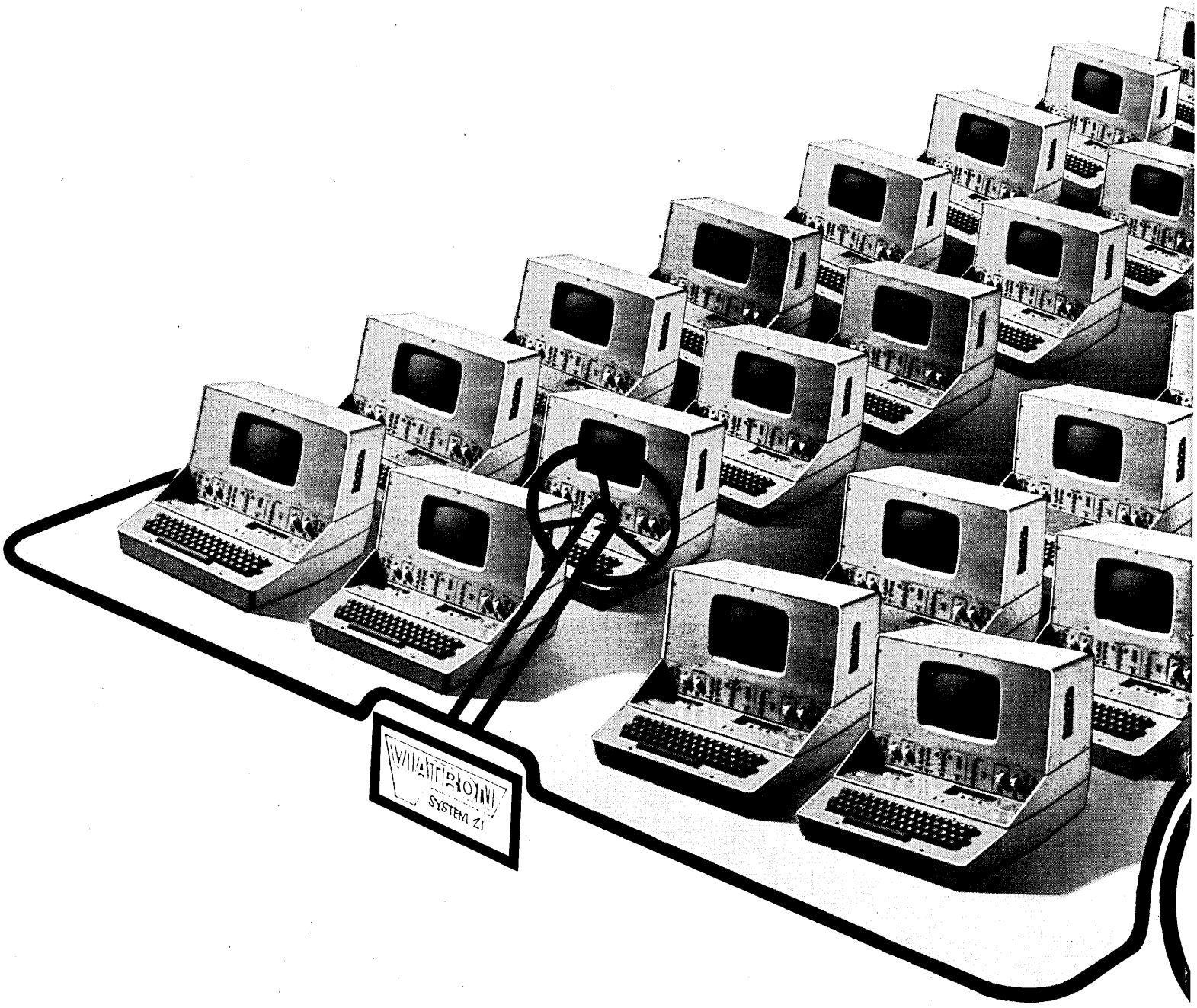
CIRCLE 585 ON READER CARD

accounts receivable

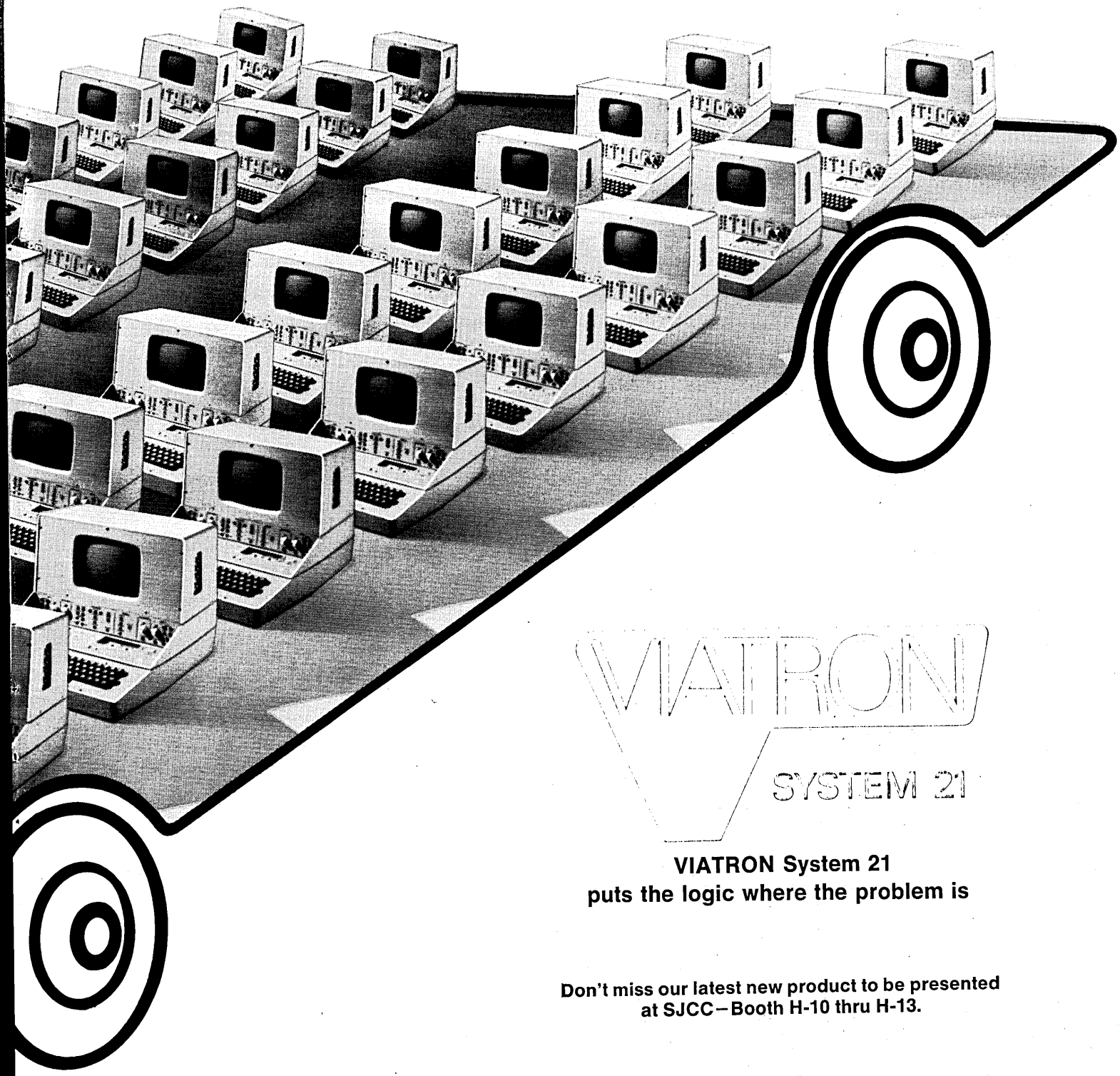
A new accounts receivable system for the GE-400 line can be used by both single-location and multi-location firms. The system posts, updates, bills, and identifies delinquent accounts. It also produces many different weekly and monthly management reports, said to provide "thorough insight" into financial trends. The package may be used by banks or service bureaus performing information processing for customers, as well as by manufacturing companies. It is presently in use by GE's Construction Materials Div., Bridgeport, Conn., processing more than 12,000 open accounts, using a GE-415 cpu, for accounts receivable and central billing functions for six production departments and nine manufacturing plants. The package operates on any GE-400 system having a 16K-word memory, five magnetic tape handlers, card reader, card punch, and high-speed printer, and is also adaptable to disc storage operation. GENERAL ELECTRIC CO., Schenectady, N.Y. For information:

CIRCLE 586 ON READER CARD

The data bus...



VIATRON System 21 will pick up data wherever it originates and get it to your computer without the delays of key punch/verifier and key/tape operations



VIATRON

SYSTEM 21

VIATRON System 21
puts the logic where the problem is

Don't miss our latest new product to be presented at SJCC—Booth H-10 thru H-13.

Data doesn't originate in one place or one department. We didn't design System 21 as if it did.

System 21 will go on any desk where data originates. Transmit it to your computer or any desk where it is needed. Without a lot of fuss. Without key punch/verifier or key/tape operations. Data input costs are cut in half.

You see, System 21 combines input and communications functions in a single unit that can be operated by any clerk. Input formats are shown on the video screen. Data input is simply a matter of filling in the blanks by typing on a standard keyboard. The data is recorded on reusable VIATAPE cartridges so it can be batched to your computer or automatically translated to error-free punched cards or 7- or 9-track, 800 b.p.i. computer tape.

System 21 stations can also be used to send and receive messages. Used as computer terminals. Used to print data.

System 21 is the closest thing you'll find to a public data transit system. The total cost for a System 21 network will probably be less than you're now paying for telephone service. And the VIATRON rental agreement will have a 30-day cancellation clause so your data communication net needn't go on the books as a capital expenditure.

For more information write VIATRON Computer Systems Corporation, Dept. D-6, Route 62, Bedford, Massachusetts 01730.

CIRCLE 112 ON READER CARD

The battery and 1/2

Whoever thought ordinary electricity would be obsolete?

Ordinary electricity from an AC outlet isn't good enough for your sensitive electronic instruments.

A tiny dip or fluctuation in the power flow can cause misinformation to be fed into a computer. Or a data logger to lose data. Or a flame control to trigger a shutdown.

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These Uninterruptible Power Supply (UPS) systems supplement the standard AC input to provide power that doesn't dip or fluctuate. Making ordinary electricity precise enough for the most critical electronic applications.

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CIRCLE 21 ON READER CARD

books

Organizing for Data Processing: AMA Research Study 92, by Robert R. Reichenbach and Charles A. Tasco. American Management Association, New York, N.Y., 1968. 159 (oversize) pages, $15.

This report summarizes the approaches that large companies have taken to the organization of their computer activity, including: (1) assignment of overall responsibility for computer activity, (2) organization structure of the activity, (3) changes that have taken place in organization and location of the computer activity, and (4) leadership of the activity. It also discusses other aspects of computer organization, such as communication between company management and the computer group, uses of the computer, and problems of planning and establishing priorities for potential uses.

The report is based on interviews held two years ago with 91 executives in 16 companies with sales of at least $250 million and from 100 to 3,000 people involved in the computer activity. Interviews were carried out with members of top management, computer managers, and managers of the areas using computers. Nine industries were represented in the survey: airlines, chemicals and drugs, diversified heavy equipment, electrical and electronic equipment, food processing, insurance, petroleum, retailing and utilities. (A lengthy appendix to the report contains the case histories of the 16 selected companies.)

Sixteen companies seems to be a small sample size for a survey presenting statistical results on centralization versus decentralization of the computer activity. In only two of the companies surveyed is the overall management control and style of organization centralized. And there are major differences in the 14 decentralized companies. Five of the decentralized companies have centralized computer operations; six can be described as having a combination of centralized and decentralized computer operations; and three have divisional computer operations.

The subject of the report is an important one since significant issues are involved and many of these are being vigorously debated. The organizational location of the computer activity can, as the report concludes, have a definite impact on its effectiveness. Moreover, the problems of providing effective leadership, maintaining coordination between the computer staff and its customers, determining priorities for future projects, and planning and controlling systems design and implementation must be dealt with in order to reap the benefits of the computer.

Despite the fact that the report does not present any significant new conclusions, it should be read by those interested in and involved in computer organizational issues. It is one of the few reports currently available. The appendix contains a two-to-three-page description of the history and organization of the computer activity in each of the companies. And, as mentioned above, the report covers a wide range of issues.

In some respects, the report tries to cover too many issues, and thus gives only brief coverage to some important conclusions. For instance, the conclusion that "No company in the study has a 'total management information system', as the term is used frequently today" has important implications for setting priorities and planning projects. Yet, these implications are not dealt with, and the conclusion itself is buried in the report.

In addition, the study conclusions need to be modified in light of the individual company situations. One of the organizational issues of vital concern to top management—and perhaps the issue most widely debated—is that of centralization versus decentralization of the computer activity. On this score, the report concludes that the responsibility for computer-based information systems is becoming increasingly centralized. As the report states, "edp activities of operating and functional divisions are being coordinated to a greater degree, in some companies having been pulled together into a central unit at the corporate level, thereby eliminating duplication of edp activities among divisions and yielding a cost saving. Such edp centralization also helps to standardize procedures. Most important, however, it permits more efficient utilization of limited numbers of edp personnel and enables the corporate computer staff to obtain from the divisions the necessary information, in the form needed, to develop corporatewide information systems."

I believe this conclusion will be greatly misunderstood. The question of centralization versus decentralization is subject to a great deal of misinterpretation, and unless one reads further he will miss many extremely significant caveats contained in the details of the report. One of these is that centralized control of computer operations does

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not imply or require centralized control of systems development staffs. For example, in many divisionalized companies, there is strong corporate control of hardware acquisitions and operations but divisional control and direction of at least some part of the systems development staff. The report shows that six types of organizational changes have taken place in the surveyed companies to achieve greater centralization. These range from centralized control of the complete activity to having one division serve as a service bureau for the remaining autonomous divisions.

A second important factor bearing on the centralization/decentralization issue is the nature of objectives of the computer activity. As the report states, "In those companies where the computer operation is working most effectively, the decision to centralize or to decentralize computer authority was based on the overall objective to be served by edp activities, considered in the light of circumstances peculiar to the company—the diversity and complexity of its products, the geographical location of its organizational components, and companywide needs weighed against divisional needs and the present stage of computer development."

Finally, as the report points out, the issue is really one of achieving effective planning and coordination. As the report indicates, "In actuality, in most of the study companies there was no true dichotomy of centralization or decentralization of computer operations, but a greater or lesser degree of centralization or decentralization. The important consideration, and the significant guideline for achieving computer effectiveness, was that the organization of computer operations, whether centralized or decentralized, was planned on the basis of management's needs, and that there was a centralized corporate computer function to coordinate overall companywide computer operations."

—Gordon P. Smith

book briefs

(For further information on the books listed here, please write directly to the publisher mentioned.)

Game Playing With Computers, by Donald D. Spencer, Spartan Books, 432 Park Ave. South, New York, N.Y. 1968. 464 pp. $12.95.

This book introduces more than 70 games, puzzles and mathematical rec-

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books

reations that may be programmed for a digital computer. Over 25 complete programs are presented, each including a description of the game, a flowchart, a program written in FORTRAN or BASIC, a description of how the program works, and output produced by the program. It is written to stimulate the interest of students as well as more experienced analysts and mathematicians in the belief that the information gained while programming computers to play games is directly transferable to other areas of scientific and business programming.

Digital Computing Fortran IV and Its Applications in Behavioral Science, by R. S. Lehman and D. E. Bailey, John Wiley & Sons, Inc., 605 Third Ave., New York, N.Y. 1968. 303 pp. $8.95.

Written as a text for undergraduate and graduate students in the behavioral sciences, this book attempts to initiate actual programming efforts on the part of the reader as early as possible. Complete description and analysis of FORTRAN IV is offered with a profusion of motivating examples and problems relevant to the work of behavioral scientists. Simulation techniques are given special attention and techniques of dealing with lists and nonnumerical data, including verbal materials, are detailed. Eighteen projects of interest to behavioral scientists are described to give an indication of the types of real problems that can be approached with FORTRAN IV.

Guide to Gathering Information in Face to Face Interviews, Morris Bolsky. Ramsey-Wallace Corp., Ramsey, N.J., 1967. 69 pages.

This ill-printed pamphlet is better than it looks because it summarizes the main points that have proved to be useful in conducting interviews. It covers such basic ideas as preparing for a meeting, scheduling, note-taking, when to leave, and so forth. It's obviously useful to reporters, but the author's point in sending it to us is that such people as systems analysts and programmers depend on personal interviews for the bulk of the information they need. Yet they may not be aware of how much time they spend this way or even that sometimes they are unintentionally antagonizing the person interviewed and cutting him off as a useful source. ■

a sid meeting

MEDICAL RESEARCH GRAPHICS

The March 11 meeting of the Los Angeles Chapter of the Society for Information Display (SID) took place at the Health Sciences Center of the Univ. of California at Los Angeles. The meeting was hosted by Dr. W. J. Dixon, chairman of the department of biomathematics at UCLA. Aiding him were members of his staff: Gwen Moore, Warren Ringer, and Dr. Pat Britt. The first part of the meeting consisted of a film showing the use of interactive graphic displays in support of computer-assisted medical research programs. After the film, the use of interactive programs involving the IBM 2250 and 2260 displays were demonstrated to the members of SID.

The Health Sciences Computing Facility (HSCF) is a part of the UCLA Health Sciences Center and is supported by the National Institutes of Health to provide mathematical, statistical, and computer support for medical research. The IBM 360/91 provides the computational capability to produce interactive programs in a batch-processing mode. These programs are developed through the cooperation of several departments of UCLA. Programs demonstrated in the film were written by various investigators, staff programmers, and graduate students. All of the 2250 programs are based on GRAF, a set of FORTRAN callable subroutines developed at the HSCF. Graphics programs execute in a multiprogramming environment, that is, the full batch stream is processed simultaneously.

Some of the interactive programs shown in the film included chromosome descriptors, bibliographic retrieval, serotyping, lung mode, epidemiological study, sampling from distributions, interactive parallax, EEG spectral response, and a number of statistically oriented programs.

The chromosome descriptors program consisted of photomicrographs of chromosome spreads drawn by a series of line segments. Here the operator interacts with the computer in deciding on the classification of chromosomes.

For bibliographic retrieval, HSCF is working with the Brain Information Service in the cataloging of data on the brain. The operator searches stored files to select items of interest which may then be hard-copy-printed in a 3 x 5 index card format.

In serotyping, interactive programs are used to match donor organs to recipients on the basis of white cell antigens. This work is concerned with the statistical aspects of the methodology of serotyping procedures and the evaluation of the desirability of matching.

The lung model consists of the outline of a lung model "drawn" on the display and is used to demonstrate the mechanics of breathing. In addition to the presentation of the lung, the operator may call up information concerning the operation of the lung and receive an alphanumeric presentation in response to the query.

In the epidemiological study, the age, sex, race, and cause of deaths for the city of Los Angeles from 1959 through 1961 may be studied. The data displayed may be either alphanumeric or graphic and can include a map of Los Angeles showing data of interest.

Sampling from distributions is a teaching program designed to assist the student in an assay of his data by "looking at" the observations. The student is scored according to his ability to guess the characteristics of the statistical distribution.

The interactive parallax program is used to study the relationship between a set of viewed objects as they change in response to a viewer's head motion. In operation, a head piece monitors head motion which is then A/D-converted and sent to the computer causing the presentation to move accordingly.

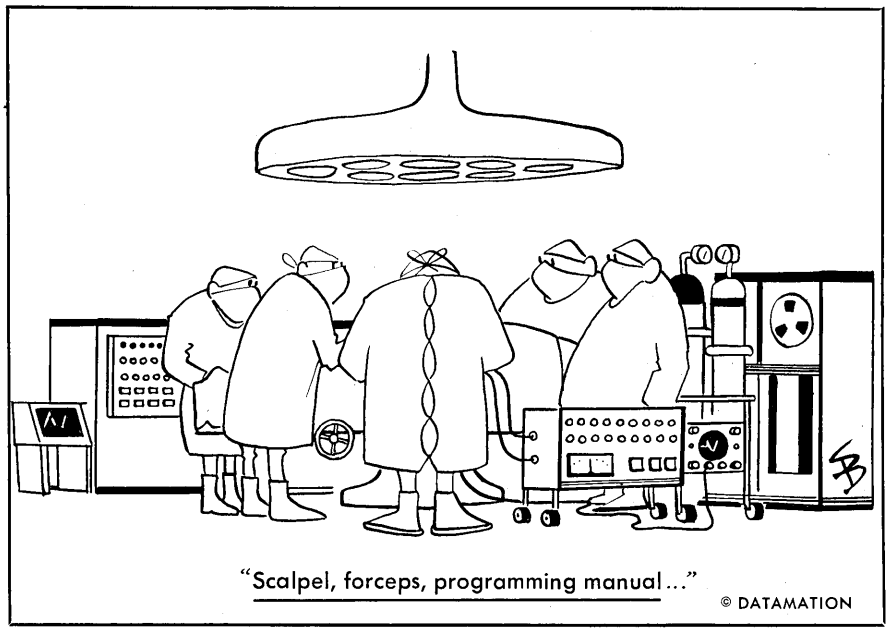
The program for the EEG spectral response is being developed to provide a near-real-time analysis of brain functions. In this way, computers and displays can assist the neurosurgeon in the detection and subsequent removal of brain tumors.

The statistical programs are used to analyze statistical data derived from medical research. These programs include simple regression, stepwise regression, nonlinear regression, polynomial regression, chi-square partitioning, and spectral analysis.

Another program demonstrated in the film was the use of computer-display interactive urban planning. This program involves the use of computer generated maps and an entry-query technique is used for determining the consequences of roadway locations.

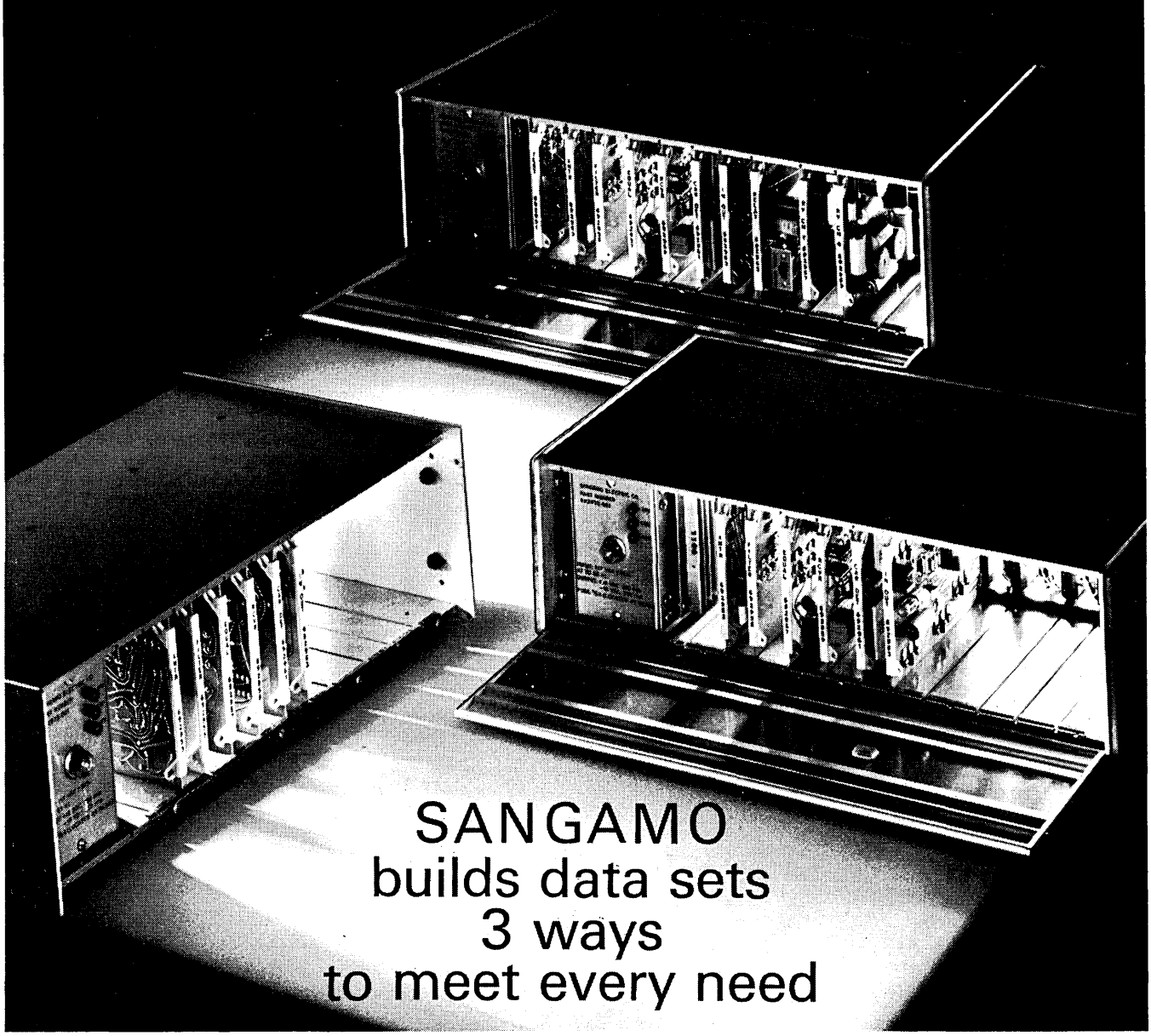
As a result of the film and live demonstrations, the use of computer data displays as a tool in medical research was impressed upon the meeting attendees. This work represents a valuable extension of the use of computers and displays and promises to provide mankind with potentially life saving information.

—SAMUEL DAVIS



"Scalpel, forceps, programming manual..."

MODEMS A LA CARTE



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new literature

MINICOMPUTER SURVEY: Sixteen-page reprint of the March, 1969, DATAMATION article on minicomputers for real-time applications surveys the characteristics of presently available 8-, 12-, 16-, and 18-bit commercial computers priced at $50K or less for a minimum system and which are offered with a normal complement of I/O equipment. Charts give 60 characteristics of the machines of 24 manufacturers. Features included are memory, cpu characteristics, arithmetic operations, I/O capability, software, basic mainframe costs, and peripherals. Explanatory text accompanies the charts. Single copies are free; multiple-copy prices available on request. DATAMATION, Pasadena, Calif. For copy:

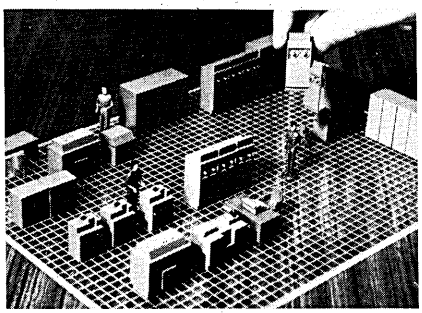
CIRCLE 555 ON READER CARD

LIBRARY COST MODELS: 166-page report provides mathematical models by which a library can determine at what frequency of use of any given serial title it becomes cheaper to borrow or photocopy an item when needed than to maintain its own copy of the title. PB-182 304. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

VIDEOTAPE IS&R: Sixteen-page booklet explains how the Videofile system handles storage and retrieval of graphic information in the transportation, law enforcement and insurance fields. Images are stored on magnetic tape with each segment of tape serving as a file folder. Filing can be ordered in the same way as paper files. Search speed for 8½" x 11" documents is 1,140 pages per second. A file is retrieved by using a keyboard or card reader to enter the address of the file. The requester can receive the file as an image on a television screen or an electrostatic copy, or both. The images can be brought to viewers at many locations simultaneously, and no document is ever out of file or lost. The degree of automation can be selected to match the needs of the user. In its simpler forms, the system can make filing nearly instantaneous and give truly automated retrieval. In its most complete forms, it can become an interconnected visual communications network that eliminates almost all paper flow. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 556 ON READER CARD

COMPUTER ROOM PLANNING: Catalog lists over 400 different ¼" = 1' dimensionally accurate three-dimensional plastic models of computer items that



allow non-technical people to plan layouts, review space relationships and spot clearance or traffic problems readily. "VISUAL" INDUSTRIAL PRODUCTS, INC., Oakmont, Pa. For copy:

CIRCLE 557 ON READER CARD

PHOTOTYPESETTING SYSTEMS: 22x34-inch chart compares the 35 existing photocomposition machines and models according to more than 50 specifications. Accompanying the chart is a report that spotlights the problems most frequently met in the selection of photocomposition systems and raises questions to which the prospective buyer must seek answers before purchasing any equipment. It is the view of the researchers that based on a continuation of current trends, the traditional output line printer will gradually be replaced by high-speed phototypesetting machines whose speed is more compatible with that of computers and whose product is typographically superior to the "hammer-head" output of most line printers. Cost of *CIS Analysis of Phototypesetting Systems* is $25; quantity discounts are available. COMPOSITION INFORMATION SERVICES, INC., 1605 N. Cahuenga Blvd., Los Angeles, Calif. 90028.

OPERATING RATIOS SURVEY: Results of the second Operating Ratios Survey, conducted late in 1968, includes statistical information on the size of operation, type of operation, and type of equipment used in relationship to sources of revenue, total revenue and operating expenses in an effort to determine measurements for profit and loss. The information is intended to be used by the data center industry as a management tool in the operating and financial control of a business enterprise. Cost: $10. ASSOC. OF DATA PROCESSING SERVICE ORGANIZATIONS, 420 Lexington Ave., New York, N.Y. 10017.

N/C MACHINE TOOLS: 32-page booklet lists numerically controlled machine tools and related products built by the association's members. Names, addresses and telephone numbers of the companies are given along with brief descriptions of the products they manufacture. NATIONAL MACHINE TOOL BUILDERS' ASSN., Washington, D.C. For copy:

CIRCLE 558 ON READER CARD

LAB NOTEBOOK: Four-page bulletin describes laboratory notebook which has been made microfilm-compatible. The hard-cover volume has screened-grid lines which permit storage and retrieval of research data by microfilm and other available copying methods. SCIENTIFIC NOTEBOOK CO., Oak Park, Ill. For copy:

CIRCLE 559 ON READER CARD

UNIONIZATION ALTERNATIVES: 81-page Proceedings of the Dec., 1968, conference on Alternatives to Unionization includes the full text of papers and discussion on such topics as the union approach to organization of professional and technical employees, alternatives through a professional atmosphere, the "sounding board" approach to management-employee relations, establishment of a positive environment, selection and indoctrination of new employees, personnel policies, in-house advancement of technical personnel, motivation of employees, the views of the National Labor Relations Board on issues involving professional and technical employees, methods of dealing with employee problems, use of personnel consultants, the importance of pension plans, relationships between the design professions and contractors, and how to communi-

new literature

cate information on the unionization problem. Cost: $5. JOINT COMMITTEE ON EMPLOYMENT PRACTICE, 2029 K St., N.W., Washington, D.C. 20006.

ACCOUNTING PACKAGE: 23-page booklet describes accounting software package for time-sharing system. The package handles accounts receivable, accounts payable, inventory, payroll, general ledger, and profit-and-loss statement. COMPUTING CORPORATION OF AMERICA, Englewood, Colo. For copy:

CIRCLE 560 ON READER CARD

IS&R SYSTEM: 456-page report compares effectiveness of the fully automatic text processing methods used by SMART and the conventional procedures based on manual document and query analysis used by the Medlars system. Covers work on SMART systems design, analysis and search experiments, user feedback procedures, and descriptions of text editing programs. PB-180 931. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

PROCESS CONTROL COURSES: Eight-page brochure describes short courses on process computer applications. Clients can organize their own courses from 24 lectures covering management aspects, descriptions of process computer applications in various industries, control theory, and practical computer control techniques. PROFIMATICS, INC., Woodland Hills, Calif. For copy:

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INDEX OF CAI PROGRAMS: Bibliography of computer-assisted instruction programs contains over 450 entries encompassing 37 subject matter areas. Each entry is described and sources for additional information are included. Cross-references are by organization, subject matter, computer language, and central processor. Additional information includes author, prerequisites, level of instruction, type of student, average completion time, logic of program, type of program, and supplementary equipment or materials. Status of program, availability, funding, published results, and terminal description are also included. Information for this compilation was obtained from annual reports, technical reports, correspondence, and questionnaires. Institutions contacted include elementary and secondary schools, colleges and universities, military installations, and industry. Cost: $7.50. INSTRUCTIONAL MEDIA LIBRARY, Univ. of Wisconsin, Milwaukee, Wis. 53201.

PIN-FEED LABELS: Eight-page catalog lists the company's line of smudge-resistant self-adhesive pin-feed labels for edp systems. Included are the new preprinted tape reel label, clear matte see-through tab label and ungummed strip tape reel label. AVERY LABEL CO., Monrovia, Calif. For copy:

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LIST PROCESSING: 173-page report studies the utilization of hardware for interpretation and execution of list languages and employment of a content-addressable or associative memory for storage of lists and operating instructions or definitions. Design of two list processing languages are given. AD-680 399. Cost: $3; microfiche, $.65. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

LAW ENFORCEMENT: The Proceedings of the 2nd National Symposium on Law Enforcement Science and Technology contains 94 technical papers presented at the April, 1968, conference supported by the U.S. Dept. of Justice Office of Law Enforcement Assistance. 632 pages. Cost: $10, by check only. IITRI LAW ENFORCEMENT SCIENCE & TECHNOLOGY CENTER, P.O. Box 4963, Chicago, Ill. 60680.

BIOMED PROGRAMS JOURNAL: A new international journal, *Computer Programs in Biomedicine,* has been established to provide worldwide information on computer programs used in biomedical research. Aims of the quarterly publication are: to promote the use of computer methods in biomedical research by an international exchange of information on programs; to make readers aware of the possible ap-

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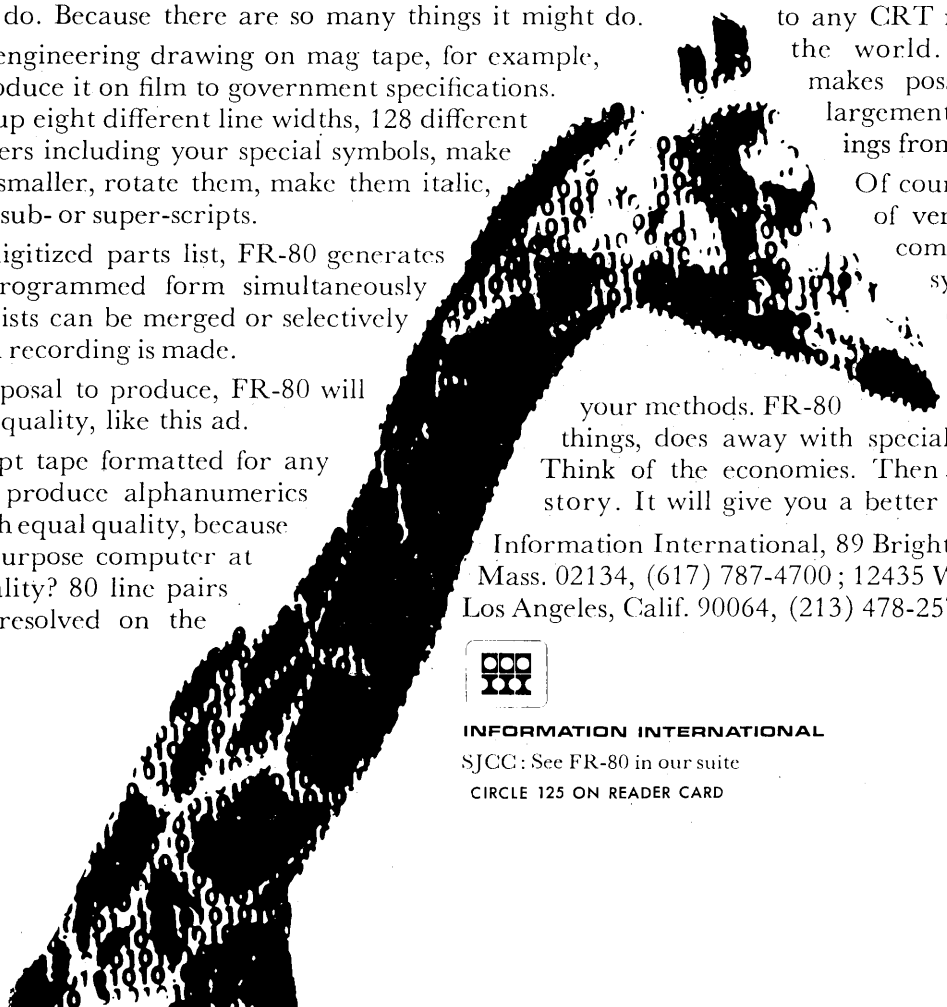

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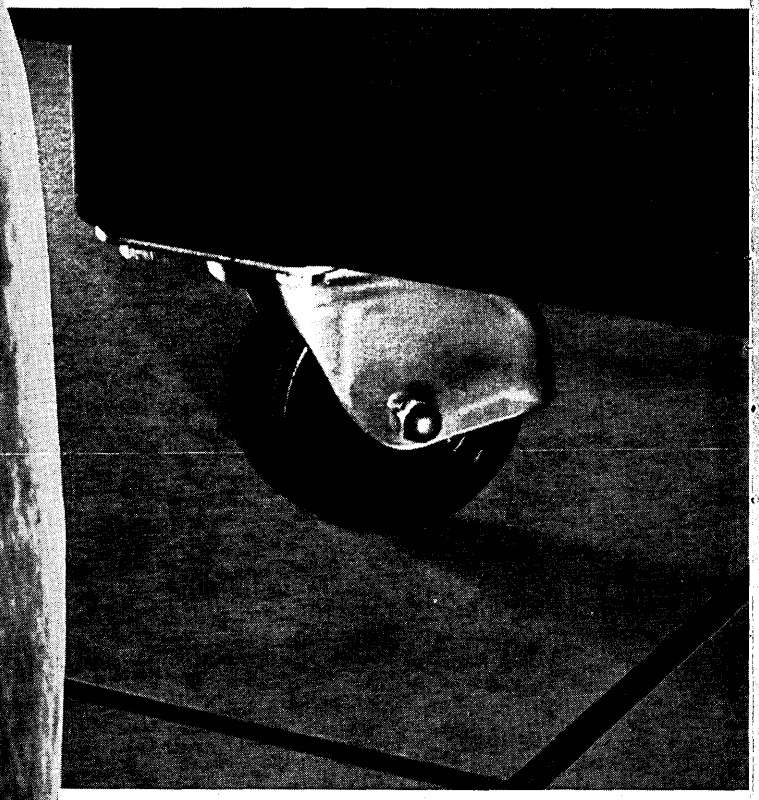

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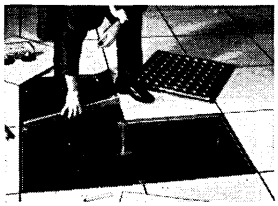

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plicability of the programs for their own purposes in order to avoid duplication of effort; to foster good programming practice in the field of the biological and medical sciences; and to provide updated information about programs earlier published in the journal. Contents will include papers on computer programs, comments from authors and users, invited review articles, news items, and book reviews. Subscription price for Vol. 1, 1969: $30. Sample copies are available on request. NORTH-HOLLAND PUBLISHING CO., P.O. Box 3489, Amsterdam, The Netherlands.

REFERENCE DATA PROGRAMS: 76-page report describes EDPAC, a package of five related utility computer programs that is one of a series being developed by the Data Systems Design Group of the NBS Office of Standard Reference Data for computer-assisted editing, copy production and data retrieval. Written in FORTRAN, the programs have been made as system- and machine-independent as possible, permitting their use on several different computers. This reflects the authors' view that the best way to attack the problem of compatibility and interchangeability of data cards or tapes is to provide a series of utility programs that will transform, translate, transpose and transcribe information from one format to another. Some applications of the EDPAC programs are discussed, with emphasis on computer-assisted text preparation. Order NBS Technical Note 470. Cost: 75¢. SUPERINTENDENT OF DOCUMENTS, U.S. Government Printing Office, Washington, D.C. 20402.

TYPESETTING LANGUAGE: Sixteen-page brochure explains the PAGE-1 electronic type composition language for use with RCA computers and Videocomp electronic typesetters. The language allows graphic arts personnel unskilled in computer programming (and programmers with little knowledge of typesetting) to instruct a computer how to handle all aspects of composition. Code words marked on the original manuscript define format, type faces and sizes, justification, hyphenation, pagination, footnotes, and captions. The marked manuscripts are then transcribed to punched tape and entered into a Spectra 70 computer. The computer and the electronic typesetter then combine to produce composition on sensitized paper or film, on short run offset plates, or on microfilm. RCA GRAPHIC SYSTEMS DIV., Dayton, N.J. For copy:

CIRCLE 563 ON READER CARD

MANAGEMENT INVOLVEMENT: Thirteen-page reprint of the speech "How to Unlock the Computer's Profit Potential," delivered at the 1969 Spring Seminar of the Steel Valley Chapter of the ASM, gives a practical approach toward convincing management to willingly involve themselves in both determining the direction of their organization's computer efforts and in the development of their individual data systems. BARNETT DATA SYSTEMS, Rockville, Md. For copy:

CIRCLE 564 ON READER CARD

SOFTWARE PACKAGES GUIDE: Two-page brochure describes a guide to currently available third-generation commercial software packages. Specifications for each package include file organization, source language(s), documentation, support services provided, price information, purchase conditions, and system compatibility. Price of $135 includes the first year's quarterly update service; future annual update service will cost $50. SYSTEM INTERACTION CORP., New York, N.Y. For copy:

CIRCLE 565 ON READER CARD

LOGIC MODULES: 40-page brochure lists the various types of logic modules available from the company, giving the function of each and the technical specifications relevant to its operation. ADTECH, INC., Honolulu, Hawaii. For copy:

CIRCLE 566 ON READER CARD

JOBS is working

Because 15,000 American companies knew a sound business proposition when they saw it.

Because 100,000 hard-core unemployed are now on payrolls instead of relief rolls.

Last March, the National Alliance of Businessmen was formed to work with the Government on a problem of critical national importance. The Program: J O B S (Job Opportunities in the Business Sector). The Task: to hire, train and retain the nation's hard-core unemployed. To find and fill 100,000 jobs by July 1969; 500,000 by 1971.

They are being hired.

The first year's goal has been reached seven months ahead of schedule! In the nation's fifty largest cities J O B S is progressing at the rate of 20,000 placements per month—*over double the anticipated rate*. At the end of December, 100,000 hard-core workers were on the job . . . earning an average of $2.25/hour.

They are being trained.

Companies are bringing the hard-core into the mainstream of American business by providing the new workers with special training both educational and vocational. And by conducting imaginative "sensitivity" programs to help foremen and supervisors understand the unique problems of the hard-core.

Extra training costs are being shared by Industry and Government. In two-thirds of the cases these costs have been voluntarily absorbed by the individual employers. One-third of participating companies have signed contracts with the Department of Labor.

They are being retained.

Two out of every three hard-core workers have remained on the job . . . better than the normal rate for all entry-level jobs.

Based on this high job retention level and upon the success of the training programs, *97% of employers surveyed said they will continue hiring the hard-core*. They maintain that the J O B S Program is "the most practical way to solve the problem of the hard-core unemployed."

JOBS is still urgent business!

Success to-date has been extremely encouraging. But thousands of the hard-core are still waiting for the chance to develop their abilities; waiting to fill industry's growing need for skilled workers.

Special training funds continue to be available through MA-4 contracts with the Department of Labor. Call the National Alliance of Businessmen office in your city for details.

The J O B S Program is more than an obligation to the country and to the economy. It's a prime business opportunity for your company.

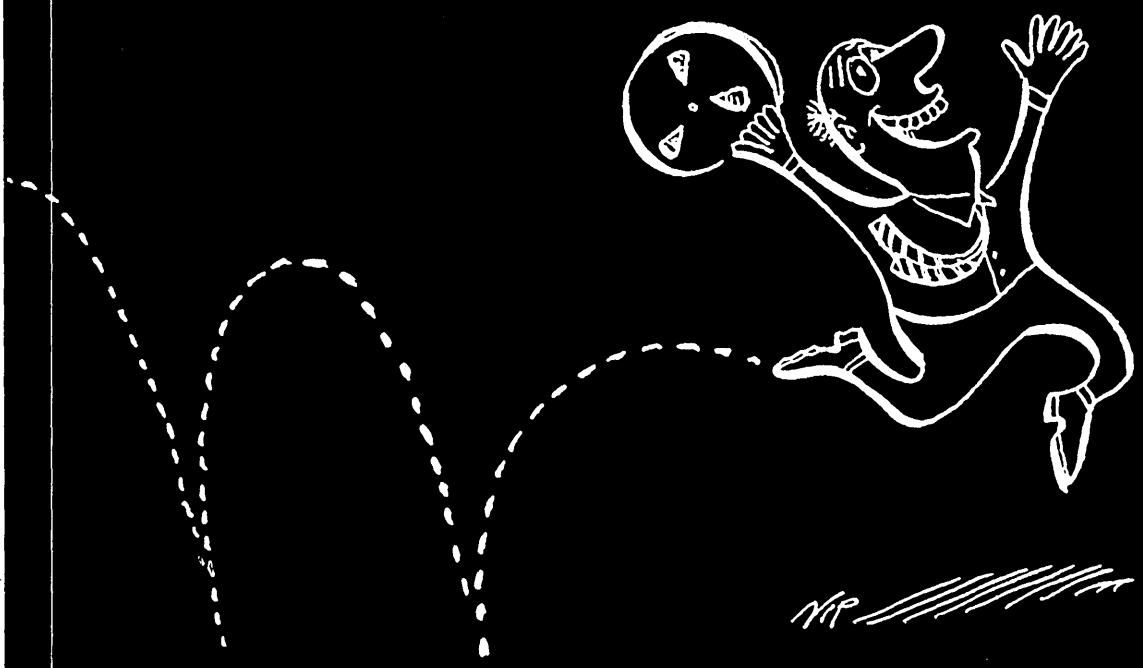
JOBS

National Alliance of Businessmen

ADVERTISING COUNCIL

advertising contributed for the public good

IT WORKS!



QWICK QWERY®

is a retrieval and reporting system that provides tailor-made analyses and reports without the costs and delays associated with writing special purpose computer programs.

Nonprogrammers can learn in three hours or less how to interrogate data and obtain reports in user selected sort sequence.

QQS is designed for CDC, IBM, GE, UNIVAC, etc. For more information on QWICK QWERY, call or write J. R. Parker:

C.A.C.I.

CONSOLIDATED ANALYSIS CENTERS INC.

CORPORATE OFFICES: 225 SANTA MONICA BOULEVARD, SANTA MONICA, CALIF. 90401, (213) 451-5771

Trademark and Service Mark of C.A.C.I.

CIRCLE 117 ON READER CARD

Moore New Ideas for Data Processing

Cut buying time by 65%

With all the slip-ups possible between ordering and receiving, lead time has to be long. Moore can introduce you to an ADP system for purchasing and receiving that's not only 65% faster, but eliminates all chance for error. There's no copying, no duplication of effort, no checking. Even the inputs are automated. Everyone gets correct information. Deliveries are on time. Fewer people have to be involved. Ask about "automated purchasing."

Light a fire under slow payers

When you already use ADP to process accounts receivable, it's easy to go a step farther and automate the collection of slow accounts. There's a Moore system which not only reminds customers of overdue accounts but makes it more convenient for them to remit by return mail. The system operates as a by-product of running off accounts receivable and does in 30 minutes what used to take all day. Ask about "slow payers."

Get rid of commission headaches

When you've got hundreds of transactions to compute commissions on, you can tie up a lot of people and overhead. It's worse when there are overrides. Moore has devised a simple system that can be turned over to your bank or service bureau. You can free up your own people for other work. Salesmen and supervisors get their checks sooner. Each party gets a full accounting. You save all the worry and fuss. Ask about "salesmen's commissions."

Tandem hookups speed billing mailings

Example: A Moore Speedisealer tied in with a Moore Detacher gets billings into the mail sooner. Cuts manual handling. Speeds collections. Ask about "tandem hookups."

Ask for more ideas like these

The only kinds of ideas we tell you about are the ones that work. More than 2400 Moore men continually comb the business world to find more such ideas that can be combined and modified to provide controls and economies you never thought of. Get your share of these ideas. One Moore idea may be what you need. Call your Moore man.

MOORE® BUSINESS FORMS, INC.

Over 675 offices and plants, 2407 salesmen in North America

CIRCLE 189 ON READER CARD

system spotlight

information for this series is invited applications submitted must be installed and operational

telemetry data reduction

RADAR TRACKING DISPLAY SYSTEM

NASA'S Flight Research Center, Edwards, Calif.

computer and peripherals

GE 225 with 8K words of core storage; 18 usec cycle time
NASA-designed Universal Digital Input-Output Buffer (Unibuf)
plus paper tape reader, card punch, high-speed printer, mtu's

application

NASA's Flight Research Center in Edwards, Calif., has been experimenting with lifting bodies that might replace Apollo-type capsules for returning astronauts to Earth. The wingless craft can be flown to a controlled landing much like conventional aircraft. One of these experimental craft, the HL-10, was designed to study performance and handling qualities of both gliding and rocket-powered wingless re-entry vehicles. It, in turn, is studied by the GE 225-based telemetry data processing and display system. Launched from a B-52 mother ship from an altitude of 45,000 feet over the dry lake beds of the Southern California area, the ship is capable of eventual speeds in excess of 1,000 mph and altitudes up to 80,000 ft.

hardware

Radar signals tracing the progress of a flight are communicated to the NASA Universal Digital Input-Output Buffer (dubbed "Unibuf") from eight tracking sites located in Boron, Calif., in Ely, Nev., Las Vegas, Beatty, Nev., and at Edwards Air Force Base.

Unibuf will accept up to 180 bits of mixed parallel and serial input from the tracking stations, with any type of logic, positive or negative. It will accept or transmit any digital signal. In this application, the buffer translates and formats the telemetry data for processing on the 225, then reconverts the resultant digital output to anaolg for the display equipment.

The test vehicle's track is plotted on a translucent screen by "scribing projectors" as an overlay on the ground plan map and "expected" flight path which are projected from previously prepared slides. The system tracks the HL-10 and the mother ship for two minutes before the launch to the HL-10's landing to create the real-time display, monitor critical parameters, and build a mission history tape.

The first pass at the GE 225 system was installed with a 19-inch crt display for use with the stub-winged rocket-propelled X-15, a craft capable of attaining 4,500 mph as the climax of 86 seconds of frantic acceleration. Since that time it has been used with

Among the aircraft tested at the NASA Flight Research Center have been the X-15, the Triple-Sonic Research Aircraft XB-70, and various wingless lifting bodies such as the HL-10 shown below.

some 20 different types of experimental aircraft, including the XB-70 Triple-Sonic Research Aircraft, now retired.

General design specifications for the initial system called for "a system that will give an indication of the amount of energy of a research airplane at any particular time and location, and a man-machine interface for the purpose of displaying the extent of the available energy." The real-time display of aircraft energy computations is projected on the screen in the shape of a cardioid—a shape somewhat like the right half of a valentine heart. The area under the curve indicates the residual energy of the moving craft at any moment, and relates to the distance the ship could travel in the event of a flame-out. The energy curve superimposed on the displayed terrain permits the immediate selection of any of the 12 available lake beds within the radar-monitored flight area for an emergency landing. This information is then transmitted to the pilot.

As aircraft speeds increase relative to the computer memory speeds, the intervals between the bits which form the tracking lines become greater. Then, as sudden changes in flight direction occur, the plotted curves become somewhat irregular. NASA's engineers are considering a switch to a GE 235 or 245 processor (which has a cycle time eight times as fast as the 225) if the curve distortion becomes more of a problem.

software

The cardioid is derived by the software from six parameters: (1) the number of miles (X) left or right of a vertical line through point of landing; (2) the number of miles (Y) above or below a horizontal line through the point of landing; (3) height above ground, in feet, designated H; (4) horizontal velocity in feet per second, HVEL; (5) vertical velocity in feet per second, VVEL; (6) heading angle, or bearing, in degrees, designated simply "heading." (This last factor also establishes the direction of the cardioid energy pattern.)

In addition to displaying the cardioid, the operating system has the ability to respond to sense switches on the 225 console to give the distance of a vehicle from selected coordinate locations. The software detects when the maximum altitude and velocity of a flight have been reached and scribes these figures on the display screen. Digital read-outs near the screen also give the heading angle, velocity, and range from Edwards.

To "close in" on a landing location, the monitor package has the ability to respond to a "Map Advance" button on the display console to change the scale factors of the maps.

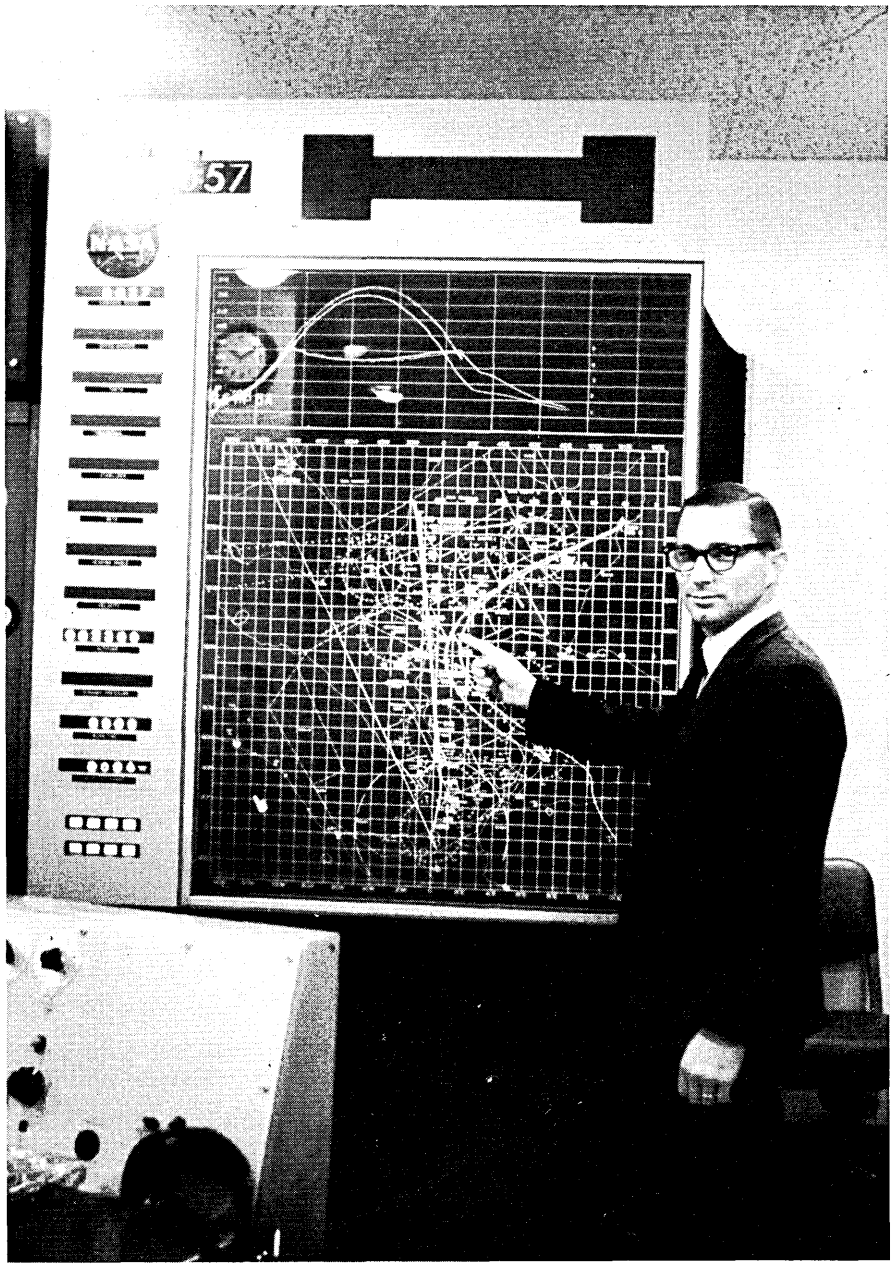
Before displaying the exploded area, the software automatically determines whether the vehicle track will be within the boundaries of the new map. Only when the magnified map area will contain the vehicle location will the operating system allow the display of the next scale. A related feature allows for the replacement on command of a scratched or old slide.

During the flight, the 3.3K software package, which is loaded from tape at start-up time, is kept busy reducing telemetry data and communicating with the Unibuf buffer. After the flight a smaller package is called into play to print out the history file. Listings include all of the parameters used in the real-time display plus total velocity in feet per second as calculated from the horizontal and vertical velocity vectors.

Other pre-flight routines calculate a parallax correction factor to compensate for the curvature of the earth in the conversion of range, azimuth, and elevation data to X, Y, and H. This calibration is done making use of high-resolution radar facilities and the GEOS navigation satellite.

All of the coding was done in VFAP (Valley Forge Assembly Program) which was chosen over GAP, the GE 400 standard assembler, because it could work with only two tape handlers rather than four. ■

Spencer G. Sheets, one of NASA's tracking and display system engineers, points to two flight tracks overlaid on a terrain map on the translucent screen in the flight center's control room.



We can prove Keytape is more productive than keypunch. And you're still punching cards?

Tell it to me.

You say a Keytape unit can increase my productivity by 30% on the average. Fine. And that my computer can read input up to ten times faster. Because Keytape records data directly on magnetic tape. Instead of punch cards. O.K. You talk about how easy a Keytape unit is to learn and run. All right. You tell me the details. Send me your 40 page description manual right away.

Name_____

Company_____

Street_____

City_____ State_____ Zip_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell

Sell it to me.

Sure, You've sold me on what a great idea Keytape is. Now's your chance to sell me a Keytape unit.

Send me your 40 page description manual and tell me where I can see a demonstration.

Name_____

Company_____

Street_____

City_____

State_____ Zip_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell

You've sold me.
I want to replace my____Keypunch units.
Send me a Keytape salesman in a hurry.
Sock it to me. Sock it to me. Sock it to me.

Name_____

Company_____

Street_____

City_____ **State**_____ **Zip**_____

Send to Honeywell Communications and Data Products Division, Wellesley Hills, Mass. 02181.

The Other Computer Company:
Honeywell

letters

want to "go" or "no go" on an individual credit application. The agency could possibly supply statistical area surveys to political organizations or marketing groups that want to know what to emphasize or whether to market and what to charge (i.e., what the market will bear).

These remarks are not intended as charges, nor are all the capabilities necessarily bad; I am simply trying to indicate the general areas of controversy, and the need for legislative controls, in order to protect the private citizen as well as the business community.

I would also like to mention two small questions raised by the system described:

a) On a telephone request from a store clerk, the operator gives a "go" or "no go" response. Does the operator or the system make the final decision, and on what basis?

b) We are to be comforted by the notion that the system has "amnesia" and forgets data, because "on-line data storage is expensive" (at the present time). Reducing the amount of on-line storage can be done in a variety of ways; compressing a file into a one-bit go-no go entry would save a great deal of space. So would keeping the 1% or 2% of old items judged to be "bad risks"; so would using off-line storage (much cheaper than on-line!). How does their system forget"?

Finally, in order to protect my *own* credit rating, I would greatly appreciate the withholding of my name, if my letter is printed.

Name withheld by request.

think you

Sir:

Your readers have come to expect editorials that are not only topical and well written, but logically sound. "Furling the Umbrella" (March, 1969) was an unfortunate exception.

Regarding the various antitrust suits against IBM, your editor states that "it would be presumptuous . . . to set ourselves up as judge and/or jury." Yet he does it. Assuming a verdict of guilty, he goes on to raise questions of "how to restructure the industry," leaving no room for consideration of the structure that exists.

Not content with an assumed verdict, your editor suggests guidelines for the court decisions. In a sentence notable for its confusion and ambiguity, he hopes "that the final decisions will be based not only upon sound legal and economic principles, but upon the nature of an esentially immature industry."

What exactly is he trying to say? Is he urging the court to base its decision on other than the law? Is he asking the court to temper its interpretation of the law by considering the consequences of applying the law? Is he asking for prudence in determining and enforcing any resulting penalties? Or is he simply arguing that industries whose natures are "essentially immature" be exempt from antitrust legislation?

Your editor would be well advised to re-read his writings . . . " 'Think. Then write."

GERARD MCBRIDE
Sperry and Hutchinson Co.
New York, New York

The editor replies: I did not assume a guilty verdict. I said the *question* the courts have been asked to consider is one of restructuring the industry, and suggested that it be done without narrow interpretations of the law or based on precedents applying to other industries differing in nature and age from edp. I am not suggesting that immature industries be immune from antitrust legislation, but that the consequences of the law should, indeed, be considered in making any legal decision.

fair discriminates

Sir:

In the March issue, you published a note in the News Briefs section (p. 117) on the Internal Revenue Service's

Codex introduces a modem that transmits 9600 bps over one voice grade line!

"Unbelievable!"

"Unbelievable!"

But true.
The new Codex Model AE-96 modulator/demodulator can make 1 leased line do the work of 4, by transmitting and receiving data at 9600 bps over lines previously utilized at 2400 bps or 4800 bps at the most. Accuracy is as good as with 2400 bps equipment.

"Tell me another"

It has an Automatic Equalizer ("AE") that conditions the 9600-bit data to travel smoothly on one voice grade Type 3002, C-2 conditioned line. You just push a button for initial equalization, which takes a mere 3½ seconds. The equalizer then monitors and optimizes performance 8 times per second to compensate for line changes. No hours of manual tweaking.

"You've struck a nerve"

Codex's 9600 bps Modem is in use and on the production line. It meets RS 232B Interface Standard (full duplex) of EIA, and MIL Std. 188B.

"O.K. Send me the whole story"

For literature, test results and full details, contact Richard Young, Marketing Manager, Data Transmission, Codex Corporation, 150 Coolidge Ave., Watertown, Mass. 02172. Phone: (617) 926-3000 TELEX: 922-443.
If you're not familiar with Codex (until now we've concentrated in military markets) . . . we have some real eye-openers to show you!

codex
corporation

CIRCLE 194 ON READER CARD

YOU HAVE A MILLION DOLLAR COMPUTER AND AN INPUT BOTTLENECK.

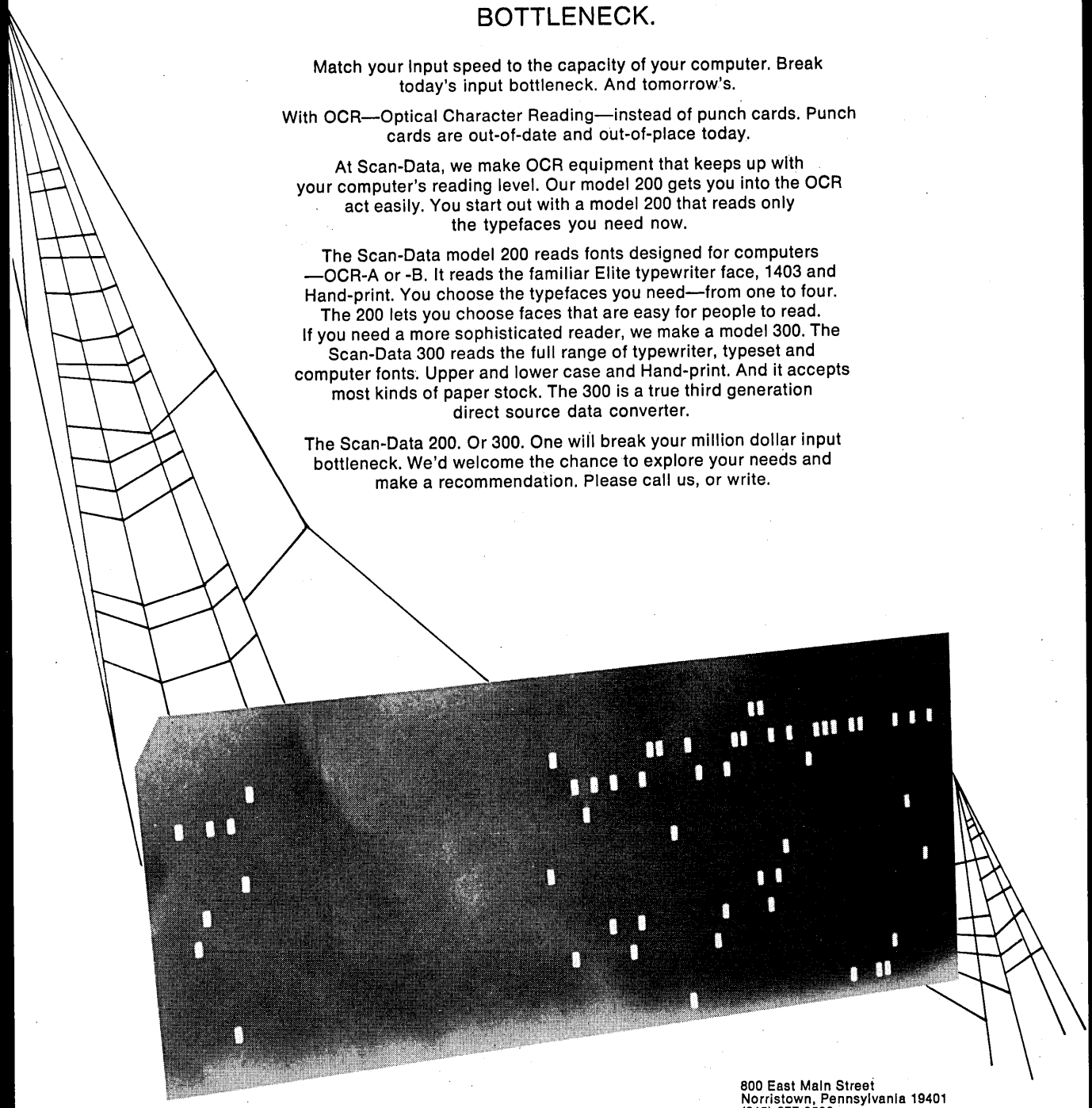
Match your input speed to the capacity of your computer. Break today's input bottleneck. And tomorrow's.

With OCR—Optical Character Reading—instead of punch cards. Punch cards are out-of-date and out-of-place today.

At Scan-Data, we make OCR equipment that keeps up with your computer's reading level. Our model 200 gets you into the OCR act easily. You start out with a model 200 that reads only the typefaces you need now.

The Scan-Data model 200 reads fonts designed for computers —OCR-A or -B. It reads the familiar Elite typewriter face, 1403 and Hand-print. You choose the typefaces you need—from one to four. The 200 lets you choose faces that are easy for people to read. If you need a more sophisticated reader, we make a model 300. The Scan-Data 300 reads the full range of typewriter, typeset and computer fonts. Upper and lower case and Hand-print. And it accepts most kinds of paper stock. The 300 is a true third generation direct source data converter.

The Scan-Data 200. Or 300. One will break your million dollar input bottleneck. We'd welcome the chance to explore your needs and make a recommendation. Please call us, or write.



Scan-Data Corporation

800 East Main Street
Norristown, Pennsylvania 19401
(215) 277-0500

8844 West Olympic Boulevard
Beverly Hills, California 90211
(213) 274-8061

Real Time Systems, Ltd.
London, England

CIRCLE 113 ON READER CARD

letters

new technique for selecting tax returns to be audited. The report is factual and informative but left out an item which may be of interest to your readers.

The name DIF (discriminant function) which has been adopted by IRS

would suggest to many people that the selection strategy used was developed from an application of classical discriminant function analysis. However, the technique actually used was a sophisticated search process which utilized the exploratory capabilities of a computer to its fullest. This technique allows avoidance of unrealistic assumptions about the nature of the data and exemplifies using computers to effectively go beyond known analytic methods.

The new methodology and supporting programs are proprietary to Fair, Isaac and Co., Inc., contractor to IRS for audit selection strategy developments.

WILLIAM R. FAIR
Fair, Isaac and Co., Inc.
San Rafael, California

knuth forsooth

Sir:
A letter from Mr. P. M. Beatts (April, '69) complains of an omission in my discussion of number systems (Feb. '69, p. 93), which leads him to doubt whether the seven-volume series I am writing will be sufficiently complete. I am quite sure that my books won't contain everything that everybody wants, but fortunately in this case I believe there was no oversight; Mr. Beatts should be pleased to find that Roman numerals are by no means slighted in my book. Besides the reference to them in the first paragraph of my article, I devote the entire Section 9.1 (in Volume 5) to Roman numerals and algorithms for dealing with them, as an introduction to algorithms for scanning more difficult languages. My DATAMATION article was excerpted from a section of the book entitled "Positional Number Systems." Cross references to descriptions of other types of number systems appear in the book but not the article.

DR. DONALD E. KNUTH
Princeton, New Jersey

talk to me

Sir:
In your article "Mini-Computers for Real-Time Applications" (March '69), you described the Raytheon 703 and 706 computers as not having a conversational compiler and having to have a minimum of 8K memory to use the relocatable assembler.

I would like to inform you that the Raytheon 703 and 706 computers have a conversational FORTRAN and only 4K of memory is necessary to use our relocatable assembler.

EDWARD KLIGMAN
Raytheon Company
Santa Ana, California

complex limerick

Sir:
I recall that you recently devoted an issue to machine-aided instruction. As a sequel, your readers may have some use for the following bit of faculty club wit:

The salesman said to the dean
With our modern teaching machine
Even Oedipus Rex
Could learn about sex
Without ever touching the queen.

ROBERT DORFMAN
Harvard University
Cambridge, Massachusetts

review of reviews

Sir:
This is my first "letter to the editor" of your magazine. I have had a subscription for several months now, although I have been reading DATAMATION for four years—borrowing anybody's copy I could find. I love your humor; the opening sentence on page 17 of the March issue is an absolute gem. I have one small complaint that I'd like to make; really, it isn't so much a complaint as I think your policy needs re-


The Ossie Award
Presented by
Systems Engineering Laboratories
for displaying a deep insight into
the problems of computer evaluation.

The Ossie Award.

A shining tribute from Systems Engineering Laboratories to executives who display a deep insight into the problems of computer evaluation.

We created this trophy for those executive decision-makers who continue to display such dogged determination in the face of the facts.

The Ossie Award is a genuine silver-colored trophy we shall be happy to send to any executive who confesses complete ignorance of the following information:

The SEL 810B sells for *half* the price of other real time computers in its class. Yet it's a lot faster—750 nanoseconds versus 2 or 4 microseconds.

If you need custom front-end equipment, remember we made our name in custom design.

We deliver the SEL 810B in 60 days. Guaranteed.

You can put two SEL 810B's to work for the price of one of the others.

Finally, we have service equal to any. But we *still* say a computer exists to work, not to be worked on: reliability is our *first* concern.

Allow us to demonstrate the differences between our computer and any other—to you and to your executive decision-makers.

We're confident you'll choose the SEL 810B. As for your executives, the choice is theirs.

They can hold their heads high and be men of vision. Or they can stick their heads back in the sand and win an Ossie for blind faith.

Systems Engineering Laboratories
P.O. Box 9148
Ft. Lauderdale, Florida 33310

Check one, or both:

☐ Here's two dollars. Send me an Ossie. I'll see that it gets into the right hands.

☐ I have an immediate requirement. Show me how I can save up to 50%.

(For faster response call Dennis Davis at 305/587-2900)

Name_____

Position_____

Company_____

Address_____

City_____ State_____ Zip_____

Systems Engineering Laboratories

letters

vising. It has to do with the book review section.

I like your book reviews; they are concise, clear, and to the point. My only beef is that you review only one book a month. This seems to me, in 1969, to be highly inadequate. It is perfectly true that in 1965 there weren't very many books on computing, and a reasonable exercise of editorial selection brought the total number of important books down to around 20 or 30. Today this is simply not true. I am positive that there will be at least 100 good books on computing published in 1969, and it seems to me that a more reasonable estimate would actually be closer to 250.

Does anybody else feel the way I do? Please consider this.

W. D. MAURER
Berkeley, California

DATAMATION welcomes correspondence about the computer industry and its effects on society, as well as comments on the contents of this publication. Letters should be typed, double-spaced, and brief. Only those reaching the editors by the 1st can be considered for the next month's issue. We reserve the right to edit or select excerpts from letters submitted to us.

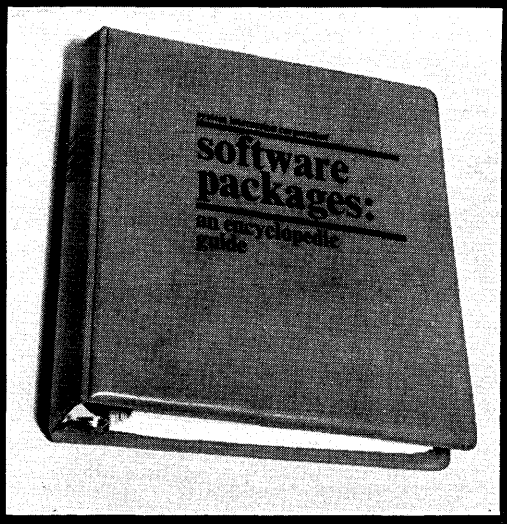
•

FOSDIC'S PERT OPUS

We're overwhelmed by acronyms,
In alpha soup we're drowning;
Each symbol new our sight bedims
The subject is for frowning.
ADP, ARGUS, ASA, ALPS, ASR and ALGOL:
CDC, COMPACT, DDA, CPU and COBOL:
PSPA, PSPB, RAM, ROTR, MICR, LAMP:
FORTRAN, FOSDIC, and IAL: SCOPE,
SDA, and STAMP.
There's also PERT and OPUS, FACT,
TABSIM and HSP:
And TIPTOP, TLU and WADS, and
WATS and PTT.
Within computer polyglot the
human brain now swims—
Is there a finite end to all these
silly acronyms?

—DAVID A. SKLAR

This is our second ad, the one where we tell you how all the really big guys bought our service— and why they think it's great.



And they did buy it, too. Really big guys like:

DuPont, Colt Industries, GE, ITT, University of Illinois, Monsanto, IBM, Western Union, Ernst & Ernst, National Dairies, Wyeth Labs, Celanese, Bailey Meter, Shell, University of West Virginia, Honeywell, Home Insurance, Auerbach, NBC, AVCO, Sikorsky, The City of Long Beach California, Arthur Anderson, United Methodist Church, Western Electric, U.S. Department of Defense, Mitre, Etc., Etc.

But frankly, we haven't gotten a lot of "your guide is wonderful because:" letters. Just a lot of checks. So we'll tell you why we think they spent $135.00 for SOFTWARE PACKAGES: AN ENCYCLOPEDIC GUIDE© and the first year's quarterly update service.

We think they wanted to find out just who has what in the exploding, third-generation software package market. We think they wanted to avoid expensive, in-house duplication of existing proprietary software. And we think they wanted a continually current, single reference source of commercial application and system package opportunities prepared by an organization not affiliated with any vendor.

Because of all this busy-work the guide can also do for you, maybe the best reason for you to buy it... is that you're not one of the really big guys... yet.

system interaction corporation
8 West 40th Street, New York, N. Y. 10018

Software Information Services

The Lonely One

Unlike the traditional keypunch it's designed to replace, the DATASCRIBE™ data recorder works alone—without a separate verifier. Also without cards and homey dust and lint and clatter.

All this, of course, because the DATASCRIBE is an electronic device that's used to enter data directly onto magnetic tape.

Its functional advantages over a keypunch are happily big enough to infuse some of the DATASCRIBE's loneliness with pride. Data entry is 30% faster. Three DATASCRIBEs will therefore easily do the work of four keypunches. And computer throughput time—because of the absence of card-to-tape conversion—is upped by a phenomenal 250% or better. Also, since it contains the most advanced IC electronic design, the DATASCRIBE is almost infinitely more reliable.

Not that the DATASCRIBE doesn't respect its heritage. It takes up the same amount of room as a keypunch. It faithfully retains the standard keyboard and data format, and so automatically qualifies any living keypunch operator. Most important, it presents the operator with an English-language display of column numbers and data.

What computers does the DATASCRIBE work with? Just about all of them. In either 7- or 9-track versions. But it was designed specifically for compatibility with IBM third-generation 360 systems. That kind of companionship should take the edge off its loneliness.

Meet the Lonely One at Booth 704, Spring Joint Computer Conference.

To learn how the DATASCRIBE might serve your own applications, write for our brochure.

Vanguard™ DATA SYSTEMS

1642 Kaiser Street / P.O. Box 1820
Irvine, California 92664 / (714) 540-7640

world report

COMPUTER HAPPENING FOGS UP LONDONTOWN

Sooner or later it was bound to come to that (alleged) swinging, miniskirted London scene--a computer happening. In fact, Event One, a joining of the minds of computer men and creative artists laid on by the Computer Arts Society, was less than a spontaneous ignition of great spiritual forces. But there again, it was difficult to tell who was artist, programmer or cybernetician beneath the beards and miniskirts. And for two days the artists valiantly grappled with machines from another world to discover if they were being offered a new brush or a pallette.

The creative men were obviously a little disappointed at the appearance of rather rigid formal structures that accompanied the exhibits of working machines put on with the aid of display consoles and keyboards by the time-sharing fraternity. They found some of the music and movement compositions failing in originality because a machine had been used to emulate a known style. Experiments with randomly introduced elements to composition and choreography began to bring some excitement to the idea. It was examples of the computer providing scope for almost unlimited change to colour, form and sound that seemed to really rouse the artists' curiosity. These were light and sound space structures that changed to a combination of programmed sequences, environmental noise and movements of a dancer.

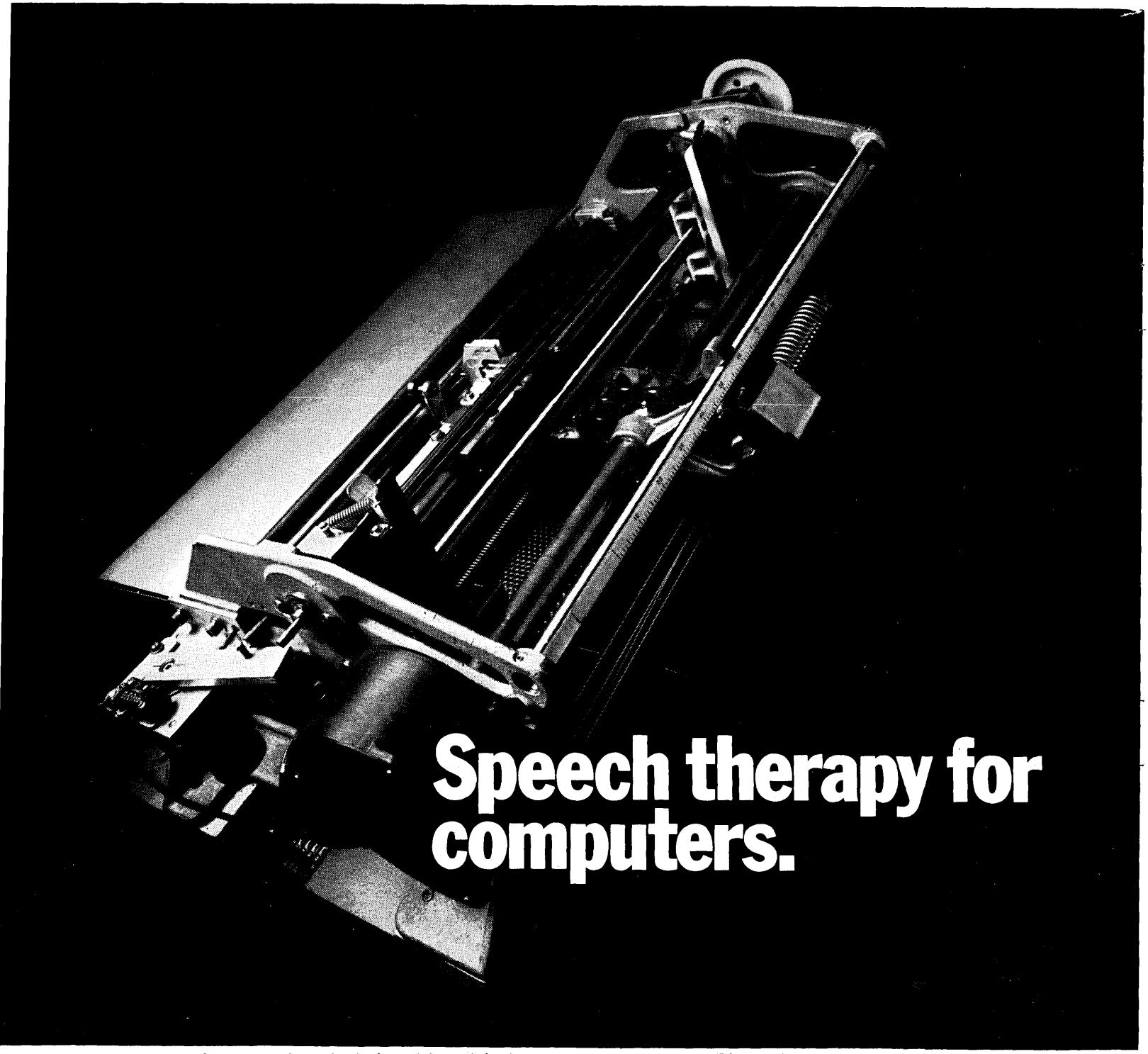
IBM SEPARATES EUROPEAN SERVICE FROM PRODUCTS

As part of the great process of unbundling, IBM is quietly restructuring its world trade operations to bring them in line with the domestic situation. The first signs have come on the service bureau fronts, which in foreign operations never fell under the axe of the original consent decree and have been built up as departmental activities of the subsidiary companies. The first step has been to firmly separate data services from product divisions. A separate company structure is expected to follow the bedding down of new services.

IT'S TIME-SHARING TIME FOR THE EASTERN BLOC

While most of the western European countries have developed time-sharing services along American lines, the eastern bloc has been short on hardware to do much at all. The winds of change have blown in with the Minsk 32, the Russian time-sharing version of an old faithful product line. Soviet press reports say 12 systems have gone into production for the USSR Central Statistical Office, Moscow. The Czechs have gone over the curtain for hardware to do similar work with a United Nations endowment for two CDC 3300s--one for a UN Computer Centre at Bratislava and the other for the National Statistical Office, Prague. Though strongly mathematically based, the eastern bloc as a whole is short-suited on edp for MIS and operations research type work. Leasco's R&D systems have been called in to help in Bratislava and consultant Urwick Diebold has been approached to help resolve systems development for a package of four ICL System 4 machines going to Russia for distribution and production planning work.

(Continued on page 237)



Speech therapy for computers.

Our new printer is designed for original equipment manufacturers. It makes it easier for computers to talk to people and easier for people to talk back to their computers.

It's the UNIVAC® 0769 Incremental Printer

It's a low-speed asynchronous device that can print at a rate of up to 25 characters per second. Making it a pretty fast low-speed printer.

Its basic simplicity of design makes it very flexible. For example you can use it with a keyboard as a remote input device to a central processor.

Or it can be a low-speed output printer. Or an integral part of a communications terminal. Or part of a magnetic-tape data recording system.

It has a changeable font. So if your customers suddenly decide to talk to their computers in mathematical symbols, they can.

The UNIVAC 0769 can handle up to 132 print positions. 52 positions more than you usually get.

It has an ink-impregnated roller that takes only a few seconds to change.

And we designed it to produce an original and five good clean copies.

We're offering the 0769 to OEM customers as a basic mechanism, without controlling electronics, power supplies or cabinetry. We can also supply intimate electronic circuits for the 0769, primarily amplifiers and drivers, on a single plug-in printed circuit assembly.

If all this sounds interesting, write to Univac, OEM Marketing Department, P.O. Box 8100, Philadelphia, Pennsylvania 19101.

We offer Readers, Punches. Printers. Communication Terminals, Graphics, Memory Devices and, of course, a little therapy.

UNIVAC

SPERRY RAND

CIRCLE 202 ON READER CARD

Until last year, the UK's ICT and English Electric had the edge on westerners marketing into eastern Europe, largely because Stateside companies were politically shy of offending strategic goods regulations. Honeywell recently closed a Hungarian deal for four H2200s. Previously ICT territory, Hungary has made an agreement with the French for manufacture of the Iris 30--the small system in the CII range. This is similar to the deal made between the Czech state's communications, electronics and engineering conglomerate, Tesla, and GE-Bull to make the GE 145 under license as the Tesla 200. East Germany remains in the most parlous state among the Soviet satellites with the most acute exchange problems. Production is increasing for a new system in the Robotron series, a small character machine of pre-1401 concept brought up to date in componentry. This is another area where an appeal for software help has gone to Leasco R&D. In general, the east has become nearly self-sufficient on small systems but is highly dependent on the west to plug the gaps on big machines.

MAINTENANCE PRICES UPPED ON OLD MACHINES

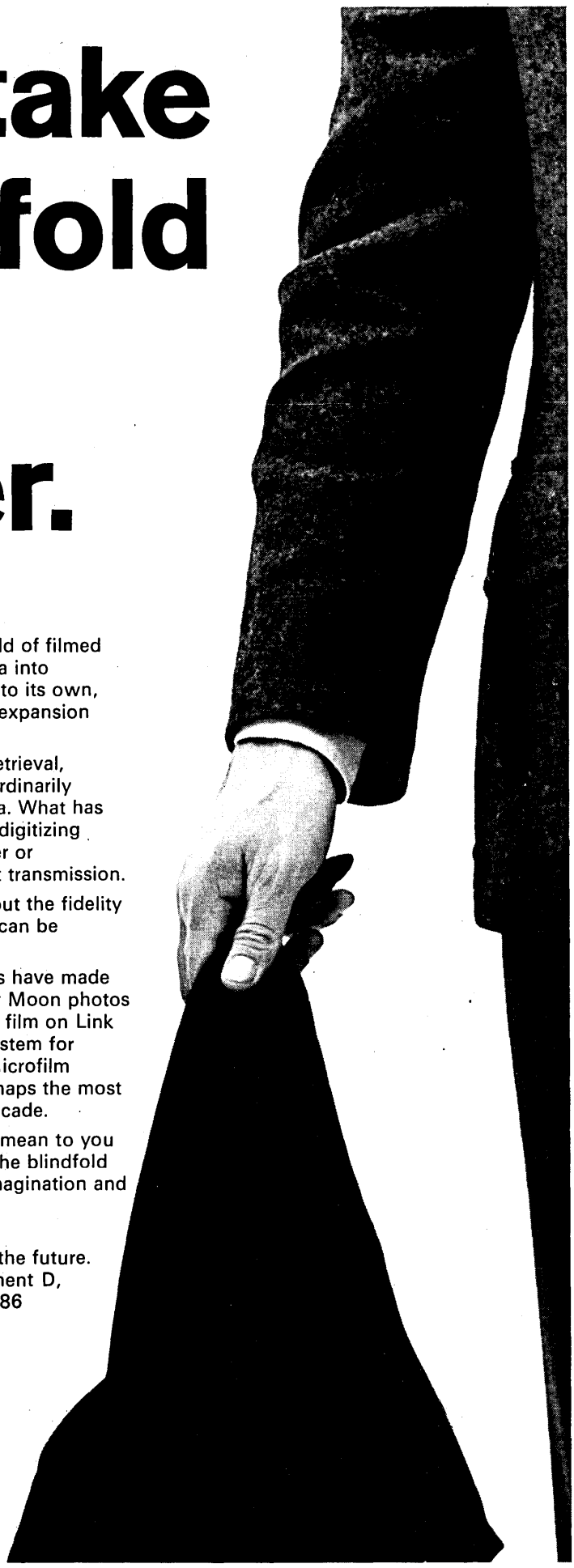
ICL has caused a flurry in the secondhand computer market by trebling maintenance prices on some of its older machines and refusing to provide any maintenance whatsoever for groups of other systems after they leave their original installation sites. The decision has brought Alan Hales, managing director of Computer Resale Brokers, out from his corner in fighting mood. Particularly as he can argue with some substance that some of the machine systems of three to four years installed life will now have a nil residual value. Hales ridicules the situation further by quoting IBM's terms, which are the same for subsequent users. And he sees ICL's long-term goal as putting the squeeze on third party lessors when the current generation of ICL 1900s start to move around customers a bit more.

In practice, ICL may have a little more justification on its side than the resale men concede. The merger last year between English Electric and ICT produced a computer conglomerate and a half. The product line includes ICT 1300's, 1500's (RCA 301's), Univac 1004's, the English Electric KDP and KDF series, the Leo 3/ series, and Ferranti originated Orions and Atlas, plus the two latest lines of ICT 1900's and English System 4 (Spectra 70). Installation of a number of these systems took place within the past two years. Nevertheless, the maintenance coverage to keep them all up to scratch must present ICL management with a painful bill for diversity. The Orions, Leo, KDP's and KDF's are the ones for which no further maintenance will be supplied on removal.

BITS AND PIECES

Com-Stute, Inc., and Computer Applications Co., two Japanese software firms, have signed an agreement whereby Com-Stute will provide support personnel for CAC. The program started in April at a modest $1.5K monthly charge, expected to reach $7.5K by the end of the year. Com-Stute is a branch of a Stateside corporation providing technical support in the Far East as well as software and application package development...Olivetti has introduced the Logos 328, an electronic printing calculator of 22 digits at $1628.

Let Link take the blindfold off your computer.



Until recently, no computer could "see" the vast world of filmed data. Graphic data conversion—translating filmed data into computer language and vice versa—has now come into its own, however. And Link is in the forefront of this exciting expansion of computer input/output capabilities.

It's no secret to anyone involved with data storage, retrieval, transmission and other handling that film is an extraordinarily economical medium for storing and manipulating data. What has been a secret has been a feasible, reliable method of digitizing filmed data so that it could be ingested by a computer or "conditioned" for other applications, such as efficient transmission.

Not only has Link found an answer to this problem, but the fidelity of the converted data is astounding. And conversion can be performed on-line, too.

Some of Link's graphic data conversion achievements have made headlines, because the Mariner, Ranger and Surveyor Moon photos were obtained by converting digital or analog data to film on Link film converters. A recent Link accomplishment is a system for electronically revising microfilm. Called Automated Microfilm Aperture Card Updating System (AMACUS), it's perhaps the most notable advance in the use of microfilm in the last decade.

What can Link's graphic data conversion capabilities mean to you and your computer operation? It's more than taking the blindfold off your computer. It's taking the shackles off your imagination and opening up a whole new range of opportunity.

As a first step, let us send you literature on our past accomplishments. Then, let's get together to discuss the future. Write: Advanced Technology Systems Sales, Department D, 1077 East Arques Avenue, Sunnyvale, California 94086 or phone (408) 732-3800.

SINGER
ADVANCED TECHNOLOGY

Link Group/Singer-General Precision, Inc.

CIRCLE 203 ON READER CARD

washington report

DELAY BECOMING STANDARD IN SETTING STANDARDS

USASI's X3 committee was scheduled to meet at NBS hq. shortly after our press deadline to consider the continuing disagreement over OCR standardization. One likely action: X3.1 will be directed to study ways of modifying OCR-B to make it more machine-readable and cost effective. Another is that X3 will decide to prepare a "white paper"--containing inputs from ECMA, NBS, X3.1, and other interested groups--clarifying the issues. Likely result: further, prolonged delay in producing a draft standard. X3.1 Chairman Joe Vincent recently left CDC, a leader of the A forces, and joined REI, variously regarded as a B advocate or a neutral. But neither Vincent nor X3.1 have decreased their support for a standard based exclusively on OCR-A characters. They shun being identified as an "OCR-A committee," though, and are striving to keep the dispute from degenerating into a political dogfight.

GSA PILOT TEST MIGHT SHOW THE WAY TO FLY

GSA recently began a pilot test of in-house vs. outside dpe maintenance as a followup to the Boston Computer Group study we reported last month. The agency has hired its own 4-man maintenance crew to service a GE435 and H200 at Region 3 hq. here. Costs and uptime will be tabulated for 6 months, then compared with the service provided by each manufacturer prior to the test. Advance projections indicate in-house maintenance, within Region 3, can save $50K/yr. If this estimate proves to be near the mark, in-house maintenance will be extended to other GSA regions. Ultimately, say officials of the agency, savings could reach $500K/yr.

ADAPSO STANDS AGAINST ONE-BANK HOLDING FIRMS

ADAPSO strongly supported Rep. Wright Patman's bill to control one-bank holding companies in testimony before Patman's committee last month. ADAPSO suggested that banks, because of profits on other services, can often undercut independent dp service centers. Also, if a prospect owes money to a bank, he isn't likely to take his dp business to a competing service firm.

The association asked for, but isn't likely to get, two amendments to the Patman bill (HR6778). One would specifically bar any bank holding company from investing in dp service centers; the other would allow commercial data processors to sue bank holding companies for unfair competition.

CAPITOL BRIEFS

A bill aimed at greatly expanded East-West trade was on the verge of being introduced by Sen. Ed Muskie at press time; hearings are likely soon, at which CDC, IBM, and Honeywell, among other dp firms, will probably testify...Lew Branscom, director of an NBS lab in Boulder, Colo., is the likeliest successor to retiring NBS Director A. V. Astin...We unintentionally slighted developers of the S3 simulator in March (p. 127) in a story announcing the Army's abandonment of the system. We should have specified that the abandonment involves only use of S3 as a bid evaluator. Army's use of S3 as a system design tool will continue; its capabilities in that area are regarded as "tremendous" by one knowledgeable source. S3 was developed by MetaSystems Corp. (formerly Leo J. Cohen Associates), Trenton, N.J.

Hello, IBM?

About those 42 keypunches, 21 verifiers, the card reader and 4 tons of cards:

Please come and take them all away.

And...can you use a dozen extra operators? They're lovely girls, but we're installing a CMC KeyProcessing System.

CIRCLE 205 ON READER CARD

Punching holes in a card, then running it through a card reader, is the standard way of getting new data into a computer. But as the flood of data continues to swell relentlessly, and as keypunch operators become harder and harder to find, many data processing managers are looking desperately for a better way.

— Business Week

Computer Machinery Corporation presents . . . a better way.

No cards. All data is recorded on one single reel of magnetic tape. And each $75-a-month keystation can be used for both keying and verifying. So you need far fewer operators and fewer units.

KeyProcessing works like this:

A special computer and a tape unit are contained in the supervisory console of each CMC KeyProcessing System.

Up to 32 keystations are controlled by the computer, which contains proprietary programs provided by CMC with the system.

Operators at individual keystations can enter or verify data independently and simultaneously, on multiple job formats. The data is processed by the computer and stored on a magnetic disk.

When batches are complete, they are transferred on command to the single tape, which becomes clean input for your computer system. Done!

At a tenth of a cent apiece, punched cards may sound like a bargain. But a user of, say, 20-million cards a year — not an unlikely output for a 50-keypunch operation — can easily see where to get the first $20,000 for new, more productive equipment. The latest systems may trim by one-third the cost of running a 50-keypunch data center.

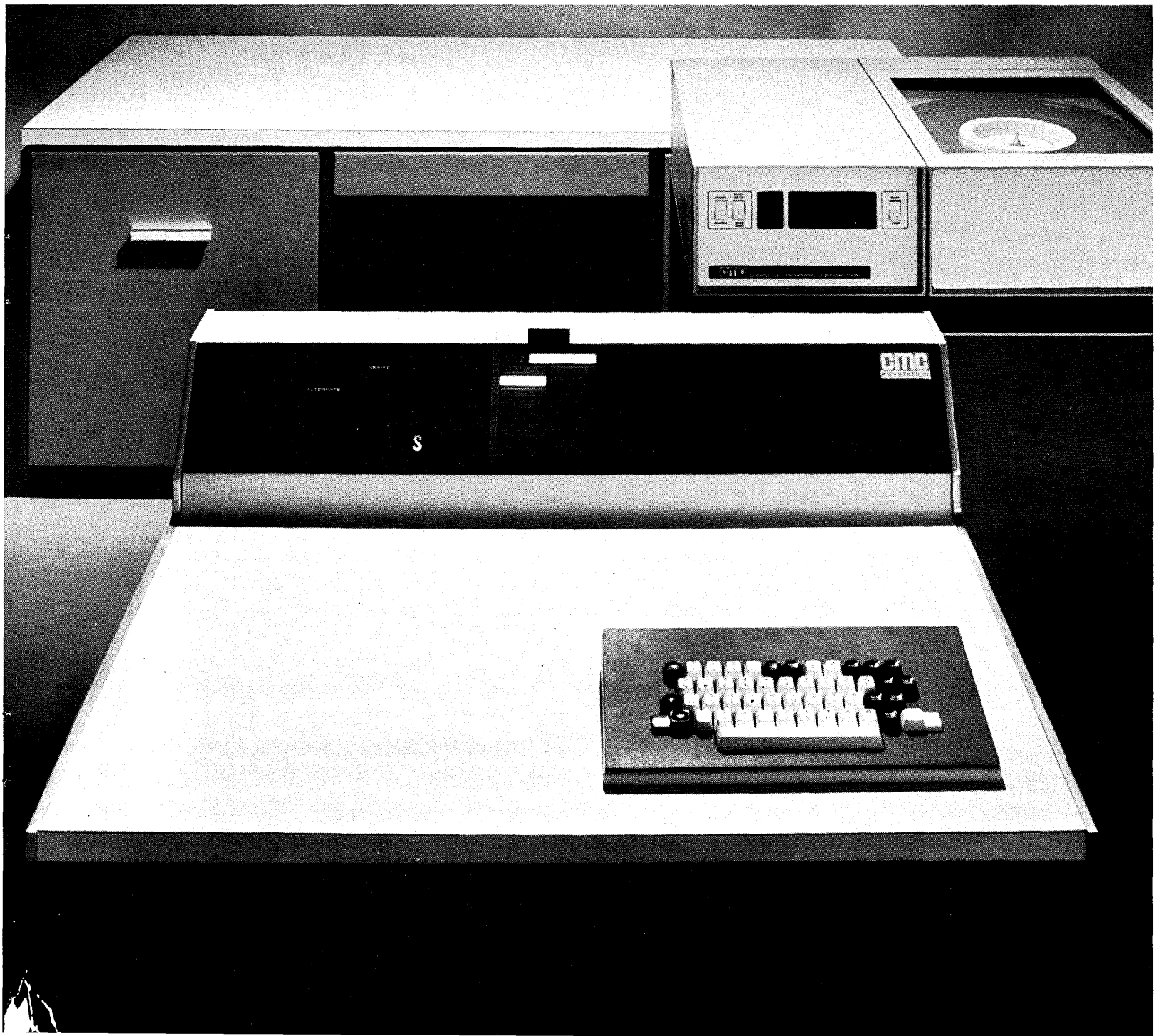
— Business Week

Check the reader card for information on the latest of the latest systems. A CMC KeyProcessing System makes your data preparation as modern as your data processing.

CMC

COMPUTER MACHINERY CORPORATION

New York Los Angeles San Francisco



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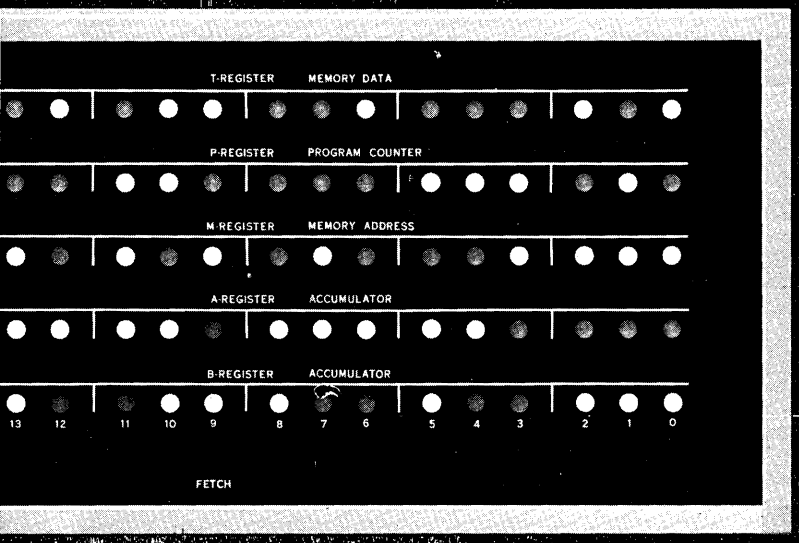

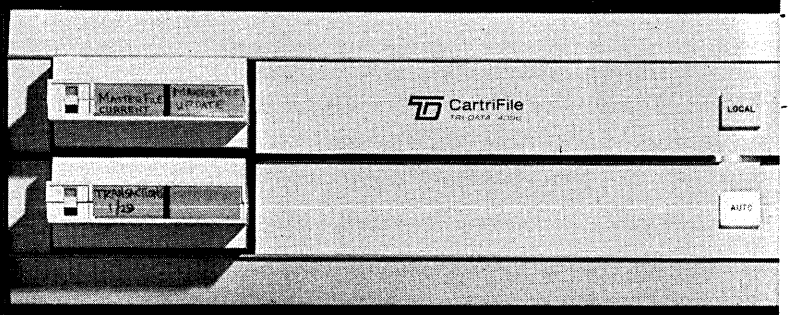

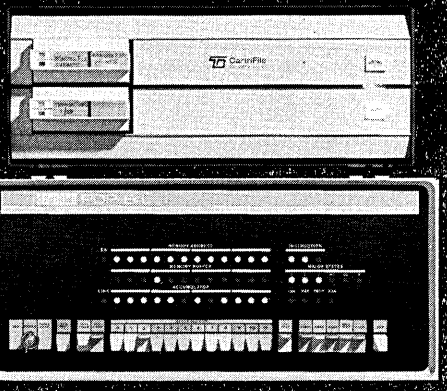

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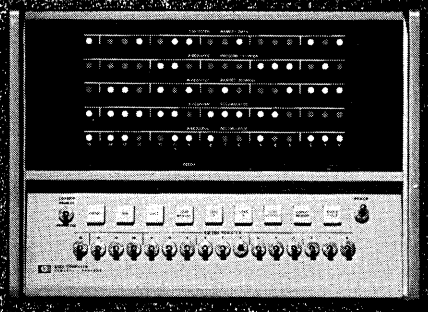

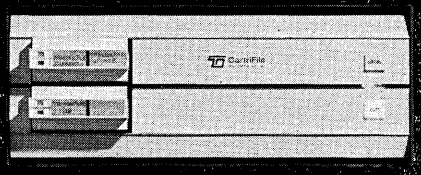

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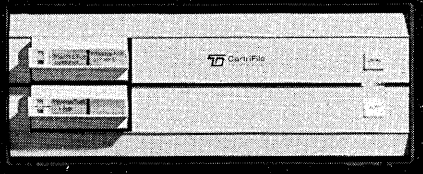


CartriFile

prototypes for Computaumation, but that the latter merely purchased a system which used standard CTC components. Computaumation states that patents are pending.

Meanwhile Computaumation, which announced the Computaumate 1 in January, has revealed its intention to unveil the Computaumate 3 in July, making the model 1 obsolete. The earlier unit interfaced a standard IBM Selectric typewriter for communication over telephone lines, and sold for $2000, with options of unattended operation ($700), and a reusable magnetic tape cartridge ($500). Now, the model 3 sports all of these features in one bundle, is expected to sell for "about $3500."

NEW MICROWAVE FIRM PLANS TO MAKE WAVES

Design of a for-hire microwave transmission system linking Chicago, NYC and several intermediate cities, is nearly completed. The system would be operated by Microwave Communications, Inc., of New York, formed last December by Jack Goeken and several associates.

They plan to offer a communications pipe 30 mHz wide, divisible into 2 kHz channels. MCI/NY intends to let customers subdivide and/or share facilities, and will also supply sharing partners. Rate savings of up to 96% over Bell charges are promised.

MCI/NY reportedly is capitalized at 2 megabucks, raised privately. An FCC license application will be filed soon. The Goeken group, whose earlier application--covering a similar Chicago-St. Louis system--remains in limbo, is planning additional links between New York and Boston, Seattle and San Diego, Washington and Miami, Chicago and Minneapolis. The group has also formed a company--Microwave Communications of America, in Washington--which offers engineering, legal, and marketing assistance to aspiring microwave common carriers.

MAGNETIC TAPE CASSETTE FOR DATAPOINT 3300

Computer Terminal Corp., San Antonio, Tex., has announced a Cassette magnetic tape companion unit to the company's Datapoint 3300 crt terminal.

According to Bob Coleman, vice president of marketing, the new unit offers both forward and reverse line-incremental playback, extending the capacity of the crt display to several hundred frames (25 lines of 72 characters each) of data. When operating in an on-line mode, the unit handles data at standard 110 or 150 bps rates, but in the local mode data is recalled at 600 bps, allowing the operator immediate access to previous transactions.

RUMORS AND RAW RANDOM DATA

Norm Ream has been appointed manager of management advisory services at S. D. Leidesdorf & Co, NYC CPA firm. Previously, he was president of CDC's subsidiary, Universal Reservations System, Inc., and before that held key dp policymaking positions at NBS and the Navy...Jim Hicks, vp of data systems marketing at Univac, and Errol W. Bartine, director of operations, service and planning for the Univac Division, have joined Comcet, Inc., the Comress computer-making subsidiary. Hicks is the marketing vp, Bartine is finance vp...We hear Graphic Sciences Inc., leasing company, GSI, has written a lease on a 360/50 at 22% off IBM rental--and with a 30-day cancellation clause. That means that 50 could have six rentors in one

(Continued on page 245)

Data General is mass-producing small computers, which puts our money where our mouth was.

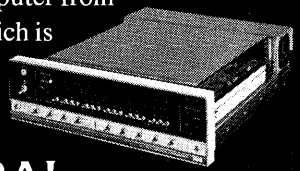
We made three brash statements when we started out. 1. We said we had the best small computer in the world. 2. We said we were rich. 3. We said we'd produce computers in volume. Let's look at the record.

First, our NOVA has had a fantastic reception. Because it's the first small general purpose computer built around big computer architecture. It has multiple accumulator/index register organization and expandable read-only memory you can program like core.

Second, we've plowed our money into a new plant in Southboro, Mass. And we've developed a technical service organization big enough to support big numbers of users.

Third, we've got our production line rolling. Delivering ahead of schedule. It isn't surprising. Because we deliberately designed NOVA to be the easiest small computer in the world to make. No complicated backwiring. It's MSI. This year we're making several hundred. Next year, over a thousand.

And that's just the beginning. Because we figure the only way you can get the price and support you want is to buy a mini computer from a guy who produces many. Which is why Data General is making such a big production of such a small computer.



DATA GENERAL CORPORATION
Southboro, Massachusetts 01772

CIRCLE 128 ON READER CARD

Harvey P. Newquist, Director of Manufacturing

year??...Congressional privacy protectors have persuaded the Census Bureau to: reduce the number of 1970 census questions from 66 to 23; reword a query regarding kitchen-bathroom facilities to make it sound less nosy; and submit new questions to Congress for approval before adding them to census forms...Jim Dunlap, one of Digitek's three founders and president until recently, has resigned to go camping...Two new companies have spun off from Com-Share, Ann Arbor, offering time-sharing packages of specialized industry programs on Com-Share's t-s facilities. Com-Pete Inc. has developed programs for the petroleum industry, primarily in fuel oil distribution, and a car locater service for new car dealers (a program acquired from Com-Share) which will later include used cars. The other company is Manufacturing Data Systems, Inc. which is offering Compact II, enabling numerical control users to generate n/c tapes from in-house terminals...Anti-trust jitters? Insiders say that IBM has become extremely security conscious, edicting that no pieces of paper be discarded. A recent Lab visitor casually picked up a document, was not-so-casually asked to put it down.

CAELUS FORMS DISC DRIVE MANUFACTURER

Caelus Memories, the disc pack supplier, has formed an affiliate, Caelus Data Products, for building disc drives. First announced product, available this summer, is an oem-directed single-cartridge drive, Model DCD 1100. With a smallish capacity of 13 million bits, the 1100 will still provide 30% more storage--and supposedly many times the speed--of the only similar unit, IBM's 2310. Features include 65 msec access time, directly addressable tracks, three reserve cylinders, and write lock-out.

CDP will share advertising, marketing, and other resources of CM, including management. Philippe Yaconelli, pres of the memories firm, is also pres-elect of the manufacturing firm. Wm. W. Wright (chairman of the board of CM), Sung Pal Chur (vp of R&D), Wm. Gaskins (ex national sales mgr), and Serge Blanc (to be dir. of engr.) will all help out. A big help will come from financial transfusions, already big enough to kick off development of follow-up products and to start a 55,000 sq-ft plant near CM in San Jose, Calif.

FRANK D. THOMPSON, 1907–1969

Frank D. Thompson, founder and first publisher of *Datamation,* died last month in Chicago.

Mr. Thompson devoted his entire career to the business press. He started selling advertising space in the late '20's, was a member of the Assn. of Industrial Advertisers and a founding member of the t.f. Club of Chicago. Mr. Thompson joined Sutton Publishing Co., Inc., as a vice president at its founding in 1941 and helped develop electrical equipment magazines.

In 1950 he founded F. D. Thompson Publications, Inc., publishers of *Research/Development* and *Datamation* magazines, and was chairman of the board at the time of his death.

Mr. Thompson is succeeded as board chairman by Gardner F. Landon, *Datamation* publisher since 1963 and president of F. D. Thompson Publications since 1966. Mr. Landon, also elected chief executive officer, has been with the company since 1953.

Amelia Auricle's Computer Dating Bureau

When a man wants a date with a wellbred computer, Miss Auricle consults her heart.

"Goodness *knows*, nobody could ever accuse me of being a snob. But when a man says he wants a date with a 360/25, I know. I mean, I just *know* I have to show him what *real* breeding in computers *is*. (Mummy always said, 'Miss Auricle, darling, one simply *must* do what one *knows*—in one's heart of hearts—is right.')

"So I explain that I can arrange a *heavenly* liaison with a *divine* number named Spectra 70/35. 'You can have three I/O channels,' I say, 'instead of one. And 6-level multi-programming instead of a mere 3-level.' One doesn't acquire that kind of breeding at finishing school.

"'And,' I say, 'Spectra is so much more *rapid*.' Who could *possibly* turn his back on 2½ times as many 'add full word' operations each and every second, or just about 3 times as many 'branches'? *Every*, simply *every* instruction speed is faster.

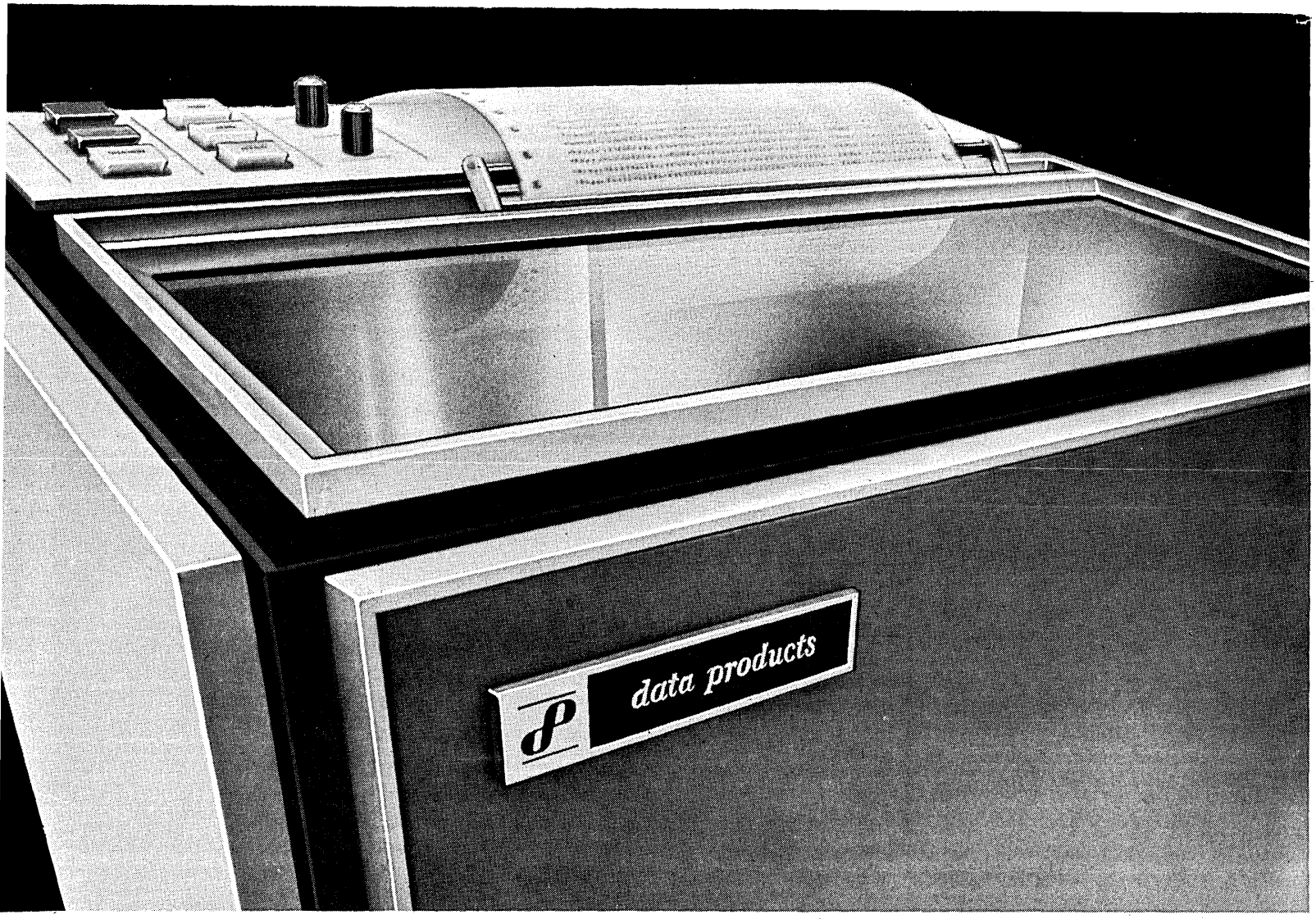
"*Actually*, Spectra's vital statistics are *all* more impressive than a 360/25's. All my friends know that the two have nothing in common except processor price and size (32, 49 or 65 thousands, my dear). They *are* technically compatible, but Spectra has so *much* more to offer in the way of true happiness.

"You can't *imagine* the enthusiastic response I get from my clients when I match them with Spectra. Indeed, I feel—in my heart of hearts—that I've discovered a winner. I'm so fortunate. I haven't lost at anything since Consuelo beat me at canasta at Newport in 1949."

To make a date with a 70/35, write RCA Information Systems, Cherry Hill, N. J. 08034 or call (609) 424-2385. We'll send one of our expert matchmakers around to call on you. It's Spring, and romance is in the air.

RCA
Information Systems

CIRCLE 209 ON READER CARD



steal it!

The 160 pound, table-model 2310, first of the new compact 2000-series LINE/PRINTERS™ designed for small computers and data communication terminals, has achieved a major price breakthrough. A drum speed of 1760 rpm allows printing speeds of 356 lpm for a full 80 columns and listings as fast as 1110 lpm for 20 columns. All this at an OEM price of under $6K . . . It's a steal!

What makes this price breakthrough possible? The secret is our new Mark IV print hammer. Based on the same time-proven, one-piece construction of previous Data Products hammers, the new simplified Mark IV results in a reliable, low-cost hammer, virtually friction-free, that gives unsurpassed print quality.

But price is not the whole story. The flexible 2000-series printers offer a wide range of line speeds, character sets and type fonts (including OCR) and column widths (optionally, up to 160). So if you need a high-speed printer but price has been holding you back, check with us . . . you may be able to steal one.

For immediate technical information call the nearest sales office listed below, or contact Bob Allen at Data Products Corporation, 6219 De Soto Avenue, Woodland Hills, California 91364; phone (213) 887-8000.

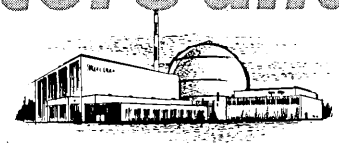
Data Products

"the peripheralists"

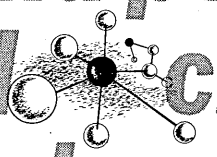
Los Angeles 213/887-8000 **Minneapolis** 612/338-4717 **Dallas** 214/239-9641 **Acton,** Mass. 617/263-3961 **Bethesda,** Md. 301/652-8120
Melbourne, Fla. 305/262-4773 **Amsterdam,** The Netherlands 020/156-297 **London,** England (1) 579-3116

Data Products manufactures LINE/PRINTERS™, DISCFILES™, Core Memories, Off-Line Printer Systems, Card Readers & Punches.

Computers and power systems



Computers and petroleum · Computers and



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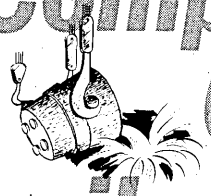

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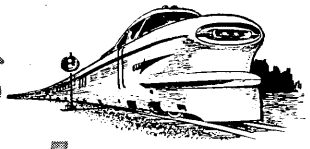

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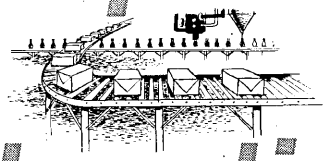
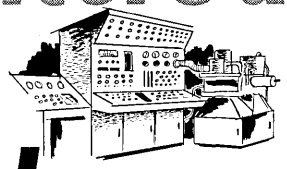


Computers and automatic testing



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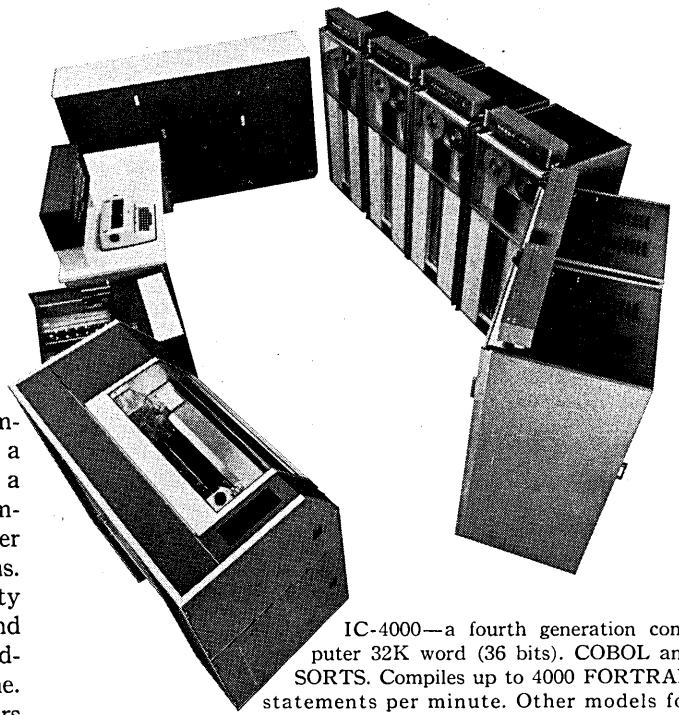

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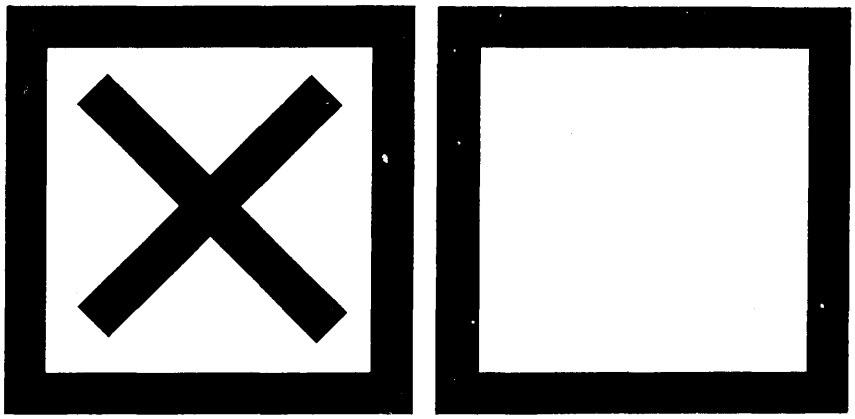

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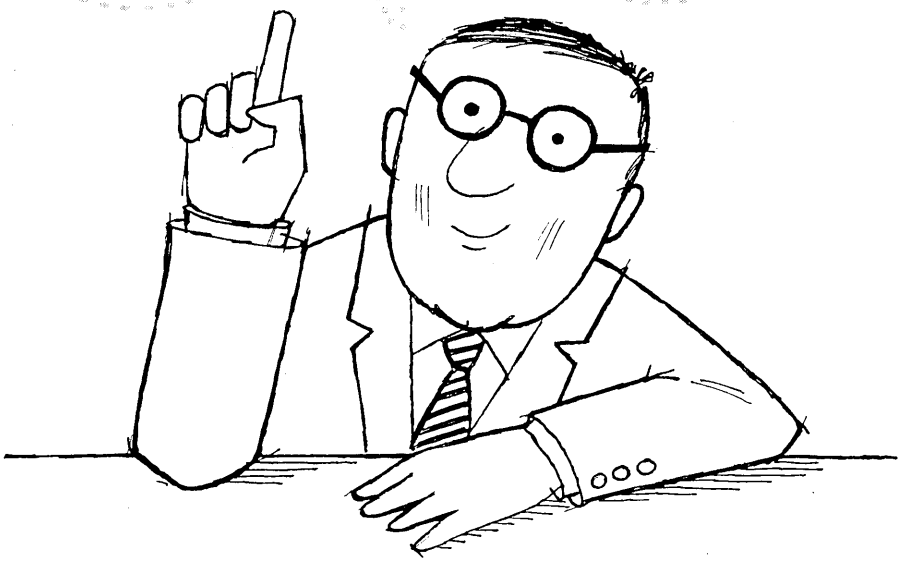

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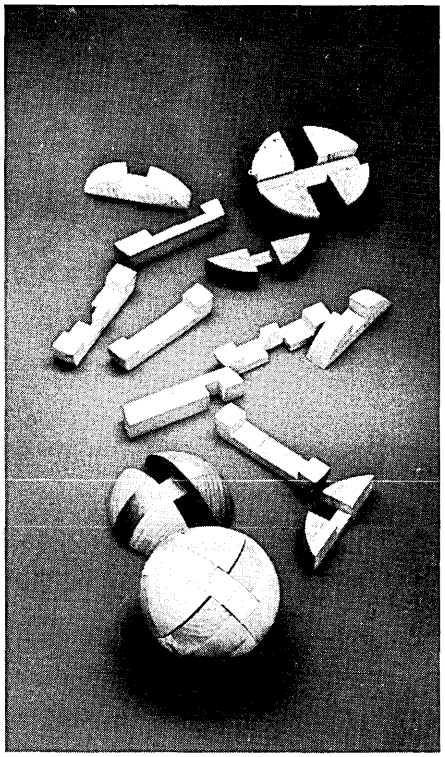

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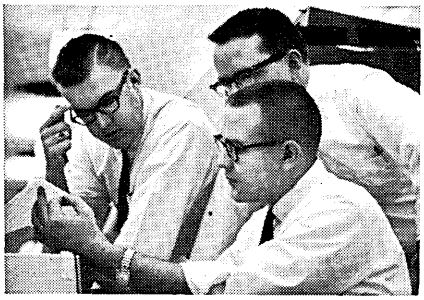

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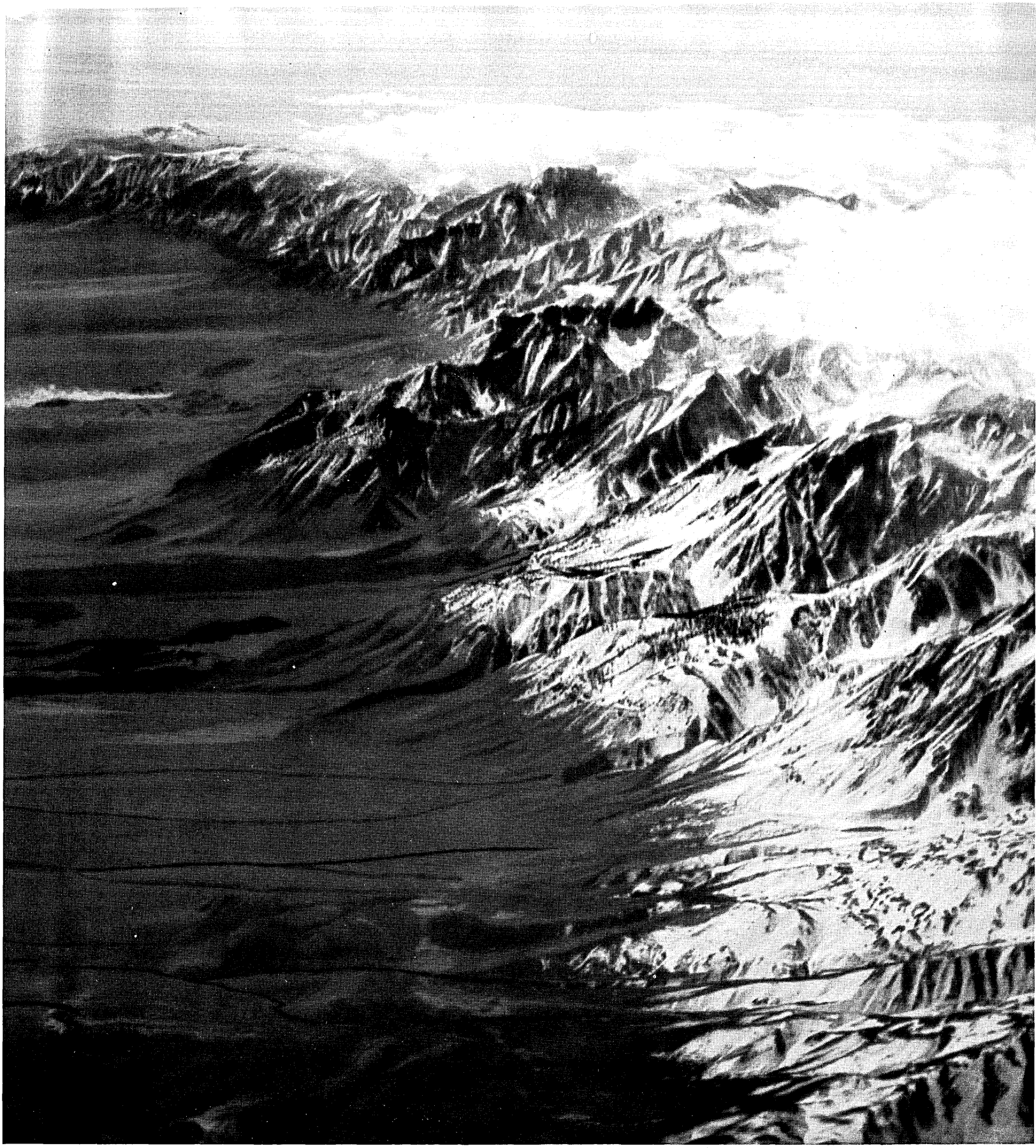

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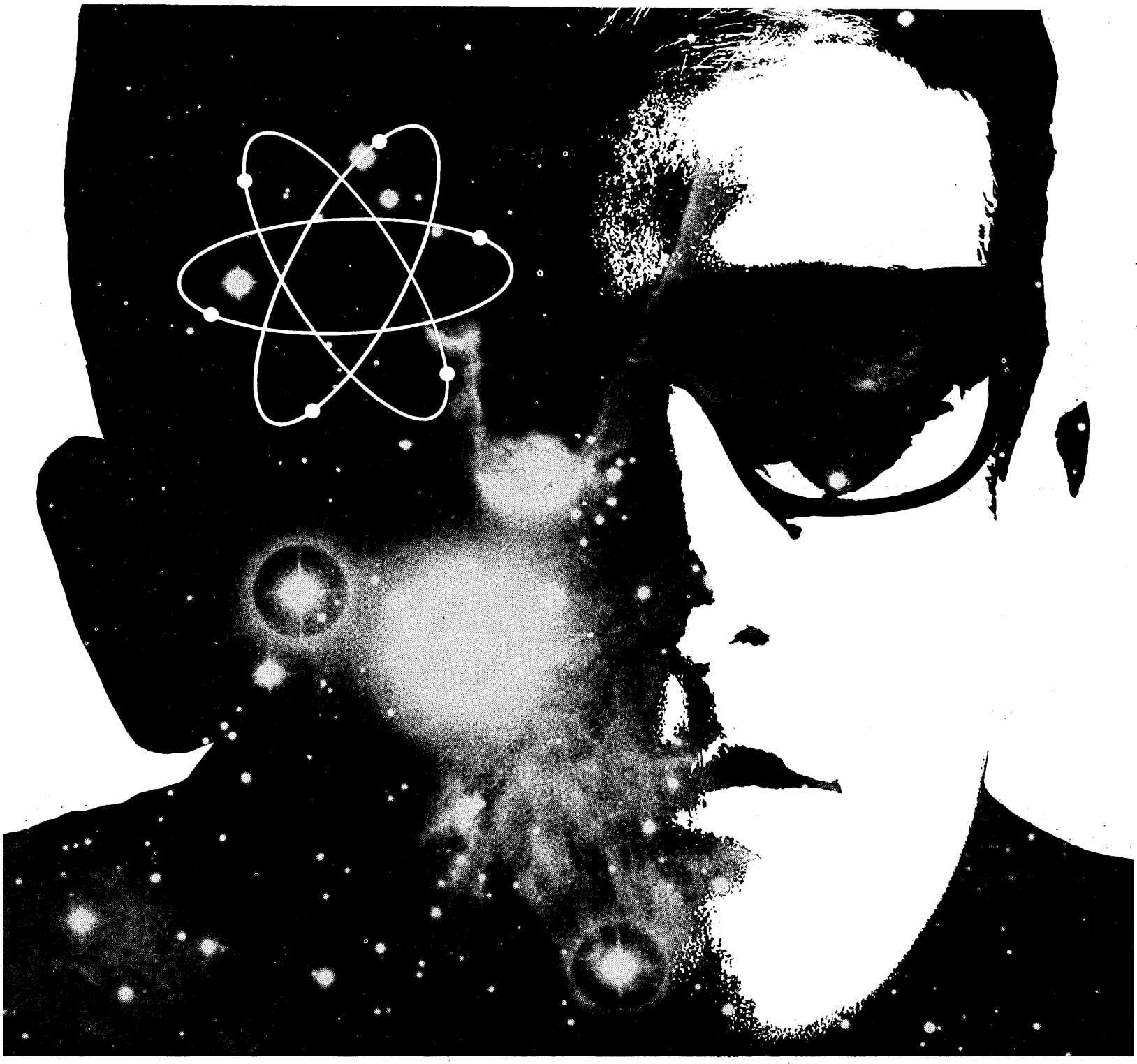
Bill Stevens is the new president of Data Disc. Ex-president **Armin Miller** is now chairman of the board. . . . **Dr. A. F. Wittenborn** has left his position as vp in charge of the Tracor's Sciences and Systems Group to devote more of his time to his position as president of Tracor Computing Corp. He is succeeded by **Dr. Wayne Rudmose**. . . . Data Technology Corp.'s merger with Perfection Plastic, Inc., has brought the company a new president, **Rex Lindsay,** former Perfection exec vp. . . . **James A. McCullough,** Burroughs' vp, product management, has been elected to the company's board of directors to succeed **Robert A. Atkins,** who has retired. **Dr. Irven Travis,** vp of technological development, has retired as an officer of the company but will continue as a board member. . . . **James K. Anderson, Jr.,** has been appointed vp in charge of the new Proprietary Systems Div. of Computer Time-Sharing Corp., Palo Alto. . . . **Albert L. Williams** has retired as one of the four members of IBM's senior executive team but will remain with the company as a consultant and board member. . . . Applied Data Research president **Richard C. Jones** has been elected a director of Security National Bank of Trenton. . . . International Automation Co., leasing subsidiary of TLW Computer Industries, has named **W. M. Morris** president. He had been Atlanta district manager with the Service Bureau Corp. . . . General chairman of the 24th Annual ISA Instrumentation-Automation Conference & Exhibit (Oct. 27-30 in Houston) is **Robert L. Mallory,** southwest area vp for Honeywell. . . . **Robert R. Everett** has assumed his duties as acting president of The MITRE Corp. President **Dr. John L. McLucas** is now Under Secretary of the Air Force. . . . At Allen-Babcock Computing, **Mrs. Michael Jane Allen Babcock** has become president and **James D. Babcock** chairman of the board. New executive vice president, replacing Mrs. Babcock, is **Edward E. Stiles,** one of the early members of the company. Allen-Babcock just opened their third time-sharing center, in Union, N. J., using a modified 360/50 with auxiliary two-million-byte mass core . . . **Arthur P. Young** of Remington Rand succeeds **James S. Nelson** of U.S. Gypsum as president of the Univac Users Assn. for a two-year term. . . . Data Management Services, Inc., Philadelphia, has named **Eugene Perlman,** former Digitronics marketing vp, as president. Former DMS president **Robert Castaldo** has been elected vice chairman of the board of directors and treasurer of the corporation. . . . 1969 Fall Joint Computer Conference general chairman **Jerry Koory** has left Programmatics, where he was vp, to join Butler Data Systems as director of information transfer services. He is succeeded at Programmatics by **Francis E. Welsh, Jr.,** vp and former marketing manager. . . . **William H. White** has been named executive director of the Numerical Control Society. . . . **J. V. Howell, Jr.,** former manager of computer memory development at Scientific Data Systems, has joined Redcor Corp. as director of engineering. . . . **Norman D. Livran,** deputy executive officer of the Los Angeles County Local Agency Formation Commission, has been named executive secretary of the California State Intergovernmental Board on Electronic Data Processing to serve "at the pleasure of the governor." . . . **Bob O. Evans,** president of IBM's Federal Systems Div., has been named chairman of the 1970 annual conference sponsored by IEEE's Computer Group, which will be held in Washington, D.C., June 16-18. . . . **T. J. Smith,** former Raytheon Computer marketing manager, is now executive vp at Sycor, Inc. (formerly Systronics). His new vp of engineering is **Dr. Kay B. Magleby,** most recently in charge of advanced systems planning for Hewlett-Packard. . . . **Thomas R. Evans,** vp of product development for American Business Systems, Inc., Philadelphia, has been elected president of the Data Processing Supplies Assn., succeeding **Paul O. Wilson,** president of Baltimore Business Forms. . . . University Computing Co. has named **Richard G. Fagin** president of UCC International, Inc., the company's subsidiary for operations outside the U.S. Fagin was formerly exec vp of D.R. McCord & Assc., UCC subsidiary specializing in consulting and software development for petroleum companies around the world. . . . **John J. Graham** is the new president of Diebold Computer Leasing. He replaces **Richard P. Urfer** who, along with exec vp **Gilbert R. H. Kennedy,** left the company to



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pursue activities in finance. . . . **Mel L. Decker** has been elected president, chief executive officer, and a director of Houston Fearless Corp. to succeed **Fred C. Mehner,** who has resigned as chairman and president but is continuing as a director. Decker is chairman of the executive committee of Capital Southwest Corp., Dallas, a major Houston Fearless stockholder. **Donald E. Chelew** has resigned as a Houston Fearless executive officer in order to devote full time to his position as president of HF Image Systems, Inc., an 80%-owned subsidiary. . . . **William P. Moyles** has been promoted to the position of vp-corporate growth for Control Data to investigate, evaluate, analyze and negotiate for proposed and potential acquisitions. . . . **James J. MacIsaac,** former manager of market planning for RCA's Information Systems Div., has been appointed a vp of Vernitron Corp. with responsibility for operations of the company's Data Sciences Group. . . . **George Canova,** president of Century Data Systems, Anaheim, Calif., peripherals maker, has been elected chairman of the board. Also elected to the board was vp of engineering **Willi Jilke. Edgar Castrillo,** director of administration, was elected corporate secretary. . . . Planning Research Corp. has promoted **John R. Smith** to principal, highest rank on the firm's technical staff. He was formerly with Mesa Scientific Corp. and has been with PRC since the two firms merged in 1965. . . . The USA Standards Institute has appointed **G. F. Hohn** manager of technical operations. He will be responsible for all institute staff activities, involved in the approval and promulgation of national USA Standards and for coordination with more than 160 organizations affiliated with the institute and responsible for the development of voluntary standards. Hohn had been director of USASI's Electrical and Electronics Div. . . . **Raymond W. Johnson** has been elected president of The Data Corp., Los Angeles-based service bureau affiliated with Insurance Co. of North American and Pacific Employers Group. He had served as president and gm of Systems Data Processing Co. in Sacramento until it was acquired by INA-PEG in July of '68. . . . **Glenn W. Bailey,** chairman of the board and president of Keene Corp., has been elected to the board of Randolph Computer Corp. . . . **Brian Knight,** vp/gm of Litton Industries' Advance Data Systems Div., has been appointed president of the new Revenue Control Systems Div. which is comprised of Advance Data Systems Corp. and Taller and Cooper, Inc. . . . **Norman R. Woodfield,** formerly vp of plans and projects, has been promoted to technical assistant to the president of Computer Planning Corp. . . . **Charles J. Purrelli** has joined Raytheon Co. as director-information processing systems and will be responsible for developing and implementing the company's policy requirements in the field of business information processing systems. He had been director of systems services for Tenneco Chemicals for the past five years. . . . Systemation, Inc., Colorado Springs, has appointed **William Marcus** manager of data processing education and **Neal Thomsen** manager of project research. Both are members of the research staff at the Foundation for Administrative Research. . . . **Donald A. Bavly** has been appointed director of systems & technology for Penta Computer Assoc., New York City, to develop new software. He will be headquartered in Dallas. . . . **Leonard M. Smith,** executive vp, operations, has been elected to the board of directors and executive committee of Cognitronics Corp. . . . **Rand W. Tuttle,** formerly vp of B-R Data Systems, has joined Photo Magnetic Systems, Inc., Maryland-based manufacturer of the Comput-A-Phone system, as exec vp of the company's overall operations. . . . **Ronald V. Paolucci** has been named president and general manager of Lear Siegler's Instrument Div. . . . Ty-core, Inc., peripheral manufacturer, has appointed **Robert C. Stark** vp-manufacturing. The company is in the process of doubling its manufacturing space in Chelmsford, Mass. . . . **Donald E Block,** former technical director of Redcor Corp., has been appointed director-project management of Astrodata, Inc., Anaheim manufacturer of computer-controlled electronic data systems and analog computers. Astrodata's new director of manufacturing is **Stephen S. Pallow,** previously gm of the firm's printed circuit division. . . . **Robert M. Miller,** formerly district marketing manager at Boothe Computer Corp. in Los Angeles, has joined Computer Financial, Inc., L.A., as exec vp. . . . **John A. Lever,** vp of Pillsbury Management Systems Co., has been elected vp, operations, of Call-A-Computer, the time-sharing operation of The Pillsbury-Occidental Co. . . . **C. T. Simmons,** former director of defense systems, has been elected senior vp of U.S. Systems & Software, Inc., Los Angeles. . . . **William J. Rust,** treasurer of Indian Head Inc., and **Robert J. Dawson,** president of Life Circulation Co. (Time Inc. subsidiary), have been elected to the board of directors of Computer Property Corp., NYC com-

people

puter leasing and services firm. . . . At Univac's Federal Systems Div., **Chris A. Christopher** has been appointed to the new post of vp of technology and manufacturing and **Walter G. Haberstroh** has been appointed director of operations programming. . . . **Richard B. Lohmann,** ex-Friden product management and planning vp, has been elected senior vp of Intercontinental Systems, Inc., and exec vp of the DURA Div. . . . **Gerald P. O'Reilly,** formerly scientific marketing manager at Service Bureau Corp., has joined Information Processing Systems, Inc., New York, as vp. He will be concerned with the brokerage and marketing of computer systems on the secondary computer market. . . . **John W. Van Wart** has joined PRC Technical Applications (Planning Research Corp. subsidiary) at the rank of senior associate. . . . **William F. Schmied,** formerly vp and director of Engineering at Litton's Guidance and Control Systems Div., has been appointed vp and assistant to the president of Singer-General Precision, Inc. His initial assignment will be with the company's Kearfott Div. . . . **Benjamin Kessel** has been appointed to the new post of vp of product planning and development for Honeywell's computer operations in Europe. . . . **Sidney L. Hasin,** former division director of information systems, has been named vp of information systems at the Autonetics Div. of North American Rockwell. . . . Brandon Applied Systems has named **William F. Gray** manager of proprietary software to concentrate on the development of new application and special purpose programming packages. . . . **Gordon Adelman** has been appointed vp/gm of Applied Business Services, Inc., subsidiary of International Industries. Formerly he headed International's computer center. . . . **Robert B. Boyle,** previously in charge of management information systems for the Aries Corp., has joined Logistic Distro-Data, Inc., New York software firm, as director of operations. . . . **Robert J. Loane** has been appointed assistant director of research for Infodata Systems Inc. to assume major responsibility for developing advanced versions of INQUIRE, an IS&R program written in PL/I. He comes from Xerox Corp.'s Information Systems Div., where he was a technical specialist. . . . **Stanley J. Applebaum,** formerly a project manager for Digitronics Corp., will head the educational services division of Lever Data Processing Services, Inc., as vp. ■

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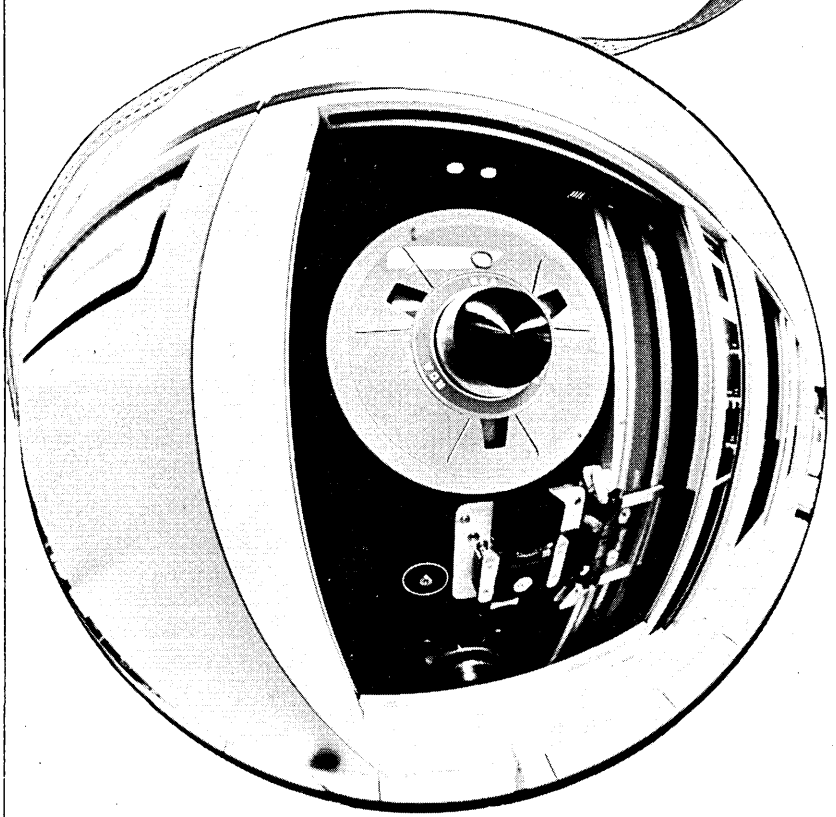

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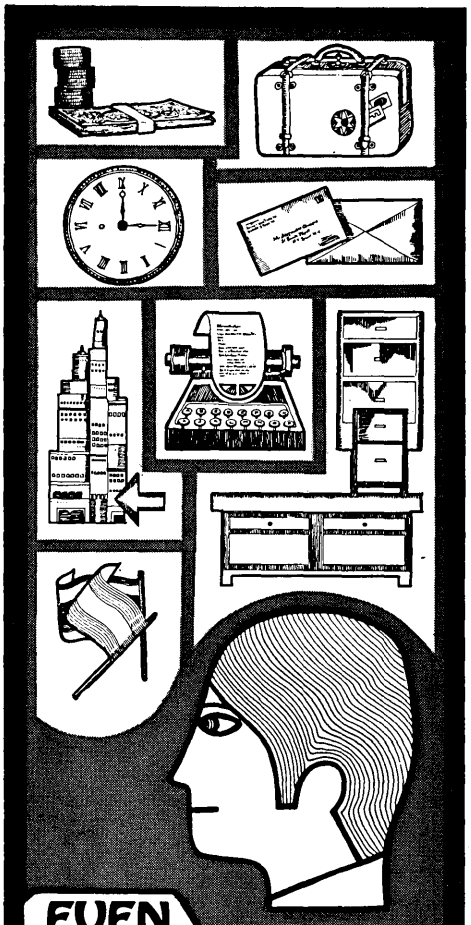

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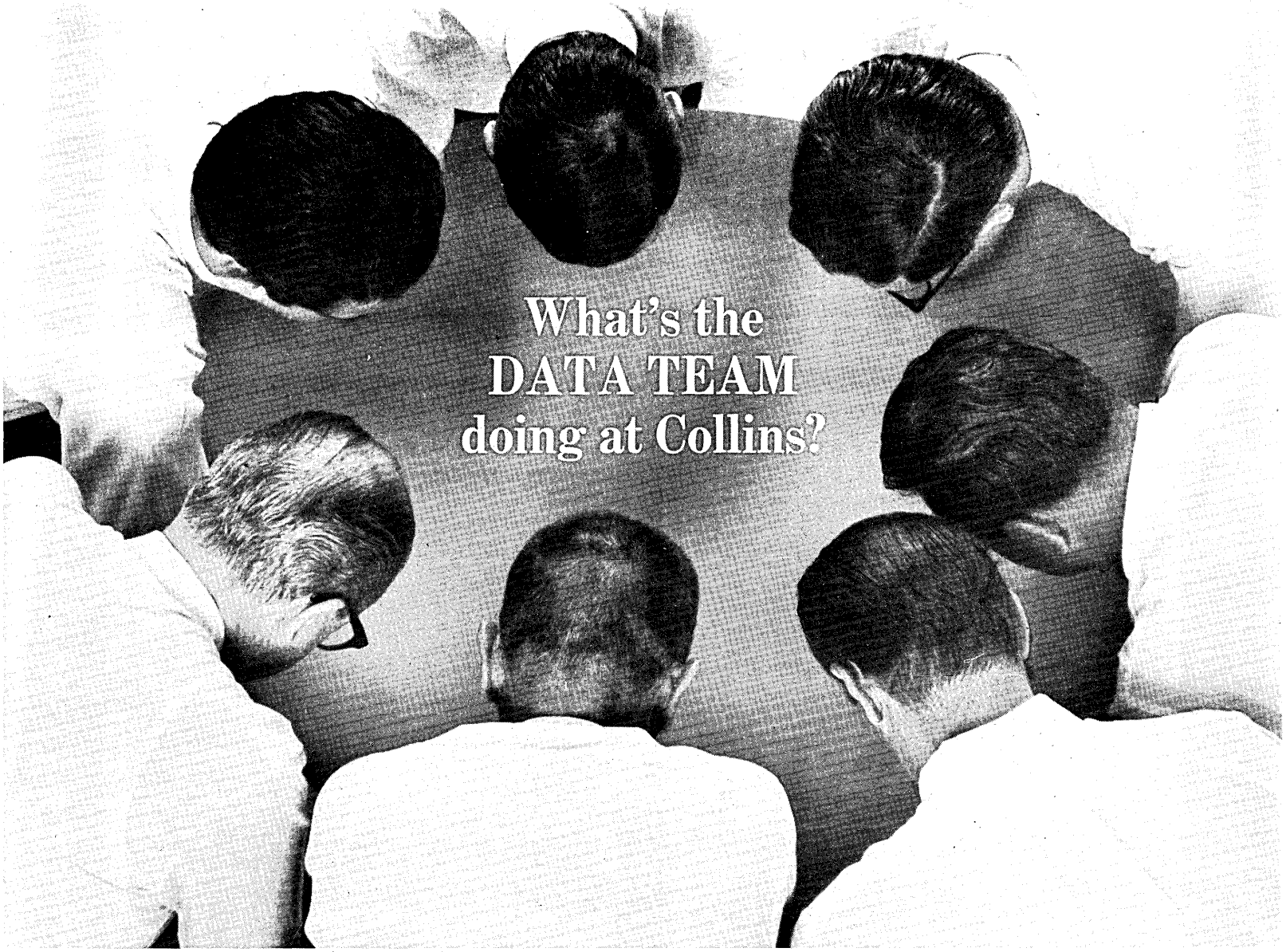

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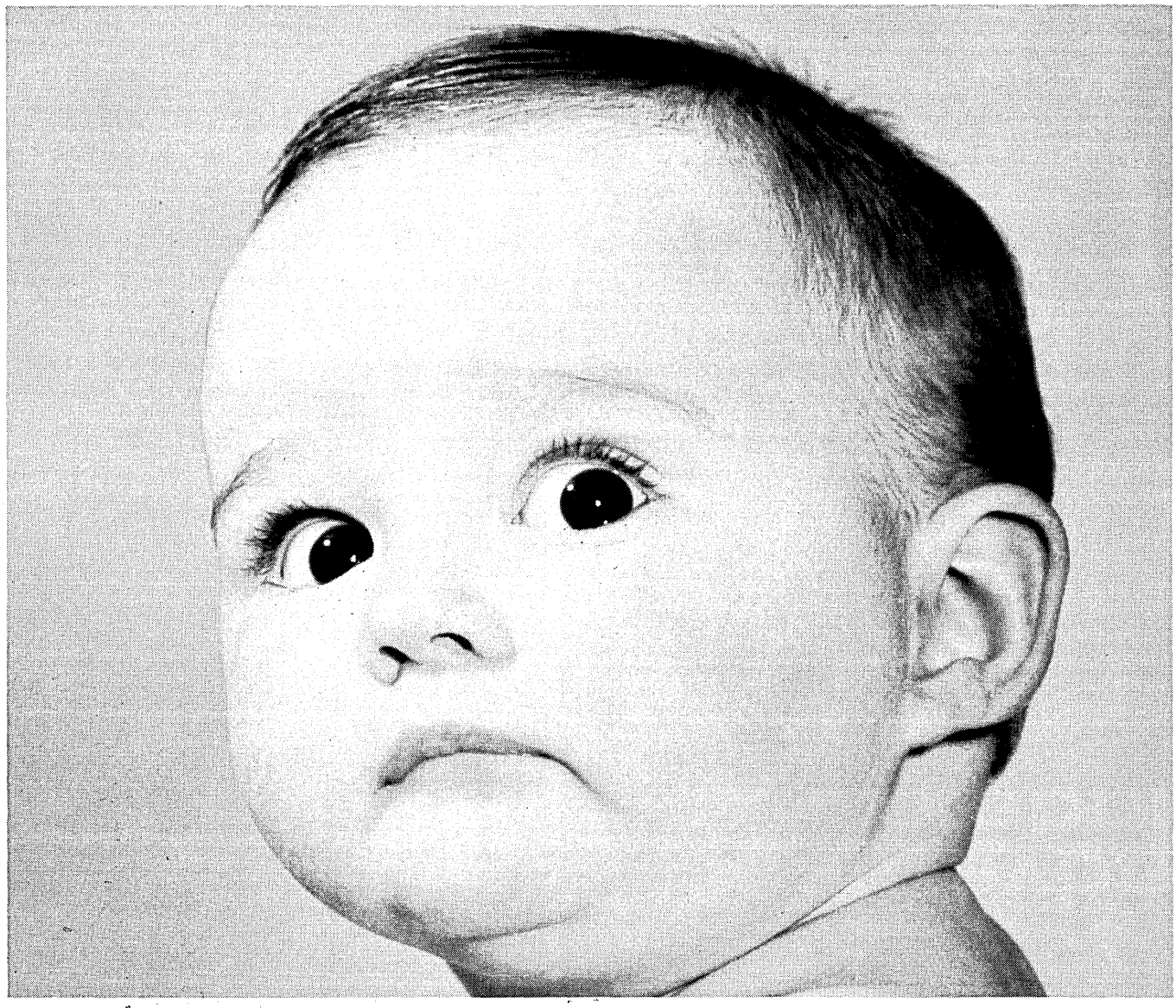

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the forum

THE IBM LAWSUITS— TWO COMMENTS

a cynic's view

Well, it looks as if the brothers have done it. They're going to break up the Yankees, sooner or later. At least there doesn't seem to be much doubt that the latest round of attacks on IBM will result in some sort of action — part voluntary, part compulsory — to subdivide one of the world's most spectacularly successful companies.

One could muse indefinitely over the philosophical and economic bases and consequences of what seems to be happening. But, since this is a cynic's viewpoint, we should confine ourselves to contemplating the irony that the American Dream urges us — goads us unmercifully, in fact — to pursue the Sweet Smell of Success. Then it rewards the most successful with voracious attacks and efforts to destroy. Life is a game of King of the Hill after all, and nobody can find the old rule book so we write a new one every year.

Regardless of the rights and wrongs, we face a world of data processing that will be differently structured than it has been before. The single dominant force will become several; muted, the critics hope, in chorus as it never was in unity. It is hard to see how this can be so. Standard Oil, when it was fractionalized, was easy to chop up. It was necessary only to create geographic fiefdoms. Then there was no way the parts could sum to a whole. IBM is not susceptible to this kind of treatment. It would be kinder to order dissolution. The only logical kinds of groupings are those along functional lines. Thus we might see: (1) The IBM Marketing Corp., sales and service agents for the (2) IBM Computer Corp., manufacturing computers the software for which is written by (3) The IBM Software Corp. (including Federal Systems, of course) and both the computers and the software are maintained by (4) The Field Services Corp. Back of the whole thing is the (5) IBM Leasing Corp. Of course, the (6) Service Bureau Corp. is already part of the picture.

Now it is simply inconceivable that under this different organizational structure IBM salesmen will forget how to sell computers, or IBM plant managers how to build them, or IBM programmers how to write instructions for them. None of the essential capability that put IBM where it is today will have changed in any significant respect. When Buck Rodgers becomes president of the Marketing Corp. he won't forget Vinnie Learson's phone number, either. So the brothers are kidding themselves that breaking up IBM is going to help the cause.

But let us accept the seemingly inevitable and assume that IBM will in some fashion be atomized. Now what has been accomplished? Simply the creation, in each new area, of the largest, most capable and best financed unit of that particular industry segment. Further, it seems only reasonable to assume that in the process of forcing the breakup the anti-IBM forces will have to make concessions regarding the scope of activities of the various new units. The IBM Software Corp., for example, cannot be restricted to writing programs only for IBM computers. It must be allowed to compete in the general software market. The Marketing Corp. would have to be allowed to take on other than IBM product lines. It doesn't take too much extrapolation of this kind of thinking to see how breaking up IBM might make it possible for the several units to take over the *entire* data processing industry in a decade or so. One hopes that those who have instituted the present actions have not naively assumed that legal or regulatory action by itself will cure the problem. It could just as easily have opened Pandora's box.

In the last analysis, though, it is not enough simply to say things will be different, so let's make the best of it. Things will be different because of that curious dichotomy we noted near the beginning: our society wants people to work hard and be upward striving, yet it penalizes too much success, without really establishing any kind of guidelines about how much is too much. You know you're there, though, when the coyotes start nipping at your flanks.

Paradoxically also the only effective attacks can come from your successful competitors. Bill Norris cries hard about IBM unfair practices, but he cries all the way to the bank, bowed under with CDC revenues and profits. Harvey Goodman screams in pain from the apex of a financial empire that didn't exist five years ago, while he asks IBM for enough money to finance a whole new generation of computers. But if these people had not been successful nobody would listen to them. Chances are they wouldn't even get a court hearing because they couldn't afford a good team of attorneys.

So what is wrong, anyway? Is bigness bad? Do we need a new standard of morality in salesmanship—that seems to be the focus of much of the complaint. (IBM selling practices as detailed in the CDC complaint would be regarded as impossibly naive and ineffective in, say, the major home appliance field. There, one top executive told me, you need the *really* hard sell.) Maybe so, but let's not single out the computer industry, where many customers are sophisticated and more are becoming so. Let's, for Pete's sake, tackle the problem from Society's viewpoint, not from Bill Norris' or Harvey

the forum

Goodman's. Further, this is likely to be the largest anti-trust case since the meat packers were broken up. After all, the computer industry is a major economic force today and pervades almost every facet of life and business. So let's take the direction away from the small minds in the Anti-Trust Division and make it the subject of scrutiny by a more broadly-based organism. There is even justification in our mind for a Presidential Commission to ponder the social, technical and political aspects of this sort of directed restructuring, in addition to the potential economic effects. Maybe this way the attention of Society can for a fleeting moment by focused on a part of itself that *produces*, and must be nourished intelligently if the rest of the organism is to flourish.

—ANONYMOUS

some possible consequences

Here are some comments on the issue of IBM's "unbundling."

1. The average IBM customer will continue to deal with IBM exclusively, regardless of what happens. There simply is no credible second source for 90% of IBM's products and services, particularly since most of them require local service and support. Furthermore, despite his complaining the average IBM customer remains unwilling to mix his suppliers, fearing interface difficulty.

2. The "IBM umbrella" will remain. Competitors in every area—peripherals, leasing, software, education, supplies—want above all to see IBM's prices high so that theirs can be lower. Given point (1), IBM can be expected to be pleased to cooperate.

3. There will surely be inter-agency bickering within the government that will cause long delays in final action. SEC, FCC, GAO, GSA and ATD have divergent interests and have often differed before. One obvious problem: ATD's complaint asks for an end to IBM's educational discount. This would mean that colleges and universities would have to pay tens of millions more. NSF now foots the bill for much university computing, would be asked to make up the difference, and will object (probably by intervention in the suit).

4. IBM will probably be delighted to charge separately for maintenance of rented machines and for customer education. They now have difficulty raising maintenance charges (leasing companies claim discrimination); with uniform charges and separate accounting IBM could move much more freely. Customer education produces no revenue now and is overused by many customers and branches; a control will surely be welcome.

5. On the other hand, IBM will probably resist charging separately for system engineering and other forms of direct technical assistance to customers. Good technicians are in short supply, and a basic rule of the game is to use them as effectively as possible to develop accounts and new sales. If they are available by the hour to all comers, a basic sales resource will be dissipated for little return.

6. Unbundling does not necessarily mean separate pricing; it may just mean discounting. To illustrate, GSA will surely press for total unbundling on quantity orders, so that 100 machines can be bought with only one charge for system software and none (unless separately specified) for system engineering. This can be done by offering a discount at the time of acquisition for doing without the item. IBM may then take the position that the decision is final, that there is no price for which the item can be added later. Maybe this approach will be followed for such "unpriceable" items as operating systems and system engineering.

7. The user, confronted with an increasing diversity of technically obscure choices, is likely to desire the services of an objective "system architect" to guide him and maybe take over part of his present responsibilities. Consultants do this now, but will the future "system architect" evolve into something different?

8. Computer industry contracting has been evolving for ten years or more (remember the "one shift of personnel" definition of prime shift?). The process has now accelerated and moved to the courts; in the future it may move somewhere else. The point is that it is irrational to expect the current action to "end" at some finite time, whether one, five or ten years away. As long as user interests and technological opportunities keep evolving, so will pricing and contracting. We will simply have to get used to doing business in this climate—and some of us will get rich by being the first to perceive and exploit new opportunities that arise within it (e.g., third party leasing).

—FREDERIC G. WITHINGTON

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