DATAMATION®

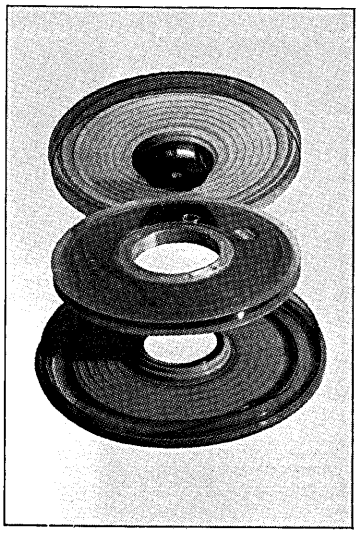
67

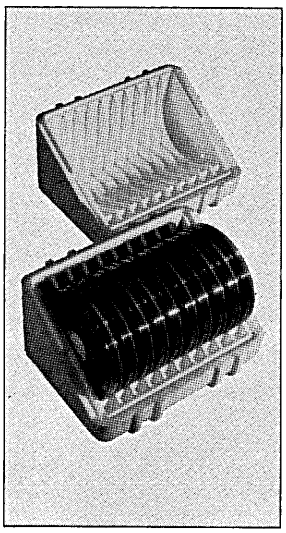
July

DIGITAL PLOTTING

Ampex makes computer tape

come clean and comfortable.





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

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

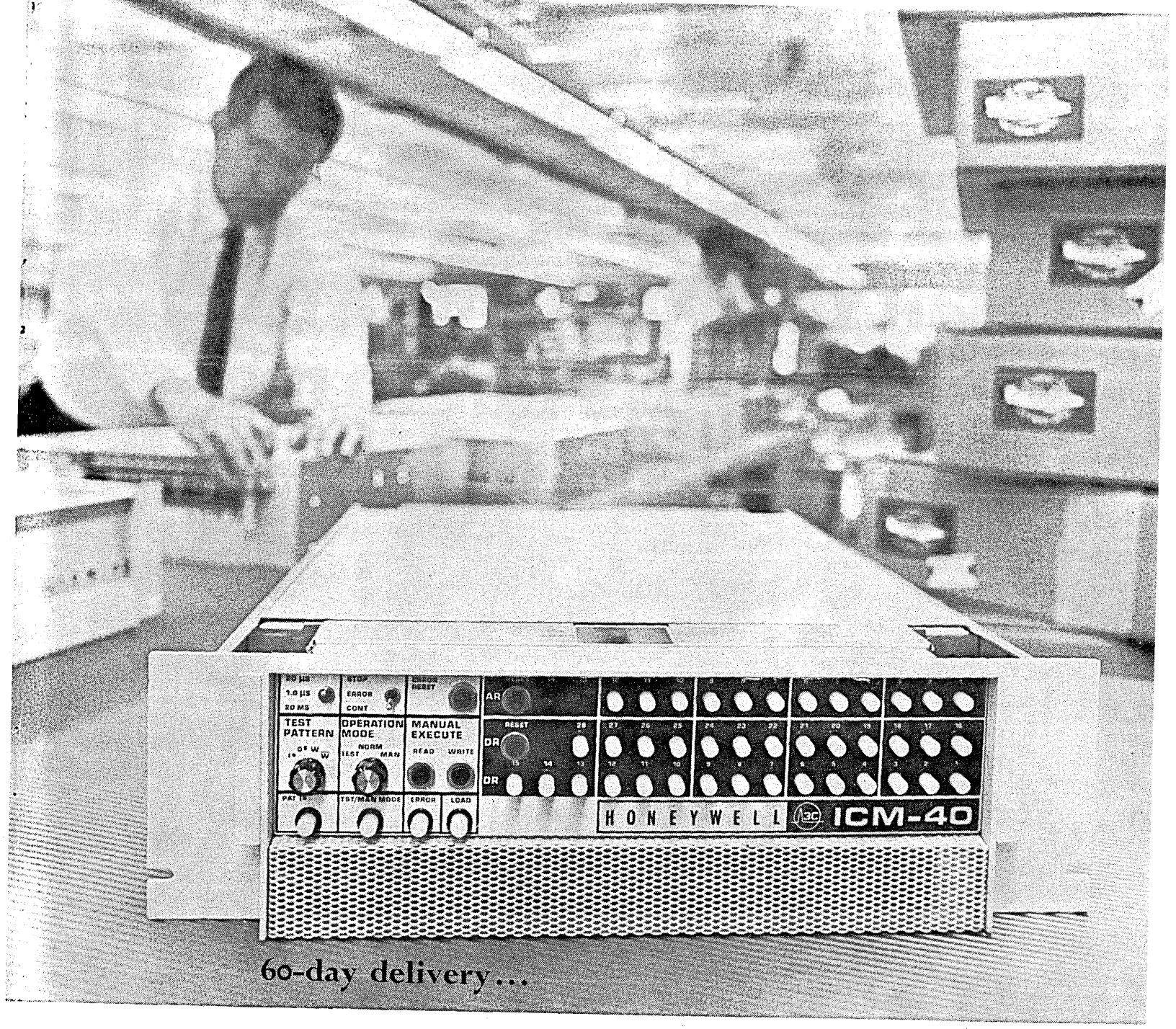
2) **A new shipper:**
Probably the best idea the industry saw last year, we modestly admit, was our new TAPE-SAFE Environmental Shipper. Made of expanded-bead polystyrene, this shipping container individually supports and separates up to ten tape canisters. Guards them against shock, vibration, temperature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

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

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

AMPEX

CIRCLE 1 ON READER CARD



...helps you meet tight schedules when you use I/C μ-STORE core memories

Our one microsecond ICM-40 memories are ready now to meet your tightest delivery schedule — 60 days or less on standard models with capacities of 4,096, 8,192, 16,384 and 32,768 words.

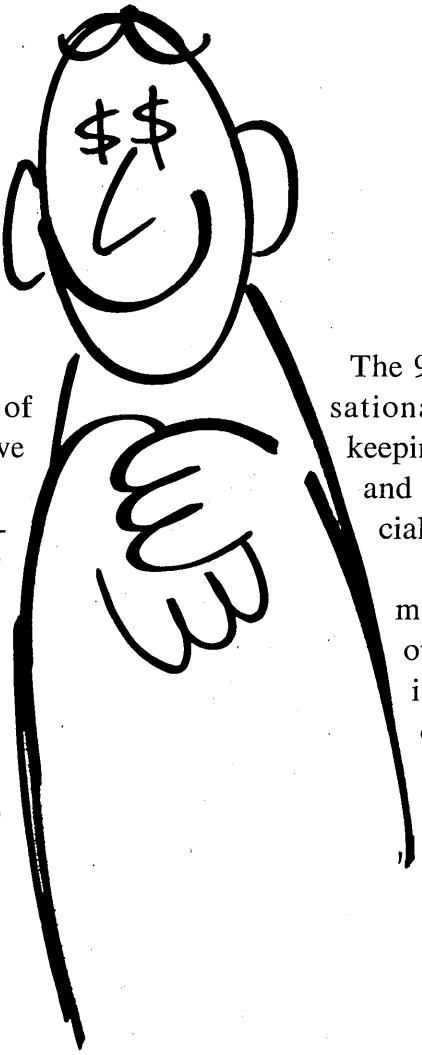
If you've drawn a block marked "core memory" recently, let us show you *μ-STORE* speeds, capacities, and fast delivery capability. You'll find that both our ICM-40 and ICM-47 (670 nanosecond full cycle time) have been designed to offer a custom solution to your memory problems. Write for our new brochure. It sums up all the facts. Honeywell, Computer Control Division, Old Connecticut Path, Framingham, Massachusetts 01701.

Honeywell

COMPUTER CONTROL DIVISION

CIRCLE 4 ON READER CARD

Half the customers for our hungry guys out to make a



Computer service bureaus.

They'd take our entire production of 940's if we'd let them. We can't. We have other customers to satisfy too.

Research companies. Government scientific agencies. The R&D divisions of large corporations. Aerospace complexes. Universities.

We didn't expect such a heavy demand for the 940. After all, third-generation time-sharing systems are coming, including our own Sigma 7. Why are so many people buying 940's?

The service bureaus will tell you why.

The 940 works. It's the only conversational time-sharing system that is keeping a wide variety of users happy and is also making a solid commercial profit.

The standard 940 hardware has memory protection, paging and other time-sharing features built into it. It costs just over a million dollars.

Forget the hardware. It's merely what the 940 software runs on.

The software now consists

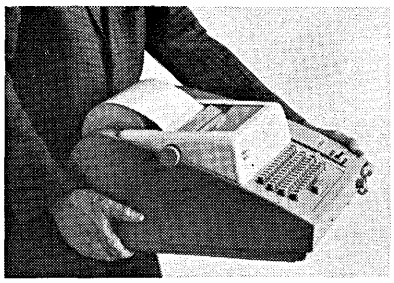
940 time-sharing system are buck.

of six fully implemented languages—FORTRAN, TAP (time sharing assembly program), CAL (conversational algebraic language), QED (text editor for symbolic files), DDT (dynamic debugging tool), and Basic (beginner's all-purpose symbolic instruction code).

In these easy languages each 940 user converses with the computer via Teletype, developing his programs, debugging them, and solving his problems. As far as he is concerned the 940 is all his.

With 24 users talking at once, typical response time is 3 seconds. Hardware safeguards, plus the Monitor, guarantee protection to everyone.

All the 940 users are busily adding to the software, so it will take third-generation systems several years to catch up.



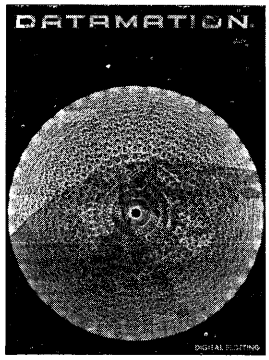
We're going to keep making 940's till the demand runs out. Any SDS sales representative can arrange a demonstration. If you don't have a Teletype handy he may even lug one into your office and hook it to your phone.

The 940 will answer on the first ring.

SDS
Scientific Data Systems
Santa Monica, California

CIRCLE 5 ON READER CARD

Plotter graphics used in this month's cover design: "doily" test pattern from California Computer Products, Inc.



1967

volume 13 number 7

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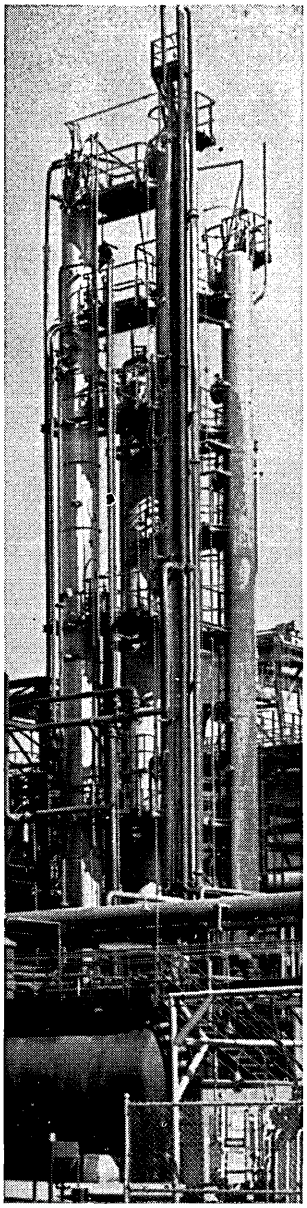

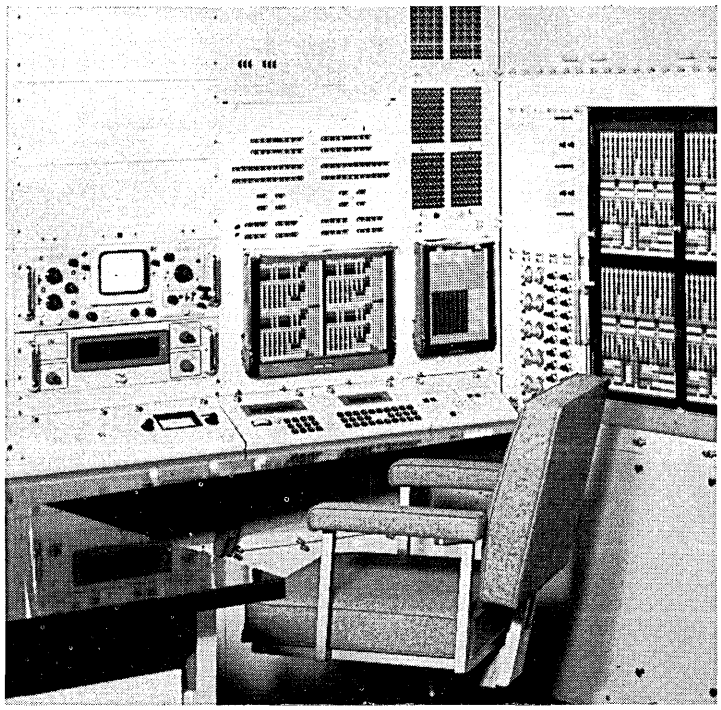

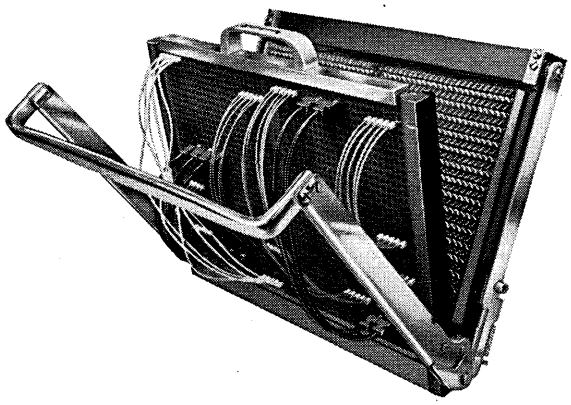

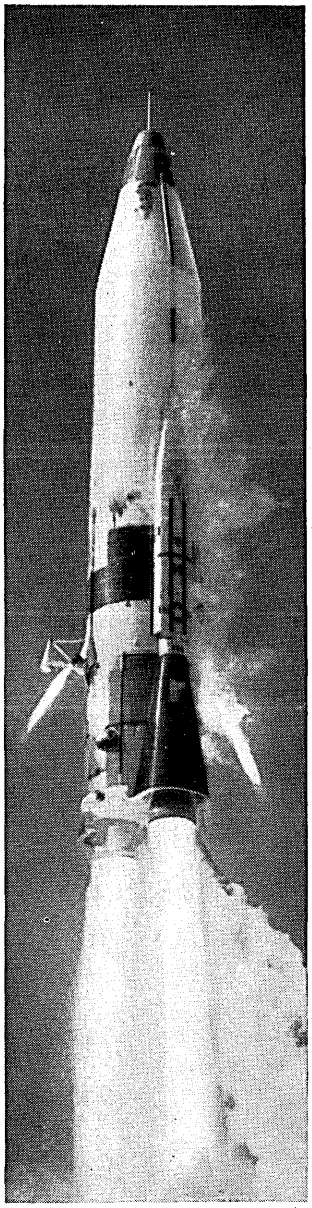

Is everything under control?

The answer is emphatically, yes . . . if you've got an A-MP* Universal Patchcord Programming System in command.

Everything on the outside—data detection, recording, processing equipment—is completely under control. Up to 5120 inputs or more can be controlled from a single panel without the slightest hint of an intermittent contact. Whatever you're programming, you'll keep it under control by selecting a universal system that is right for your application from industry's broadest line.

Everything is controlled on the inside, too. Reliability is enhanced by the use of a minimum number of parts, quality controlled throughout. "Zero entry" patchboards are equipped with our patented double wiping action which pre-cleans all contacts every time the front board is engaged. Your choice of taper pins or precision crimped LANCELOK* terminals wired to the rear bay assure a smooth, dependable path for each line under the roughest conditions.

These universal patchboards actually exceed the standards required in both military and commercial requirements. Do you need this quality? When you consider that the programming system is an important part of your equipment, we believe you would want the best. That's why the following important features are designed into our systems:

- Double-wiping contact action
- Gold-over-nickel plated contacts
- Easy, rapid post patching
- Choice of panel mount, rack mount, fixed panel, and anti-vibration systems

What price can be placed on quality? What price can be placed on system reliability? For complete specifications, write now for Catalog No. 642.

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Harrisburg, Pennsylvania

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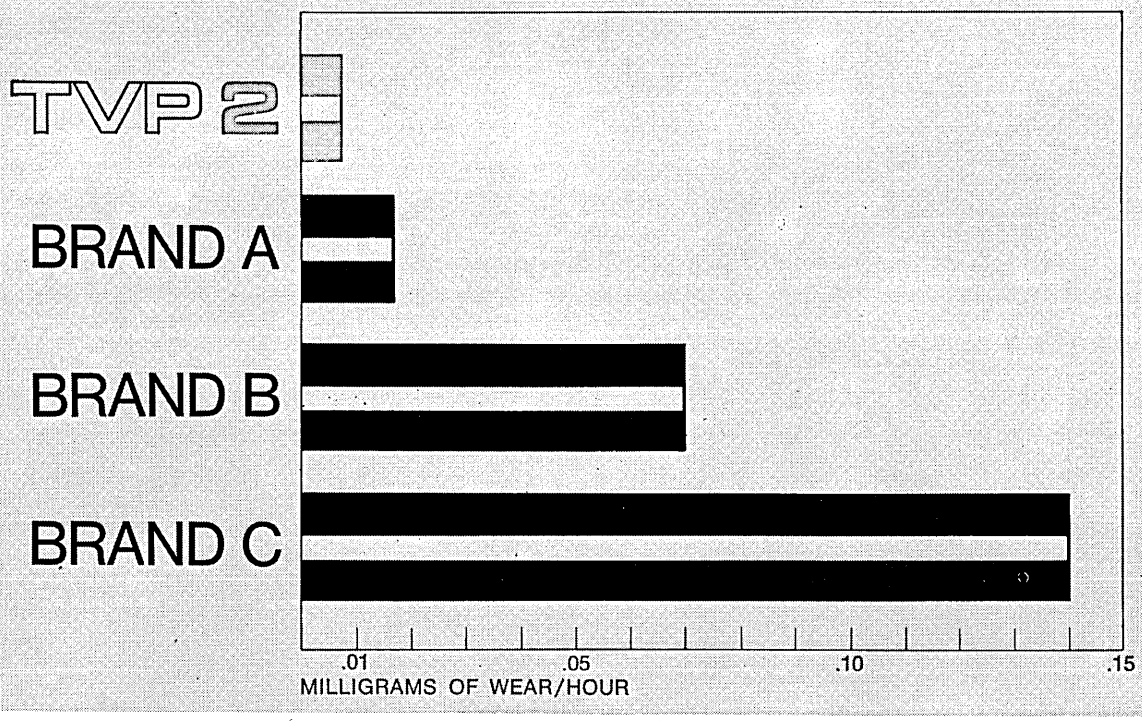
CIRCLE 7 ON READER CARD

HEAD WEAR TEST RESULTS



NOW...
pick your computer tape

☐ Head wear was one of the characteristics measured in a series of laboratory tests conducted recently on three leading brands of "premium" computer tape, and Computron's new TVP2.

☐ Should the results have a bearing on the tape you choose?

☐ Perhaps not if there were only small percentage differences in relative wear, but where the amount of head wear can be shown to vary by factors of 2 to 20 times, this becomes significant.

☐ The replacement of read-write heads invariably means expensive computer downtime, even if you, the user, rent your equipment. Furthermore, head characteristics change when the head wears and your tape can be damaged as a result of changing head surface characteristics.

☐ We don't suggest that you select your computer tape on the basis of low head wear alone. Pick your tape on the basis of Total Value Performance. Watch for comparative test results on other important characteristics in the months to come.

TEST METHOD:
A continuous, 20-meter loop of tape is driven at a constant velocity of 1 meter/sec., with tension accurately controlled within ±8 gms. A precision mu-metal disc, simulating the recording head, is cycled transversely across the tape, under constant pressure, thus limiting the contact exposure to any given tape segment. Wear is taken as a measure of weight loss, in milligrams, produced on the disc during a 1-hour continuous run.

Results of repeated trials were found to be reproducible within ±5%.

TVP2

COMPUTRON INC
CROSBY DRIVE, BEDFORD, MASSACHUSETTS 01730

CIRCLE 8 ON READER CARD

DATAMATION 67®

july
1967

volume 13 number 7

automatic
information
processing
for business
industry & science

datamation departments

Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't get mad and make silly mistakes. Or pout for days. Or cry. But it *can* read. And gobble data at the rate of 2400 typewritten characters a second. It can read hand printing, too. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

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

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

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

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

RECOGNITION EQUIPMENT Incorporated

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CIRCLE 9 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/ CONTACT
Aug. 13-18	SHARE XXIX	Carillon/Deauville Hotel Miami, Florida	SHARE & Univ. of Miami
Aug. 22-25	Western Electronic Show	Cow Palace San Francisco, Calif.	IEEE & WEMA
Aug. 23-25	Conference on Computational Linguistics	Grenoble Univ. Grenoble, France	International Committee on Comp. Linguistics
Aug. 26-28	Symposium on Interactive Systems for Experimental Math	Sheraton-Park Hotel Washington, D.C.	ACM
Aug. 28-Sept. 2	5th Congress, Analog Computation	Lausanne, Switzerland	Intl. Assn. for Analogue Computation
Aug. 29-31	Annual Conference	Sheraton-Park Hotel Washington, D.C.	ACM
Sept. 6-8	First Annual Computer Conference	Edgewater Beach Hotel Chicago, Ill.	IEEE Computer Group
Sept. 6-8	Users' Meeting	Netherland Hilton Hotel Cincinnati, Ohio	COMMON (IBM small computers)
Sept. 11-14	Symposium on Automatic Control	Technion City Haifa, Israel	Israel Committee for Automatic Control
Sept. 19-22	Users' Meeting	Hotel Leamington Minneapolis, Minn.	Univac Users Assn. and Univac Scientific Exchange
Sept. 25-28	Int'l Symposium on Automation of Population Registers	Jerusalem, Israel	IFIP & Int'l Computation Centre
Oct. 1-4	Int'l Systems Meeting	Cobo Hall Detroit, Mich.	Richard L. Irwin Systems & Procedures Assn. 24587 Bagley Road Cleveland, Ohio 44138
Oct. 16-19	Users' Meeting	Statler Hilton Washington, D.C.	Users of Automatic Information Display Equipment
Oct. 17-19	Business Show	Milwaukee Arena Milwaukee, Wis.	Milwaukee Chapt. Nat'l. Assn. of Accountants

The first practical instrumentation computer

...to turn measurements into on-the-spot problem-solving engineering terms.

HP 2116A

Instrumentation computer with simple, flexible plug-in interface and traditional computer peripherals for a broad range of HP measuring instruments PLUS instrument environmental performance and a complete device-independent software package designed specifically for instrument application...

All this deliverable now.

Immediate, practical computer benefits are finally available for on-line production testing, lab design work, all applications involving measuring instrumentation with conventional digital output. The Hewlett-Packard 2116A is the first digital computer designed by instrument people specifically for instrument applications. At moderate cost, it brings the computer into your instrumentation environment, where you need it, without complicated interface problems. Software and input/output lend maximum ease in computerizing instrument measurements to save time and money in reaching the solutions that count.

Plug-in cards provide simple and flexible interface with digital voltmeters and signal converters, electronic counters, nuclear scaler-timers, quartz thermometers and other HP instruments—with no modification, special wiring or interface boxes. Interface is just as simple for traditional input/output equipment...computer peripherals such as magnetic tape, punched paper tape and teleprinter.

And a complete software package, available now, device-independent so that there's no need to rewrite the basic program when changing input/output devices. Easy-to-use extended basic FORTRAN with a 4096-word memory.

Unique usefulness of the 2116A also is its ability to operate at the measuring location—in standard instrument environments. And the computer is available now, the purchase package including customer training in programming and hardware service, delivered with the same warranty as offered with all other HP instruments.

Complete information is available with a call to your local HP field engineer or by writing Hewlett-Packard, Palo Alto, California 94304; Europe: 54 Route des Acacias, Geneva.

Computer features

Environmental operation to 55°C, humidity to 95% ▪ 68 basic one-word instructions, combinable to 1000 one-word instructions ▪ 16 bit word length ▪ memory cycle time 1.6 microseconds ▪ up to 2048 words directly addressable ▪ 4096-word memory, expandable to 8192 in main frame ▪ 9 registers, contents of 7 displayed on operator panel ▪ two addressable accumulators.

Input/Output

16 individually buffered I/O channels with automatic priority interrupt ▪ plug-in interface cards for all I/O options ▪ general-purpose interface cards for HP instruments, other traditional computer peripherals.

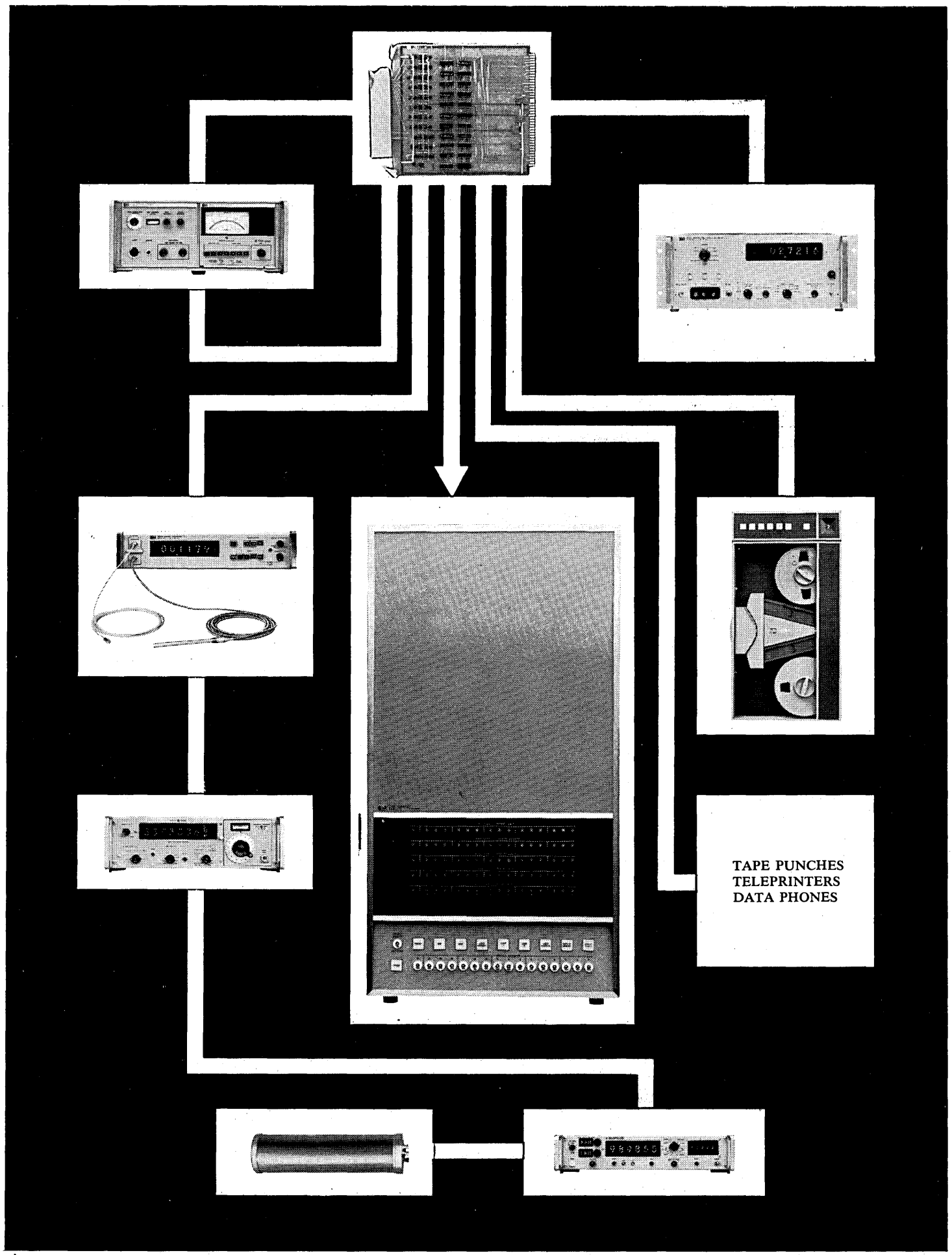
Software

Complete package, fully operable with basic 2116A, 4096-word memory, Teleprinter I/O ▪ extended ASA Basic FORTRAN compiler ▪ assembler generates relocatable code ▪ assembly language programs may be linked to FORTRAN-generated code ▪ utility routines—software configurator, debugging package, hardware diagnostics.

Price: HP 2116A, with 4096-word memory, $22,000. Input/output options, extra memory additional.

HEWLETT hp PACKARD

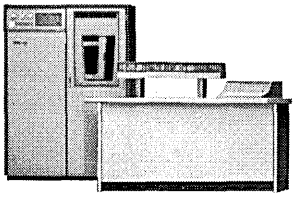
2582



CIRCLE 11 ON READER CARD

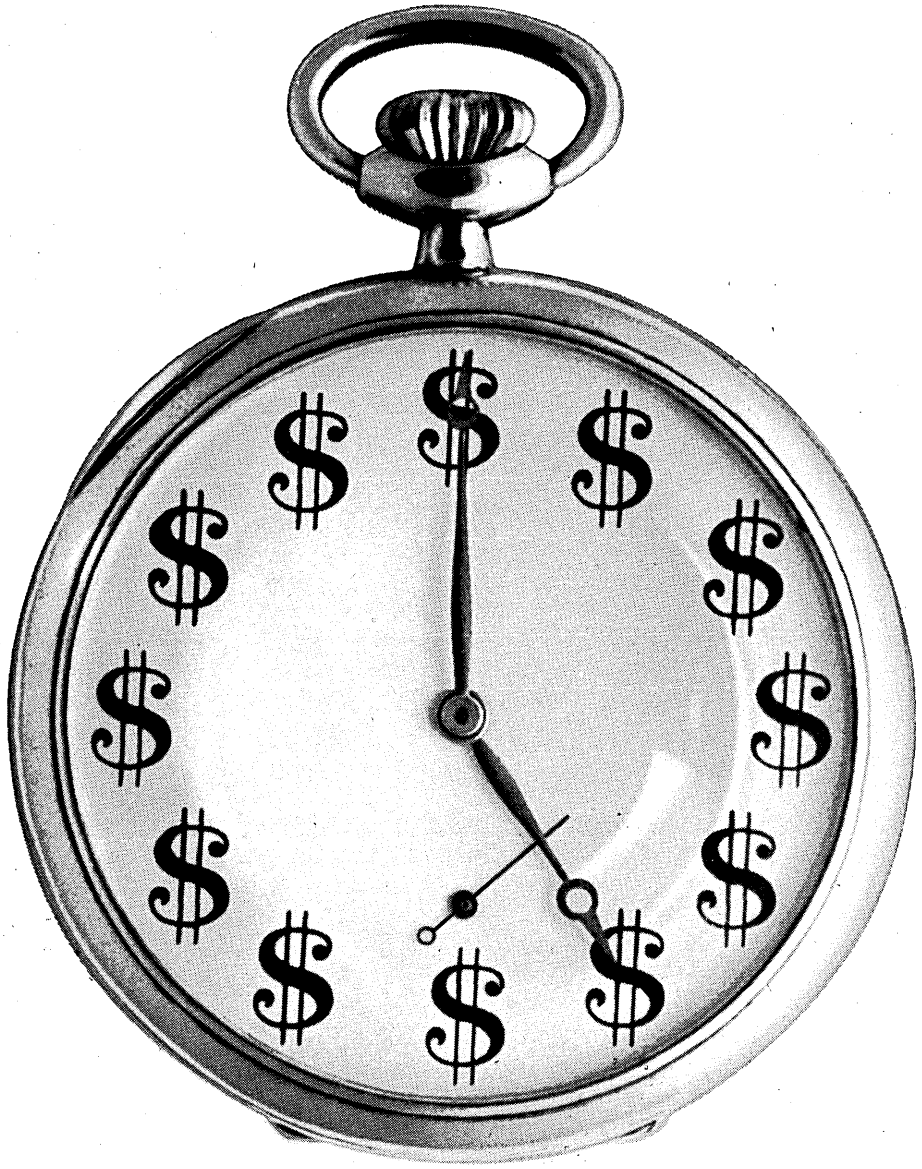
Multiprogramming saves you more than just time.

NCR multiprogramming gets more data processing done faster by, in effect, letting more than one program run at a time. An executive program keeps one from interfering with another. You don't have to add a computer to add computer capacity. The NCR 315-502, newest in NCR's Rod Memory Computer line, is a multiprogramming computer with a 160,000-character capacity. With the new NCR 365 Disc Unit, this memory can be expanded to 64 million characters. Use it for file directories, program overlays and tables. It complements the high-capacity CRAM (1.98 billion characters). Add CRT units for a more powerful, modular management system. Every 315-502 user has access to NCR software for finance, retailing, industry and government. Talk about NCR multiprogramming with an NCR EDP man. You'll have a lot going for you. All at one time.



NCR

THE NATIONAL CASH REGISTER CO., DAYTON 45409 ®



CIRCLE 12 ON READER CARD

letters

glossary & standards

Sir:

USASI Standards Committee X3 Computers and Information Processing, welcomes the publicity given to the American Standard Vocabulary for Information Processing as presented in the Readout (June, p. 21). The area of definitions has long been a favorite one for critical comment. Definitions indeed represent an area where the requirement of consensus is extremely important. The X3.5 Vocabulary Subcommittee has worked hard to achieve a terseness of expression worthy of a standard dictionary. The published vocabulary is not intended as a tutorial —the textbook writers, as well as journal and trade publication authors, are taking care of that aspect of the communication problem.

As further clarification, it should be emphasized that the publication cited was completed in November, 1965. Extensive additions and clarifications have been made to the document and an expanded version should be ready for publication early next year. In the meantime, the Subcommittee X3.5 would welcome specific comments and new definitions and request that they be addressed to the undersigned.

MARTIN WEIK
Chairman, USASI Subcommittee X3.5
U.S. Army Research Office
3045 Columbia Pike
Arlington, Virginia 22204

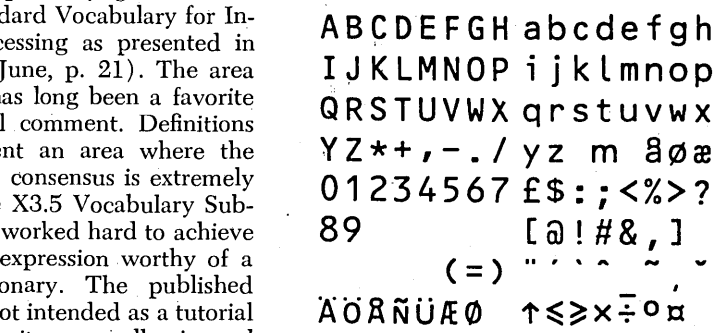
The Editor replies: We still feel that Mr. Weik and his committee are missing the point. First of all, we don't agree that a "terseness of expression" befits a standard glossary. And surely there's a middle ground between terseness and a tutorial. But let the readers decide.

ocr font

Sir:

In the May issue (p. 86) standard USA X 3.17: character set for OCR is mentioned, as well as the fact that its content is contained in an international proposal for an ISO (International Standardization Organization) recommendation. The last sentence of the USA standard says: "OCR-B is a character set developed in Europe."

I believe your readers might be interested to hear more about this mysterious font from Europe (illustrated below). Free copies of the standard



ECMA-11, giving full details on OCR-B font, are available upon request from European Computer Mfrs. Assn., Rue du Rhone 114, Geneva, Switzerland.
D. HEKIMI
Geneva, Switzerland

crime reports

Sir:

In commenting on the Symposium on Law Enforcement Science and Technology (May, p. 61), Charles Smith asked what science and technology can offer to attack the major problems of organized crime and "white collar" crimes.

Your readers might be interested in an article entitled "Economics and Criminal Enterprise," by Prof. Thomas C. Schelling of Harvard Univ., which was given to a panel of the American Assn. for the Advancement of Science in Washington, D.C., in December 1966. It has been published in *The Public Interest*, 7 (Spring 1967) 61-78.

Readers might also wish to see the pertinent parts of the President's Commission on Law Enforcement Report, *The Challenge of Crime in a Free Society*, as well as the valuable Task

letters

Force Reports (particularly the ones on organized crime and on technology), which are being released piecemeal at the time of this letter. Both the report and the task force backups are or will be available from the Government Printing Office.

MICHAEL A. DUGGAN
Bethesda, Maryland

Mr. Smith replies: This letter provides two citations well worth reviewing. However, Professor Schelling's position, as reflected in a paper entitled "Some Economics of Criminal Organization and Market Structure," and the pertinent part of *The Challenge of Crime in a Free Society*, had both been reviewed prior to preparation of my article. Although the summary report of the President's Commission discusses application of technological capabilities such as wiretapping and central computer processing of "intelligence" information, these two documents are essentially oriented to the sociological, legal, political, economic and ethical problems related to organized crime.

In addition, these documents contain no substantial recommendations concerning any approach to reducing "white collar" crime. Thus, I believe that science and technology could make a major contribution to society by developing bold, imaginative technological methods that break through the barriers of the internalized value systems in our social order. Existing generalized social values are a paradox in that they reflect a distorted view of the severity of organized or "white collar" crime, as opposed to those more visible offenses against property or persons that are traditionally impacted in the mainstream of the administration of justice.

terminal annex

Sir:

As manufacturers of time-sharing computer systems, the problems of Dr. Pooble (May Forum, p. 147) were quite familiar to us. I wish that we could all heave a sigh of relief and settle on a coding system, but this does not appear to be the case.

As one example (due to the self-evident fact that a committee which does not continually revise its standards soon ceases to exist), the cheery vertical arrow is doomed to extinction. In fact, it has been extinct since the 1965 version of ASCII, not to be confused with the new and different proposed 1967 USASCII.

Man does not live by computers alone, and we must realize this. Therefore, the obvious arithmetic and functional applications of vertical and left arrows must yield to the far more universally useful characters, carat and underscore, respectively.

Regarding hardware, I must regretfully report that the good doctor's idealistic expectation that the carriage return function would not change is (alas) incorrect. I am presently evaluating a new model 74 keyboard/printer terminal. Although this unit is basically quite nice, it appears that the "return" function is heading for obsolescence. The "line feed" code has been replaced by a "new line" function which performs both a carriage return and a line feed.

In addition, this new unit not only has parity-generating keyboard, but also requires parity to be sent to its printing unit.

All is not lost, however. Although there is no key labeled either "Alt Mode" or "ESC," there is one labeled "Prefix." And wonder of wonders, its code (though not its mechanical function) is identical to that of "ESC."

Do not lose all faith in the world, Dr. Pooble. Science, as always, marches on.

ROBERT C. CLEMENTS
Digital Equipment Corp.
Maynard, Mass.

model v relay

Sir:

In the article, "The Relay Computers at Bell Labs" (May, p. 45), Dr. Stibitz and Mrs. Loveday report that one of the Model V computers was given to the Univ. of Arizona. In fact, it was New Mexico State Univ. at Las Cruces, New Mexico, that received the machine.

The system consisted of two processors, each with an associated printer and tape punch station. The two machines shared four input stations, each consisting of four program tape readers and four table tape readers.

The system was running as late as 1964 when, as a graduate student in electrical engineering, I ran several demonstrations. It was awe-inspiring to watch the Model V in action.

R. WADE WILLIAMS
Oaklyn, New Jersey

Dr. Stibitz replies: Mr. Williams' evidence with regard to the location of one of the Model V Relay Computers seems indisputable. The information was taken from the *Bell Systems Technical Journal*—a usually reliable source—of March 1963 (Vol. 42, #2, p. 351). It does seem that the BSTJ was in error.

Concerning our article, Mrs. Loveday and I would like to acknowledge the valuable assistance of E. G. Andrews in collecting historical facts and dates about the early computers, their installation and later disposition. Mr. Andrews' early work in the design and construction of the relay computers has been noted in the article.

computer performance

Sir:

I have just reviewed Dr. Knight's article, "Changes in Computer Performance" (Sept. 66, p. 40). In evaluating input/output time ($t_{I/O}$), he effectively says two computers with the same word transfer time have the same effective I/O capability. In other words, a 36-bit and an 18-bit machine having the same word transfer rate are equivalent. I do not agree. Obviously, the 36-bit computer can transfer a given file at twice the rate of the 18-bit machine.

MONROE JUDKOVICS
Owego, New York

The author replies: As I interpret Mr. Judkovics' letter, I feel he is partly right in that the I/O transfer rate is one of thousands of items that the model attempts to average using an approximation. The model does consider word length and character or byte transfer rates into and out of storage. Mr. Judkovics does not appear to recognize this point. A second article awaiting publication in DATAMATION has a short discussion of some of the limitations of my model.

mis praise

Sir:

Bob Head's article, "Management Information Systems: A Critical Appraisal" (May, p. 22), is very good. I think he covers a very difficult, controversial subject in an easy-to-understand manner. He provides a realistic, refreshing insight into the mysteries of MIS.

E. G. SUELFLOHN
San Francisco, California

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

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

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

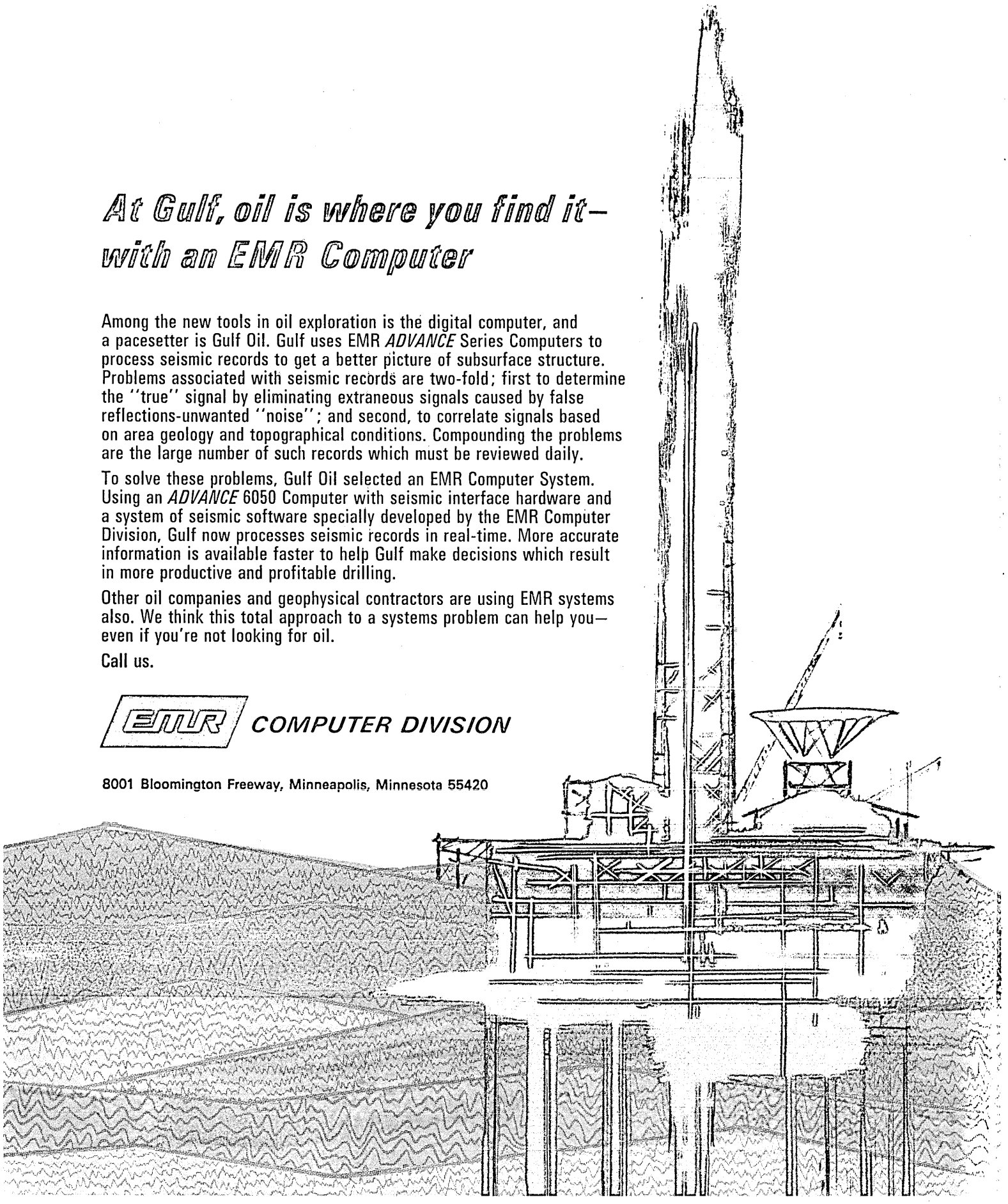
To solve these problems, Gulf Oil selected an EMR Computer System. Using an *ADVANCE* 6050 Computer with seismic interface hardware and a system of seismic software specially developed by the EMR Computer Division, Gulf now processes seismic records in real-time. More accurate information is available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

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

Call us.

EMR *COMPUTER DIVISION*

8001 Bloomington Freeway, Minneapolis, Minnesota 55420



look ahead

AIRLINES PONDER ON-LINE QUANDARY

A little American Airlines bombshell is forcing fellow carriers to quickly decide on a common system for on-line reservations in travel agent and major commercial offices. At the Air Traffic Conference in May, AA indicated intent to withdraw from an industry agreement which prohibits any one carrier from putting its own agent set in these offices, and the Conference came up with a compromise resolution: 1/3 of the lines representing at least 50% of the revenue passenger miles (1966) must agree on a single system by Sept. 1 or it's every man for himself. (Carriers can install now, but would have to withdraw if a single system were selected.)

Two leading candidates for the contract are Reuben H. Donnelley's DOARS system, originally an interline reservations project, and J. Shuler Co., Inc.'s SAFIR. DOARS uses a Houston-Fearless microfilm reader (for flight info) with a teletype on-line to dual Univac 494's. Cost per set is $2850 for hardware, paid by participating carriers, plus user-paid maintenance. The airlines' Telpak system would be used, with interline reservations an option.

SAFIR, developed under a Braniff R&D contract, is more costly — about $5000 for a keyboard crt with receive-only printer; and high speed lines are needed. But it offers — besides reservations — ticketing, optimal flight scheduling, fare calculation and other services. The system, though not in final hardware and software form, is now being demonstrated on an H-1200. Crt-makers, like Sanders, are vying to be suppliers.

Both firms offer to begin operation 9 months after a decision. DOARS would be based in Chicago with concentrators (DDP-516's) to be phased into other cities. SAFIR would probably be in New York or Washington, D.C.

P.S.: There are 6000 U.S. travel agents.

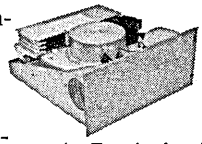
THE BIG-SYSTEM USERS: WHERE ARE THEY NOW?

Now that the big big-system users have had their machinery for six months to a year, we conducted an informal survey to get an overview of how they're making out. The consensus: we're getting there, production is increasing steadily; but it's been a year to make strong men weep. (See p. 21.)

A recurrent complaint is about OS/360. It can be heard in many forms and degrees of violence but the neatest summing up was by one experienced, mild-spoken gentleman who has a 65/40: "It spends all its time looking things up in its table of contents to find out what to do next." Those organizations with plenty of money and top programmers, who can make software modifications, have found ways around the problems. One of them, who just happened to have some big drums handy, switched from the standard disc storage and reduced overhead by the brute force method of cutting access times.

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

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



An F-series head-per-track system.

Records at twice the density

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

Stores 50% more per dollar

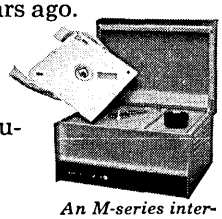
A single track holds 100,000 bits—enough to fill the core memory of many small computers. The higher storage density gives you 50% more storage capacity for every dollar invested in equipment.

Takes only 8¾" rack space

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

Unusual reliability

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



An M-series interchangeable-disc system.

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

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

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

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

DATA DISC

CIRCLE 16 ON READER CARD

But this kind of complaint is not reason enough for the other manufacturers to rejoice. One user of machines from several suppliers said: "IBM got in the same boat as the others this time and it will be another year before they get back to where they were. But they're still the best company for support."

Many of those who moved up from 7094's are still on emulators. On the 65, they report speed ratios of 1:1 or less. A 75 user gets 3:1 over a 7094. But the same user found the 40 "nothing but trouble," was showing a production rate of one-third his old 7080. So he turned in the 40 for a 50 — and so far has got the speed ratio up to .6 of the 40's performance.

Rerun problems on the big IBM gear are widespread. Everyone misses the 7000 series checkpoint/restart facilities and is, to varying degrees, deploring the need to start all over with recompilation when something goes wrong with a 360 program.

Testing time is another sore point with 360 users. One logged 200 hours this way, compared with 63 hours on the replaced 7080.

Either all users of big computers are optimists — which somehow seems hard to believe — or the manufacturers are putting enormous efforts into overcoming the complaints. The few we talked to all said that early problems of hardware reliability were steadily being eliminated and that each new version of the operating systems showed considerable improvement. Release 11 of OS/360, for example, was viewed with varying enthusiasm but everyone agreed it was an improvement. CDC's Scope 2.0 for the 6400 was considered inadequate, 3.0 better, and 4.0 — to be released about the end of the year — is expected to be very good.

So onward and upward.

FAULT NOT FRIDEN'S

Our June report (p. 87) that bugs in the Friden 7311 terminal hurt RCA's Phase II bid and caused problems for Burroughs as well is evidently not true. In both cases, it's not clear the 7311 was at fault; it's more likely that hardware, communications or software was to blame. And we hear the unit performed successfully the day after benchmark demonstrations. One company that used the 7311 — a remote typewriter card/reader inquiry station similar to IBM's 1050 — feels the 7311 will be better than the 1050.

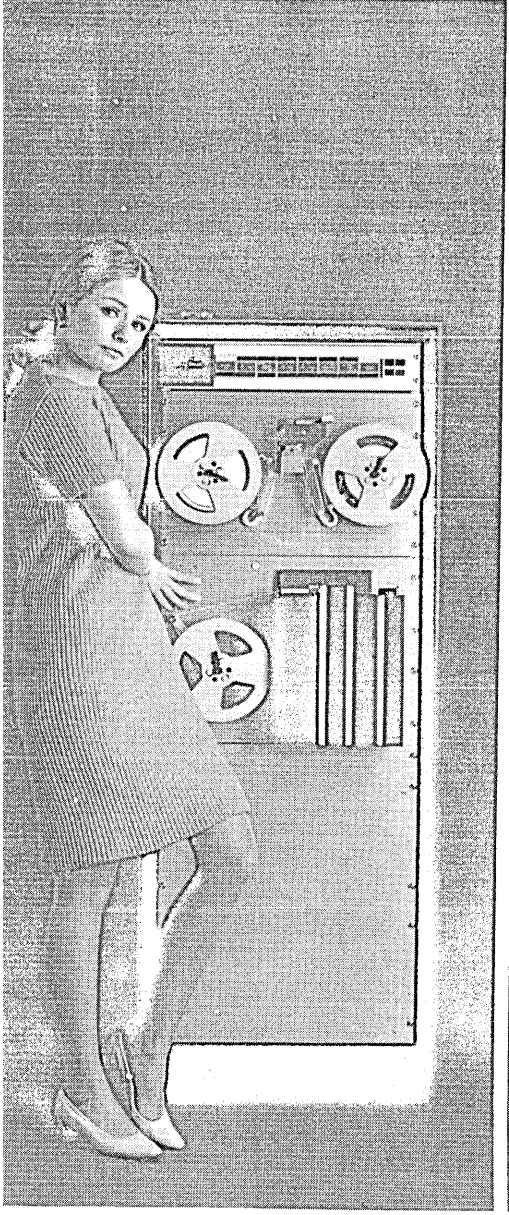
OTHER STATES MAY USE CALIFORNIA CLAUSE CLAWS

The liquidated damages section of the state of California's contract for edp system suppliers — based substantially on a similar federal GSA clause — may spread to other states. The clause is part of a model contract being readied by a special subcommittee of the Council of State Governments' Committee on Information Sciences, which will this month recommend it to all other states.

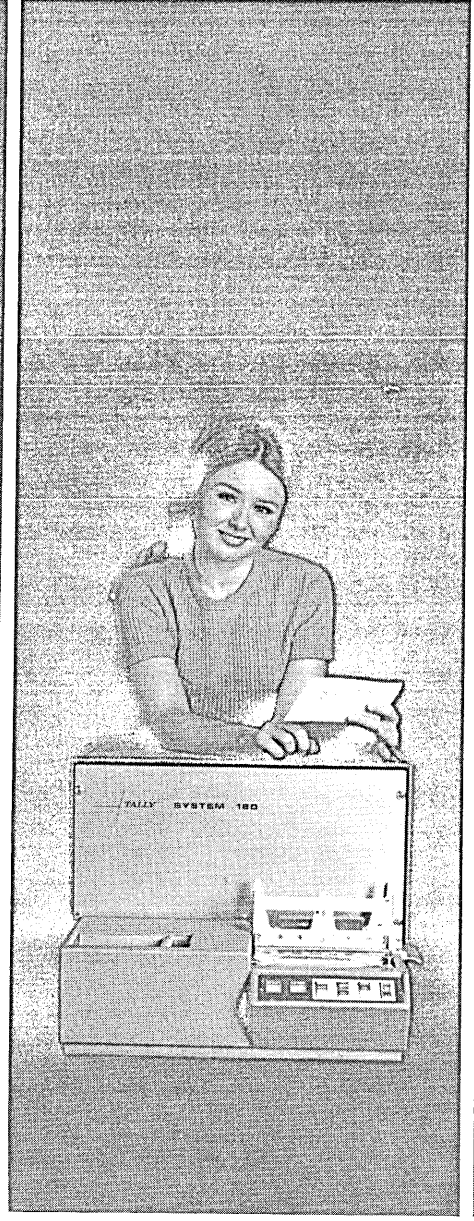
In California, the LD clause works this way: for late hardware, the supplier pays $100 for each tardy day, or 1/30th of the monthly rental, whichever is greater; it's a flat $100 a day for late software up to six months. The contract also requires the state to pay the vendor $100/day or 1/30th of monthly rental for every day of delay caused if the site is not ready.

A critical phrase which has caused IBM to balk at accepting both the California and model contracts is one which calls for software to show "substantial conformance to the contractor's specifications."

(Continued on page 129)



The versatile error-correcting Tally 311 send/receive terminal operates over ordinary phone lines at 1200 words per minute. Use it for offline tape duplication and editing in its spare time.



Tally 180 transmits punched card data over ordinary phone lines at 42 cards per minute. Field selection and automatic error indication are standard.

Tally's error correcting magnetic tape Dartex Data Terminal transmits or receives data at 1200 words per minute over ordinary phone lines. The same unit reads or writes at 1600 char/sec, making an ideal communications input/output channel for most computers.

Take your choice, paper tape, punched cards, or mag tape—Tally data communication systems transmit all three.

Transmit, receive, and store data in any form you want or in any combination of ways. The diversity of business systems lets you go tape-to-tape, card-to-tape, mag-to-perforated tape, and so forth. □ So, if you have a data communications requirement, it will pay you to get in touch with your Tally communications consultant. He'll be more than happy to analyze your data collection, storage, and processing problems—at no obligation, of course. □ In addition to the equipment illustrated above, your Tally communications consultant will explain more than 18 other Tally data terminals (one probably meets your exact requirements). Installation is quick and easy. Have your local telephone company install a data set, plug in your Tally system, and you're ready to transmit data. □ For complete information and the name of your nearest Tally communications consultant, please address Robert Olson, Tally Corporation, 1310 Mercer Street, Seattle, Washington 98109. Phone: (206) MA 4-0760. In Europe and the U. K. address Tally/APT, Ltd., 6a George Street, Croydon, Surrey, England. Phone: MUN 6838.

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CIRCLE 17 ON READER CARD

editor's readout

EDP'S WAILING WALL

Those moans, groans, sobs and whimpers you hear from the big corner office down the hall from the beautiful, clean, glass-enclosed shrine they call the machine room are coming not from children but grown men, grizzled veterans of the edp wars, pioneering heroes who are trying to make their large-scale third-generation systems work.

The problems and the agonies have to be lived with to be believed, but starting with early hardware failures, tardy and bug-ridden software, they involve cascading problems which include software manuals that don't indicate which features are implemented and which are not; inadequate statistics on hardware component failures so that the manufacturers haven't been able to back-order sufficient spare parts; new, critical timing problems; emulators which run slower than they ought to; complex new loading card procedures; lack of the restart procedures on older machines which allowed blown-up runs to be re-established without starting all over at the beginning; trying to install the latest version of the monitor while the previous version is still being debugged . . . but you get the idea.

The results: the shop's users are running over budget and beefing but good. One large-scale user claims that he's being conservative in his estimate that his company is paying twice the rental it should. "Our training bill is three times what it used to be, and it should be larger," he says, adding a gloomy guess that it will probably be two years before their systems are working good like a third generation system should.

Remember, this is 1967. Third generationsville. The people we're talking about have been through the conversion snarl before. They are experienced and knowledgeable. What in the hell is going on here, anyway?

It would be easy to blame it all on the manufacturers, but it's apparent that plenty of users wear black hats too. They're suffering today from the syndromes that afflicted the manufacturer two years ago—underestimated and overcommitted. Says one consultant, "Our estimates failed to make allowances for the difference between adolescent software and the mature systems we knew so well. Our old programs were only partially documented, and the original program designer was long gone. No thread of test cases remained to assure that the old program really worked as advertised . . . or to provide a test base against which to verify the operation of the new program. In short, the users naively assumed they were ready to start installing the new system when, in fact, considerable maintenance and upgrading of the *old* systems were necessary before successful conversion could begin."

Many users listened to the siren song of the salesman . . . then ran around while they tried simultaneously to merge commercial and scientific shops, install a new programming language, run the shop, plan the future and convert. Whee! Under strong management this would have represented the stiffest of challenges; it's clear that edp management is not always strong.

Poor management and weak supervision have too often made an already mobile work force absolutely liquid. One big shop had a *sustained* turnover rate of 10% per month before they finally convinced Personnel to do something about working conditions, paid overtime . . . offer concessions for hardworking staff.

Some users are ruefully matching early manufacturer claims against performance and wondering why they didn't insist on stiffer contracts with penalty clauses. Well, it's an idea to store away for use when the fourth-generation "breakthrough" bombardment begins.

Back in today's real world, it's apparent that chaos is still the order of the day, and growing continually. Now is the time for you to take stock, critically evaluate your status and prepare for the row back to shore. It behooves us to stop wailing, start planning and intelligently work our way out. Let us review our schedules, our commitments and our resources to re-establish a sanity based on a clear-headed assessment of what needs to be done and when we can accomplish it.

AUTOMATIC PLOTTING IN THE THIRD GENERATION

fast & accurate

by DALLAS TALLEY

The fine line separating second from third generation computer philosophies may very well have been drawn when the industry at large stopped purring over the internal efficiency of mainframe processing and began a concerted drive to optimize overall systems performance. Improved graphics and graph-plotting devices are part of the forward move into third generation systems. As long as man remains in the decision-making loop—presumably for some time to come—effective display of computed data will be essential. The purpose of this article is to provide an overview of plotting technology, how the various equipment designs were developed, and what the present state of the art offers today's potential users.

the reason for being

One way to assess the importance of automatic plotting is to imagine all of the world's computed data spewing out of electrostatic printers at the rate of 30,000 lines per minute. Multiplexing a number of high speed printers would reduce the output bottleneck. But in what sense would the result be information? Who could digest its meaning? How could it be communicated to others? And outside the immediate confines of the computing room, what effect would this staggering data load have on the larger world of problem solving and decision making?

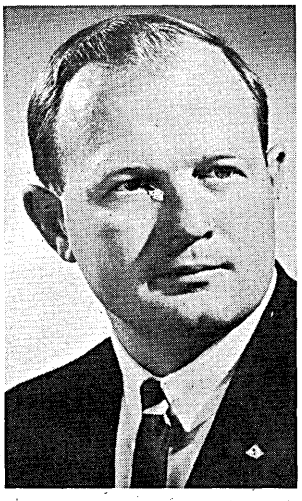
Plotting one variable against another has always been a quick way of making sense out of a mass of numbers. The message comes with the immediacy of a picture, rather than the serial delay of 1000 words.

Across the wide spectrum of engineering and science to industry and commerce, hand-drawn graphs have been used to depict relationships underlying data long before the advent of electronic data processing. The growth of computer installations merely added to the amount of data which had to be displayed in plotted form.

This growing demand for improved plotting capability was felt most strongly in the engineering/scientific community, which led to the almost simultaneous development, during 1949 and 1950, of three different types of automatic plotting devices.

Of the three types, the most unusual one is no longer manufactured. Designed and built by Telecomputing Corp., it was the first and only pure digital plotter. Its plotting head sensed the lines on the graph paper (30″ x 40″ bed) and most of its 500 vacuum tubes were used to count the lines in both x and y. Inputs were from parallel keyboard or IBM Summary Punch. Several hundred of these truly fascinating machines were put into service and no doubt some are still plotting today. If ever there is a museum for "computing devices," it should contain one of these "one and only" pure digital plotters.

The forerunners of the present day incremental plotters were originally developed as output devices for digital differential analyzers. This incremental mode fit the



Mr. Talley has recently joined Systems Engineering Laboratories as marketing director. He was previously director of marketing for Benson-Lehner Corp. He holds a BS degree in personnel management from Southern Illinois Univ.

punched tape output, which was in the form of a series of incremental changes. These forerunners took two forms: drum and flat bed. The drum machine was pioneered at the Autonetics Division of North American Aviation by a group of engineers who in 1950 left to start California Computer Products. The flat bed equipment was developed by Benson-Lehner Corp. as an output unit for a Madida type of DDA.

The Benson-Lehner Dactylograph was the granddaddy of what is now the "analog controlled digital input plotter." The original units had either a serial keyboard input or input from an oscillograph reading device. Because they used lead screws in the drive system, they were slow but accurate. The Benson-Lehner units that followed, called Electroplotters, were faster and had inputs from card or paper tape units as well as keyboard and graph readers.

About this same time several users of that fine old 30″ x 30″ Electronics Associates Analog Plotting Board found that the addition of a digital-to-analog converter and some control circuitry gave them digital plotting capability. Electronic Associates, quick to see another market for their boards, started manufacturing input units themselves.

Although a considerable improvement over manual plotting, the early machines were limited. Output speed boundary (for points more than a few inches apart) was 20 points per minute. Maintenance time vs. operating time was 50-50. Input was mostly from manual keyboard, paper tape or punched cards.

improvements

Over the next several years, plotting equipment designers translated growing user needs into expanded operating capabilities. In addition to conventional curve plotting and data reduction, new applications emerged in map making and cartography, including contour mapping, weather charting, radiation and population density studies, and traffic analysis.

Before the end of 1958, digital drafting also made its debut at Universal Drafting Machine Corp. and Gerber Scientific Instrument Co. By 1959, new plotters were introduced with mag tape input and speeds of 300 points per minute which produced lines, contours, symbols and alphanumeric characters at the rate of three linear inches per second.

Gradually, plotting hardware evolved toward greater flexibility in operation, higher accuracy, improved quality of output and higher operating reliability. Legibility was improved with a greater variety of pens, colors, tonal contrasts, and symbol sets which were not limited to print heads or existing type fonts.

By the turn of the decade, therefore, plotting hardware consisted of three basic equipment designs: analog, digital drafting, and digital incremental. (The old Telecomputing "line counters" were no longer being manufactured.) All three used an electromechanical plot-driving mechanism, actuating either the paper underneath the pen or the pen cursor arm across the paper.

The chief advantage of the digital drafting and digital incremental systems stemmed from their systems design. Both accepted digital data without requiring cumbersome digital-to-analog system interfacing. Basic design simplicity, systems compatibility, and convenient operation particularly marked the digital incremental philosophy. Although limited at first to speeds of three inches per second, digital plotting eliminated the usual problems of dynamic response, drift and gain setting.

Then, in 1960, the first CRT-microfilm system was delivered by Stromberg-Carlson: the SC 4020. The success of this plotting concept led to other units, such as the B-L 120, the DD 80, and the CalComp 835.

advances & applications

In late 1965, digital drafting became more practical with the incorporation of low-cost, general purpose computers into a plotting system configuration. At little more than $25,000 additional hardware cost, the added flexi-

bility and control of computer logic opened up nearly unlimited applications potential in automatic drafting, tool path drawing, numerical control, circuit card design, engineering schematics, contour map generation, and other fields requiring close graphic tolerances.

In printed circuit production, for example, artwork masters require tolerances up to ±0.001" so that accumulated errors in the rest of the manufacturing process will not interfere with precise stacking of multi-layer, integrated circuits. Draftsmen cannot meet these tolerances. Computer-controlled drafting systems can. Moreover, the output from a normal eight-hour shift provides the equivalent of the work of 30 draftsmen.

By the end of 1965, automatic plotting may be said to have come of age. An abundance of equipment representing the four basic designs offered exceptional speed and operational flexibility, with accuracies to ±0.001". New interfacing and software development increased overall systems performance, on-line and off-line.

In addition to improved plotting for conventional requirements in engineering, science, automatic drafting and map making, many new applications began to emerge.

After a slow start, plotters were beginning to demonstrate results in management information systems. Output took the form of readily understood charts, graphs, and other plotted formats. Content included forecast data, cost accounting, investment analysis, economic indicators, and other business statistics of value for management decisions.

Extended-length plotting and butting of frames in electronic (CRT) systems played an important role in flight test analysis, PERT diagramming, and other CPM displays.

High-volume printing via plotter-produced visuals was also becoming more important in the production of stock catalogs, wire lists for fabrication, directory listings, failure report reviews, and statistical abstracts.

buying a plotter

Ironically, as plotters have increased in systems compatibility and performance capability, the buying habits and selection criteria of potential users have remained relatively static.

In fact, most plotter hardware still comes as an afterthought, rarely considered in the original systems analysis and frequently purchased without benefit of complete evaluation.

Technologically, an enormous range of plotting wherewithal is represented within the present state of the art. Initial investment can be recouped in many cases within the first year, merely from the savings in reduced manhours, computer operating time, and other systems overhead now being charged against second-generation plotting procedures.

At the buyers' end of the supply-demand nexus, a wide variety of operating economies are still being overlooked.

The main obstacle to the natural exchange of supply and demand seems to be a lack of awareness on the part of the potential user. This can also be read as the failure of manufacturers to communicate the message of third-generation engineering. In any event, updated guidelines are needed for considering such factors as cost, accuracy, speed, quality of output, software availability, and availability of local maintenance.

Each of the four equipment categories offers a unique mix of cost, applications suitability, and performance advantage. In the past, the mainstay of the plotting industry was the analog plotter. This is changing rapidly, however, due to the improvements ushered in with digital drafting, incremental, and CRT-based systems.

Of the four, digital drafting and CRT-based systems

PLOTTING 1967

Specifications	Drafting Machines	CRT	Analog	Incremental
Accuracy or resolution	0.001" (max.)	0.01% full scale	0.015"	(Incremental step sizes) 0.0025" 0.005" 0.01"
Speed	12"/sec. line drawing	3 frames/sec. (or more than 300x faster than electro-mechanical systems)	7"/sec. line drawing	900 steps/sec. (4½"/sec. max., 2"/sec. min.)
Plotted output format sizes	5' x 5', up to 5' x 20'	35mm or 16mm film 8½" x 11" hard copy	Standard: 30" x 30" large: 48" x 60"	12" x 120' 30" x 120'
Cost	$90K and up	$100K-$200K and up	Off-line: $50K and up On-line: $25K and up	On-line: under $7K Off-line: $16K w/card input $25K-50K w/mag tape input
Applications	Automatic drafting, lofting, numerical control, eng. drawing, production artwork masters, etc.	Management information systems, wide range of reports, commercial to scientific, miscellaneous mapping.	Large maps and special-purpose contouring.	MIS, engineering/science, biomedical, petrochemical, traffic analysis, general data reduction, statistics, etc.
Manufacturers (refer to list at end of article)	1, 2, 3, 4, 6, 13, 22	4, 5, 7, 8, 12, 16, 20, 21	4, 9, 10, 11, 14, 17, 18	4, 5, 13, 15, 19

are unquestionably the most sophisticated and most expensive. Fastest are the CRT's, which produce up to two finished 8½" x 11" plotted pages per second. A graph or plot is created at high speed on the face of a cathode ray tube. The image is then photographed by means of a high-speed 35mm or 16mm camera. Standard output media is microfilm, with optional quick-look hard copy produced by ancillary equipment. Plotting is accomplished by incremental or vector and line drawing techniques. Resolution is a function of the cathode ray tube itself. Standard report-size formats are 8" x 8" and 8½" x 11". For larger format sizes, additional processing is required.

Higher cost of the CRT's restricts their applicability and cost justification to a small fraction of the user population. The min-max range for this equipment is from under $50,000 to $300,000. Digital drafting systems run from $90,000 up.

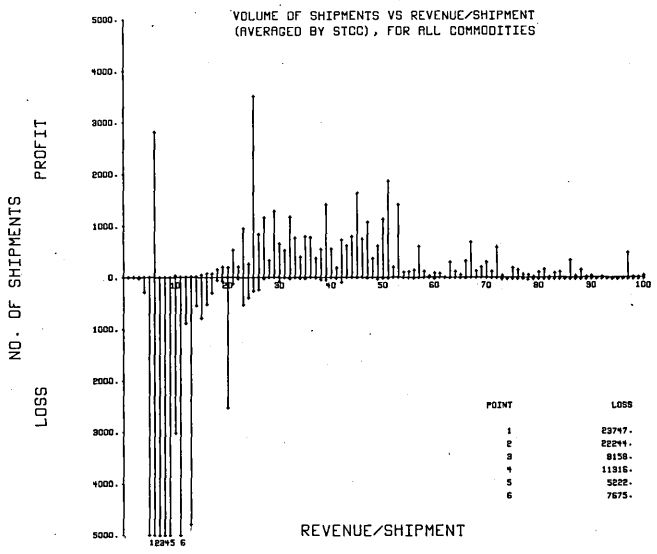
a comparison

By way of comparison with the two more expensive equipment categories, analogs range typically from $30,000 for on-line systems to $50,000 for off-line configurations with mag tape. Digital incremental plotters can be purchased for less than $5,000.

Design differences between analog and digital incremental plotters account for the cost differential, as well as some of the performance advantages inherent in each. Analog systems are generally larger and, in some cases, faster. Analogs also require D-to-A conversion circuitry to provide analog signals which drive the servo motors.

Digital incrementals use a bi-directional stepping motor. Plotting is produced step by step in .01", .005", .002", .0025" and in 0.1mm. and .05mm. increments. Line drawing is not as smooth in appearance as analog or digital

Fig. 1



drafting output; however, the digital incremental provides better resolution and accuracy than the analog systems.

For purposes of comparison, a typical cost-analysis plotting as illustrated in Fig. 1 (revenue vs. shipment) was generated on three different categories of equipment. A CRT plotter produced hard-copy output in ½ second. The same plotting requirement took two minutes and 40 seconds on a card-input incremental. Large table analog plotting time was four minutes and 10 seconds. In this example, the CRT speed differential is 320-to-1 compared to the incremental, and 500-to-1 over the analog. In general, any average engineering plot can be produced by CRT plotter in less than a second, or hundreds of times faster than the fastest analog system.

Other salient considerations in equipment evaluation are the format size and printing characteristics suitable to the end use of the plotting output. Will the application require contouring capabilities for geophysical plotting? Close tolerances for automatic mask drafting? Large size formats for aeronautical maps and charts? Smooth, free-line drawing for reproduction lithography? Extended length for CPM reporting? Or some combination of these features for a cost trade-off?

Standard printing in CRT systems is on a roll of microfilm. Optional quick-look hard copy is available in report-size format. Exposed microfilm can also be further processed into transparencies and magnified for direct viewing or photographic reproduction.

Analog plotters and digital drafting equipment offer the largest format sizes, with the additional advantages of smooth line drawing. Standard plotting is one sheet at a time on a flatbed table. For the analogs, general-purpose printing format is 30" x 30". Large table models include 4" x 58" x 60" and other oversizes. Digital drafting formats range from 54" x 72" on up to 60" x 240".

rise of the digitals

For many years, analog designs dominated almost 90% of the applications areas due to free-line drawing and large format accommodation. This was especially true in meteorological, geophysical, and other special mapping or contouring applications. The days of this privileged sanctuary, however, are over. CRT's are more suitable for high volume plotting. The digital plotters are less expensive. Digital drafting systems are faster by 50%, and more accurate by an order of magnitude. They also meet size and precise drawing requirements in many areas where analog plotters are inadequate.

At the low-cost end of the price scale, digital incrementals are encroaching on another large segment of traditional analog application areas. Typical plot format sizes are 12" and 30" widths, and up to 120 feet in length. Above 30" in width, pin-registration is the limiting factor.

Line drawing is also less smooth. But due to steadily rising reliability, speed and resolution, the new generation of incremental plotters offers competitive graphic capabilities at unequalled low cost.

In fact, digital incrementals offer several distinctive performance advantages. Printing in the analog systems, for example, is limited to vertical and horizontal axes. Digital incrementals, on the other hand, provide complete annotation and labeling at a wide variety of angles throughout a complete 360°. Software of the new digital incrementals is available for drafting all types and sizes of symbols, providing an unlimited character set which can not be matched by analog systems. Operation is also less complex. For most applications, a single set-up is all that's required.

In 1966, buffered control units were announced by incremental manufacturers. These units combined already available high speed plotting capability (10" to 20" per second) with multiple step capabilities to open new avenues of digital plotter usage.

Previously digital plotters had faced the inherent design limitations of stepping speed and computer time requirements. The buffered control units incorporate internal programming logic, allowing multiple steps or Delta commands similar to the more expensive digital drafting systems.

Stored program logic of some control units has demonstrated dramatic operational advantages in reducing input instruction, slashing computer mainframe requirements,

and multiplexing digital plotters to on-line operation. The new control equipment is compatible with all families of plotters and computers.

Off-line with magnetic tape, one kind of controller (B-L's Delta Control Unit), allows more commands in less write-space with reduced requirements for generating the input tapes. It also reduces the need for "no op" codes and fillers.

The Delta Control Unit also made off-line plotting with punched card input practical for the first time. Prior to 1966, each plotting command would have required one complete punched card; i.e., thousands of punched cards to produce a routine graph. With the DCU, 2000 plotting steps can be generated from just one punched card.

The new, stored-logic control subsystems are particularly adaptable for efficient multiplexing via the multiprocessing and time-sharing capabilities of third-generation computer systems. A short burst of data from the computer is enough to feed the control memory. Necessary commands for each of the various on-line plotters are then generated until the beginning of the next cycle. If any waiting occurs, it's the plotter waiting for the computer, not the more expensive other way around.

the future

Rounding the first quarter of 1967, some exciting new developments in the plotting industry are underway and should be watched with interest by potential users in the immediate future.

Before the end of this year, you can expect to see the introduction of the fifth basic plotting approach, centered around highspeed optical printing without the use of CRT.

Watch for higher speeds and accuracies about to be announced in new incremental and digital drafting systems hardware.

Expanded use of transceivers and other communications equipment will make better use of time-sharing, third-generation computers for remote plotting. Especially for those users who have already paid the basic overhead of time-shared systems—either with in-house computers or as part of a subscriber time-sharing service—remote digital plotting promises unusual report-generating capability for relatively low cost.

In terms of applications development, look for management-information-systems plotting, numerical control and digital drafting to become the center of attention at forthcoming public exhibits, industrial shows and technical conferences.

From the secluded labs of R&D, new printing technologies, lasers, and other advanced research projects may enter the user vocabulary. But, except for the optical plotting systems and interactive light pens, probably no radical new design principles will be implemented in operational hardware before 1970.

As for the four basic design philosophies, you can expect hardware refinements to emanate continually from some 20 manufacturers throughout the nation. This year has already seen announcements of increased speed and resolution in the digital incremental plotting field. Digital drafting systems now include state-of-the-art speed combined with accuracies and resolution previously available only with precise numerical control systems. CRT systems are incorporating integrated circuits and new optical capabilities, thereby providing increased speed, accuracy and reliability.

To support the industry's need for software, plotter manufacturers are developing comprehensive programming packages with subroutines for line drawing, point plotting, contouring, programmed scale setting in linear or logarithmic scales, axes drawing, drafted character generation, and printed annotation.

Automatic plotting has come a long way since its inception in the early '50s, but this is no time to rest on our technological laurels while the gap continues to widen between available potential and implemented reality. Of today's 45,000 computer installations, less than 3000 are equipped for plotting . . . the users' need to catch up and absorb a new generation of graphics technology has never been greater.

(The following is a list of U.S. plotter manufacturers known to DATAMATION. *They are listed alphabetically and numbered. These numbers appear at the bottom of the accompanying chart, in one or more of the four columns, to show what types of plotter are included in each company's product line. Requests for further information about the equipment should be sent directly to the manufacturers.)*

1. Airborne Instruments Laboratory, Div. of Cutler-Hammer Corp., Comac Road, Deer Park, N.Y. 11729.
2. Auto-Trol Corp., 6621 W. 56th Ave., Arvada, Colo. 80002.
3. Baldwin-Kongsberg, 11750 Chesterdale Road, Cincinnati, Ohio 45246.
4. Benson-Lehner Corp., 14761 Califa St., Van Nuys, Calif. 91401.
5. California Computer Products, Inc., 305 N. Muller St., Anaheim, Calif. 92803.
6. Concord Control, 1282 Soldiers Field, Boston, Mass. 02135.
7. Cubic Corp., 9233 Balboa Ave., San Diego, Calif. 92123.
8. Data Display Div., Control Data Corp., 2401 N. Fairview Ave., St. Paul, Minn. 55113.
9. Data Equipment Div., Bolt Beranek & Newman, Inc., 2126 S. Lyon St., Santa Ana, Calif. 92705.
10. Electro Instruments, Inc., 8611 Balboa Ave., Box 1369, San Diego, Calif. 92112.
11. Electronic Associates, Inc., 185 Monmouth Parkway, West Long Branch, N.J. 07764.
12. GeoSpace Corp., 3009 S. Post Oak Road, Houston, Texas 77401.
13. Gerber Scientific Instrument Co., Box 305, Hartford, Conn. 06101.
14. Hewlett-Packard, Dymec Div., 395 Page Mill Road, Palo Alto, Calif. 94306.
15. Houston Omnigraphic Corp., 4950 Terminal Ave., Bellaire, Texas 77401.
16. Loral Electronic Systems, Div. of Loral Corp., 825 Bronx River Ave., Bronx, N.Y. 10472.
17. Milgo Electronic Corp., 7620 N.W. 36th Ave., Miami, Fla. 33147.
18. Mosley Electronics, Inc., 4610 N. Lindberg Blvd., Bridgeton, Missouri 63042.
19. Spatial Data Systems, Inc., 108-A Aero Camino, Goleta, Calif. 93017.
20. Straza Industries, 790 Garfield Drive, El Cajon, Calif. 92021.
21. Stromberg-Carlson Corp., 100 Carlson Road, Rochester, N.Y. 14603.
22. Universal Drafting Machine Corp., 5200 Richmond Road, Bedford Heights, Ohio 44014. ■

DIGITAL PLOTTING WITH PUNCHED CARD INPUT

a user's experience

by DEAN LAWRENCE

Back in the first two generations of computing technology, systems planners rarely gave a second thought to plotter hardware. The main frame was the overwhelming preoccupation of early edp; adding a plotter was an afterthought, a matter to be handled by telephone. In fact, just two telephone numbers would have put you on-line with the entire plotting industry of the first generation.

Not so in the third generation. Today we are confronted with a rapid proliferation of CRT, digital, analog and other plotting systems, emanating from numerous manufacturers, offering diverse system configurations and prices ranging from under $6,000 to well over $200,000. Without a well-laid approach to graphics planning, total performance and profitability of the entire man-machine complex can go wildly astray.

How, then, can the small-to-medium computer center manager make use of advanced graphics technology, maintain equipment balance within budget limitations, and avoid disproportionate expenses merely to optimize one set of data handling operations? Equally important, how can he be sure his eventual selection will be part of a smooth transition into the future without major disruptions in system organization, staffing or performance?

The purpose of this article is to explain how Midwest Research Institute faced these questions, examined the available alternatives, and finally opted to become the first user to test the practicality of off-line digital plotting with punched card input.

Midwest Research Institute, a non-profit organization engaged in contract research, has applied scientific methods to the solution of a wide variety of client problems for over 22 years. Its scope of interest ranges from development of products and processes for industry to applications of management science for government agencies and private groups. In mathematical science, MRI is noted particularly for its work in numerical analysis and approximation theory. In chemotherapy, MRI scientists have synthesized nearly 2000 biologically active compounds, contributing to the search for effective cancer treatment.

Although MRI's computer center has been comparatively small, electronic data processing and computer-generated reports are vital to the progress of our research activity. Visualized presentations of information also serve as a guide to MRI management decision-making.

custom output

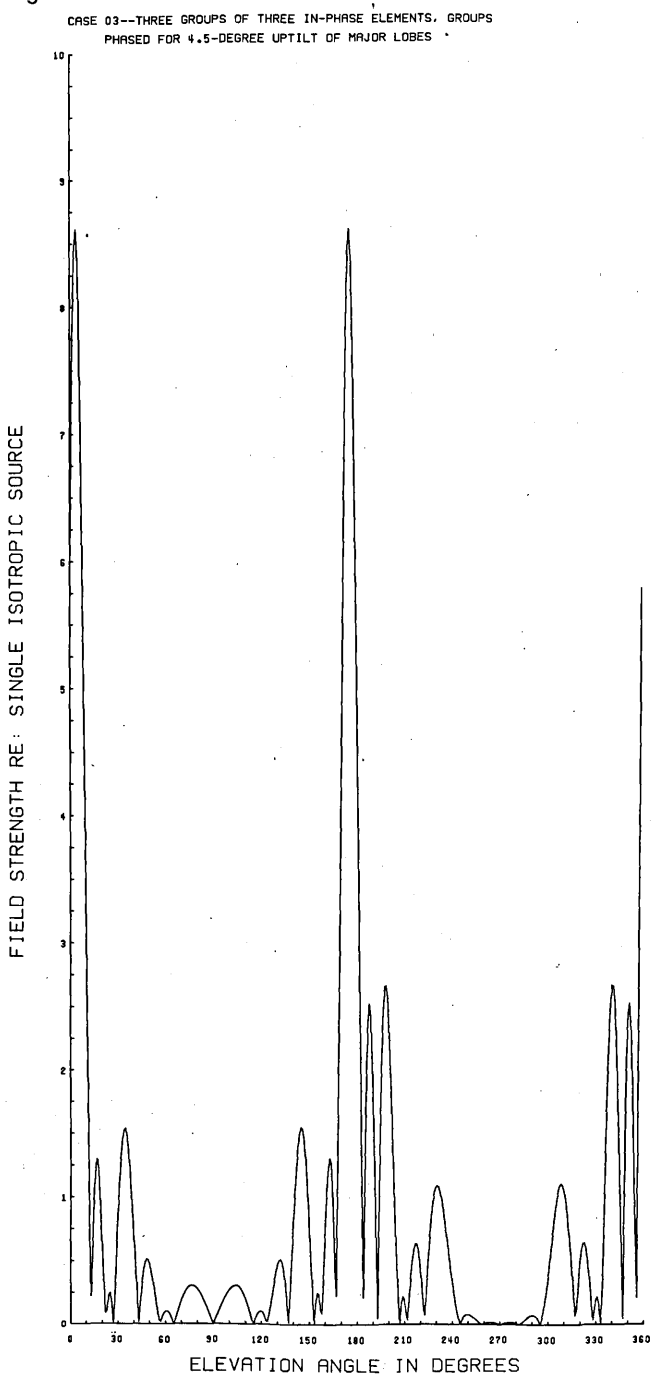
It is important to note that MRI does not have the heavy-load, special-purpose plotting requirements which

Mr. Lawrence is manager of the computer center at the Midwest Research Institute. Before joining the institute in 1962, he worked on digital simulation for the U.S. Naval Ordnance Test Station in Pasadena, Calif. He holds an MA in mathematics from the Univ. of Kansas.

characterize weather bureaus, highway departments, or aeronautical cartography. Ours are generally "one-shot" report presentations, running the gamut from contract administration to theoretical physics. Their purpose is to quickly communicate the results of data processing to the various technical and management levels involved. In early 1965, MRI faced the need for improved graphic capabilities which would combine economy, speed, and minimum use of main frame processing time.

We had, of course, followed with interest the development of sophisticated input/output systems, including the high speed CRT plotter-printers, TABLET, SKETCHPAD, DAC, and many other advanced projects in progress around the nation. This degree of sophistication and the vast expenses involved, however, are not practical for the smaller computing centers.

Fig. 1

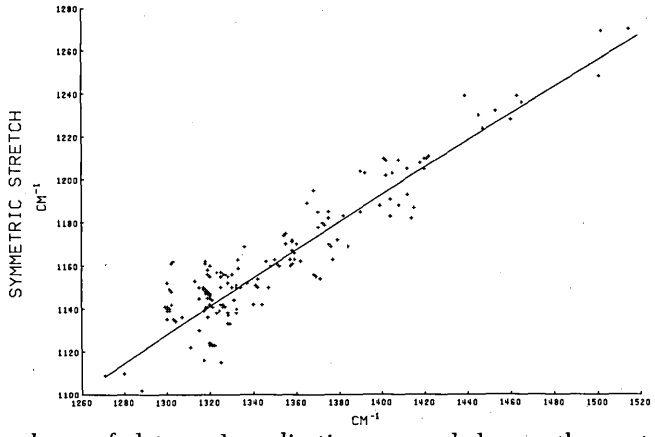


We were also more aware of the advanced new developments than of the steadily increasing level of performance, speed, and reliability of the less expensive plotters. Our problem in selection was complicated by the onset of a third generation of computing equipment, questions of system compatibility, and software availability. By early 1965, we were already in the process of converting from the small-scale IBM 1620 to the new IBM 360/30. It was therefore important to maintain effective but inexpensive graphic capabilities which would fit into the long range plan for growth, conversion, and continual incorporation of new equipment.

Later in the same year, MRI purchased a Benson-Lehner 305 incremental plotter for $6,000 and connected this to a 1620 by means of a 1626 interface unit for on-line plotting. For that volume of plotting load, the combination proved to be highly effective. We had been plotting an average of one-and-a-half hours during normal eight-hour shifts. The 305/1620 combination saved about 10% of main frame processing time. More importantly, it cut down the lead time between receipt of data and finished reports. Often, as many as five full working days were sliced from report schedules. This allowed MRI to improve its service to clients by getting the final reports of contract research into their hands more quickly. It also provided more timely inter-organizational reports for budget control and administrative decisions by MRI management.

With the conversion to a 360 in mind, MRI went to IBM for interfacing rather than to the plotter manufacturer. IBM also supplied FORTRAN routines with the 1626 for point-to-point plotting and annotation via 1620. As the

Fig. 2



volume of data and applications expanded over the next several months, MRI took steps to develop software for more fully utilizing the 305 plotter's potential. This again met the need at the time and we were soon averaging over two hours a day producing plots similar to those in the accompanying illustrations. *(Figs. 1, 2, 3 and 4.)*

So far, so good. But the time soon arrived when the long range plan moved up to become a short range problem. In mid-1966, we discovered some unsuspected snags in our plans for plotting on-line with the 360. First, the system would require two interfacing units with a total cost of about $16,000. One of these units, a 2701 to be used as control for data communications, couldn't be promised for delivery earlier than December, 1969.

converting to a new computer

We then considered the possibility of obtaining on-line interface equipment from a plotter manufacturer. One firm offered a controller for $6500 and a 2048-byte buffer

for a total of $15,000. But this amounted to several times the cost of our plotting hardware itself. Further, there was no assurance that the hardware and software system would enable efficient conversion to the 360.

What about going off-line with mag tape input? Again, several obstacles became apparent. MRI's computer system and application had never required mag tape. Ours was a disc-oriented system providing random access to the comparatively small volume of data needed in scientific computations. Just to introduce mag tape as an input capability would have entailed three to four times the cost of the basic plotting hardware.

In short, it looked like we were in trouble no matter which way we went. Off-line or on-line, we faced delays, disproportionate costs, and little hope for a sensible solution to our problem.

What we hadn't considered yet was to go off-line with punched card input. But then, what sane person would consider reading in an input deck containing over 100,000 cards just to obtain one routine plotting output? That's what would be required with any digital incremental plotter known to be in use at that time.

Then, while still on the horns of our dilemma, the report came in that a new series of hardware called the Delta Plotting Systems had been announced by Benson-Lehner. Although the Delta included provisions for mag tape, what interested us most was a feature suggesting a practical method of off-line plotting with punched card input.

With a standard digital incremental plotter, each incremental command requires a separate card. The card, with its incremental command, gives an instruction code needed to direct the plotter pen one increment, usually .005″ or .010″, across the paper. The incremental movements are expressed along three axes: x, y, and z (pen up/pen down).

The Delta system uses a command decoding feature so that a large number of incremental instructions can be punched into each card. One complete command, including pen direction and sign, can be written in four columns of a standard 80-column card.

As an example, the Delta command "55,-43" would be decoded into a sequence of 55 positive x-axis moves and 43 simultaneous moves in the negative direction along the y-axis. The plotter pen proceeds in the best "straight line" to this position on the paper.

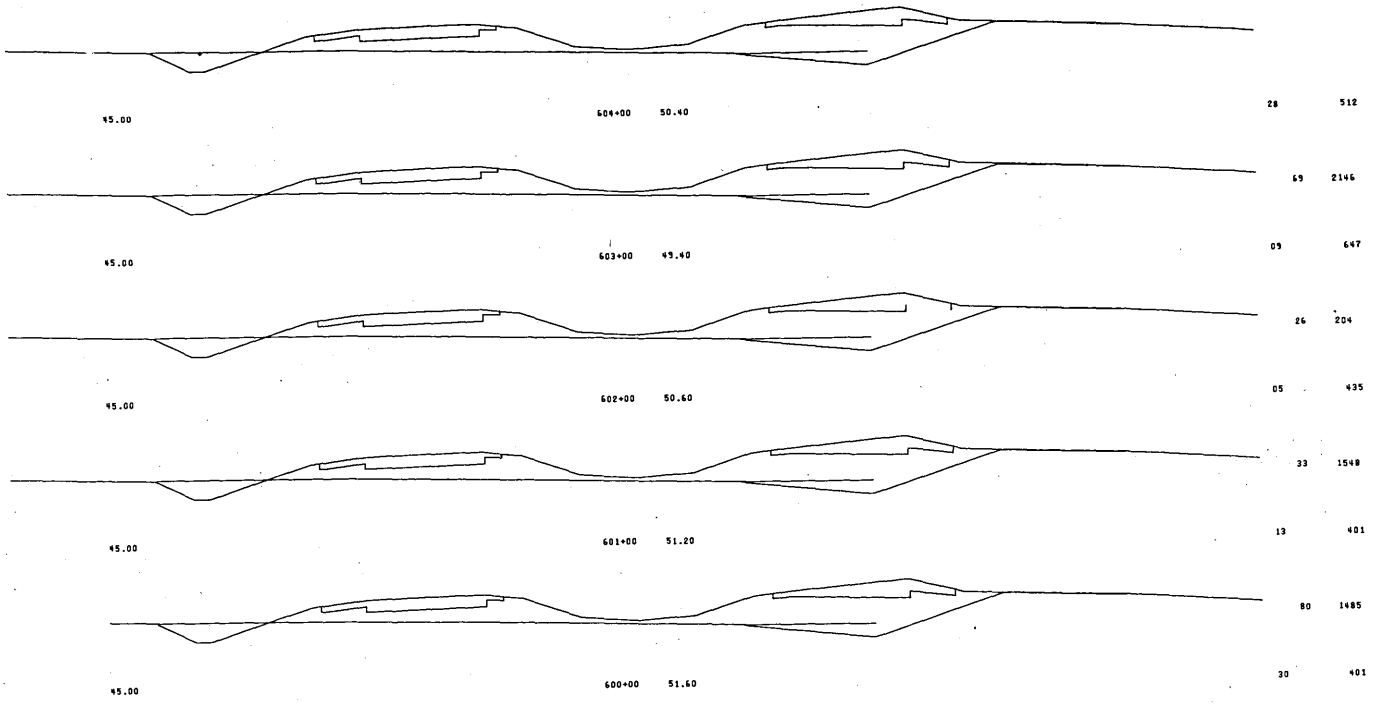
In theory, then. such a system would allow up to 100 moves in both x- and y-axes; i.e., 0-99 in both. With 20 such commands per card, it wouldn't take many cards to generate several thousand instructions. Indeed it sounded good on paper. But although the Delta system was on display at the '66 SJCC in Boston, the first sale remained to be made and we could not consult another user for actual operating experience.

trying it out

We decided that the best way to test Delta decoding would be to generate plots typical of those illustrated here. In demonstration runs, we discovered a reduction in plotting programs by up to 90% or more. Main frame write-time was also less.

Estimating that even our larger plotting applications would require no more than several hundred cards input, we felt this new approach might very well prove feasible. Moreover, the price—a total of $8,500 for the Delta system plus NCR card reader—was definitely right for our budget. After weighing these considerations against the available alternatives, we ultimately opted to go off-line with punched card input.

Fig. 3



The delivery of the Delta Plotter to MRI marked its first trial by user. No standardized definition of software routines existed at the time; even the SHARE GRAFPAC approach, announced later, would not have served our purposes. Although the manufacturer provided software packages—including line drawing, point plotting, axes drawing and drafted character annotation—we wanted to develop the programming further and tailor it to our own special needs. For example, call-out routines for individual letters of annotation were provided. We wanted to simplify the procedure to use one call-out for multiple symbols and letters. It took about three man-months, but we were able to create this and other software suited to our application. The programming supplied by the manufacturer with this first system probably reduced our

programming chore by about 50%. Later, with the conversion from the 1620, we were able to use the same software on the 360 intact (after "LIFTING" FORTRAN II to FORTRAN IV).

At last, we were getting the results we had hoped for. The low-cost, off-line system brought new levels of performance and exceptional systems economies to our plotting operations. And MRI users had experienced no reprogramming or retraining costs.

checking efficiency

To further confirm the advantage of off-line plotting with cards, we made the following experimental demonstration. We had the 360 read the plot deck to determine the number of Delta commands as compared with the number of standard (on-line) incremental commands. Included, of course, in the on-line commands were all movement of the pen, both x/y, and up/down. On-line main frame plot times were calculated for two standard speeds of plotters. Card main frame times were also computed for the two standard 360 punch units, using punching rates actually experienced in our applications. Each plot was analyzed to provide statistical data comparing computer time requirements for on-line plotting and actual Delta time requirements. Selected examples from the summarized table are in Fig. 5.

In some cases, computer write-time was reduced by 60% to 90%. Commands were reduced by a factor of over 50. Previously, with command list needed to generate plotting was as high as 141,256. With the Delta 305, the maximum command requirement was 4,487. Recalling that up to 20 plotting commands can be punched into a standard 80-column card, standard plotting could now be accomplished with input decks seldom exceeding 200 cards.

The result of this analysis testifies to the economic soundness of our decision. Comprehensive comparative data, supplemented with mean average cumulative statistics, underscore economies in performance and systems overhead. We feel that the plotting industry as a whole has made major strides to reduce the traditional problems of operational inflexibility, systems incompatibility, and lack of software support.

Fig. 4

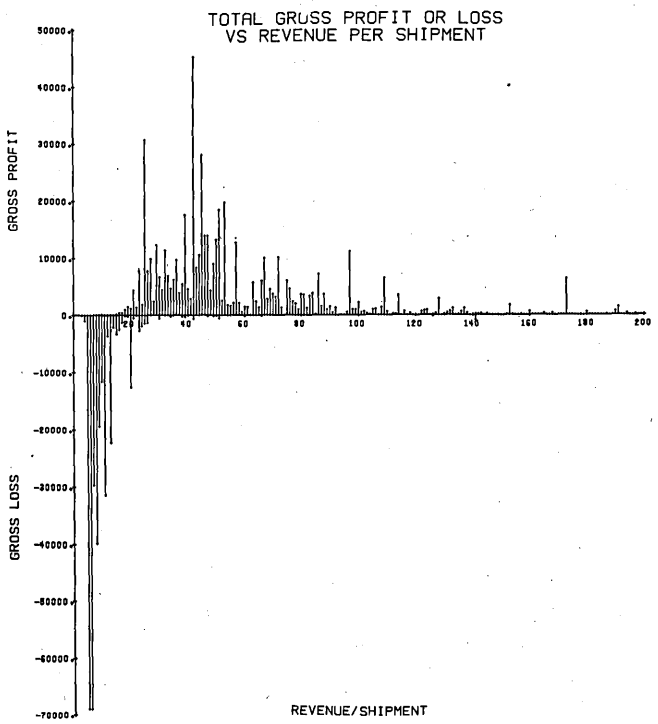


Fig. 5

graphics for the small installation

Most important, we believe MRI experience strongly suggests that the small computer center can indeed incorporate advanced graphics without disproportionate peripheral expenditures. In fact, very real economic penalties may more probably result from a delay in plotting or graphics implementation.

At the present time, digital plotting with punched card input is tailored to our current budget and systems requirements. MRI anticipates future expansion in plotting and data processing operations. But built into our present plan is the provision for growth without disruption. As the workload expands, we intend to convert our 360/30 from disc orientation to mag tape. Fortunately, the Delta Control Unit is designed to accept both punched card and mag tape input. It will therefore facilitate future conversion without added expenditures for systems interfacing. ■

	STANDARD INCREMENTAL ON-LINE				CARD INPUT DELTA SYSTEM		
			Main frame time for plot (in seconds)			Main frame time to produce plot	
Figure No.	Pen motions required	Pen up/down motions (seconds)	300 motions per second	400 motions per second	Commands required for plot	1442-7 (125 cols./sec.)	2540 (380 cols./sec.)
1	66,115	125.55(1)	345.93	290.83	4,487	143.58	47.23
2	141,256	17.55	488.40	370.69	2,813	90.01	29.61
3	16,927	21.85	78.27	64.16	2,366	75.71	24.90
4	42,393	21.75	163.06	127.73	2,434	77.88	25.62

(1) These figures are included in all main frame time columns.

DIGITAL PLOTTING IN BUSINESS

by JAMES L. PYLE

When the digital plotter was developed, it was intended primarily as a business management tool. But it is still an infant in business data processing. Of some 3,000 plotting systems now in use on-line or off-line throughout the free world, only a small percentage are performing the function they are perhaps best qualified for: producing charts and graphs for decision makers in commerce and industry.

But at least the infant is no longer an orphan. It has been "adopted" by stockbrokers, bankers, sales managers, treasurers—even ministers—to eliminate study and analysis of printed computer data or to speed the reduction of data to graphic form.

Computer-controlled graphic reports permit managers to compare current performance with forecasts and spot short and long-term trends. They also are valuable in predicting or evaluating the results of marketing and advertising programs, and in calculating the probable success of a proposed new product—or providing a means for rapid and precise checks on budgets, cash flow and inventory.

London stockbrokers Hoare and Company use a digital plotter to produce stock analysis charts for institutional clients. The charts provide a picture of price movement, growth of dividends and earnings adjusted for capital changes, together with price and dividend yield relative to the total market. The charts are completed in three minutes from data in the computer memory. They cover 1,000 companies and about 90 industry groups. Typical charts are shown in Fig. 1 (p. 32).

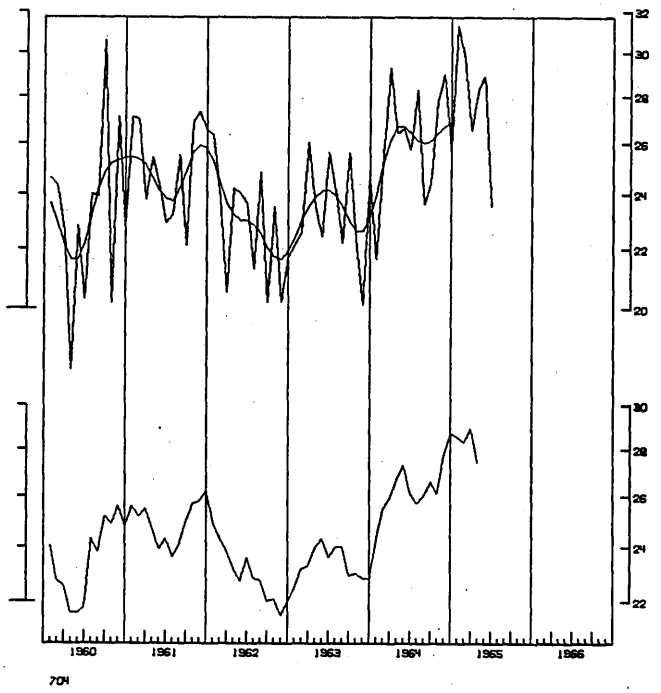
Johns-Manville Corp. provides management personnel with sales charts produced by a plotting system from data prepared by computer on magnetic tape. One chart presents time series data, or a 12-month moving total, which allows a manager to compare at a glance the current month's sales with sales for the same month of the previous year. Another chart supplies data on a seasonally adjusted basis for each month. The two monthly sales charts provide managers with a graphic tool to compare current performance with forecasts for the year and to revise forecasts when necessary. They also provide a visual means of comparing short-term sales trends with other indicators, such as industry sales or data from the Department of Commerce. Until the plotting system became available, the charts could be supplied only on a limited basis because of the time and expense involved in preparing them by hand. In Fig. 2 (p. 32), the top curve shows seasonally adjusted sales in terms of annual rate and the bottom curve shows actual sales.

In the Chicago area, the Methodist Church uses a digital plotter to audit the performance of 400 churches of the Rock River Annual Conference. Profiles of individual churches, as shown in Fig. 3 (p. 33), are prepared annually to display at a glance the relative rank of each local church and its record in each of 83 categories. Reverend Lawrence D. Boyer of Algonquin, Ill., who handles the project, says the profiles help to spotlight successful performance and pinpoint problems. Successful performance is thus reinforced and encouraged, and activity is stimulated to improve neglected areas. Pattern repetition in the profiles also helps church leaders develop general strategy and speeds administrative deci-

Mr. Pyle is assistant to the president and public relations director at California Computer Products, Inc. He has recently been appointed publicity chairman for the Fall Joint Computer Conference. Before joining CalComp in 1962, he was with Packard-Bell Electronics. He has a BSEE from St. Louis Univ.

sions at the conference level. Reverend Boyer states that profiles of this type can be an effective management tool for any organization with a number of branch units, but adds that "trying to produce the charts by hand would be impractical."

Fig. 2



Charts for 387 companies included in the Statistical Supplement to the Quarterly Investment Review, supplied to clients by Drexel Harriman Ripley, Inc., are prepared on a digital plotting system at Standard Statistics Co., computer arm of Standard & Poor. Typical chart in Fig. 4 shows Litton Industries stock prices, earnings and price-to-earnings ratio relative to the Dow-Jones Industrial Index. Charts are plotted at the end of each calendar quarter.

H. Russell Morrison, former Standard Statistics president and now president of Standard & Poor, reports that the computer is rapidly changing the whole science of investing.

"For example," he explains, "a client can call for a comparison of all the international oil companies. They may want the earnings trend, the gross sales trend, the dividend trend, the return on capital trend or a hundred other comparisons. In a matter of a few hours this can be plotted, or supplied in tabular or written form. Within a year it will be possible to generate charts on-line as requested. When this occurs, use of computer graphics will become a commonplace and indispensable tool in modern investment decision making."

Up to now, the major stumbling block has been the same one that inhibits the expansion of automation generally—the human function called programming.

But the day has come when computer programs are available for many graphic report applications—basic programs that adapt a plotter to a particular computer, and functional programs that permit the user to generate specific graphs and charts without prohibitive additional expense.

The digital computer has become an important tool in management. The full use of digital plotting in business data processing is now only a matter of time. ■

Fig. 1

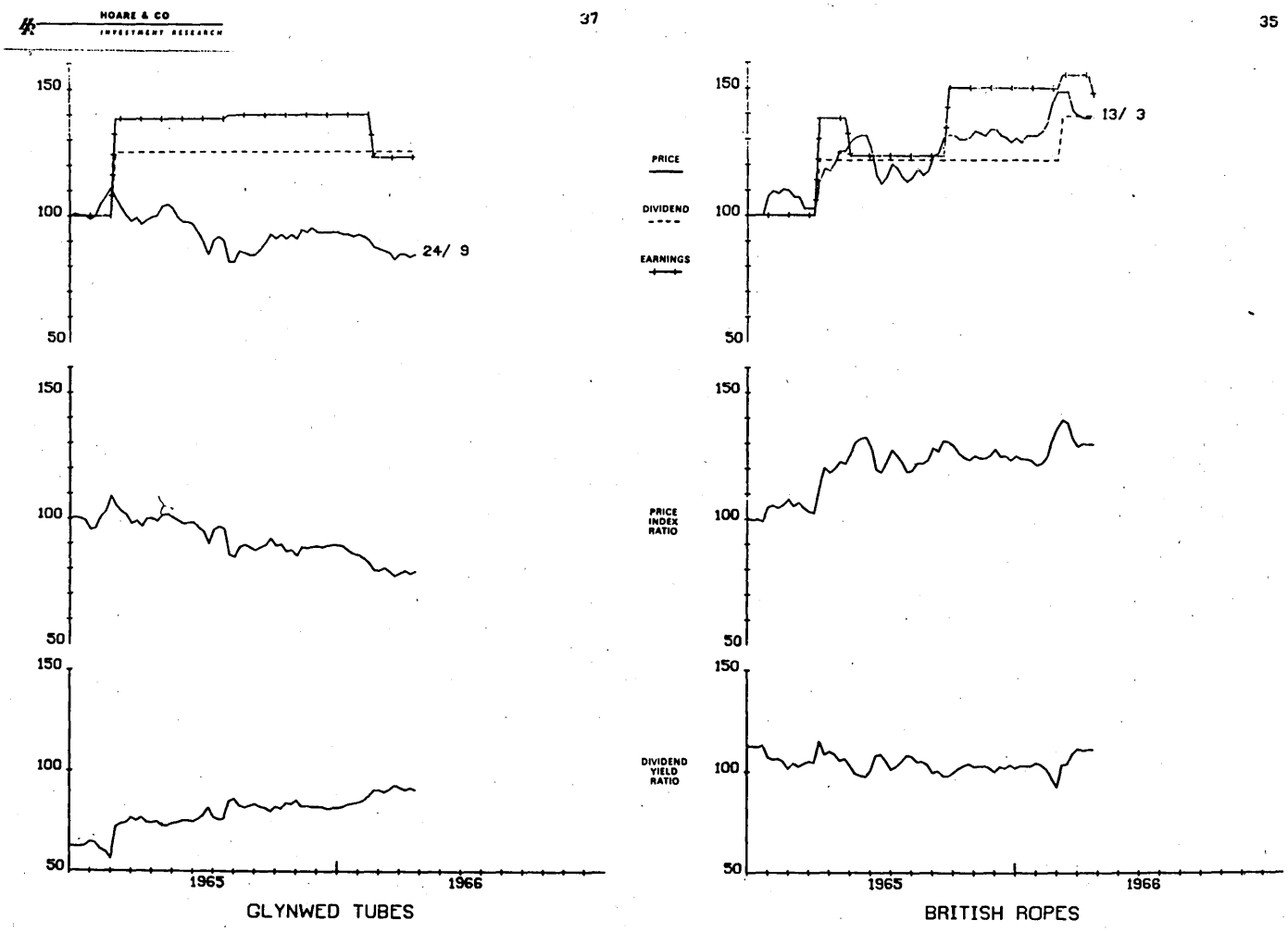


Fig. 3

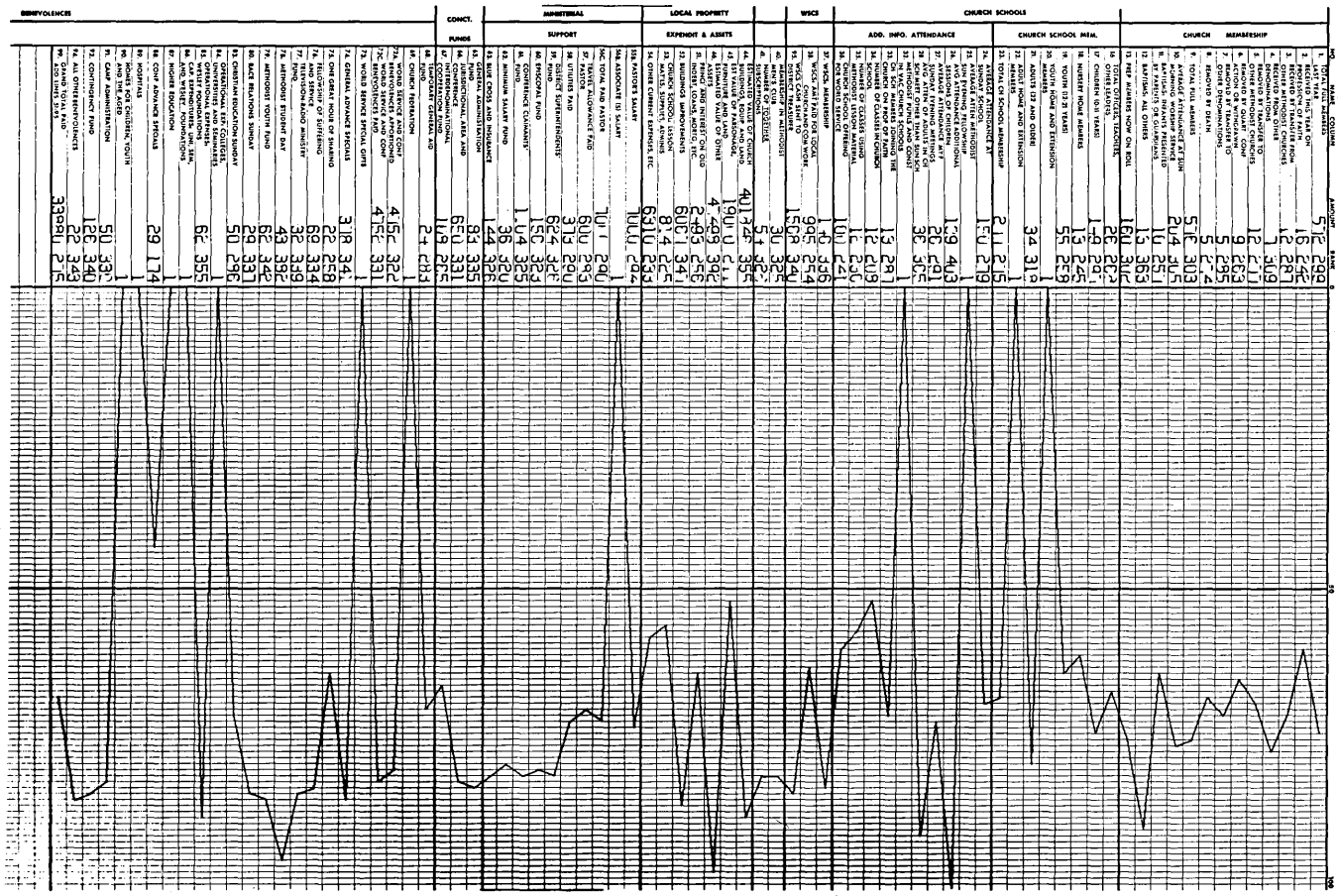
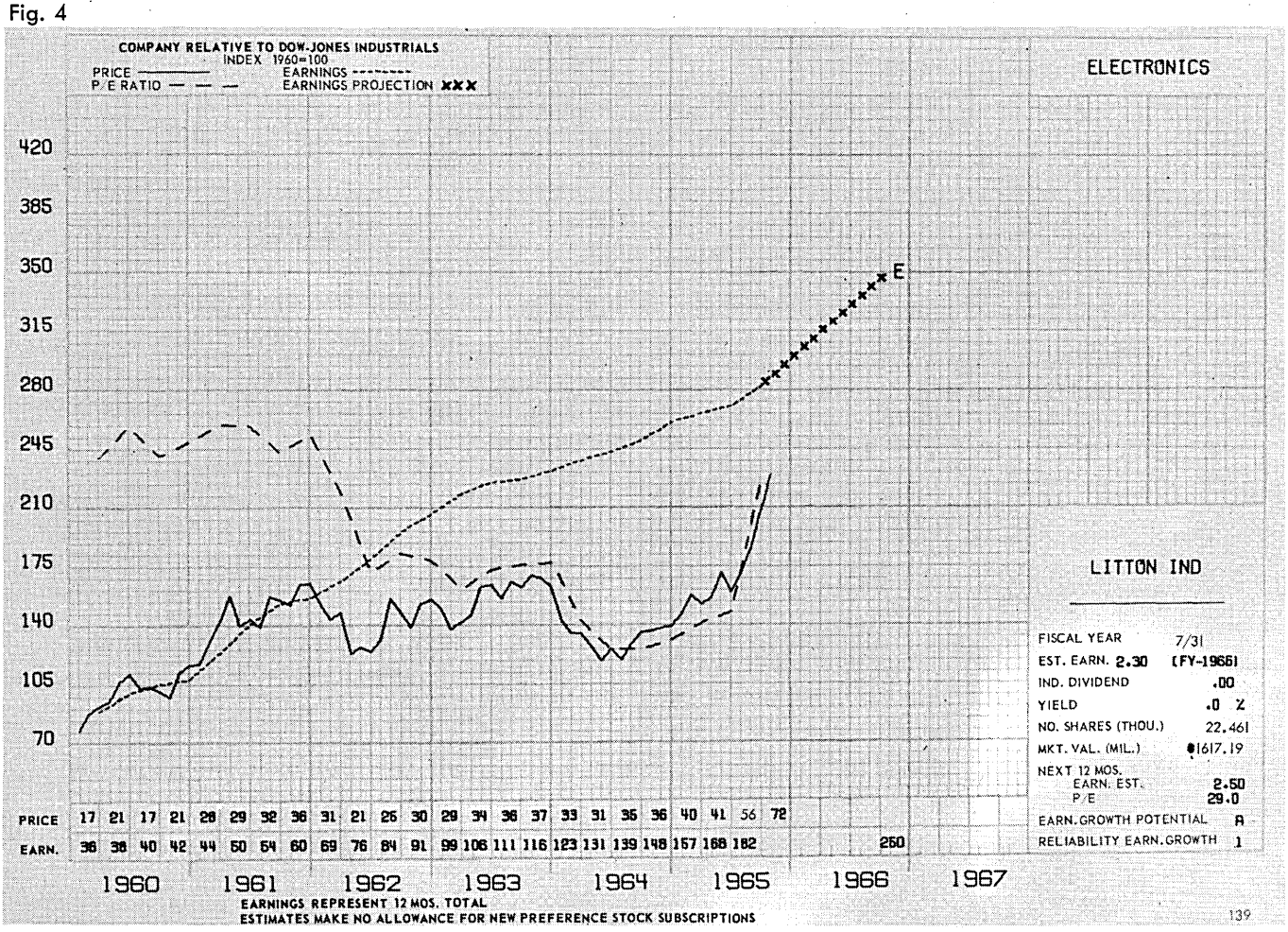

BENEVOLENCES
CONNT. FUNDS
MINISTERIAL SUPPORT
LOCAL PROPERTY EXPENDIT & ASSETS
WSCS
CHURCH SCHOOLS
ADD. INFO. ATTENDANCE
CHURCH SCHOOL MEM.
CHURCH MEMBERSHIP
COLUMN NUMBER
AMOUNT
RANK
1. TOTAL MEMBERS LAST YEAR
2. RECEIVED THIS YEAR ON PROFESSION OF FAITH
3. RECEIVED BY TRANSFER FROM OTHER METHODIST CHURCHES
4. RECEIVED FROM OTHER SOURCES
5. REMOVED BY TRANSFER TO OTHER METHODIST CHURCHES
6. REMOVED BY ACTION OF WITHDRAWN
7. REMOVED BY DEATH
8. TOTAL FULL MEMBERS
9. AVERAGE ATTENDANCE AT SUNDAY SCHOOL
10. AVERAGE ATTENDANCE AT WORSHIP SERVICE
11. BAPTISMS: INFANTS PREVIOUS
12. BAPTISMS: INFANTS PRESENT
13. BAPTISMS: ALL OTHERS
14. PREP. MEMBERS NOW ON ROLL
15. OTHER LEADERS
16. CHURCH SCHOOL TEACHERS
17. CHILDREN (0-11 YEARS)
18. NURSERY ROOM MEMBERS
19. YOUTH (12-20 YEARS)
20. ADULTS (21 AND OVER)
21. TOTAL CH. SCHOOL MEMBERSHIP
22. MEMBERS AWAY AND EXTENSION
23. TOTAL CH. SCHOOL MEMBERSHIP
24. AVERAGE ATTENDANCE AT WORSHIP SERVICE
25. AVERAGE ATTENDANCE AFTER METHODIST
26. AVE. ATTENDANCE ADDITIONAL
27. SUNDAY EVENING MEETINGS
28. SPEAKING OTHER THAN PASTOR
29. IN YOUR CHURCH SCHOOLS
30. IN YOUR CHURCH SCHOOLS
31. CHURCH ON PROFESSION OF FAITH
32. NUMBER OF CLASSES ORGANIZED
33. NUMBER OF CLASSES UNORG.
34. CHURCH SCHOOL OFFERING
35. BOR WORLD SERVICE
36. CHURCH SCHOOL OFFERING
37. WSCS, METHODIST CHURCH
38. DISTRICT TREASURER
39. CHURCH AND CONFERENCE WORK
40. WSCS EQUIP IN METHODIST
41. ESTIMATED VALUE OF CHURCH
42. EST VALUE OF PARSONAGE
43. EST VALUE OF FURNITURE AND FIXTURES
44. ASSETS
45. TOTAL DEBT INTEREST ON
46. DEBTS (LOANS, ADDTO, ETC.
47. BUILDING IMPROVEMENTS
48. CHURCH SCHOOL LESSON
49. OTHER CURRENT EXPENSES, ETC.
50. PASTORS SALARY
51. ASSOCIATE (S) SALARY
52. TOTAL PAID PASTOR
53. HOUSE ALLOWANCE PAID
54. UTILITIES PAID
55. DISTRICT SUPERINTENDENTS
56. CONFERENCE CLAIMANTS
57. EPISCOPAL FUND
58. CONFERENCE FUND
59. ANNUITY SALARY FUND
60. CONFERENCE CLAIMANTS FUND
61. BLUE CROSS AND INSURANCE
62. FUND FOR ADMINISTRATION
63. CONFERENCE, AREA AND INTERDENOMINATIONAL
64. TEMPORARY GENERAL AID
65. CHURCH EXTENSION
66. WORLD SERVICE AND CONF BENEVOLENCES APPORTIONED
67. BENEVOLENCES PAID CONF
68. WORLD SERVICE SPECIAL GIFTS
69. GENERAL ADVANCE SPECIALS
70. FELLOWSHIP OF SUFFERING
71. TELEVISION-RADIO MINISTRY FUND
72. METHODIST STUDENT DAY
73. METHODIST YOUTH FUND
74. CHRISTIAN EDUCATION SUNDAY
75. RACE RELATIONS SUNDAY
76. ONE GREAT HOUR OF SHARING
77. ANNUITY
78. ALL OTHER BENEVOLENCES
79. CAMP ADMINISTRATION
80. CONTINGENCY FUND
81. CAMP ADMINISTRATION
82. RENTS FOR CHURCH, YOUTH
83. HOSPITALS
84. CONF ADVANCE SPECIALS
85. HIGHER EDUCATION
86. ANN. WESLEY FOUNDATIONS
87. CAP. EXPENDITURES FOR EDUCATIONAL INSTITUTIONS
88. OPERATIONAL EXPENSES
89. OPERATIONAL EXPENSES
90. ANN. WESLEY FOUNDATIONS
91. CAP. EXPENDITURES FOR EDUCATIONAL INSTITUTIONS
92. OPERATIONAL EXPENSES, COLLEGES, UNIVERSITIES
93. OPERATIONAL EXPENSES
94. OPERATIONAL EXPENSES
95. CAP. EXPENDITURES FOR EDUCATIONAL INSTITUTIONS
96. ANN. WESLEY FOUNDATIONS
97. HIGHER EDUCATION
98. CONF ADVANCE SPECIALS
99. ADD'L GIFTS PAID

Fig. 4


COMPANY RELATIVE TO DOW-JONES INDUSTRIALS
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EARNINGS REPRESENT 12 MOS. TOTAL
ESTIMATES MAKE NO ALLOWANCE FOR NEW PREFERENCE STOCK SUBSCRIPTIONS
139

TERMINAL NETWORKS FOR TIME-SHARING

a user's comparison

by THOMAS C. O'SULLIVAN

Engineers and administrators at Raytheon's Space and Information Systems Division are being provided time-sharing services through use of a network of terminals. The network is operated as a system under the administrative direction of a terminal network center, which provides a "time-sharing brokerage" service to its users. Time is bought from six commercial time-sharing services at centers located from Hanover, N.H., to Arlington, Va., and sold to users as they require services. This frees the users of the burden of making contractual arrangements with suppliers; of validating supplier bills; guaranteeing minimum use; contacting suppliers about special scheduling, user manuals, changes in the system, etc.; arranging for special telephone requirements; ordering supplies; adding terminals; requesting maintenance; scheduling terminal use where user demands conflict; and providing backup in case of computer failure. Removing these administrative burdens has allowed users to concentrate their energy on the application of time-shared computer capabilities to their specific problem.

To encourage the use of time-sharing, new users are trained, programming consultation is offered, utility programs are developed, new services are tested, and demonstrations are given. The system has enjoyed substantial acceptance by users. There are 10 Teletypewriters and three IBM 1050 terminals located at six facilities in the Boston area. To provide control over usage and allow the collection of accountability data, these terminals are wired to a desk top switchboard to the remote terminal center.[1] (See Fig. 1.)

The present system involves month-to-month minimum commitments, while providing a broad spectrum of software and high flexibility to adapt to future user requirements. There are no major hardware components. If the work load were to suddenly drop off, service and equipment could be returned in 30 days with no penalty. If the use level suddenly expanded, additional terminals could be ordered, and arrangements with suppliers adjusted. Service could be doubled or tripled in six weeks.

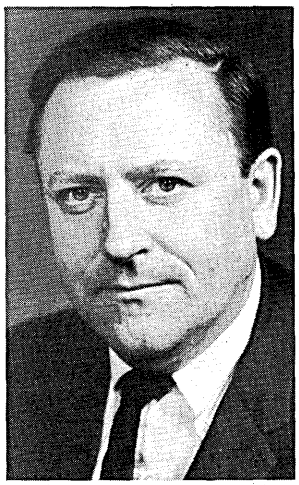
a user's world

Instead of a world of the central computer with satellite terminals, the system offers a user's world with his terminal at the center and various computers satellite to it. In many senses it combines the benefits of decentralized computation facilities and large centralized facilities. In this environment, the user views himself as being at the center of a universe of computers, able to call on the system which will handle his problem and be consistent with his own programming capability.

Observers have asked whether the system will continue to be useful after Raytheon installs its own multi-programming computer facility. Every third generation system available today has major software gaps. The terminal network can provide access to a central Raytheon computer and to the outside services capable of filling these software gaps. As special dedicated systems are introduced to Raytheon for support of management information systems, inventory control, market data, and scientific computation, the terminal network can act as a switching center for data communication between a terminal and the various available internal services. Later, as overload conditions are experienced, the

The author acknowledges the support at Raytheon of Robert Jacobson (now at Bolt Beranek and Newman), with whom he was responsible for the early implementation of the remote terminal network, and the support of Sharon Kubecka, Claudette Lawton, Richard Morway, and Irwin Wenger for their substantial contributions and continuing flow of ideas about the need for further developments.

[1] O'Sullivan, T.C., "Shadow Telephone Networks for Time-sharing Terminals;" *Computers and Automation*, Oct. 1966.



Mr. O'Sullivan is manager of the data systems section of Raytheon's Space and Information Systems division. He has been in the computer field since 1958 and is active in ACM and SHARE. He holds a BA in psychology from Cornell Univ. and an MA in education from the Putney Graduate School.

terminal network could provide internal load leveling by directing users to lightly loaded systems as well as provide access to outside services able to absorb some of the activity. In view of these various potentials, it is expected that the terminal network will continue operations in order to meet these future needs.

Fig. 2 shows the use made of various services for the second six-month period of operation from March through August of 1966.

While the terminals are scattered geographically to meet the needs of concentrations of users, they are owned by

Fig. 1. Terminal Network Configuration and Available Services

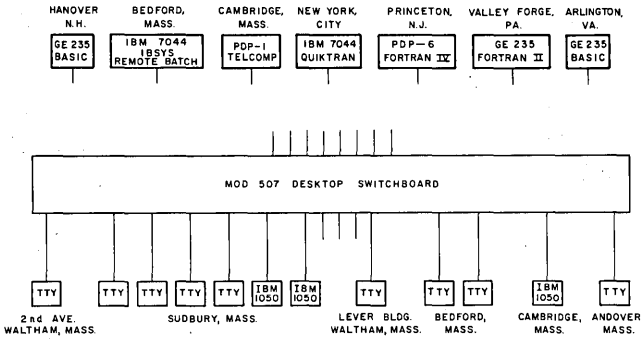
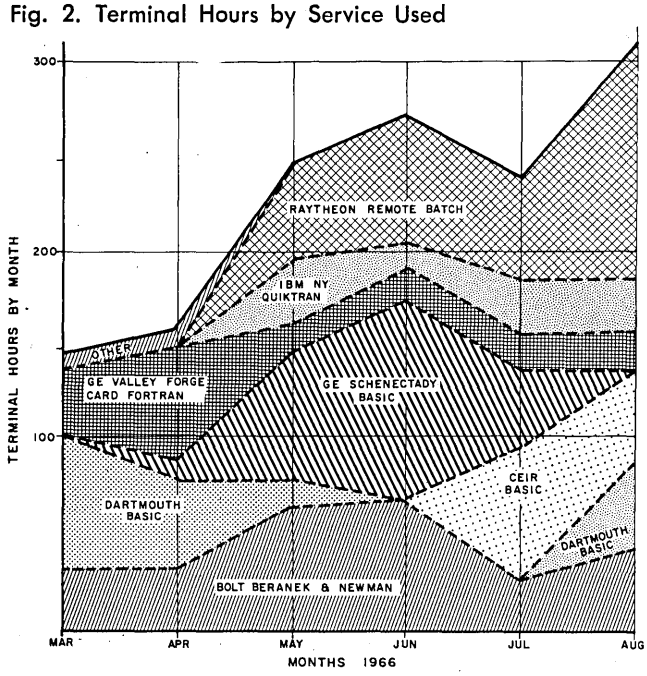


Fig. 2. Terminal Hours by Service Used



the center and considered by users to be communal property. This eases the problem of scheduling around conflicts and takes advantage of the improved statistical chance of access as the number of terminals increases. It has been suggested that the pressure of needing to get work done, combined with a conflict in terminal access, will result in a change in the usage behavior, forcing users to come on early, stay late, work on weekends, etc. While we have noticed some examples of this, we have taken the position that in the early stages of introducing time-sharing it is more important to provide unobstructed access than to attempt to achieve the higher efficiency of heavy terminal use at the expense of changing user work patterns. Experience suggests we should eventually achieve 50% utilization of terminals during the working day.

services employed

The first service employed, offered by Bolt Beranek & Newman of Cambridge, Mass., provided TELCOMP, a derivative of the JOSS[2] language. This proved useful to nonprogrammers. After several weeks of use, some users had requirements for performing lengthy computations. The PDP-1 proved slow, in some cases, requiring more than 20 minutes to determine the value for a point through use of a double integration technique. Other users had lengthy programs requiring little computer time. The service did not provide for storage of programs, which were loaded from punched paper tape each time they were required. Both the high compute and large program users asked for a new system.

To overcome these problems, arrangements were made with Dartmouth College to use their BASIC[3] system, which provides local storage and was reported to be much faster than TELCOMP. As some users switched over, use of TELCOMP decreased for several months, after which newer users boosted usage. The BASIC system was about 20 times as fast as BBN for problems with high compute content.

Soon some users had requirements for large data base programs requiring a low or modest level of computation. Neither the BBN system with its limitations nor the BASIC system, which has a severe limitation on storage available to handle an operating program and data base, could meet their new requirements.

General Electric's Missile and Space Division at Valley Forge, Pa., offered a time-shared version of GE Card FORTRAN II.[4] It provides for the simulation of tape operations of their GE 235 disc system. Data store, manipulation, update, and purge could be handled on larger data bases involving over a quarter of a million characters. For compute bound programs, we found it much faster than TELCOMP but only half the speed of BASIC. We have not conducted tests to determine how much of this is a function of the relative compute efficiencies between BASIC and Card FORTRAN, and how much a function of the conventions for I/O and queueing up for processor time. Since both systems are on the GE 235 and use the Datanet 30, and since the terminal command languages are similar, we suspect that the differences are largely in compute efficiency.

As usage continued to build, some services were found to be inadequate in terms of availability. Early in its development, the TELCOMP service was available only in the morning hours. Before the schedule was extended to include afternoon and evening service, users were dissatisfied; their need was not conveniently postponable to the next morning. Some users switched services in order to have full-day service assured even though TELCOMP was in other ways satisfactory. The Dartmouth service was found to be unreliably available. Channels were full up to and beyond midnight for several days before class assignments would be due. When it was necessary to try to gain access during these periods it would take hours of constant dialing to find an available channel. Some users needed backup capability to insure that when deadlines were close they could still meet their commitments.

The General Electric Data Center at Schenectady, N.Y., offered a duplicate service for BASIC. It was more expensive than Dartmouth but was reliably available through

[2]JOSS is a high order language developed at RAND. It requires about 30 minutes to understand it to the point where a numerically inclined user is able to begin to get useful results. It is run interpretively.

[3]BASIC is a high order language designed by John Kemeny at Dartmouth and developed jointly by Dartmouth and General Electric. Somewhat more complex than JOSS, it takes about one hour of exposure before the new user can get useful results. BASIC is a compile and go system.

[4]GE Card FORTRAN was developed at GE Missile & Space Division for use by their own engineers and mathematicians.

the work day. Access was supplied to the GE facility when necessary, but Dartmouth was used when available.

billing & utilization

Dartmouth bills for the amount of CPU time used. GE bills for CPU, lapsed time of hook-up, and library storage used. We had assumed that CPU utilization would average 4-5% of total hook-up time. The GE service was excellent, but when one of the heavier users started to use all available CPU (at times up to 30% of hook-up time) the economics of using BASIC were re-examined. Fig. 3 shows the cost per hour of hook-up of three costing structures of BASIC service being offered on the East Coast. CEIR in Arlington, Va., charges for hook-up time only. The Dartmouth costing structure works to the advantage of new users who are likely to be building programs having a low compute content, at the expense of users whose compute content is high. The CEIR costing structure favors the high compute content programs at the expense of the others. High compute content problems were assigned to Dartmouth and low computers problems to CEIR. GE Schenectady was dropped, even though their cost structure is reasonably fair for all users, since we were able to selectively exploit the inequities of the other two services to the benefit of our users.

The rapid increase in use of the remote batch operation suggests that a fast turnaround batch system will continue to meet many users' needs even though it may not provide the ability to conduct a conversational form of analysis where the user watches output develop, changes program parameters, and converges on a solution. These needs may be met in a limited way through reiterative submission of short batch runs.

Fig. 4 summarizes some of the preceding discussions, showing a comparison of the various services used. The judgments are based on limited experience and are highly subjective. Selections of a service for a particular job have been based on these subjective judgments. Selection of systems to be added to or dropped from the center's operation have been largely based on the uniqueness of the service and its cost. There is a need to replace these subjective judgments with quantitative criteria to measure the absolute utility of time-sharing systems and their re-

Fig. 3. Costs and Function of CPU Used

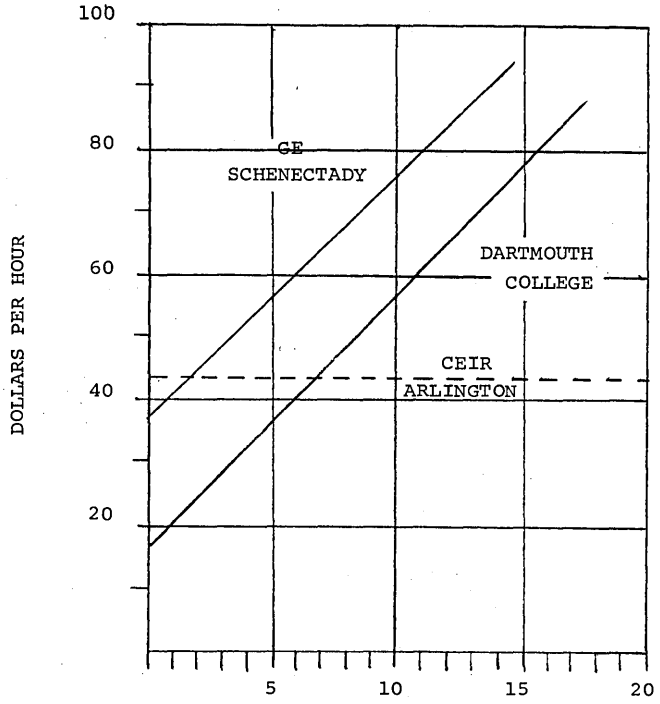


Fig. 4. Comparison of System Qualities

SYSTEM / ATTRIBUTE	TELCOMP	BASIC (Dartmouth GE Schenectady CEIR)	G.E. Card FORTRAN	PDP-6 FORTRAN IV	IBM QUIKTRAN	IBM 7044 Batch IBSYS	REMARKS
DIAGNOSTICS	Complete, clear	Modestly helpful for occasional coders, adequate for experienced programmers		Obscure	Complete, clear	Useful for experienced programmer	Diagnostics & command language seemed linked
COMMAND LANGUAGE	Simple	Modestly difficult		Complicated & obscure	Modestly difficult	Difficult	
RUNNING EFFICIENCY	Low	Medium-high	Medium	Very high	Low	Modestly high	Inversely linked to diagnostics & command language
PROGRAM SIZE	Medium	Small	Medium to large	Large	Small	Large	
AVAILABILITY	Good	Fair Good Good	Very good	Fair	Good	Very good	
I/O SPEED	Low	Low* and High Low Low	Low & high	Low	Medium	Medium and high	

* Low and high indicate both speeds are provided.

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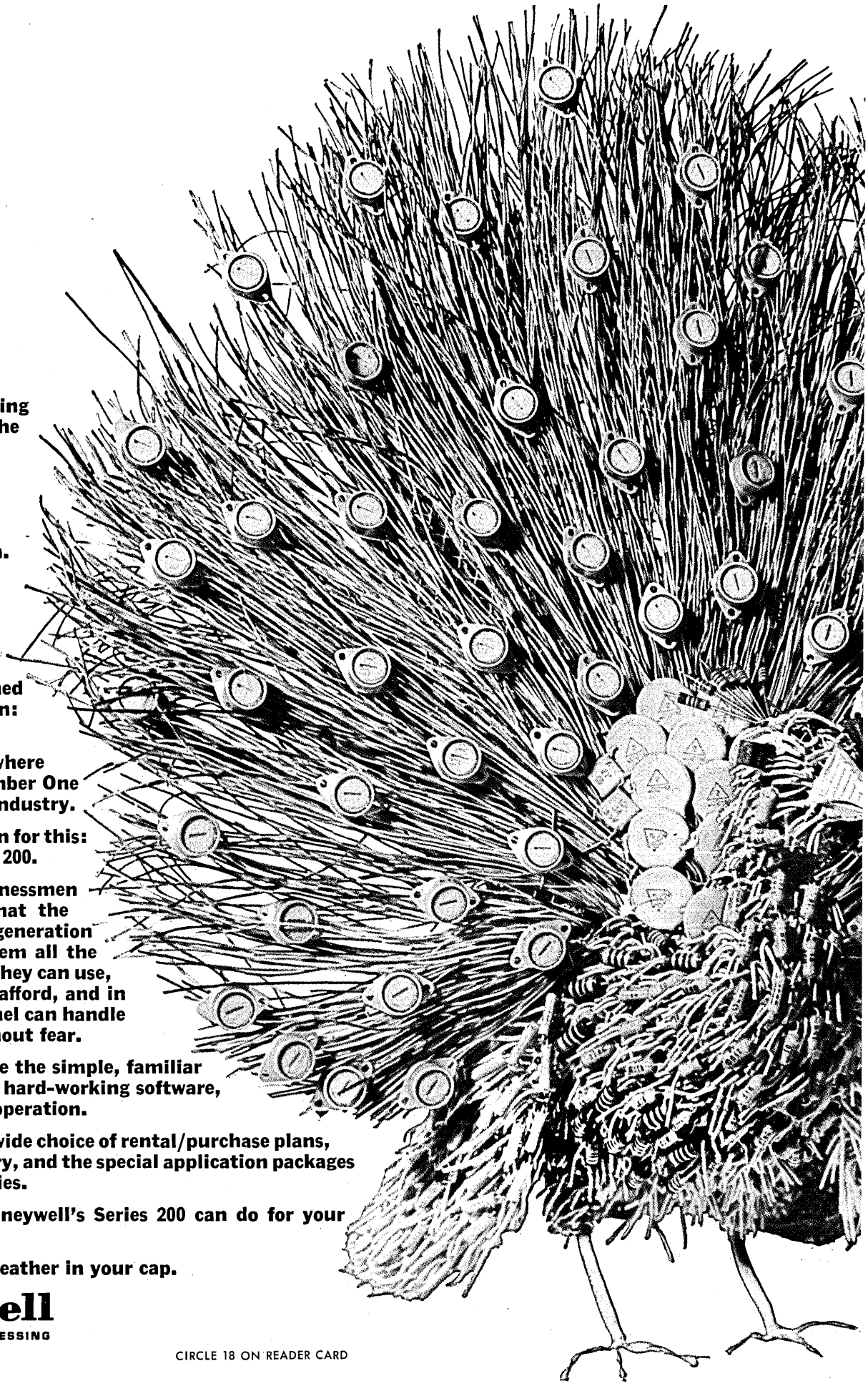

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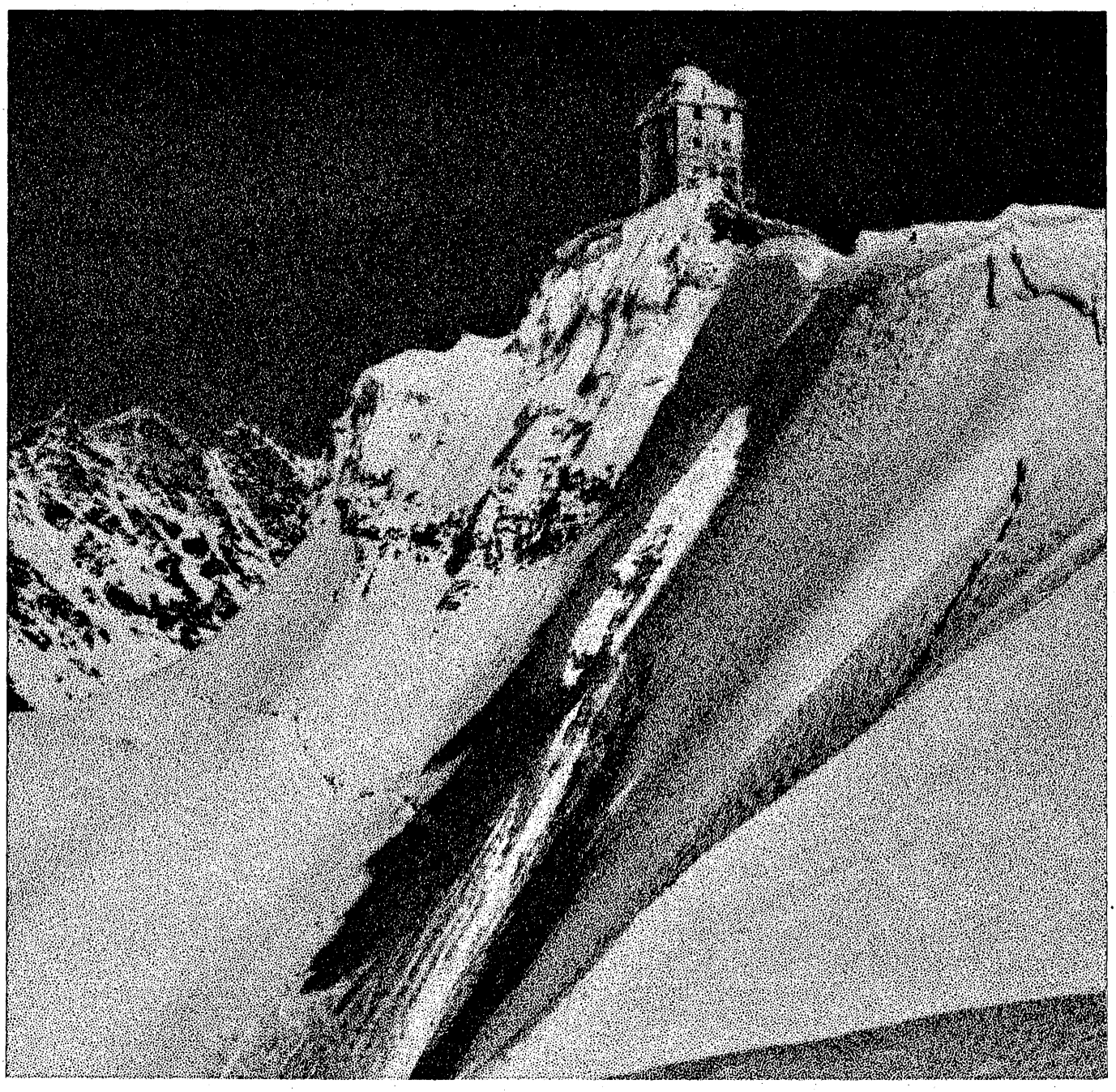

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DIGITAL DEVELOPMENT CORPORATION

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lative performance rating to accomplish specific tasks. The nature of the diagnostics and the complexity of the command language are important in matching the user's background and experience to the system.

The data in Fig. 4 shows, in general, that the completeness of diagnostics is linked to simplicity of command language and inversely proportional to efficiency of execution. System developers should examine this to determine whether inefficient execution is an inherent feature of systems supplying complete and easily understood diagnostics, or a function of the specific interests and prejudices of the developers. The latter should be carefully examined, especially for non-interpretive systems.

Some patterns of user behavior have been observed during the early development of the remote terminal network. These patterns point out some of the inadequacies of present systems, and some areas where further development is required.

current inadequacies

New users, with no previous programming experience, as well as occasional users, benefit from the completeness and clarity of diagnostics provided by the interpretive systems. Some areas have been noted where errors are not picked up until execution, creating substantial editing in cases where the user consistently repeated the error throughout (e.g., the wrong kind of bracket used for the subscripting). Where possible, these errors should be checked for as statements are typed.

The occasional users, as well as new users after they have achieved a minimum level of coding capability, become dissatisfied with the slow computing capacity of interpretive systems. At this point, they seem willing to invest some time in learning a system which is more efficient for working the problem at hand. Some users have progressed from TELCOMP through BASIC to FORTRAN systems. QUIKTRAN* from the IBM Data Center in New York was provided as a time-sharing complement to the Raytheon remote batch system. It gives the diagnostics of an interpretive system with the capability to transfer the job to a batch production system after the program is developed. In theory, it seemed like a reasonable combination; however, it has not been well accepted by either beginner, occasional user, or professional programmer. QUIKTRAN, a limited subset of FORTRAN, a more difficult for novice programmers to learn than are other available systems. The same holds true for the occasional user who does not already know FORTRAN. Some petty annoyances inhibit use of the combination for larger programs. The COMMON and DIMENSION statements must be dummied to permit checkout interpretively, and recorded to run the full problem on a production machine. Experienced programmers do not need the detailed diagnostics supplied by QUIKTRAN. They can compile in FORTRAN on the first or second pass and prefer a fast turnaround batch system. Other experienced programmers prefer to code at the machine language level. QUIKTRAN has, however, proven useful for new users learning FORTRAN.

hardware, software needs

There appears to be a need for an easy-to-learn higher order (JOSS-like) interpretive language with several levels of diagnostics available to the users, which may be expected to run either on an interpretive or on a compile and go basis.

Users whose applications seemed to require substantial output have been frustrated by the low speed output of Teletypewriter terminal devices. Because there was no alternative, these users re-examined their output requirements, decided that for purposes of solution of their problem the output specified was not really required, and redefined the output of their programs to reduce the printed output. Techniques for printing summary output and storing more detailed output for later selective retrieval need to be developed.

Few systems permit a user to interrupt a run and store it with its data to be started up again where it was stopped. This capability has proven useful and should be more widely available.

Most users have not naturally adopted conversational

Fig. 5. User Cost Breakdown

COST ITEMS	COST FOR SERVICE PER HOUR OF HOOK-UP						
	Bolt Beranek & Newman	Dartmouth	CEIR	QUIKTRAN	G.E. Valley Forge	Applied Logic	G.E. Schenectady
Redistributed overhead	4.50	4.50	4.50	4.50	4.50	4.50	4.50
System support	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Long Distance calls	N/A (local)	9.45	24.50	12.25	N/A (1)	12.50	12.55
Terminal charge	2.00	2.00	2.00	4.50	2.00	2.00	2.00
Supplier's charge	12.50	8.80 (2)	5.00	13.00	30.00	19.40 (2)	17.20
Total cost per hour	$24.00	$29.75	$41.00	$39.25	$41.50	$43.50	$41.24

(1) Supplier provides foreign exchange lines in Boston, eliminating need for long distance calls.

(2) Assumes an average use of CPU of 4% of hook-up time.

*QUIKTRAN is an interpretive form of FORTRAN which is compatible with 7044 batch systems operating under the IBSYS.

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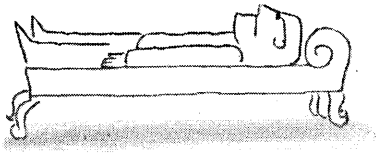

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CIRCLE 27 ON READER CARD

techniques of analysis. Many build their programs in a batch format. Special effort must be invested to demonstrate the usefulness of a conversational form of analysis, and to introduce it to the user community. Until this is done, multi-programming systems will not fulfill the potential that exists for significantly enhancing analysis capability.

In environments where computation capability is placed at the disposal of users as an overhead expense, there is no particular difficulty in keeping cost details separate, except for purposes of validating the bills of outside suppliers. In the development of the system described above, it was necessary to collect costs in a way that would make it possible to redistribute them to users on the basis of their particular use. To accomplish this, five cost pools were established. These are shown in Fig. 5 for the various services used. Charging precisely for those elements of service used will probably gain in popularity as we learn more about how to fairly distribute costs.

the interface computer

The current Raytheon effort is modest. We are learning daily about time-shared capabilities, user requirements, and new applications. As the terminal network continues to grow, additional service functions seem desirable. Currently, we are examining the feasibility and economics of developing software for an interface computer to reduce the manual switching operations; to increase the utility of terminal operations; to provide lower costs and more flexible access to outside services; and to complement those services. The functions that might be performed by an interface computer may be described as three phases of development: communications control and accountability, translation, and special system support.

Communications Control and Accountability. Answer call from terminal, interrogate user for identity, charge number, and service required, initiate call to requested service, time length of access, intercept sign-off command, interrogate computer used for billing information, store and report accounting data, turn call over to operator if there is trouble.

Translation. Provide compatability between terminals and computers that are otherwise incompatible by supplying code translation, bit rate control, code format control, and storage of necessary data to execute appropriate control conventions.

Special System Support. Permit linking of terminals to provide remote assistance from experienced programmer, cooperative analysis and gaming. Provide storage of tabular data output to be selectively retrieved and viewed as needed and when pre-processing and post-processing services.

As suggested early in the paper, in addition to providing a user oriented "time-sharing brokerage" service, the system could be used to provide access to a number of an organization's own special purpose multi-access systems, permit load leveling between systems, provide customer, subcontractor and consultant access to available systems, and permit more efficient use of available communications channels. Eventually, such interface devices may not only provide for a user's serial access to a network of independent computer systems, but also permit the user to link channels to independent computer centers, establishing an intercomputer network of the user's choosing. ■

THE GRAFACON MAN-MACHINE INTERFACE

a commercial rand tablet

by H. J. RIDINGER

Moving a pencil across a writing surface is one of man's most highly developed skills. Under the sponsorship of ARPA, the RAND Corp. investigated ways to use man's pencil-moving skill to simplify the user-computer interface, and in 1963 they completed development of the first model of the RAND tablet.[1] A commercial version of the tablet manufactured by the Data Equipment Div. of Bolt Beranek and Newman (BBN) is sold under the trade name Grafacon.

The Grafacon, shown in Fig. 1 (p. 47), consists of a writing surface, a stylus, and associated control and interface electronics. When an operator touches the stylus to the tablet, the coordinate position of the stylus appears in the Grafacon output register as 20 bits of x, y data. In on-line applications the x, y data, along with flag bits, are fed directly into a computer. In off-line applications the bits are recorded on paper tape, cards, magnetic tape, etc.

The x, y position information is available in the Grafacon's output register whenever the stylus touches the tablet. Pressing the stylus against the tablet closes a switch in the stylus. This gives the operator positive control over the transfer of data into the computer or storage medium.

Because the Grafacon converts stylus position to x, y coordinates, it is an extremely general input device, and is used in a wide variety of applications. In one very broad applications category, the Grafacon can be considered as a keyboard matrix with a potential resolution of 1024 x 1024 items. In a second applications category, the Grafacon is used for input of points or curvilinear data from sketches, graphs, photographs, maps, etc. In applications with a CRT, it provides a convenient and conservative way for pointing at displayed data and entering new data.

In most applications, several capabilities are combined. For example, when using the Grafacon to enter sketches on-line into a computer, the keyboard is used to anno-

1. Davis, M. R. and Ellis, T. O., "The RAND Tablet: A Man-Machine Graphical Communication Device," AFIPS Conference Proceedings (FJCC), Vol. 26, pt. 1, Spartan Books, Baltimore, Md., 1964, pp. 325-331.

Mr. Ridinger is president of Ridinger Assoc., a computer systems consulting organization. He is also an applications engineering consultant to the Data Equipment Div. of Bolt Beranek and Newman, Inc. He has been manager, computer products, Scientific Data Systems, and manager of equipment and product engineering at The Bunker-Ramo Corp. While with Bunker-Ramo, he was responsible for the development of process control hardware.

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tate drawings and pointing is used to edit the drawing displayed on a CRT.

During the 12 months that BBN's Data Equipment Division has been manufacturing Grafacons, 30 units have been built in a variety of on-line and off-line configurations. A few of these configurations will be described in the context of specific applications.

text editing

In a final editing step, typeset copy can be displayed on a CRT. The editor moves his stylus on the Grafacon surface while watching the CRT. Used in this manner, the position of the stylus appears as a dot on the CRT. Pressing down on the stylus intensifies the dot. This provides a close interaction between the natural "blue-pencil" movements of the editor's hand and the computer-displayed data.

When the editor has identified the place in the copy requiring an editorial change, he makes conventional proofreaders' marks such as "slash" for lower-case, triple underline for capitals, caret for insert, etc. He then prints letters on the Grafacon to correct the text. The computer recognizes the marks and characters, then generates corrected copy.

Inforonics, Inc., uses a PDP-1 in phototypesetting work. As a research project they are using a Grafacon on-line with the PDP-1 in conjunction with a Model 30 CRT. When errors are detected in galley proofs, the original text on punched paper tape is fed back into the PDP-1 and displayed on the CRT. The PDP-1 has been programmed to recognize letters printed by the editor on the Grafacon's writing surface. After the text has been corrected by the editor, the PDP-1 generates a control tape for resetting the block of type which was in error.

Although a light pen would be less expensive to purchase, the Grafacon has some distinct advantages in text-editing applications. From an economic standpoint, the computing power requirements are lower because a light-pen tracking program is not required. From the standpoint of the editor, it is less tiring to write on a flat, horizontal surface than it is to write on a CRT. Another text-editing procedure being investigated involves placing the galley proofs directly on the tablet surface; in this mode of operation it would be impractical to use a light pen.

composing

At NASA's Command and Control Center, closed-circuit TV, Charactrons, and slide projectors are used to create a combined display of mission data superimposed on background formats of instrument panels, maps, etc. Philco-Houston Operations is including Grafacons in an advanced system to be evaluated by NASA. Instead of using slides for displaying background formats, the experimental system will use digital television, and the background formats will be generated using the Grafacon, then stored on magnetic tape. The background formats, recorded from the Grafacon on magnetic tape as a series of x, y coordinates, will be fed into a delay line and recirculated for refreshing the digital TV display. This technique will assure registration of the mission data superimposed on the background format. Although this is basically an off-line application, the Grafacon can be used on-line to annotate the background format with mission data.

In a system such as this, the Grafacon appears to offer greater freedom in console design by relieving the requirements for locating the display with an arm's length of an operator using a light pen.

A program written in 360 Assembly Language by the RAND Corp. recognizes symbols printed on a RAND Tablet connected on-line to a 360 Model 40. The symbol set recognized by the program includes the alphabet, numbers, punctuation, frequently used arithmetic symbols, plus a set of flow-charting symbols.[2]

The symbol recognition program is an important element of the GRAIL. (GRAphics Input Language) being developed by RAND. Although the GRAIL system is extremely general in nature, and could be applied to tasks ranging from text editing to machine design, its greatest immediate value is in composing programs.

form generating

Typical coding sheets and flow-charting sheets are generated on a CRT by the computer; symbols are sketched free-hand by the programmer on the tablet and redrafted by the computer as they are recognized. A flow-chart block can be assigned a macro function which refers to other macro functions of any level of complexity; or the flow-chart block can refer to lines of code written by the programmer. The details represented by a flow-chart block are subsequently retrieved by pointing to the block.

Because flow charts and coding sheets are usually written on several pages, "paging" and "scrolling" symbols appear on the programming forms. Pointing at the right-hand arrow adjacent to the word "page" displays the next page of text. Pointing at the upward arrow adjacent to the word "scroll" displays lines of code below those directly visible on the selected page of the coding sheets.

A "scrubbing" action of the stylus erases symbols. When the scrubbing action is applied to character spaces or blank coding lines, the surrounding characters and/or coding lines are moved as a result of deleting the indicated spaces or lines.

The above discussion is not intended to be a comprehensive description of the GRAIL research project, but only shows how the tablet is used in a system for writing and documenting programs.

Experimental and evaluation work with the Grafacon by Philco-Houston Operations has led to development of on-line message composition and information storage/retrieval applications. These projects have been performed by R. F. Johnston and Mrs. I. F. Johnston. In the area of programming, Mr. Johnston has suggested the development of a programming system requiring that the computer tell the programmer what the computer can do, as opposed to burdening the programmer with remembering what instructions he can give to the computer. Johnston suggests that the programmer's chore should be reduced to pointing at the things he wants, and saying "ugh"—the system would be called UGHTRAN.

designing

Probably one of the most promising application areas for the Grafacon is in sketching. In these applications, it is used in conjunction with a CRT display. While it may sound awkward to watch a point on a CRT while moving the stylus on a separate writing surface, the strangeness is about equal to that experienced during the first few minutes behind the wheel of a rented car—and the danger is considerably less. Somehow the naturalness of the desktop writing position enables the operator to coordinate easily with the CRT display.

Design projects involving hospital layout have been per-

2. Groner, G. F., "Real-Time Recognition of Hand Printed Text," AFIPS Conference Proceedings (FJCC), Vol. 29, Spartan Books, Washington, D.C., 1966, pp. 591-601.

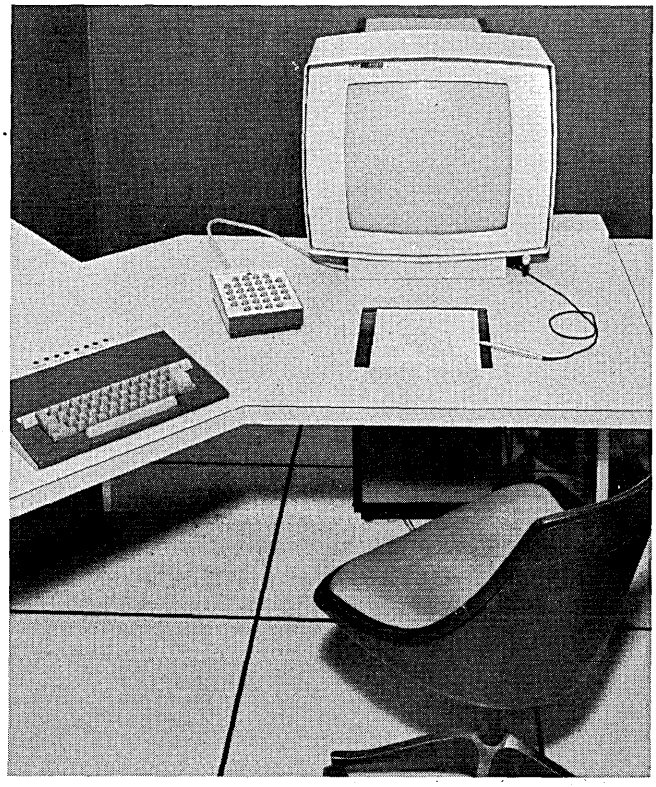
formed by BBN. Inputs were sketched by establishing end points of lines, and connecting lines were added automatically by the program. The program also calculated floor area, walking distances between working stations, and other design variables. On one project, a conventional light pen was used, and the sketches were annotated using a conventional keyboard. On a second project, the Grafacon was used, and an overlay was placed along the edge of the tablet to serve as the keyboard. Lettered on the overlay were the ordinary typewriter symbols, plus special operational symbols. Touching the Grafacon stylus to the operational symbols enabled the operator to control system activities (e..g, clear display, transfer figure to disc), and control drawing activities (e.g., line connections, labeling, figure closure, line squaring).

In other design applications, the tablet overlay could include special symbols representing electronic circuit elements, construction hardware, etc.

routine digitizing

Most routine digitizing can be performed off-line. The Grafacon has been connected to card and tape punches in several applications. Operated in a "continuous" mode, it digitizes points to a precision of 20 bits (10 bits x, 10 bits y) at a rate of 5,000 points per second, exceeding the capabilities of punching equipment. Therefore, when used in off-line applications, the Grafacon is frequently operated in the "point" mode to be compatible with recording equipment. In this mode, a pair of coordinates is recorded once each time the stylus switch is activated by pressing the stylus against the tablet. Most routine digitizing applications are similar to the two described below.

Fig. 1. Grafacon installed for on-line use with an IBM 2250 as part of a System/360 Model 30.



In a project for evaluating the effects of explosions, the Grafacon is used to digitize curves from strip-chart recordings, and to digitize photographs of ground profiles. Data points are recorded on punched paper tape in 1620 format for computer processing. In digitizing strip charts, cornermark pointing is used to establish reference points when a new section of the strip chart is advanced across the tablet.

The Grafacon was used by Panoramic Research to evaluate a method of personnel identification involving facial characteristics. Using a simple slide projector, photographs of faces were projected onto the rear of the tablet. The 10″ x 10″ writing surface is translucent, with a light-diffusion layer near the surface of the tablet to enhance resolution and reduce parallax in background projection applications such as this.

The facial-feature identification scheme involved the use of ratios of distances between specific points on the head (e.g., pupil-to-pupil distance, nostril-to-pupil distance, chin-to-eyebrow, etc.). The coordinates of specific facial landmarks were obtained by touching the Grafacon stylus to the tablet. The coordinates were punched on paper tape, along with descriptive information from a separate keyboard. Paper tape was in 1620 format. The experimenter processed about two photos per minute, obtaining 16 measurements for each photo.

Although the variables of photographs and projection systems make it difficult to obtain absolute measurements, ratios of distances can be obtained accurately, and these can be related to a known distance on the photograph. Measurement of microscopic particles and large molecules is another photo-projection application being developed.

problem-solving systems

Grafacon-CRT equipment combinations are usually used in a creative environment, where man-machine interaction is important in solving problems. In an operational environment involving routine digitizing of photographs and curves, the operator does not interact with the problem solution, but only inputs data. However, there is another environment—somewhere between the creative and operational—which may be classified as a technical environment. Here the operator is concerned with entering graphical data, processing the data, and evaluating results. His interaction with the problem-solving procedure only involves the selection of different sets of input data and the selection of processing procedures.

In the technical environment, the problems and the several possible solution processes are well defined. Therefore, an economical problem-solving system can be developed which matches the needs of the problem. Economies can be achieved by matching the power of the computer to the requirements of the problem, and by using an x-y recorder in place of a CRT as a graphical output device.

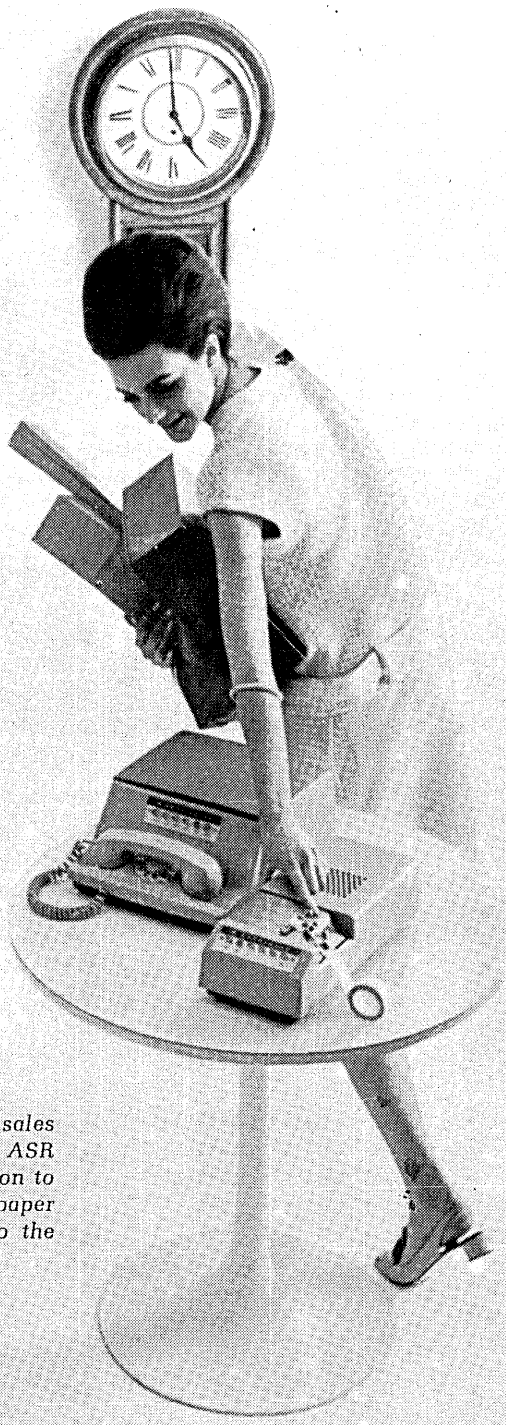
A general curve processing system being supplied to Fort Belvoir consists of a Grafacon, PDP-8, keyboard-typewriter and an x-y recorder. (See Fig. 2, p. 50) Curves are traced on the Grafacon, processed by the PDP-8, and results are drawn on the x-y recorder. Programs supplied with the system process continuous curves or points representing logarithmic or linear functions. Mnemonic commands typed on the system keyboard adjust scaling and control curve addition, subtraction, multiplication, division, integration, and differentiation. Approximately 2.5K of the 4K memory is used for curve processing, and the remainder of memory is used to store curves.

proposed applications

Expansion of Grafacon applications in creative environments will probably be paced by the development of software systems such as GRAIL, and by user acceptance of computer graphics as a way of life. Expansion of applications in the technical environments depends upon the definition of specific user problems to a degree that problem-

Keyed to accurate data collection

Throughout the day, this girl is typing sales orders using a Teletype Model 33 ASR (automatic send-receive) set. In addition to preparing page copy, she punches a paper tape off-line for later transmission to the home office.



Keyed to move data unattended

At the flick of a switch, this table-mounted Telespeed 750 tape-to-tape sending set is placed in a "ready" position to transmit the entire day's incoming sales orders at 750 words per minute without an operator present.

keyed to keep data moving

Data. You can't manage a vast field sales force profitably without it. And Teletype terminal equipment offers the simplest, most reliable method of collecting, integrating, and distributing data. Teletype machines put your data processing system on-line. Move facts and figures. Provide the vital data needed in time to make effective marketing, sales, distribution, production, and inventory decisions. They provide data for planning, data for action. Link all departments, plants and field offices in a moment. Day and night . . . Teletype equipment is keyed to keep data moving.

The capabilities of Teletype equipment are more fully described through actual applications in a brochure, "HOW TELETYPE EQUIPMENT MOVES DATA FOR YOUR BUSINESS OR INDUSTRY." To obtain a copy, contact: Teletype Corporation, Dept. 81G, 5555 Touhy Avenue, Skokie, Illinois 60076.

Keyed to work after hours

The home office Telespeed 750 high-speed tape-to-tape receiving set can be equipped to poll all branch offices at night automatically and unattended. Each office will be called in sequence to send all its data accurately and economically.

Keyed for timely decisions

In the morning, taped data is translated into page copy by a Teletype Model 35 ASR (automatic send-receive) set to further process the sales orders. Punched data can also be fed into a computer to provide management with up-to-date reports for production scheduling, sales analysis, and inventory needs.

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CIRCLE 23 ON READER CARD

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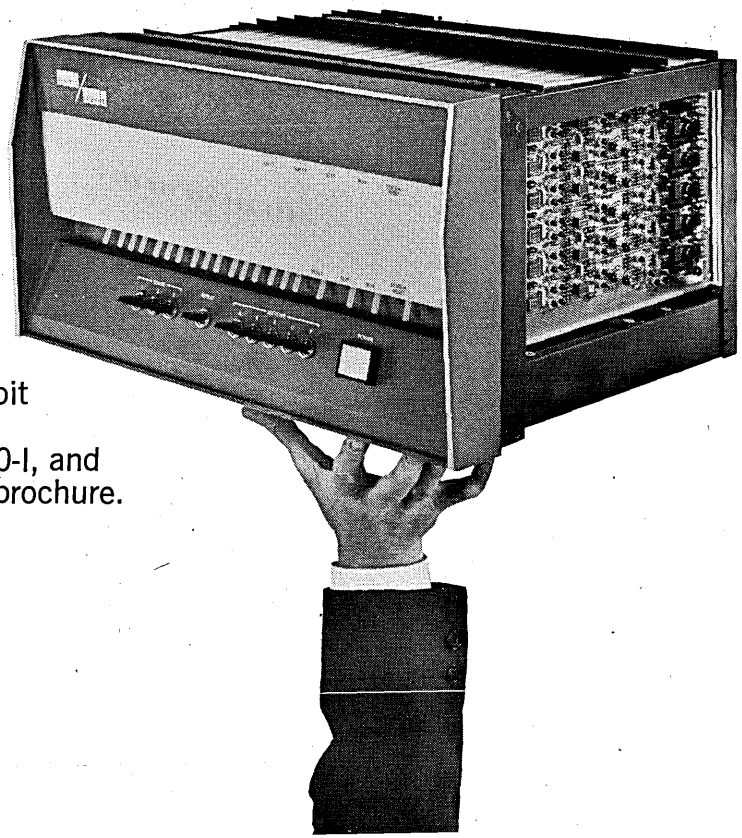

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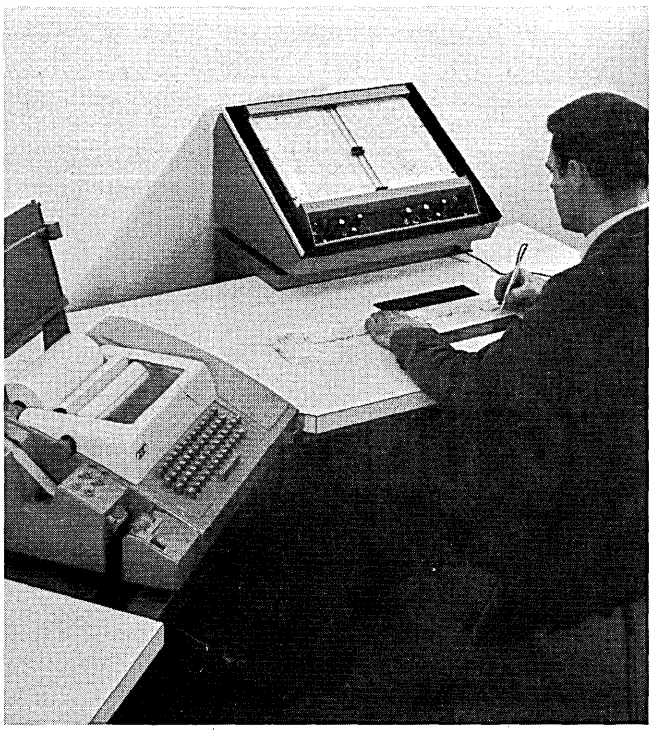
CIRCLE 26 ON READER CARD

solving systems can be developed.

One application under development involves the automatic preparation of perspective drawings for architects. Here the technician uses a Grafacon to trace elevation and plan views of proposed buildings. Perspectives are then drawn automatically on a digital plotter from several points of view. The system will also provide "walk through" views from within a group of buildings. As a fringe benefit, areas and volumes are computed as an aid to cost estimating and drawing checking.

Fig. 2. General curve processing system using a Grafacon, PDP-8, and X-Y recorder.



In the operational environment, a process-control application is being developed. Typically, when a control computer is installed in a processing plant, the computer is inserted between the operator and his plant. To make the process control scheme work, the operator must communicate with the plant through the computer. Where he formerly looked at an instrument in the context of a meaningful process flow diagram, the operator is now required to identify the instrument by an alphanumeric designator, and must set switches and push buttons to find out how the computer is reading an instrument.

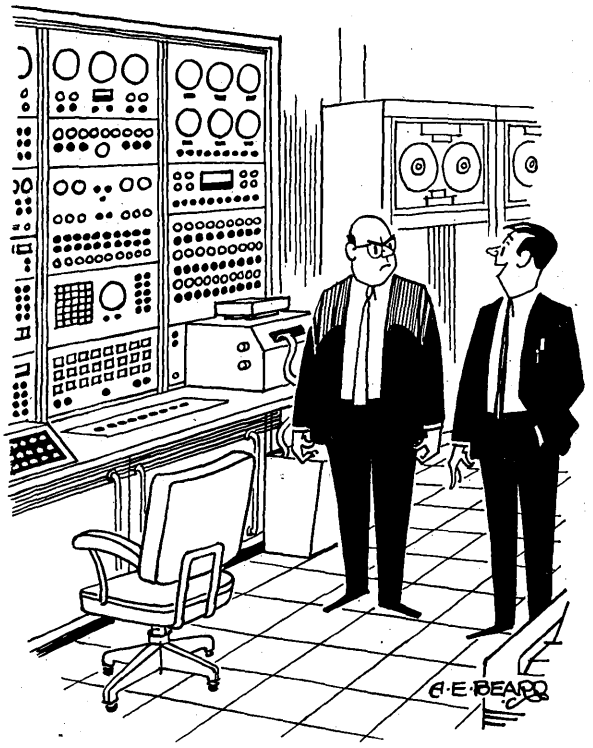
The Grafacon will show all instruments in the context of the process, and a legend on the edge of the diagram will permit the operator to select operating functions (e.g., request logs, set alarm limits, etc.). The operator uses the Grafacon stylus to point at the things he wants. Another benefit of the system is the ease with which the instrument and control functions can be changed: it is only necessary to change the drawing and the program response; the hardware is not affected.

In the process control application, a conventional CRT-light pen could be used, but the burden of the pen-tracking program would be a significant handicap for a real-time system.

The process control application illustrates the concept of selecting an item by pointing to it in the context of a familiar arrangement of items. This "context-addressing" concept could have wide applications in management information systems, where the user doesn't know the name of what he wants, but can identify it when it is surrounded by other familiar items. Specifically, a family of organization charts might be contained in the magazine of a slide projector, and any chart could be accessed by proceeding downward through the hierarchy of charts. Computer file data associated with the charts might be indicated by a table on the charts. Pointing to the table item would store or retrieve the desired information from the computer's file. As used in an information system the slide-projector/Grafacon equipment provides low-cost memory and relieves the computer of the burden of displaying a large volume of constant data which is of only transient interest.

While a light pen or Grafacon can be used interchangeably in many applications, either one or the other will usually have a clear-cut economic and/or operational advantage when all factors are considered: price, operator fatigue, programming burden, etc. However, in some applications the Grafacon has a purely mechanical advantage: tracing from hard copy, immunity from high ambient light levels, and operation with large, distant displays (e.g., command and control centers).

The price of the Grafacon is approximately $10,000. Interfacing hardware costs range from $500 to $15,000, depending upon I/O controller requirements. Although this cost is higher than light pens and some other types of digitizing equipment, the saving in computer program burden and the saving in operator frustration often justify the cost differential. Simplifying the man-machine interface seems to be worth the price. ■



"Ah, they don't make 'em like that anymore."

CHICAGO'S POLICE EDP SYSTEM

substantial progress

When Orlando W. Wilson, superintendent of the Chicago police department, took over his job more than seven years ago, he installed, almost immediately, an edp system. Although Chicago police officials are reluctant to boast and indeed go out of their way to avoid doing so, they obviously regard themselves as pioneers if not leaders among the world's police departments in their use of data processing in day-to-day police work.

Chicago's chain-smoking "scholar-cop," who is heading into retirement Aug. 1, looks upon the edp system as among the great achievements of his administration. Asked to evaluate the department's work in edp, Wilson, whose seemingly leisurely method of choosing his words seldom prompts him to say more than is necessary, sums up simply: "We've made substantial progress."

His director of data systems, Richard Golden, describes a future that includes third generation equipment that should be installed by the end of 1968. At present the department is using an IBM 1410 with 80K core, 12 1014 typewriter terminals, a 1301 disc, and six tape drives. In operation since 1962, the system is used in a variety of real-time and batch process applications. For example:

It helps the policeman on the beat —via radio from a patrol car or a telephone—to check out whether a suspected automobile has been stolen. Time: about 10 seconds after the request has been received at the headquarters' "hot desk."

Information on wanted or missing persons is also available to the police officer on the beat 10 seconds after his request has been received at the communication center in the department's headquarters.

Into this center every day come about 2,500 requests from Chicago policemen concerning persons or vehicles. Other police agencies from outlying communities also may obtain this information by relaying their request via telephone, Teletype, or radio.

a clear picture

Besides these real-time applications, Chicago's edp system is designed to give police officials a clear picture of what the action is and where it is taking place. It compiles reports that show precisely what kinds of crimes have been committed and what other non-criminal incidents (which total about 80% of police work) have required service. This information is weighted according to its seriousness; it is described as to kind; it indicates, among many factors, the incident—where and when it took place—and its ultimate disposition. Each of the city's 21 district commanders is thus able to get detailed information as to what is happening in his own district and to compare his district with others and the city at large. Even weather statistics play an important part in the department's fact-gathering because police experience indicates that crime is related to temperature and precipitation. (Warm, dry month? Watch out!)

The facts and figures thus compiled enable police officials to make a number of administrative decisions. For example:

The allocation of manpower is revised twice a year. Men will be assigned to beats where they are most needed. As the city changes and as the socio-demographic factors of metropolitan life shift, the need for men changes as well. "Every square block within the city," says Superintendent Wilson, "gets service in proportion to need insofar as we can measure it."

Similarly, whether patrol cars are manned with one man or two is a decision made with the assistance of computerized findings. Since arrest incidents are weighted according to hazardousness, police administrators are able to assign two-men patrol cars where they are most needed, and one-man cars where there is less likelihood of continual danger.

How to best maintain a squad of 1,800 patrol cars is also assisted by edp. "The precise time when it is most advantageous for us to trade in an old car for a new one—that's what we use edp to tell us," says Director Richard Golden.

The frequency with which reports are updated depends upon the nature of the information being compiled; the list of stolen vehicles is changed six times a day; wanted persons, once a day; reported crimes, once a day; arrest files, three times a month; auto cost data, once a month.

cost

How much does it all cost? This year's budget, which breaks down to approximately 30% for equipment and 70% for personnel, adds up to $1,365,000. Edp Director Golden explains that the figure is high because it includes systems analysis and conversion costs related to third generation applications for which equipment is not yet installed. Studies are now being made as to which computer manufacturer and terminal vendor will

be selected. By the end of 1968, when the new equipment will be installed —Sanders Associates 720 Data Displays are now replacing second generation terminal devices—the ratio between equipment and personnel should approach 65/35, he says. The department's current equipment is on a lease-purchase plan. Since the department must deal in annual budgets approved by the City Council and cannot commit itself into future years, the IBM plan available to municipalities with right of 30-day notice for annual cancellation has been found to be attractive. Furthermore, in Chicago's rejuvenated police department, money for this modernization has always been approved by the city administration.

Golden and his staff are looking to the day when their third generation equipment will be installed and fully operative. Plans for the future are grouped into three phases—first, the automation of a manual file of some 4½ million names (persons arrested, witnesses, victims, etc.) for direct access from headquarters and outlying districts; second, data retrieval by the CRT terminals to and from outlying districts as well as headquarters; and, finally the inauguration of a system of direct entry and direct updating from outlying districts.

Discussing Chicago's edp system, O. W. Wilson anticipates the visitor's comment:

"No," he says, "crime does not stop at the city's boundaries."

That is why Chicago police make available to their suburban neighbors information in their edp files. Yet if the smaller, suburban community is to make maximum use of edp methods, it too will eventually have to provide equipment to tie directly into a larger system, made available either by a central city or by the state. Wilson agrees that unless smaller communities make use of computers on some kind of shared time basis they will generally be unable to afford them. The state will either provide a statewide system into which the local community can tie in or the local community can "buy into" a larger system such as Chicago's.

Statewide systems have been proposed and are in various stages of development in Michigan and in New York. Another edp system is being developed in Washington, D.C., and five surrounding counties. In St. Louis an excellent real-time system is operative and in Alameda County in the San Francisco area (see March, p. 28) —an areawide system is in effect.

Chicago police are tied into Washington's National Crime Information Center via two telephone lines, using two IBM 1050 terminals. Information for the present is confined to stolen vehicles, stolen property by serial number, lost or stolen guns, wanted persons for whom a state is willing to undergo extradition proceedings. When third generation equipment is operative there will be computer-to-computer communication with the NCIC as well as with such agencies as the State Department of Public Safety and the Secretary of State (auto registrations, license numbers, etc.).

security

The security of information is always a concern. Chicago cooperates with suburban police officials, the states attorney's office, and provides information to the county sheriff's office on a limited hook-up basis. Reports based on the accumulation of data are made for other agencies with the permission of the superintendent. An example of one report: the extent of vandalism inflicted upon Chicago school buildings, made for the Chicago board of education.

Since all equipment is now in police headquarters, security has not been a problem. With the advent of equipment in outlying districts the problem will become somewhat greater. Officials have not yet determined whether they will institute software or hardware security procedures, says Golden, but at present they are leaning in the direction of software.

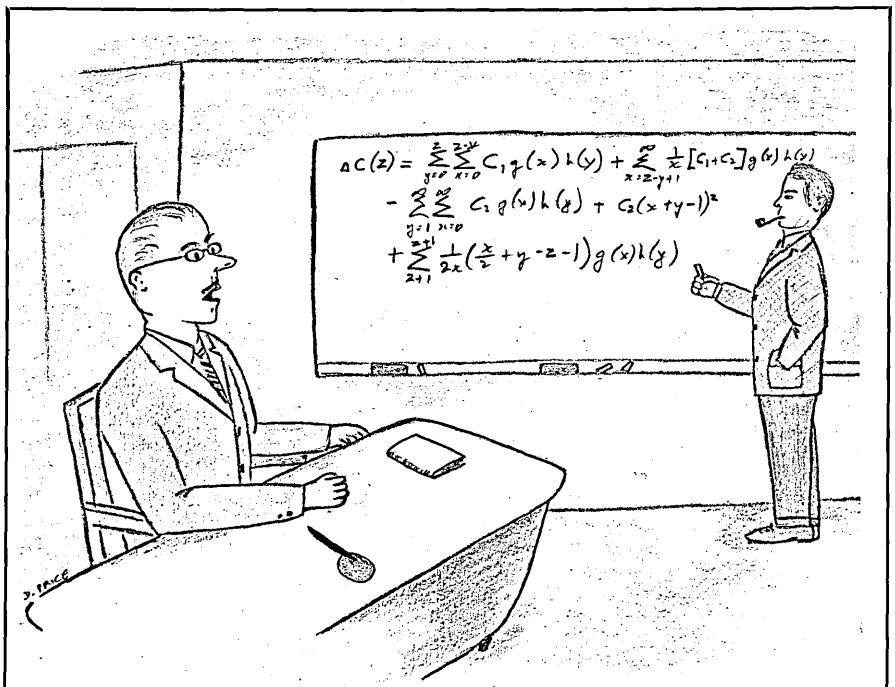
One point both Richard Golden and O. W. Wilson stress is that edp is an advancement of speed and efficiency, but does not alter the nature of the records being collected. The laws that now apply to manual files apply with equal force to information collected and stored through edp.

"Nothing new has been added," says Superintendent Wilson. "We're collecting and recording the same information and we're guarding it with as much care as we do our manually recorded data. The big difference in edp is its speed and efficiency."

future

For the future, Superintendent Wilson sees a "vastly enlarged retrieval system." Only a few years ago the department's data retrieval was limited to stolen vehicles. Now it applies to missing persons, wanted persons, escapees, AWOLS, stop orders, and the like. Stolen property of all kinds could be listed, just as is now the case with vehicles. Information on bikes, watches—indeed almost any object with a serial number—can be recorded and retrieved. Objects in pawn shops can perhaps also be recorded by serial number (since objects stolen throughout the metropolitan community, Wilson points out, "often find their way into Chicago pawn shops"). And of course the direct entry and access of information from across the city, from each of the city's police districts, will provide quicker reaction time to improve the odds in the contest between police and lawbreakers.

—LAWRENCE RAGAN



"But it's not that simple!"

© DATAMATION

INFORMATION DISPLAY SYMPOSIUM

conference report

Members of the Society for Information Display found their conference interesting enough to compete successfully with the other attractions of San Francisco; all technical sessions of the hybrid technical society were crowded—even a special off-night program on holography.

The mixture of ID technical disciplines is extensive. Among topics discussed by the 750 SID participants meeting May 24-26 at the Jack Tar were: magnetic particle displays, plasma cell discharge, lasers, CRT theory, world-wide Comsat switching, Kalvar film, dry silver imaging, tactile displays for the blind, remote displays and software at Mayo Clinic, particle physics, multicolored electroluminescent panels, surface-deformable media, multicolored photochromic film, three-dimensional CRT displays, and graphics in numerical information processing. As an added challenge, the keynote speaker urged delegates to master yet another discipline—practical economics.

keynote—cost effectiveness

Dr. Arthur L. Aden, vice president of corporate operations, Electro-Optical Systems Inc., delivered the cost-effectiveness challenge in the opening address. He said the potential for the future of information displays is tremendous, but challenges are "enormous" if the potential is to be realized.

"A major challenge—probably *the* major challenge—is to convert from the technically feasible to the economically justifiable, and thus meet the cost-effectiveness criterion." He noted that military, space, and probably in the near future health programs—those programs which involve national security and national prestige—are so urgent they can override cost factors.

He stressed the point that *all* other applications are evaluated by the "marginal utility of the service rendered." Thus the broad use of information display falls in areas where cost effectiveness will be the dominant consideration.

Other challenges he cited include the matching of displays to both the machine and the "narrow-band device" called man; overcoming management resistance to new methods; and guarding against displays becoming a bottleneck in future information systems.

Despite his warnings, Dr. Aden is optimistic. For computers, he predicts continued decline of data processing costs and continued rapid increase in national data processing capacity. Simultaneously, he believes, there will evolve greater softward compatibility, increased standardization of software, and extension from software to preprogrammed plug-in units sometimes referred to as "firmware."

Regarding information display technology *per se*, he sees these trends:

The cathode ray tube will remain king of the display devices for the immediately foreseeable future. Although a number of light valve mechanisms have been under investigation during the past decade (no papers on them were delivered at this meeting), none is yet ready to challenge the CRT, except in special circumstances. The same is true of the solid state displays.

The scanning electron beam remains supreme as a means for sequentially switching and controlling of individual elements. With the advent of thin-film active components, the prospects have improved for development of scanning circuitry arrays of solid state light emitters. However, a strong factor still operating against such systems is their inherent complexity and cost, compared with the well-established electron beam technique. There

are also trade-off limitations in key performance parameters.

The invention of the laser and the subsequent generation of images by the scanning of sharply focused laser beams have provided new potential capabilities in large display technology. However, evolution of significantly improved techniques for electro-optical scanning, among others, still are required to make this method a serious competitor for practical systems.

Over-all, he believes, there will be increased attention to integration of displays into complete systems. He also predicts increased flexibility in future displays, with more functions built into the actual display unit (storage, selective erase, etc.). Hard copy option and rapid update capability will continue to increase in importance.

Cost effectiveness will be the key to widespread acceptance of information display systems in business and other non-defense areas. These include education, printing, library service, health, weather, and personalized display use in the home.

The ultimate display in the foreseeable future will be a "versatile, solid-state, wall-type display several feet square in size," according to Dr. Aden. It will be capable of presenting images at TV scanning rates, as well as presenting stored information or slowly integrated information. Such displays will emerge because the need for them is increasing, and the technology—particularly the ability to synthesize special materials and devices—is improving rapidly. Basic new developments and merging of varied technologies will be required before such a display can be built, he added, concluding, "I will be surprised if we see this as an accomplished practical device before a decade has passed."

As though on cue from the keynote speaker, economy considerations threaded their way through the entire program. Perhaps not unrelated was the strong contribution to the symposium by educational institutions.

plasma displays

The paper which evoked greatest interest was presented at the close of the first session, and it drew approximately one-third of the delegates to an informal front-of-the-room Q-and-A period which ran well into the lunch break. Entitled "The Plasma Display—A New Device for Information Display and Storage," it concerned an invention by University of Illinois researchers H. G. Slottow, B. M. Arora, D. L. Bitzer, and R. H. Willson (now with Westinghouse). An outgrowth of the quest for a low-cost addressable display for the PLATO educational project remote stations, it will provide a direct selective-access matrix. The university expects to have 300 such stations in use by 1971, and 3000 to 5000 throughout Illinois by 1973. It utilizes bistable gas discharge cells in the center plate of a three-piece glass sandwich. Electrodes are deposited in the form of wire grids on the two outside plates, crossing at each gas cell. A mixture of neon and nitrogen is used for the plasma. It can be operated to provide lighted letters on dark background (preferred), or dark letters (dropped out) on a lighted field. Transparency of the unit makes it adaptable to backlighting. Full color is possible by use of three phosphors on each cell. Adjacent cells are spaced regularly at 0.025" intervals providing a density of 1600 per square inch. Properties include brightness, memory, display, simple structure and circuitry, selective access, and cycling time of 15 to 30 microseconds. The program received a boost from Syracuse Univ. Research Corp. which obtained $500,000 in ARPA support for an airborne military application; hardware is expected to be airborne in this project within 18 months. According to Dr. A. Sobel, of Zenith, plastic prototypes of the gas cell display have been successfully fabricated by his firm, which may guarantee the economy of future mass production. He said the outstanding feature of the design is that electrodes do not require access into the cells.

mac's plans

Another high-interest paper was "A Low-Cost Graphic Display for a Computer Time-Sharing Console," a progress report of work in Project MAC at MIT, by R. H. Stotz and T. B. Cheek. Their aim is development of a terminal with keyboard input and graphic output which can stand alone with information transfer by telephone line, at a cost of $5000 per station in volume production. Ideal criteria include 1 million points resolution in an 8½ by 11" format (4000 characters with equivalent graphic display), but they may settle for less. One indication of their problem: in the prototype, about $1700 of the total $5000 cost is represented by parts alone. In a design frozen for use of a storage CRT as the display element, they are between $5000 and $10,000 in unit cost, without benefit of mass production. In their cost-effectiveness drive, they utilize an incremental vector generator (X-Y plot) and two digital-to-analog integrators in a binary rate multiplier. The symbol memory is a 6720-bit diode matrix array contained on a single half-inch-square IC chip. They use a dot raster for character generation, and have adopted such shortcuts as formation of curved lines with numerous straight-line increments. They have achieved high resolution and high speed. Instead of correcting errors on the display, they are crossed out by light pen and eliminated when the display is regenerated. Cheek said they may later adapt a new display system such as that discussed by Slottow et al, or by others during the SID symposium.

The potential of remote displays for central computers in schools was suggested by luncheon speaker Prof. Patrick Suppes of Stanford Univ., now using standard teletypes modified with IBM displays computer-linked by telephone lines. About 900 stations are in use in the Palo Alto area; this fall the number will increase to 2000 including the addition of new facilities in Appalachia and Mississippi. The greatest potential advantage of such systems, according to Prof. Suppes, is individualized instruction geared to a student's capability, interests, and pace. The present program involves students from first grade upwards, including drill and practice work, tutorial individual instruction, and true two-way dialogue systems. This fall the facility will add a course in Russian for university credit, first eliminating the lectures, then absorbing language laboratory and homework in the automated program. A Model 35 Teletype with Cyrillic keyboard will be used.

Cost effectiveness was also a factor in a paper presented by W. D. Fuller of Lockheed (Sunnyvale), who discussed remote addressable displays for medical use in hospitals. His paper was entitled "Physician-Machine Interface in a Hospital Information System." Fuller noted that $15 to $18 per day of the average hospital bill represents manual processing of information. By using a portion of this cost to pay for medical automation, the balance could be eliminated, Lockheed reasoned. After surveying four hospitals, the firm designed and built pilot "video-matrix terminals" presently in use at the Mayo Clinic in Rochester, Minn. The system offers a physician a visual input/output system from a remote station. A light pen is used for selection of a function code of increasing instructions, medications, etc.

High-speed printers are being incorporated to provide hard copy for physicians' signatures as required by law. Redundancy of computers is required for 100% reliability over 24 hours. Six different computer combinations are contemplated, dependent upon the requirements of a single installation. Lockheed is presently constructing 1900 video-

matrix terminals for use in the first full-size installation, which will include Mayo Clinic and nearby St. Mary's and Methodist hospitals. Fuller said a marginal "black-ink" operation might be set up with 2000 beds in a minimum of seven hospitals, but 12 to 15 hospitals is best as a starting point.

ibm experiments

Two experimental systems were presented involving graphic displays. Carl G. Beatty, IBM (Kingston), discussed a "Graphic Approach to Numerical Information Processing (GATNIP)," in which numerical information is selectively extracted from existing data files and summarized in the form of a graph, displayed on the firm's 2250 display unit. Automatic scaling and dynamic on-line plotting are provided. Aimed toward the business market, a demonstration showed progressive selection, through the display console, of stock market data, first from various categories of stocks, then from lists of specific stocks plotted over a specified period, later a single stock over a 5-month period, then an expanded portion of the single-stock graph. The number of graphs which might be generated with the system from a single data file is virtually infinite.

E. T. Johnson, IBM (San Jose), discussed a "Graphic Output Adapter for Remote Plotting," which utilizes a unique and simplified plotting scheme involving simply X and Y coordinates, and horizontal, vertical, and 45-degree vectors. Even alphanumeric notations are formed with these elements. It is designed for use with the firm's 1051 and 2741 typewriter terminals over voice-grade telephone lines.

In addition to the plasma cells, a number of other promising new display techniques were discussed. Dr. G. J. Chafaris, GE Electronics Laboratory, described the use of "Surface Deformable Media as Applied to the Generation of Projection Command and Control Displays," with specific reference to an 8-by-8 ft. square wall unit containing 9 million display elements which can be updated in half a second. Electron beam writing is done on 70-mm thermoplastic film. A 50-mm-square film section is sufficient to record all 9 million point registrations, which are then projected. D. A. Morgan, T. J. Werner and W. H. Libby, 3M Co. (St. Paul), discussed "Dry Silver Recording Materials for Display Purposes." This negative-operating photosensitive system requires only

THE EXHIBITS ...

Several hardware innovations were introduced by exhibitors at the Eighth Symposium of the Society for Information Display in San Francisco.

Sylvania had what it claims is the first commerically available single-gun tube providing readout in two colors. The Type SC-4689 features excellent color separation from red to green by switching voltage on anode No. 3 from 6000 to 12,000 v. Multilayer phosphors of red and green are utilized, and high resolution is claimed. A 5-in.-diam. circular tube was exhibited; larger sizes to 27-in.-diam. are under development and custom inquiries are invited. Features include electrostatic focus and deflection, and spiral post deflection acceleration.

Stromberg-Carlson introduced its new 3-discrete-level integrated display, which features rear-port projection of static background in color, Charactron alphanumeric symbols and vectors for real-time computer data, and a low-speed colored data-track capability, all on a single display tube. The scribe system is employed to generate relatively low-speed displays. This is essentially an x-y plotter fitted with a stylus which etches a moving trace on the opaque surface of a projection slide. Symbol resolution through the real-time Charactron exceeds 5000 lines.

Granger Associates displayed a high-resolution 1029-line CCTV system, Model V1000, which was used in a program relay from the auditorium to the exhibit area throughout the 3-day meeting. It offers 30 MHz bandwidth for high horizontal resolution at high line rate (1000 lines horizontal, 720 lines vertical). The camera is about the size of a carton of cigarets.

Ferranti showed a new A2 phosphor which it claims is the fastest available. A2 is a green phosphor with ultra-short persistence, more burn resistant than Q, said to be suitable for flying-spot scanner applications. Another new Ferranti product exhibited is the MA100 microspot analyser which offers four methods to measure resolution. Ferranti also introduced a new Ceramic Tube 161, which features a tube envelope constructed from ceramic cylinders. Electrodes are formed by metal discs or by metallising the inner wall of the ceramic cylinder. The 0.5-in.-diam. tube will resolve 500 lines.

Raytheon introduced a series of self-locking, push-to-turn knobs designed for applications where control settings must be maintained under conditions of shock and vibration. Raytheon also exhibited an unusual new series of keyboard switches designed to simulate the action and touch of fine typewriters. All are designed to plug into a 0.125-in. PC board. Contact pins snap and lock the switch into place for soldering, allowing flow-soldering fabrication techniques.

Six new rectangular CRTs were shown by General Atronics. They were the M-1252, all electrostatic with a rectangular helix and a mesh deflection system, in a 4 × 5 in. configuration; T-543-A, a 5-in. flat-faced tube with electrostatic focus and deflection; M-1234, a 3 in. magnetic deflection and electrostatic focus tube; 4QP, 3¼ × 2¾ in., designed for use in compact transistorized equipment; M-1248, a 5-in-diam. magnetic deflection tube for minimum power/space applications; and M-1225, a 2⅝ × 4⅝ in. electrostatic focus and deflection tube with very high deflection sensitivity.

Gamma Scientific introduced its new Model 2020 microphotometer, designed for scanning CRTs, measuring light intensity of the spot, and (with appropriate apertures such as double-slits) to make line-width measurements. One of the most useful projected applications is for profile measurements on IC masks. It is able to provide full-scale indications to 0.05 ft.-Lamberts over an area diameter of 0.01 in.

moderate heating for development, and is fast enough to record a frame of video material with up to 1500 lines/mm resolution. "A Novel Application of Magnetic Technology to Electronic Display Devices" was introduced by Richard C. Sinnott, Sinnott Co. (San Mateo). By combining alternating and static magnetic fields with permanently magnetized particles, black lines or dots may be formed on a white background. A matrix of such lines or dots is combined in this process to display alphanumeric symbols. The author said the device has survived a 30- to 50-g shock in memory mode (power off).

"Tactile Image Projection" to transmit images to the blind was discussed by C. C. Collins, Presbyterian Medical Center (San Francisco). A TV camera views the object to be projected, and a video matrix switching system converts the image to a "dot pattern" on a bank of regularly spaced styli. The styli transmit pictorial information by impressing the dot pattern on the skin forming a crude "half tone" image. The blind can "read" with such methods but rates vary widely between individuals; reading speeds to 60 wpm have been achieved in similar projects, through the fingertips, which are the most sensitive skin areas used. This system is designed to expand the technique to image projection, augmenting the reading skill.

laser progress

Laser display progress was discussed in two presentations. Samuel M. Stone, of the GT&E Bayside Laboratory, described an "Experimental Multicolor Real-Time Laser Display System" which produces three-color images in real-time. Although admittedly far short of the ideal goals for laser projection, the system is an operative test bed for new components as they evolve. Two lasers are used, an argon-ion laser emitting blue from one end and green from the other, and a 1-meter He-Ne laser for the red.

Randy Sherman, Technical Operations Research (Mountain View), presented "Motor/Bearing Breakthroughs in Ultra High Speed Laser Beam Scanners," which concerned a 200,000 rpm synchronous solid-state motor with a long-term phase stability of ¼°, and a self-lubricating bearing with a minimum life of 1000 hours operating continuously at 120,000 rpm. Bearing performance to date is so encouraging that an additional 1000 hours at 180,000 rpm is expected without difficulty. Success will provide a major step in perfecting laser scanning techniques.

W. F. Miller and J. Van der Lans of SLAC (Palo Alto) discussed "System Design for CRT Film Scanning and Measuring" supplemented by "Display Control of a CRT Film Scanning System" presented by C. R. Dickens, also of Stanford. It comprises a complete film data analysis system including a digitizer, an IBM 360/50, and a package of analysis programs. A high-resolution CRT serves as a spot generator in a device to digitize film generated from bubble chambers in particle phsyics experiments. Scanning is entirely under control of the computer. Anywhere from 10^4 to 10^6 events recorded on 35- or 70-mm film must be analyzed with each experiment. Dickens described means used to reduce human interaction in the procedures involved.

C. Norman Winningstad, Tektronix (Beaverton), evoked much interest with his discussion of "The Simplified Direct-View Bistable Storage Tube in Computer-Output Applications." Through design trade-offs between collector potential and target potential, he showed how performance can be enhanced, including significant extensions of tube life. Winningstad also stated substantial savings could be thereby provided in fabricating storage tubes and appropriate electronics for remote terminals.

Another tube development was provided in "A Com-

puter-Controlled Multichannel CRT Television Symbol Generator," by Raymond Winfield, Sperry Gyroscope (Great Neck). In this generator, an alphanumeric composite target is formed with 40 switchable matrix segments. Winfield said the generator is easily interfaced with a computer for automatic control of character selection and character display positioning, and he described an IC design, based on the new CRT, to implement channel capacity growth.

Leon S. Yaggy and N. John Koda, Hughes Aircraft (Oceanside), described "A Versatile, High-Performance Scan Converter Storage Tube" which is capable of accommodating the extreme diversity of input information associated with multisensor displays. Resolution is 1600 TV lines per diameter at 50% response, and about 2000 lines at 25%.

One mystery remained unresolved in the paper "Automated Display Chart for Program Management," by Donald J. Hilt, Boeing (Seattle). The chart employs a new technique in projecting up to 3500 alphanumeric characters from Kalvar dry-processed film. Data are computer-generated and displayed in virtual real-time for management consideration. Hilt did not say how the system uprates Kalvar film from the manufacturer's specification of 200 line pairs/mm, to the Boeing resolution of 2000 line pairs/mm. He did say about half the improvement is achieved by reverse exposure, through the transparent film base instead of on the emulsion side; Hilt said the emulsion contains a thin oxide coating which interferes with resolution (his firm has patented the reverse exposure process). Additional improvement may result from Boeing's use of a Litton P-16 phosphor (uv) and Litten-optic face-plate tube with exposures at 833 in/sec, and development at 245° F in half a second.

what comes next

Privately, both Jan Engel, technical program chairman, and William P. Bethke, national SID president, expressed disappointment that no comprehensive papers were submitted on the subject of display standards. The society is extremely interested in establishing standards, and will devote an entire session to this topic during the Ninth Symposium in Los Angeles next March. Bethke said, "We welcome comment, violent or otherwise!" Several SID committees are already engaged in standards studies.

Bethke said SID is also actively engaged in a program to bring its members closer to scientists in allied disciplines such as the computer field. During a directors' meeting in San Francisco, the first steps were taken to affiliate with the American Federation of Information Processing Societies. Sol Sherr, past national vice president, will coordinate liaison activities.

Bethke agrees with Dr. Aden that the current challenge to ID design is cost effectiveness, but hedges on the status of technical capability. He reasons that a tremendously broad and sophisticated technical capacity has evolved in the past 20 years of display development. In addition, design flexibility has also evolved as a natural outgrowth of changing emphasis in both industrial and military displays. Bethke contends the technology permits achievement of any goal, if dollars are available for the R&D, which returns the discussion immediately to cost effectiveness.

—Robert L. Mount

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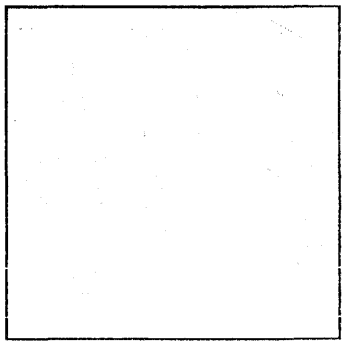

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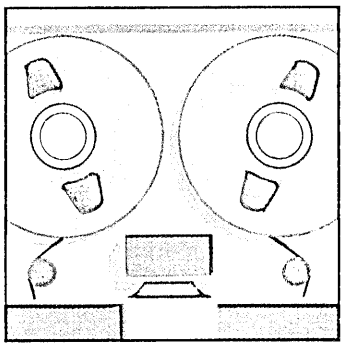

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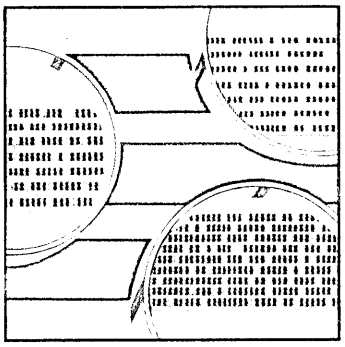

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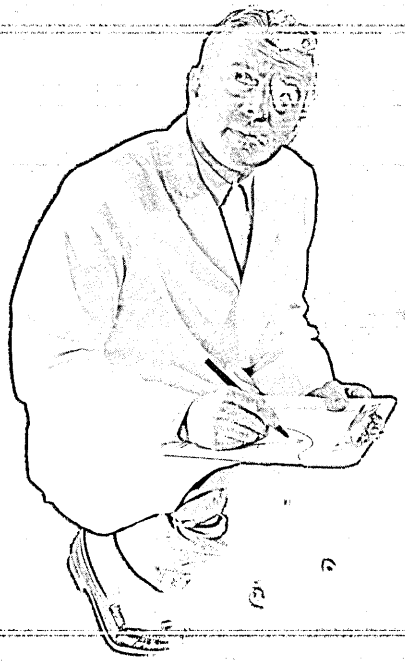

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CIRCLE 30 ON READER CARD

a conference report

CANADA REVIEWS THE COMPUTER IN SOCIETY

In the land of Marshall McLuhan, the Toronto section of the Computer Society of Canada assembled an impressive array (or was it a string?) of speakers to consider "The World of Computers — Today and Tomorrow." Appropriately enough, the first speaker was Arthur Porter, who will take over McLuhan's Center for Culture and Technology at the Univ. of Toronto as acting director next year, while the oracle of communications takes up his $100,000 scholarship at Fordham Univ. in New York. Dr. Porter, who heads Toronto's Dept. of Industrial Engineering, was chairman of the advisory committee for science and medicine for Expo '67—the Montreal Universal Exhibition which Ed Sullivan called the best World's Fair ever put on. The reader will—I hope—forgive this plug in Canada's Centennial Year.

Appropriately, too, the day was opened with a colour-slide commentary on the far-reaching influence of computers on society, to the background of lively go-go music. The slides, prepared by Bill Kerrigan, president of the Toronto section, presented a rich variety of colourful pictures of all aspects of life: rice pickers, huge farm machinery, stage coach, spaceships, hockey, the pill, etc., interspersed with grey pictures of computers and the men who run them. This mosaical experience, which current fashion would call "McLuhanistic" and "psychedelic," seemed to say: "Where is the Impact?—Everywhere".

However, when one looks squarely at the here and now, as the chairman of the seminar, Pat Hume (another television personality of the Univ. of Toronto) asked us to do, one realizes that the computer has not really changed our way of life so far—though it is pregnant with potentialities to do so.

Professor Porter deplored the tendency of the press to harp on job displacement and the fear of a mechanistic society. The computer, in his view, is a new step in biological evolution, a sophisticated tool of mankind. Breakthroughs were always treated with suspicion: printing was rejected by the medieval professors. The major objective of the computer is to aid learning. It will aid us in pattern recognition and pattern building tasks basic in learning to adapt to the environment. Responding to the exponential growth of change and limiting it is not the job of the universities; multidisciplinary dialogue is the major need.

G. T. McColm of the Science Secretariat of the Government of Canada outlined Canadian government policy and financing of science. It emerged that support for computers has significantly declined as a percentage of the science budget!

S. D. Baxter, chief of the National Research Council's Computation Center reviewed computing in scientific research in Canada. He told us that even today many scientists feel they cannot delegate their programming tasks. The scientist must remain selective in choice of research area, not let his fascination with computers sidetrack him into less fruitful areas.

in education

Tom Hull of the Univ. of Toronto, who is on the advisory board of the School Mathematics Study Group as well as on the Curriculum Committee of ACM as chairman of Graduate Education, outlined his ideas on high school computing education. The question is not whether it should be taught, but what should be taught.

Basic principles should be stressed, with procedures as the central focus. This can be implemented on various levels in the different streams of the secondary education program—arts and science, business and commerce, science, technology and trades. It is easy to motivate, and will help shift the emphasis from pure mathematics to applied mathematics, which—he pointed out—is still good mathematics.

When he suggested that computer-assisted instruction may well go the way of machine translation as an unfilled promise, great applause greeted his suspicions. (Although I do not think that "the medium is the message," the medium does dictate the form the message must take for it to be effective. Computers can do things for education which are impossible to do in any other way, but computer-assisted instruction tends to be a book packaged in a slightly different manner). W. T. Newnham, president of one of the new community colleges of Ontario,

the Seneca College of Applied Arts and Technology, outlined the data processing programs being introduced into the high schools and the community colleges.

For a provocative but thoughtful luncheon speaker, the deputy leader of the New Democratic Party in the Canadian Parliament was invited. To him, "automation and cybernation" are primarily the means to improvement in the quality of life for the individual. He looked forward to economic and social planning made possible by more accurate, reliable and timely forecasting. Though technological change does not have to bring unemployment with it, it necessarily involves the displacement of large portions of the unskilled and semi-skilled workforce. He quoted a U.S. study which showed that of the 4 million new jobs created in the period 1957-1963, 81% were absorbed by the public sector, for 14% no breakdown was given, and only 5% were shown to be absorbed by private industry.

He asked us to bend our prejudice about increasing public enterprise expenditures, for we are making this necessary to provide for the increasing numbers of the labour force, and also because only in this way can we fulfill some of the social needs of our civilization. On labour-management relations he asked that the introduction of new procedures and techniques should depend not only on efficiency and profit, but also whether it is socially the best thing to do at the time, and labour and government should have at least a consultative voice in these matters. He told us to stop complaining about increasing taxes, for only in this way can governments fulfill the ever increasing educational needs brought about by our technologies. He felt that governments will have to play larger roles in the economy, in distributing the increasing quantity of goods we are producing, to all of the peoples of the world. Finally, he foresaw a future in which there will be an end to "wage-slavery," a morality in which the sadistic ideal of "nose to the grindstone" will disappear.

management

After lunch we returned to the current problems of management. The chief economist of the Ontario Provincial Government, H. I. Macdonald, debunked, or at least modified, five current beliefs:

- Computers will reduce the total amount of work to be done.
- The consequences of computer applications are all net gains.
- Computers always improve decision-making.
- Computers made a qualitative breakthrough in human behaviour.
- Computers relieve us of all drudgery.

He then outlined the ways in which computers can aid in administration and in economic decision-making. The biggest limitations appear to be the shortage of trained programmers and unfamiliarity with the possibilities. A danger of over-reliance on formal computer-gathered data was brought out in the inventory buildup of 1966 due to overoptimistic sales forecasts based on past trends. (The cybernetic concept of overcontrolled feedback must be heeded: instant decision-making on highly up-to-date data may well tend to lead to unstable oscillations. I also feel that our built-in homeostats (resistance to change and inability to bring vast resources to effect sudden, radical change) save us from a lot of grief . . . otherwise the effects of our bugs, our failures and our over-optimistic planning could well cause chaos.

The next speaker was a "Toronto boy who made good," H. Aitchison, IBM corporate director of systems engineering at Armonk. He emphasized the need for "fail-safe, fail soft" backup methods needed in the management revolution, which are difficult to implement with real-time systems when the computer is put into the management loop. He identified three phases of innovation:

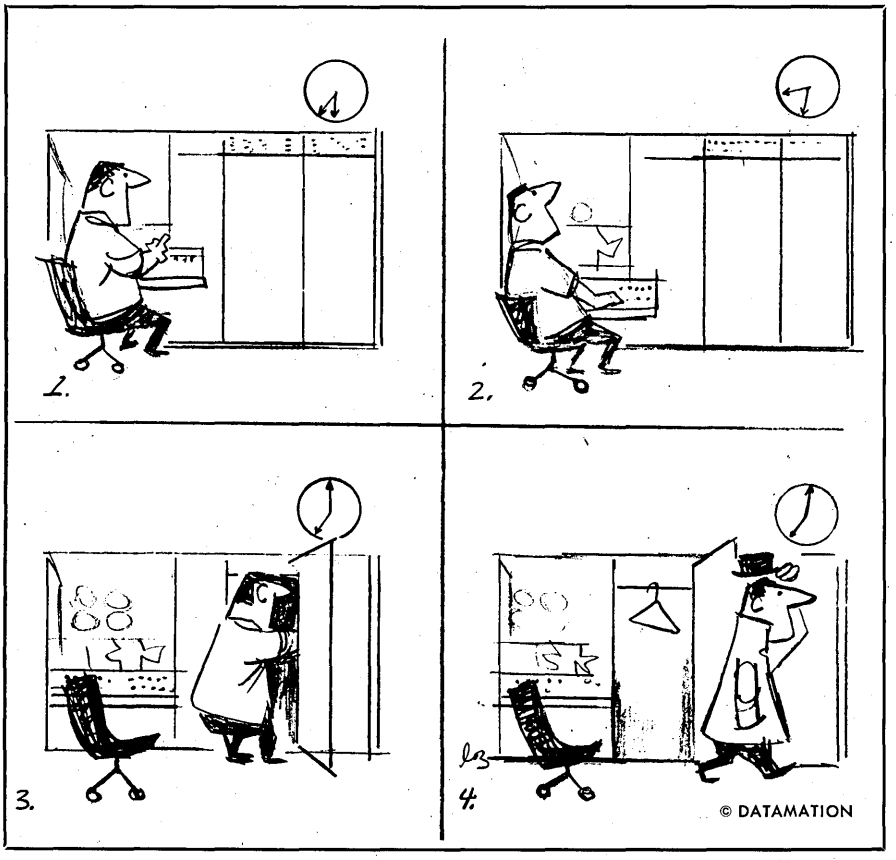
1. Improved efficiency (horseless carriage)
2. Improvement of end results by new techniques (today's car)
3. The innovation becomes a new driving force in our life (suburbia)

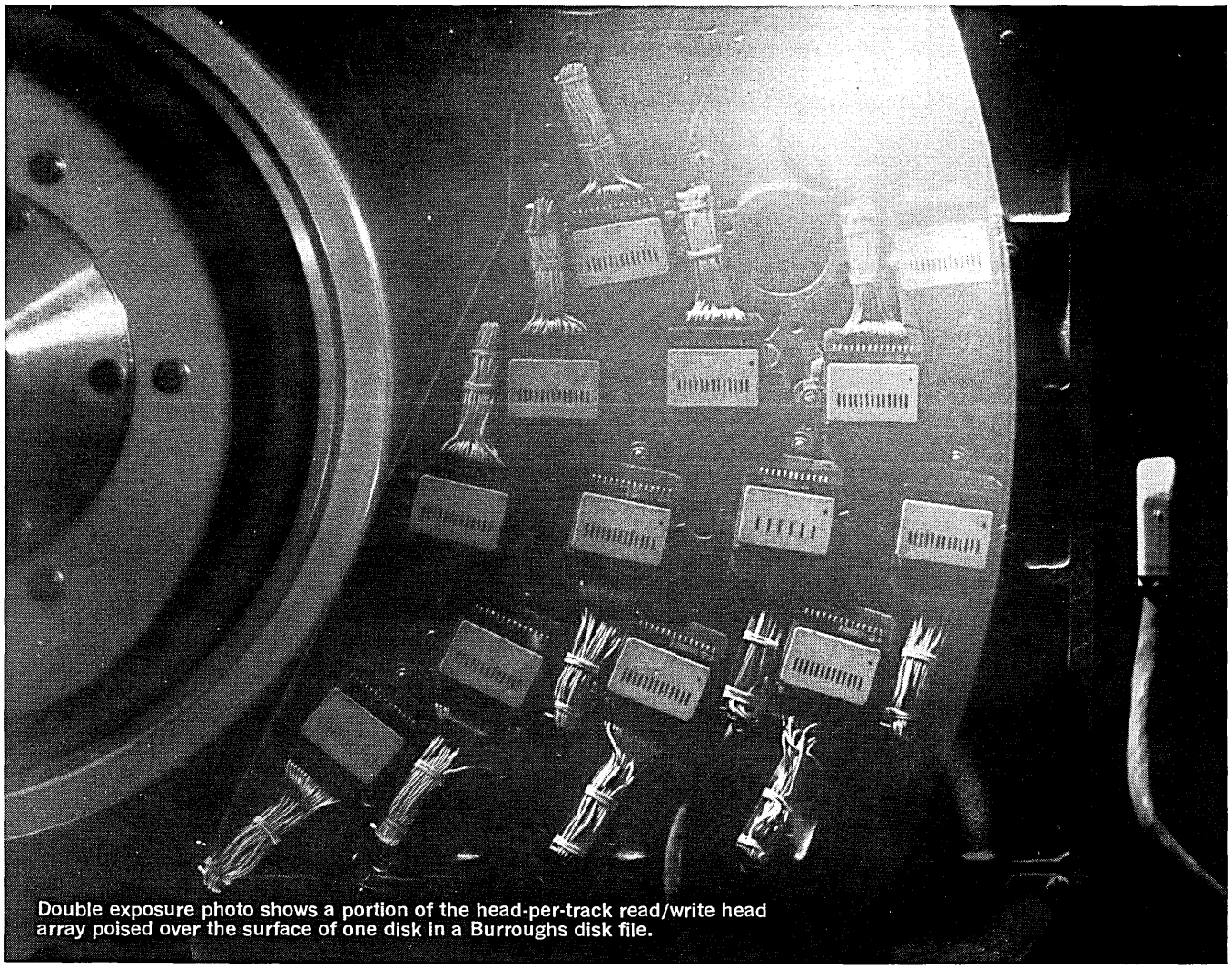
We are about to enter the final stage with computers.

He then described IBM's efforts to maximize computer use and management efficiency within IBM through a "dedicated" corporate vice president for this purpose. He stressed that the top executive's function is long range planning that does not require instant data and a computer terminal.

J. C. Davidson, executive vice president of Confederation Life Assn., outlined the introduction of the computer into the insurance industry, one of the most highly automated today. The medium-size life companies were early pioneers in introducing the "consolidated functions approach" with Mr. Davidson's company in the lead under his guidance. (I know, I was there). The emphasis has now shifted to management tools for long range planning and forecasting.

E. W. Haack showed us what the second generation of whiz kids—





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CIRCLE 32 ON READER CARD

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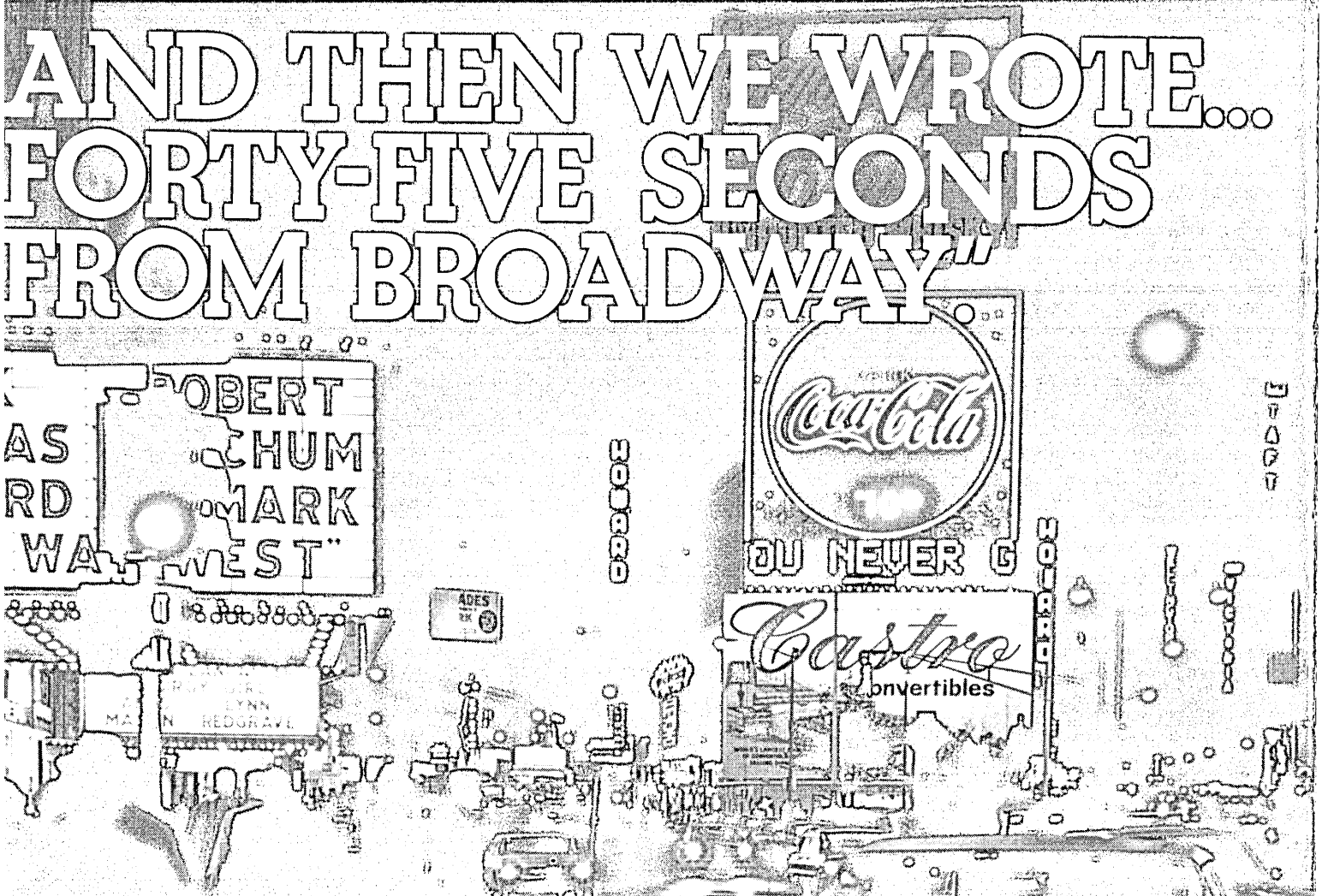

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computers dangling out of each pocket—are doing to the Ford Motor Co. It was one of the "Gee whiz, we have these 181 computers, and all these terminals, and all these plans, and 20,000 miles of magnetic tape" types of talks which I thought were no longer being made, at least not in computer circles. (Admittedly, it was the hope that more noncomputerniks will attend, but the vast majority of the hundred participants of the seminar were members of the Computer Society. The problem remains, how do you bring the considerations of such a seminar to the businessman, labour leader, government functionary?)

in the future

The final speaker, Les Green, partner in K.P.M., Canada's largest computer consulting firm, focused his crystal ball on the future of software and hardware. He pointed out that we still depend on that Egyptian mode of communication, the papyrus, using the computer to produce even more of it. The second generation of data processing will come when it disappears, when the typical worker will no longer be primarily concerned with carrying pieces of paper around. He foresaw less trusting of promises: tighter contracts, fewer software gambles, less hardware emphasis, use of tried and true equipment and software; i.e., a more business like procedure, except for research. Since I assume the reader has his own crystal ball I will not reproduce the equipment speed-cost trends.

Of course, operating systems came in for their licks, including the joke "What is a mouse? It is an elephant with an operating system." (I am sure it is supposed to be the other way around, but that is the way Les said it, and it did make me think). He thought that all software will be written in higher level languages in the future. His final prediction found great favour with this computer art enthusiast: The computer will become primarily an entertainment medium! Shocking? It is too important and serious a scientific and management tool? It is too expensive? So were radio and television, initially!

This was a most searching and stimulating session. What are the answers? Where are we today? Where is the impact? I do not know, but I do hope those programmers do not go out on strike, or we might find out.

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MEDICARE AND HOSPITAL EDP

This month marks the first anniversary of the Medicare program. With one year past, the problems—anticipated in any program of such scope—are beginning to emerge in definable shapes. For the nation's hospitals, the amount of paper work required by the Social Security Administration's billing forms is one of the major problems.

The problem of slow manual preparation of detailed forms is complex; each hospital is affected differently and there are many suggested solutions. In some hospitals, the workload is handled by one or two extra people—the "Medicare girls"—in the accounting department. For others, data processing equipment seems the only practical solution.

But how feasible would it be for all hospitals to install some type of system to handle—at the least—the SSA's three types of forms? About 80%[1] of the 7,100 hospitals in the country (approximately 5,680) are short-term general hospitals with an average patient stay of about a week. Yet despite their size, the volume of patient traffic is tremendous. These hospitals handle 38%[2] of the daily patient census, 92% of all patient admissions, and 72% of out-patient admissions.

The large majority of these hospitals are non-profit institutions, operated by religious or charitable groups, state or local government. The other types of hospitals are federal (355) and private (about 1,100, most of which are operated by groups of doctors).

The short-term non-profit general hospital is, then, the institution most affected by the Medicare program. The Medicare patient load, estimated to increase medical care work by a surprisingly low 5%, nevertheless takes its toll in the accounting department. The increased amount of paperwork is estimated by some to be double that of regular hospital accounting work.

Rotating between the hospitals and the Social Security Administration through claims processing intermediaries such as Occidental Life Insurance of California and Blue Cross, the program works this way: A patient enters the hospital, either for in-house care or on out-patient status (e.g., X-rays, lab tests). Following treatment, the hospital prepares the bill and sends it to an intermediary. The intermediary transfers the data to punched cards for its own records, and transmits a copy of it via paper tape to the SSA in Baltimore. After the patient's eligibility is determined by the SSA, reimbursement is sent to the intermediary, who pays the hospitals.

to start the process

To put this process in motion, the hospital is responsible for preparing one of three types of detailed billing forms. Form #1453 is concerned with Part A of Medicare—in-patient billing—and is processed through Blue Cross. Part B (form #1554) covers patient services by a physician, and is handled by various intermediaries (in California, by Occidental). The third and most complex form is for out-patient billing—a designation involving so many factors and determinates that most dp personnel feel it would be completely unfeasible to attempt computerization. (The definition of the term "out-patient" is so vague in the original Act, that a bill, HR 5710, designed to clear this up, is now before the House Ways and Means Committee.)

Medicare billing procedures require three parts to each bill: the amount paid by the government, the amount paid by the patient and the total sum. This differs from regular patient accounting by the inclusion of the government's portion of the balance due.

In addition to this extra detail, the receipt of government funds through reimbursement has brought the accounting departments of most non-profit hospitals real problems. Although federal and private hospitals had to keep detailed records for tax purposes, non-profit hospitals merely had to file tax-exemption certificates. Now, because they are receiving federal funds through the SSA, they are required to tabulate formal income and expense records to the satisfaction of Blue Cross and/or Government Accounting Office auditors.

Still, despite the paperwork obstacles, the installation of data processing equipment is not the answer in the smallest hospitals, or those in areas where Medicare patients are few. In this category, two community hospitals, Long Beach (Calif.), with 325 beds, and Centinela Valley (Calif.), with 146 beds, are examples. Medical records and billing information are recorded on source documents, picked up, processed and filed on mag tape at service centers. Billing at Centinela Valley will soon be done on a newly purchased Burroughs 4000 accounting system, but Long Beach has not felt the need for even tab equipment.

The very large hospitals have had administrative dp systems for a long time. The New York Univ. Medical Center (650 beds) shares the nine computers at NYU with Bellevue Hospital. For Medicare, they use a 360/40, soon to be replaced by a GE 435. The number of patients has not increased noticeably, they say, and the billing procedures used before Medicare were detailed enough to make an easy changeover.

the need for machines

In many hospitals, however, the advent of the Medicare program is proving to be an impetus for the development of data processing facilities. As a broad category, these seem to be the middle-sized (250-450 beds) hospitals, that were enjoying a slow wooing by manufacturers presenting such systems as on-line patient monitoring, EKG analysis and diagnostic assistance. This courtship has been interrupted by the sudden, immediate need for systems to handle Medicare's increased paperwork load.

A hospital that has kept its head above water by careful planning is Hollywood Presbyterian Hospital in California. A non-profit, middle-sized (nearly 300 beds) institution, Hollywood Presbyterian prides itself on only 10 days' delay from time of patient's discharge to the delivery of billing forms to Blue Cross. (Some hospitals are months behind, and Robert Samsel, a hospital-liaison man for Blue Cross says, "Things will get much worse before they get any better.")

Hollywood Presbyterian, anticipating the workload

[1]Statistics from American Hospital Assn.

[2]This is exceeded only by psychiatric hospitals with 45% average daily census. The bed size of these hospitals, however, average 1,419 beds. An example is New York's huge (2700 beds) Bellevue Hospital.

from the first, began using a service bureau last July when the medical aid program went into effect. Lists of patient charges were sent to the L. Greenwood Co. who recorded the data on punched cards, and produced a monthly summarization of Medicare charges and individual patient reports. These reports were returned to the hospital for use in filling out the SSA forms. Three new people were added to the billing department for this task.

Although this temporary system was satisfactory, a system under their own roof was preferred. Medicare is a large portion of Hollywood Presbyterian work: one-third of the patient load. And the average stay of a Medicare patient is 10 days, compared to 6 days with the younger patients.

In the fall of '66, Hollywood Presbyterian decided to write a more comprehensive program for monthly analyses and patient discharge reports to run on a 2K Univac 1004 card processor.

At the beginning of this year, the program was ready to run. They obtained permission from nearby Covina Inter-Community Hospital to use their 1004 twice a month for in- and out-patient billing and general ledger accounting. For weekly reports, they used the more convenient facilities at the Univac Data Center. This month, they will go one step beyond this successful interim system: they are awaiting installation of a Univac 9200 system.

the system

At considerable expense[3] and work, Hollywood Presbyterian had developed a self-auditing system that produced a coded summarization of all patient charges; amount owed by the SSA; and breakdowns according to either Part A charges (Blue Cross) or Part B charges (Occidental). Two summaries are produced. One is a monthly analysis report giving total charges for all patients involved, and this is kept for the hospitals own records. The second is a Medicare Cost Analysis Discharge Report which is written up for each patient. This gives the detailed accounting of all charges, amount due by the patient, and amount to be reimbursed by the SSA.

This Discharge Report is used by the billing department in the manual preparation of the SSA forms.

Special continuous forms have only recently been available for use in hospital dp systems.

In the meantime, Chicago's Wesley Memorial Hospital designed its own continuous forms for Part A and Part B billing, had them SSA-approved, and printed them at the hospital's own expense. In a separate effort, the Chicago Hospital Council, a research and service organization, has established a subcommittee to consider consolidation of the forms. (But they're not talking about computers. The council's executive director, Howard Cook, commenting on computerization of Medicare billing, replied, "Too many problems, too many errors in human judgment, too much difficulty, and too expensive.")

Meanwhile, Covina is looking for more neighbors who would like to share the 1004. They also have a reciprocal point of view. Bill Dunham, dp manager, says, "Now that Hollywood's getting the 9200, we'll be looking to them for help." Covina is also eyeing a Univac 490 real-time system, but installation would require outside financial assistance.

Another type of shared center is the one developed by the Hospital Assn. of New York State, whose non-profit membership accounts for 95% of the beds in the state (320 hospitals). The association has formed CHART, an on-line center that has been in operation for over a year; Medicare was a big consideration in its formation. The center uses an IBM 1440 with 1050 terminals; they are getting a 360/30 in November, and say they will consider larger systems as the service grows. Nine member hospitals are now using the center, and the number should grow to 20 by January '68 (association officials say over 60 hospitals have indicated interest).

The center, which handles hospitals up to 170 miles away, claims it is the first shared center in the country that does not require a standard accounting procedure among members. There are, however, some commonalities in their procedures: the 360/30 will make possible, via I/O format control, the input and printout of data in varying forms—as long as there is basic data in the input.

the computer

The Univac 9200 system, chosen by Hollywood Presbyterian as a starting point in their own data processing activities, has been a popular recent choice among hospitals goaded by Medicare into the realization of their dp needs.

Hollywood Presbyterian will start with the minimum 8K (8-bit) byte plated-wire memory (expandable to 16K).

The system will be used first for Medicare billing forms and general patient accounting. Payroll, now done by a bank, will be converted to the system and, later, the 9200 will hold medical records.

Other hospitals plan a more gradual development. At Gallatin Medical Clinic in Downey, Calif., a 9200 to be installed next fall will be used first for payroll, and then for the hospital's own accounting. "We're going to get our bread and butter on it first," said Brian Lewis, dp manager, "In a year or so, we'll think about Medicare."

Further development of computer facilities at Hollywood Presbyterian, or any other non-profit institution, depend on financial help. Now the hospitals are paying for the systems out of their own pockets. While windfall gains such as federal grants and donations of used computers by corporations are possible, a more immediate source of financial assistance might be found in a redefinition of the term "reasonable cost," now contained in a bill before the House Ways and Means Committee. The bill, HR 5710, amends the "reasonable cost" statement from the original Medicare Act with these words: ". . . the term 'reasonable cost' shall include amounts attributable to depreciation of plant and equipment in the case of any provider of [Medicare] service." The bill continues to qualify this as available to those who keep separate accounts of amounts attributable to plant and equipment depreciation, and are willing to furnish these accounts to the Dept. of Health, Education and Welfare.

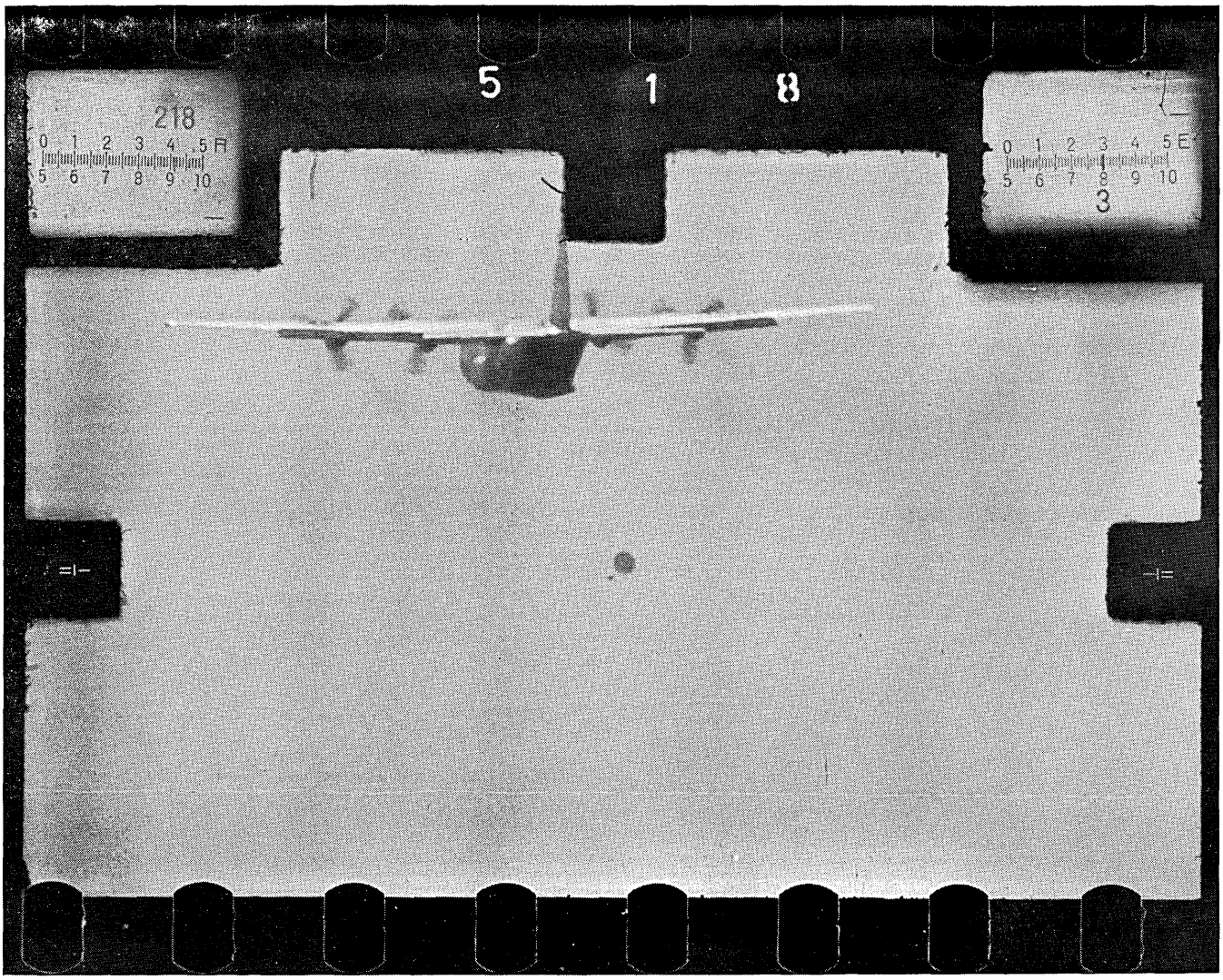
If, under this definition of reasonable cost, data processing equipment depreciation (includes upkeep and replacement) is applicable, the hospitals have a chance of getting federal reimbursement.

Few hospitals have heard of this clause. Harley Murray, business manager at San Gabriel (Calif.) Community Hospital, who is awaiting delivery of a 9200 in October, sums up the general feeling for the entire program when he says, "It's an up-in-the-air thing. There's been no government audit or survey. The load of Medicare has been considerable, but we just don't know where we are. There's been no final reckoning."

This is only the beginning. But the Medicare program, with all its stumblings and painful beginnings, has an immediacy that is finally bringing an appreciative awareness of data processing aids to the medical community.

—WENDY REID

[3]So far, the costs for the programming of the analyses and billing system have been paid by the hospital. No government reimbursement is in sight. Blue Cross is currently compiling a report of software costs paid by the hospitals; it is scheduled to be published late this summer.



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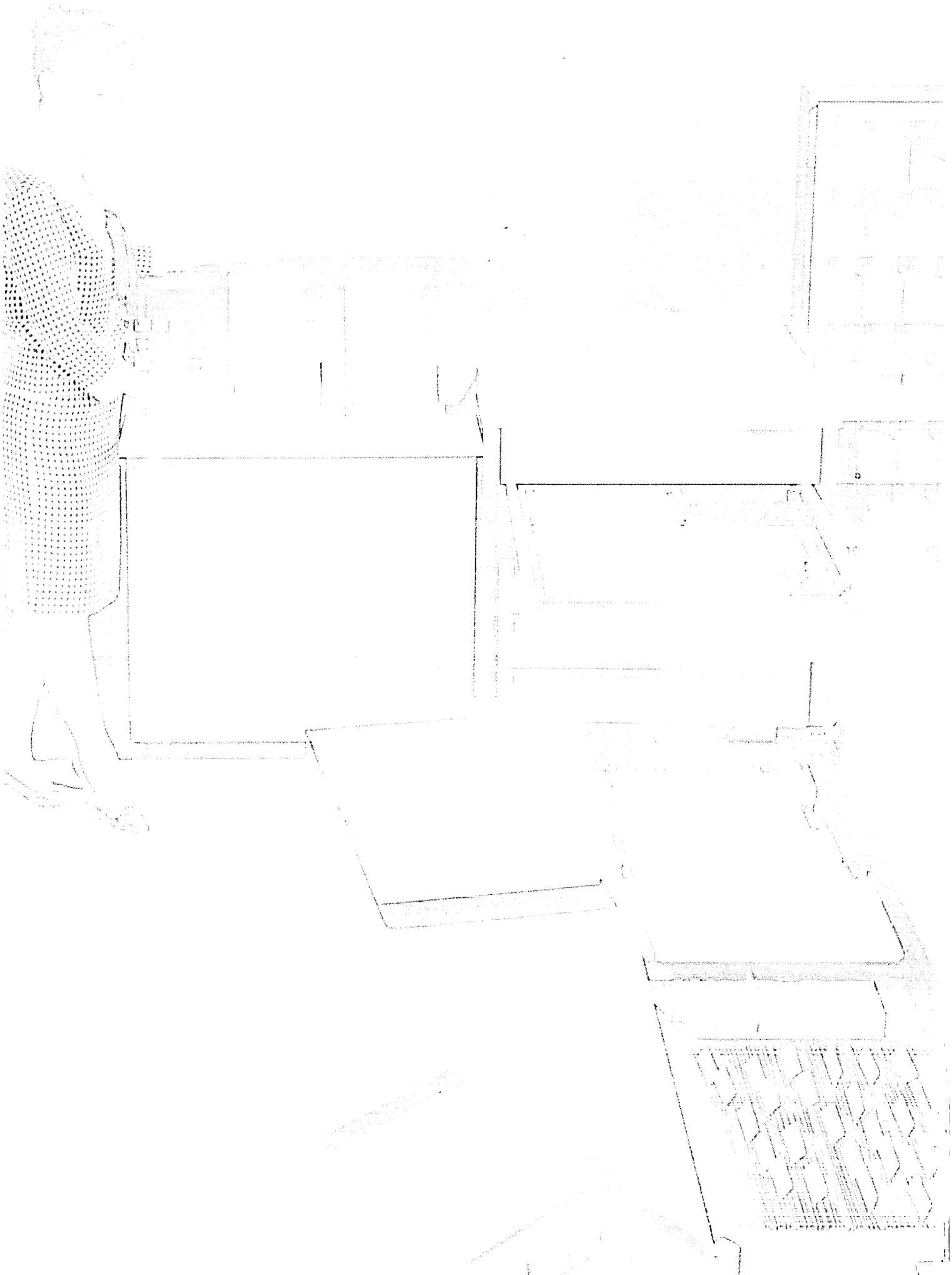

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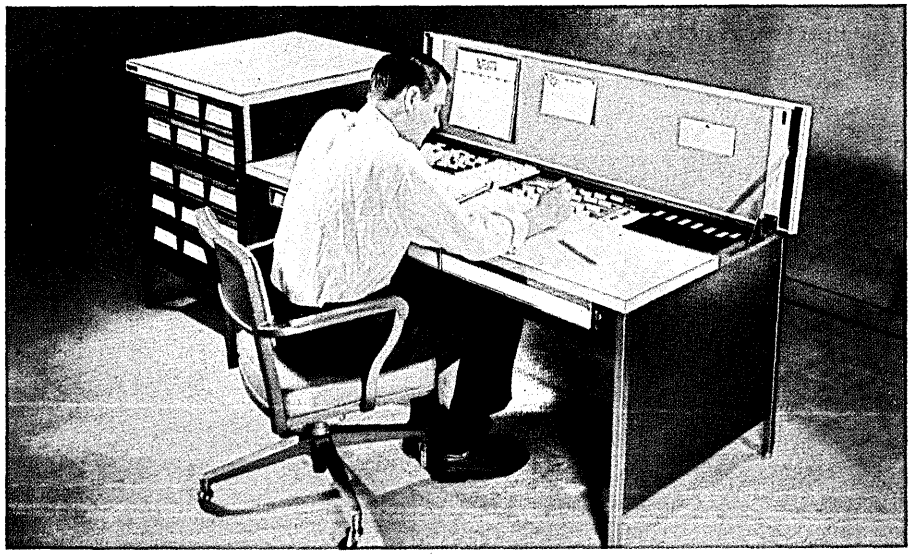

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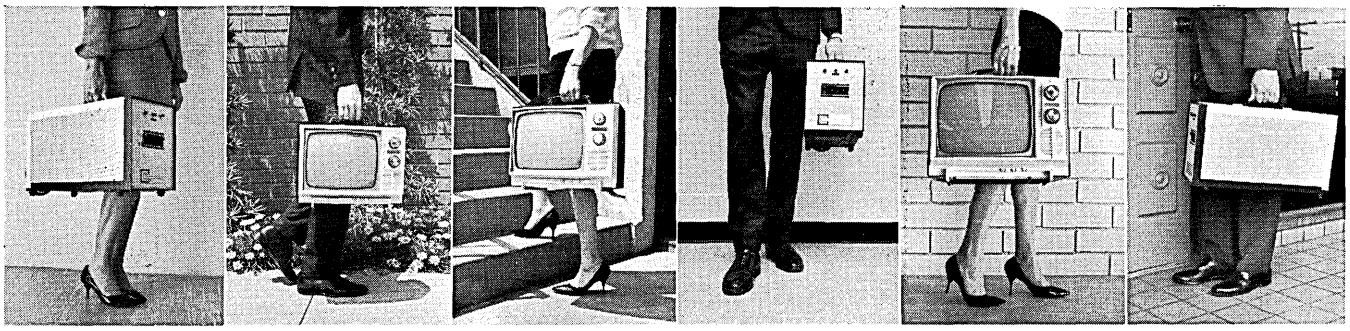

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CIRCLE 38 ON READER CARD

WESCON '67: COMPUTER SESSIONS

26 papers

A wide range of computer subjects will be included in the program of the 1967 Western Electronic Show and Convention, scheduled for Aug. 22-25 in San Francisco's Cow Palace. The 20 technical sessions will be supplemented by an 1100-booth product exposition, also in the Cow Palace.

The first data processing discussion will be Session B, "Large-Scale Integration of Computer System Design" (Wed., Aug. 23, 2-4:30 p.m., Edison Hall). Chairman of this special session is W.H. Davidow, Hewlett-Packard. Members of the panel are Richard Petritz, Texas Instruments; Gordon Moore, Fairchild Memories; and Gene Amdahl, IBM.

Of the contributed sessions, six topics (a total of 26 papers) will be of particular interest to the dp community. Session 6, "Data Compression" (Wed., Aug. 23, 10 a.m.-12:30 p.m., DuBridge Hall), includes five papers concentrating on high-volume data transmission problems, and the logical design and implementation of computing machinery. Chairman is C. M. Kortman, Lockheed Missiles & Space Co.

Session 7, "Patient Monitoring Systems: Progress, Problems and Prospects" (Wed., 10 a.m.-12:30 p.m., Terman Hall), will present four papers giving a critical review of instrumentation needs, suggesting improvements, and proposing standards for patient intensive care systems. Dr. Curtis E. Miller of Beckman Instruments is chairman.

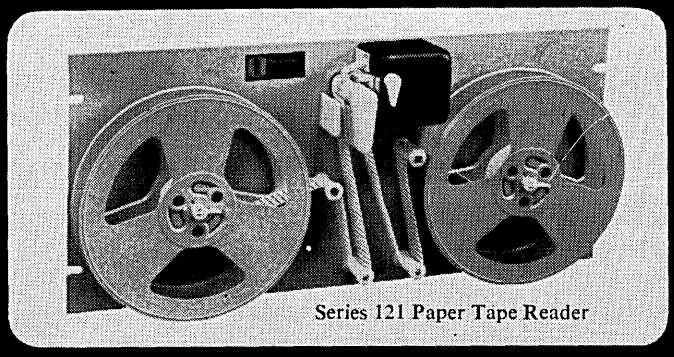
"Recent Developments in Communications Systems," Session 9 (Thurs., 10 a.m.-12:30 p.m., Edison Hall), will discuss communications systems of the future. Four papers will be presented under the direction of John V. Granger, Granger Assoc., session chairman.

James F. Kaiser, Bell Telephone Labs, is chairman of Session 10, "Digital Approach to Analog Functions" (Thurs., 10 a.m.-12:30 p.m., DuBridge Hall). This session will explore the use of digital techniques (circuits and arrays) to perform analog functions.

Papers on fluidic control systems and a pneumatically-controlled document handling system will be included in Session 11, "Progress in Fluidics Applications" (Thurs., 10 a.m.-12:30 p.m., Terman Hall). D. F. Folland, Sperry Utah, is the chairman.

"The Computer as a System Component" is the topic of Session 16 (Fri., 10 a.m.-12:30 p.m., DeForest Hall). Under the chairmanship of Peter England, Scientific Data Systems, four papers will consider the computer as an element in problem-oriented systems: computer design, nuclear physics and medical processing. A paper on software will also be given.

Two special-interest meetings at the San Francisco Hilton Hotel, complementing the Wescon program, are the 8th International Electronic Circuit Packaging Symposium (Aug. 21-22) and "Microelectronics Comes of Age" (Aug. 23-24), a course sponsored by the IEEE/PMP group. ■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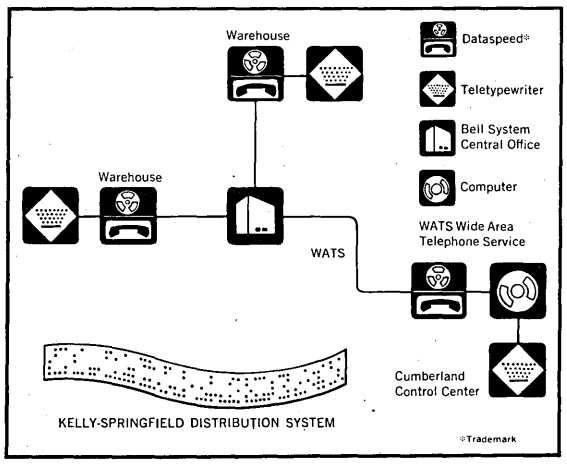

BELL SYSTEM AT&T and Associated Companies

news briefs

FEW SYSTEMS USED FOR MAJOR DECISION-MAKING, DIEBOLD FINDS

While 8% of corporate expenditures went toward computer systems in 1966, up from 4% in 1961, few users have tailored the information produced to help in making major business decisions, according to a study done by the Diebold Group, Inc.

At the Group's annual soiree given for the press, the results or plans of several studies—on the checkless society, technological developments in computer industry and business' use of computers—were presented. Of 2,636 executives responding to a Diebold Research Program survey on the cost effectiveness of software and hardware, 72% felt that their operations churned out a "great deal of useless paper." John Diebold noted that "in making decisions regarding the things we will do, and will not do, with the computer, we rely almost entirely on the concept of displaceable cost—the cost of machines and people presently used to produce date. Thus we know with considerable precision what it costs to produce data; but we have only the most primitive analytical tools for measuring the value of the information."

Among actions called for are studies of information flow in an organization, the effect of its availability and timeliness on the planning cycle, studies of the human decision-making process, and other elements which can't be measured precisely in dollars and cents.

The effective use of information is being far outstripped by the technological capability and corporate plans to produce it: By 1973, the typical company will be spending twice as much on computers as in 1965. Equipment performance per dollar will have increased eightfold between 1964 and 1973. Reasons: main memories (due to improved manufacturing techniques and cryogenic developments) will be four times faster and costs only 2% of the '64 unit cost; similar improvements will be made in discs and tapes; image file development for drawings, designs, documents; input communications devices at 20% the '64 cost and modems with significant cost drops. Software costs will increase to 60% of total systems costs by the late '60's and be the "main bottleneck in achieving information systems advantages," although on-line programming and debugging "is estimated to improve programmer efficiency by 30%." Systems analysis and design will take a bigger chunk of software spending (70% in '73 over 45% in '65), while applications programming costs will decline because of meta-compiler developments.

New capabilities developing are optical character recognition, industry-oriented transaction and I/O devices, g-p devices in modular form that permit tailor-made combinations, and the various display devices. Special purpose devices developed for particular applications "will become increasingly rare."

In an on-going study of the "business implications of the electronic transfer of money and credit," the Diebold group has thus far determined that the bulk of the proliferating bank-credit card ventures may be marked for failure because of a "large element of chaos, lack of realistic planning and unsound economic expectations." Cost factors, the structure of banking and business institutions, as well as the optimal utilization of available technologies, point the way to a regionally and nationally integrated system. Few of the current bank ventures appear headed in this direction or capable of joining the leaders who are preparing themselves to take it. Such leaders as Bank of America and certain joint bank-credit card company ventures are likely to determine the future environment for financial transactions, said the firm. With the exception of a safe and relatively low-cost identification system, the hardware, software for the automated money and credit system are here. Voice i-d should be ready for use during the early 1970's. As for economics of the future system—the major investments won't be in equipment, but in marketing and management.

7080 AUTOCODER-TO-COBOL TRANSLATOR DEVELOPED

White Plains, N.Y. software firm, Systems Programming, Inc., has developed a translator with which it will convert IBM 7080 Autocoder programs to COBOL. Most macro-instructions and many common one-for-one sequences are translatable. Advantages SPI lists are that the translation allows certain users of 7080's to select more advanced systems without compatability considerations, makes maintenance of programs possible by persons fluent in COBOL, but unfamiliar with the computer's characteristics; for those programs already committed to 360/65 emulation (the 65 is the only 360 with a 7080 emulator), use of COBOL generally decreases running time and eliminates the hardware emulator.

Depending on the nature of the object program, 85-98% is translated, and annotated exception listing is produced. The translator's limitations are that it bypasses: any one-for-one sequence, which if translated might hide a bug; address modification instructions, and certain machine-oriented instructions. Also a Report Generator is not translatable. In each case a warning message is given in the listing, and the programmer re-writes these elements in COBOL. Due to the mechanical nature of the translation the number of compiles and tests is markedly lower than for a completely manual effort. Turnaround time for a 1,000-card program would be two to three days. Each program is priced separately and is a function of the size and complexity of that program.

CIRCLE 130 ON READER CARD

CHECKLESS SOCIETY FASCINATES ABA

While hundreds jammed the sessions on "Toward a Checkless Society" at the recent American Bankers Assn. national Automation Conference in May, a handful attended a session on software problems to ask such questions as "What's best to use—COBOL, assembly language, or PL/I?"

There is no doubt in the minds of many bankers that the checkless or near checkless society will be hitting its stride by 1975-1980, but the work that must be done—in such areas as information system and communications development, identification hardware, cards, numbers, and other security measures, acclimating the consumer to this new way of buying—is staggering, and in most cases in the study and embryonic implementation stage.

Among the more important "stepping-stones" to this new society are closer bank/retail store relationships and the establishment of the bank central information file—neither of which the bank can afford to do

without, emphasized Robert Oelman, chairman and chief executive officer of NCR. "By 1980, this era of super-affluence will have produced retail sales of $575 billion, and unless we do something about it, some 43 billion checks annually." (Sixty per cent of all purchases are retail.)

The vast majority of retailers (1.5 million stores) "have yet to make the necessary commitment to the appropriate automation program," and are ill-equipped to handle the paperwork and cost of the credit business alone. "Through obtaining retailer's approval to cooperate with a credit card plan, a bank may realize perhaps 5-10% of a community's total credit business."

Oelman recommended an even broader scope of service—the establishment of a retail department within the bank to provide sophisticated financial, merchandising, and accounting information. It could also give a line of credit made possible "by accurate accounting for receivables, inventories, and other store assets." Any store with "properly regimented computer input from its point-of-sale equipment" could use the service.

"Such a service is feasible today with off-line data capturing equipment, and it could build the necessary base for the networks of on-line equipment which will be commonplace tomorrow in both banks and stores." Banks starting on this now will have a competitive edge, he asserted.

What about the effort to establish a central information file—the base of the bank's future on-line and management information system? The CIF (meaning one number per person, regardless of how many different accounts) is now technically feasible. Building the data base might take "about two man-years for a typical bank under $100 million," Oelman said. A $100-500 million bank—6 man-years; a $500 million-plus bank—in excess of 30 man-years. In all cases corresponding software development requires 20 man-years.

"Technologically, we shall be ready for the unprecedented demands of the 1970's—with powerful new data processing and memory systems, new types of communications devices . . . and fantastic customer-identification methods in which the problems of indexing and instantaneous file search will be solved by entirely new sciences —for example, holographic and laser techniques."

But all things being implemented back at the bank, the most arduous task facing bankers is consumer education, according to Jack Whittle of Continental Illinois National Bank and Trust. The public will not easily take to a paperless transaction.

The potential malignancies of the credit card, a candidate as the identification tool in the checkless society, could cause some public rebellion, warned James Vergari, Federal Reserve Bank of Philadelphia vice president. (An ABA survey showed that there were, as of March 1967, 1,371 banks issuing or planning to issue credit cards.) Some of the "growing sores" of the present credit card systems are "increasing fraud loss potential in franchised card operations and nationwide interchange of credit cards, wild buying and abuse of credit, usury charges, customer liability for charges on unauthorized card use, embroilment in the invasion of privacy and character assassination controversy."

Furthermore, said Vergari, the credit card is not an effective substitute for check use, and "if some proposals for clearing credit card sales slips of interchange or cooperative bank card plans come into existence, the volume of paper entering bank check collection channels from this source will far outweigh any reduction of the paper mountain that may result from preauthorized direct debit arrangements being promoted by banks and large-volume check payment receivers."

Elimination of the check is not the answer, thought Vergari. The volume can be reduced by "vigorous use" of preauthorized transfer of funds and the computerized giro system (based on a machine-readable stub bill issued by the creditor which the debtor gives the bank to make payment).

A money card system is the goal to strive for, he said, but it will have to have a nationally-accepted tamper-proof identification device and a computer-communications network which will credit a check, process the transaction, and effect the transfer of funds. Among requirements are a universal numbering system, and other identification methods, high-security standardized terminals, code scramblers, and interfaces for different computers.

JOINT SOFTWARE EFFORT AMONG BANKS URGED

At the May American Bankers Assn. conference, bankers heard a strong recommendation for a cooperative bank language research and development program. Robert V. Head, manager of management information technology at Computer Sciences Corp., pointed out that many commercial banks installing large third-generation systems are launching system develop-

Looming large on the computer horizon...

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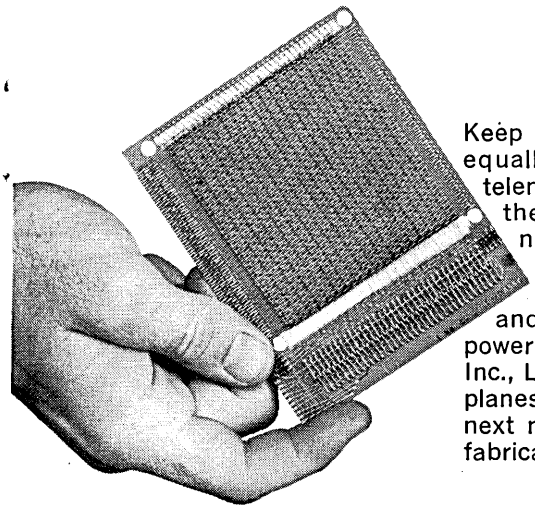

Keep in mind: its thirteen advantages apply equally to military/commercial computer, telemetry, and data-handling systems. About the memory plane shown at left: 2,592 non-destructive readout (NDRO) bits. Completely potted to withstand aerospace environments of shock, vibration, and temperature. Ultra-high-speed, low-power operation. ■ Keep General Precision, Inc., Librascope Group in mind to stack some planes or supply a complete system for your next memory application. Plated, woven, and fabricated in the U. S. A. Write for brochure.

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Systems Engineering Laboratories

CIRCLE 43 ON READER CARD

ment projects to "more effectively exploit the equipment capability now abundantly available."

"The payoff potential is great," said Head, but the "design and development problems are also enormous. Among the major problems being encountered in such banking systems are those having to do with the way the applications programmer interfaces with the manufacturer-supplied system software and the way non-technical personnel obtain information from an advanced banking system once it becomes operational."

Cooperation among large-scale system users could substantially defray the expenses of system development effort, assure more quality, and contribute toward the language and data element standardization that will be necessary for information exchange in the banking community, Head urged. The program he outlined should be directed toward three classes of realistic language specification and implementation: systems programming, applications programming, and management languages.

Under this program, estimated to take three years, a minimum expectation within one year would be an "immediately useable specification covering at least a portion of the language requirements." Then the group could develop either a "preliminary specification covering the entire spectrum of bank language requirements," or a more detailed specification "covering a particular aspect of the bank language, such as data element identification and standardization." Then, software would be prepared and tested.

At least three full-time senior professionals would be needed, with talents in systems programming, information systems design, and human factors analysis. Meetings between these experts and participating banks would undoubtedly contribute to an awareness of current thinking involved in the "most promising techniques and approaches in the field of advanced banking systems."

IBM CONDUCTS PORTABLE PROCESS PRESS CONFERENCE

IBM lugged some 25 editors and reporters across the country in late May to visit four IBM 1800 installations in New Jersey, Michigan and California. Here's our travel-weary editor's report.

At Mobil's Paulsboro, N.J. refinery, an 1800 is being used to control one of two Thermal Catalytic Cracking units, which processes up to 20,000 barrels of crude oil a day. Based on a mathematical model of the process and pricing information, the 1800 allows the unit to produce the most profitable mix of products—gasoline, heating oil, and liquid petroleum gas.

The 1800, which was installed last October and accepted May 1, monitors instruments at 250 different data points, converts the data to digital formats, and prints out hourly reports which show the average value of all variables (including some which are calculated rather than measured), and overall material balance. A special process keyboard allows interrogation of the unit, or changing of the values of specific variables. A total of 650 variables are calculated.

Rental for the machine, the largest 1800 in terms of core and disc, is $6700 and Mobil says "it's paying for itself," although they will not, for competitive reasons, spell out the size and scope of their programming effort. The system has a 32K (4 usec) core, and a 512K-word 2310 (three-disc) unit. The company says it has 16-18 other TCC's, and presumably they are being considered as candidates for computer control, although an 1800 could control more than one TCC.

This isn't Mobil's first venture into process control. The 1800 was preceded by a Bunker-Ramo 340, which evidently lacked the memory capacity and the reliability of the 1800.

Software for the installation includes TSX—the Time-Shared Exec—assembler language, FORTRAN, and something called PROSPRO/1800, described by IBM as a "'fill-in-the-blanks' programing method" which programming." Also mentioned: "dynamic programming."

Next stop was Dearborn, where an 1880 is controlling the production of plate glass for windshields. After the materials leave the 2800°F. mixing furnace (containing 1440 tons of molten glass), they flow over a 175-foot long bath of molten tin, with temperature gradually decreased to 11-1200° F. at the point the glass enters a 350-foot annealing bath. The glass emerges at 200° F. and is automatically cut to size, and moves on to be laminated and formerly into windshields.

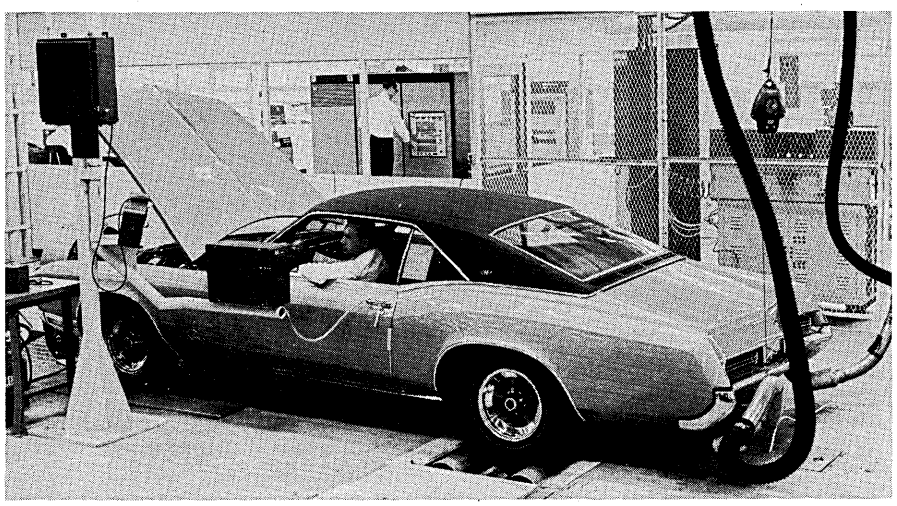
Ford officials say that the 1800 should enable them to "increase productivity 5% and maintain consistently high quality standards." They figure that the 1800 allowed them to save more than $100K in equipment costs over conventional measurement and control instrumentation for the plant, which was designed and built with computer control in mind.

It's the only computer-controlled float glass plant in the world, and went on-line in March. Production, which was 1 million square feet B.C. (before computers), is 1½ million square feet now. Installation began January 10 and was released to Ford Feb. 14. (Happy Valentine.)

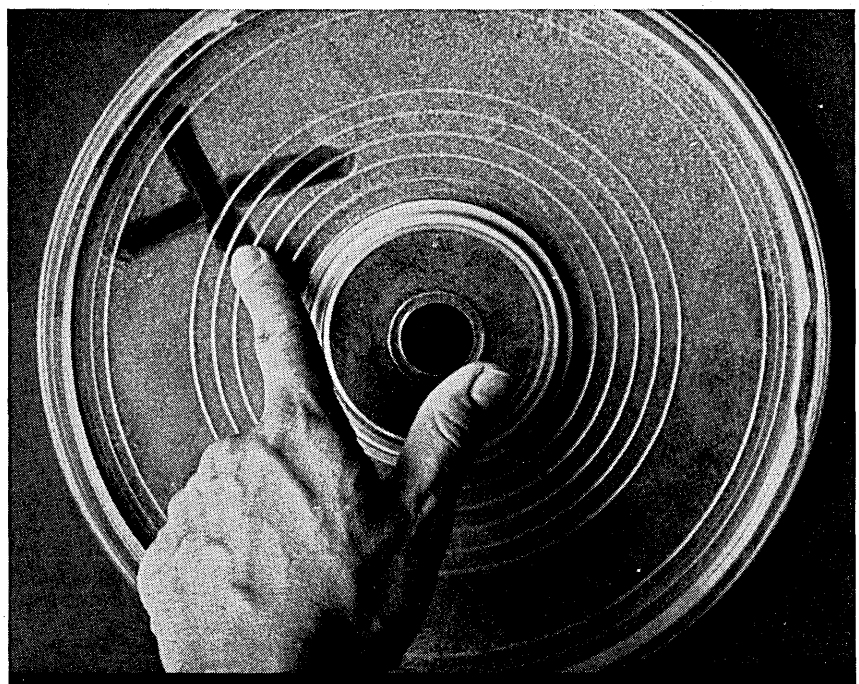
Using Direct Digital Control, instead of analog controllers, the 1800 accepts 500 analog and 96 digital inputs, produces 80 analog and 208 digital outputs, and controls 80 closed control loops. There are 80 process interrupts. The control programs, written in assembly language, reside in core.

Big DDC fans, Ford says that it allows them to eliminate expensive analog controllers with their attendant maintenance costs. The computer permits accurate recording and monitoring of all operator changes,

Buick's computer-based facility tests anti-smog devices. Coming up: computer-controlled stations to inspect wheel alignment and balance, engine performance, brake effectiveness.



The death trap.



Dust is death on computer tape. And it can collect anywhere. Even empty tape containers, left lying about, will capture dust and eventually transfer it to the tape edges.

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and stabilizes the process, increasing equipment life in the process. Right now, Ford plans to run the plant non-stop for about three years. At that point, the equipment will have to be repaired.

In Flint, Michigan, Buick is using an 1800 at one station of a quality audit plant where the company samples about 80 cars a day (about 8% of production) from the production line. The only test now under 1800 control is that for exhaust emission analysis (smog), required now by California state law and to be required by the federals next year. Sample emissions are sent to analytical instruments, which produce voltages indicating concentrations of different gases. The 1800 measures the voltages to determine amounts of carbon dioxide and hydrocarbons in the fumes.

The start of the test interrupts the computer—it's not clear what it was doing in the meantime—which checks the car identification, matches data about the car (motor size, etc.) against its information, and selects the appropriate tests. The program calls for test data every half-second, and at the end of the test computes the data and stores the results. This is the first of six stations, a "lion's share" of which will be on-line, probably by the end of summer. Installation began in December, and the computer was in operation six weeks later.

California here we come. In Palo Alto, Syntex Corp., proud producer of one-half the world's supply of oral contraceptives, currently has an 1800 being used on a production basis with a Varian HA-100 nuclear magnetic resonance spectroscopy unit which records the electronic environment of hydrogen atoms in a molecule . . . giving important clues to the structure of chemical material. By increasing the spectrum being swept, the computer makes it possible to improve signal-noise rations; the painful alternative: to use more of the precious material being analyzed. Before, 10 milligrams was the minimal amount required; this will now be cut to .5 milligram. The computer will also allow Syntex to speed up the turnaround time (from one week now to one day) for letting chemists know the intermediate structures of the compounds they are striving to synthesize. As they subject a chemical to reactions, they want to know precisely how this is affecting the structure of the material.

To develop a library of these chemical structures, the company also has a Grafacon input unit (nee Rand Tablet). Soon to go on-line, this will allow them to enter drawings of compounds and make subsequent studies of their bonding characteristics.

Shortly, the 1800 will be tied into the Allen-Babcock Computing 360/50—located in the Syntex building—so that the results of the HA-100 (and other instruments soon to be tied into the 1800) can be stored on the 50's Datacell after these results have been digitized and analyzed. This data will be available through Rush programs (*see* June, p. 17) at ABC terminals. Right now, Syntex is paying the minimum amount for six ABC terminals—$500/month each—but as the /50 and the 1800 are tied together, the company expects usage to rise sharply.

Presently, the 360/50 is being used as an information retrieval system, with Chem Abstract tapes used to offer Syntex scientists abstracts of articles pertinent to the company's work in steroids, anti-inflammatory drugs and nor hormones, among others. In anticipation of greater use of the /50 and the ABC terminals (available from 7 a.m. to noon, and between 1 and 8 p.m.), Syntex is training some 30 scientists in PL/I. They estimate that there are perhaps 50 potential terminal users within the plant.

The conclusions reached by this reporter after a whirlwind, coast-to-coast visit to four 1800 installations: IBM is determined to become No. 1 in process control; the company says it now has over 200 process installations . . . won't indicate how many of them are 1800's.* Process control has come a long way, but four samples (presumably carefully selected) indicate it has a long way to go. As a reporter who had listened to claims several years ago that process control was here, it was refreshing to see a new humility and honesty among people who are *beginning* to partially solve some of the tremendously complex process control problems.

TOUCH-TONE DEVELOPMENTS COVERED AT SEMINAR

With several hundred thousand touch-tone phones in used already, and a potential of over 100 million in the U.S. Alone, many industries like retailing, banking, and airlines are making plans to use them as that long-elusive low-cost input device to computer-based systems.

A June seminar, sponsored by Compute-A-Credit Inc. and Pennyslvania Research Assoc., delved into the current developments, applications, and problems with the evolving touch-tone system. According to CAC president Peter James, several efforts enchance this future: Bell System's experimentation with 12- and 16-button (versus the common 10) phone more adaptable to alphanumeric transmission; Computer Telephone Co.'s development of a hardware translator which separates codes, numbers, and letters transmitted by depression of one or two (simultaneously) buttons on the 10-button unit; and continuing development and improvement of audio-response units. (An example of interest is that IBM has 200 orders for its two audio systems, the 7770 and 7772, 100 in the banking industry alone. Several other mainframe manufacturers are talking to audio-unit makers like Cognitronics about OEM agreements.)

Donald Dittberner, of Center for Management Technology, summarized the advantages and limitations of the touch-tone system. A key plus is that the user can call into a computer without waiting for polling: the queuing problem can be handled by a buffer. The phone is low-cost, can be implemented without major change to the system, is available, fairly reliable and rugged, has alphanumeric capability, is easily used.

The phone can be built with voice exclusion capability so there won't be any cross-talk, will read dial cards (for inputting call or account numbers, etc.), and is, importantly, portable. Touch-tone pads are being manufactured for attachment to dial phones so that a user can input from anywhere in the country. And, the phone companies have maintenance facilities everywhere.

On the minus side, said Dittberner, are that: the phone is not good for long-message transmission because of the human-error factor, limited alphanumeric capability, and lack of easy error correction methods. Its applications in banking, retailing, such as credit authorization and money transfers without cash, are also bound to meet some human resistance.

Walt Trabbold, comptroller of the Bank of Delaware—a leader in on-line bank automation—noted problems in peripheral areas. A seemingly minor time that has slowed the bank's progress is the unavailability of fast methods of punching holes in the plastic dial-cards; embossing is also a problem area. Trabbold noted that Delaware has been urging Bell and others to develop cheaper strip printing devices for attachment to the phone, as well as to work more quickly on voice identification system development. IBM, he said, is so close

*GE, the current leader, says it has 264 process systems installed and on order. The breakdown: utilities, 87; steel, 52; petrochemical, 50; cement, 12; paper, 5; and "other," 58.

news briefs

to the latter that, but for 360 problems, its voice i-d system would be on the market now. RCA seems to have an experimental system reaching 90% accuracy.

Such identification is critical, as already evidenced by the numbers of fraud cases with credit cards. Some security measures, such as input cards with unseen numbers which only the holder knows and must verify, are also being developed. Too, said Trabbold, the Bell ESS system will provide some security since it will have a record of all calling and receiving numbers, available in an instant (given the legal right to divulge this). The idea of a personal i-d number, being worked on by the American Bankers Assn., is far from solution, said Trabbold.

The Bank of Delaware is well into credit-system development, planning to offer supermarkets touch-tone terminals through which managers can dial the bank computer through its switchboard to authorize checks—important to markets, number one recipients of rubber checks. Professional offices will also be offered home billing via the phone.

UCC BUYS BENSON-LEHNER, SETS UP NEW DIVISION

University Computing Co. has acquired Benson-Lehner and is setting up a new organization, the Computer Industries Div. of UCC.

The acquisition was a cash transaction—$3.4 million to buy Benson-Lehner, including Benson Ltd. of England, from parent company United Gas Corp. B-L president Andy Huson will continue as chief executive officer, with the added responsibility of Benson Ltd.

Benson-Lehner is the first major segment of UCC's new Computer Industries Div., which is headed by Robert G. Dee, formerly a vice president at Computer Sciences Corp. Other acquisitions will be sought—companies manufacturing products for, or related to, the computer business.

This division makes the fourth for Dallas-based University Computing. The other three are Computer Utilities, Data Link, and Computer Leasing. Computer Utilities has ordered 12 Univac 1108's, of which two have been installed—in El Segundo, Calif., and Houston, Tex. The next two are going to Dallas and Tulsa, Okla. The schedule calls for four installations a year. They offer both time and the use of proprietary programs and also include time-sharing; University is now manufacturing its own terminal, the Cope 45, for time-sharing customers and deliveries should start towards the end of this year. This division is managed on a regional basis by William Grubbes, Tom Lyons, and Gene Scott.

The Data Link service is aimed at smaller, business-oriented operations and uses 1401's, Honeywell 200's, and 360/30's. Plans call for 30 such centers by the end of 1969. This group is headed by Karl Young.

Computer Leasing, under former C-E-I-R president Robert Holland, has also been active, is just completing a $2 million deal with General Atomics, San Diego, for an 1108.

Several key appointments have been announced recently by UCC president Sam Wyly, in addition to that of Robert Dee. Sy Joffe, formerly southwest regional manager for Univac's federal government marketing branch, has joined UCC as a vice president. His responsibilities will include marketing of the Cope terminal. Joffe is given much of the credit for Univac's spectacular showing against IBM at the Manned Spacecraft Center in Houston and in other southwestern areas. GE has provided John Coleur, a key man in development of the 600 series; Dr. Dan Scott, manager of remote processing services; and Gene Scott, manager of 600 series sales. William Grubbs, another newcomer, came from IBM, where he has been in charge of World Trade Corp. service bureau activities in Europe.

With the addition of Benson-Lehner, UCC now has over 650 employees. Last year the company grossed about $4.5 million and is estimating this year's revenue at around $12 million. B-L has been doing about $5 million yearly, but not showing much of a profit recently during its uncertain tenure at United Gas.

Predicting where Wyly is going and when he will get there becomes increasingly difficult as UCC's activities multiply. As this is written, Dr. R. McCord and Associates, a wholly owned subsidiary of UCC, has just announced that *they* are forming a new section, the Geoscience Division, to offer international services in geology and engineering.

LEVIN-TOWNSEND GETS BIG PART OF REALTIME SYSTEMS

For $500,000, Levin-Townsend Computer Corp. has picked up a substantial part of Realtime Systems, Inc., by buying convertible and other debt securities from Realtime and common stock from Loeb, Rhoades & Co. If the leasing company converts the securities into stock, it would own about 60% of Realtime while Loeb,

Rhoades would retain about 25%.

Levin-Townsend now has some $20 million worth of computers out on lease and also has control of EDP Leasing Corp., which deals in punched card equipment. Realtime Systems operates a commercial time-sharing service in the New York area, which just acquired a Burroughs B5500, does consulting in process control, and has about 100 people in New York, Houston, and London.

GENERAL LEARNING CHANGES PLANS, PEOPLE

"There is still too much uncertainty about how children learn." This belief among leaders at General Learning Corp. led to the March decision to abolish plans to enter manufacture of the "first generation of equipment systems for computer-assisted instruction" and subsequently to dismiss President Richard Shetler and 90 others. The New York-based firm, formed late 1965 by GE and Time Inc., has reorganized to concentrate on educational system consulting for U.S. and overseas schools and on development of various learning aids ranging from textbooks to course programs for computer systems. Board chairman and former U.S. Commissioner of Education Francis Keppel is now also president, and Joseph Hazen of Time-Life Books has recently been named acting general manager.

The shakeup, engineered by Keppel with support of the boards of GLC and the parent companies, was not only based on internal conflict over what should come first: hardware or better understanding of learning concepts. There was also disagreement over the kinds of contracts, federal or state and local, GLC should be taking on.

Shetler and several executives had come from GE's defense operations and were moving GLC into an increasing number of Defense Department contracts for computer-assisted training. (One now being completed is work on a Navy computer-based instruction center for experimentation.) While many CAI systems being commercially developed today are partially based on government projects, Keppel and others did not feel that military hardware was best suited for public schools, and hence that contracts in that area were not leading GLC in the right direction. "The principles used in giving torpedo training in the Navy aren't the same as those for teaching third-graders," said Clifford Springer, GE veteran who now heads GLC's new Educational Services Division.

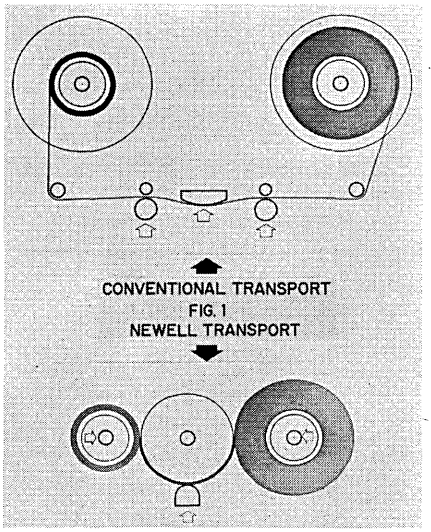
Springer's 40-man group, located in Washington, D.C., will be General Learning's force for computer-related activities. Composed of talents in education, psychology, and computer technology, the division will consult on the development of total systems for both administrative and instructional use in schools. Software (primarily user languages for students and for authors of instructional materials) and course programs will also be developed.

GLC also has a textbook publishing division, Silver Burdett. This 500-man operation was formerly a subsidiary of Time Inc. and was given to General Learning in payment for half-interest in the firm. GE provided $18.75 million in capital to bring the initial worth of GLC to $37.5 million. The Washington Facility, in addition to housing ESD and support personnel, manufactures educational kits. GLC also runs a job corps center in Clinton, Iowa.

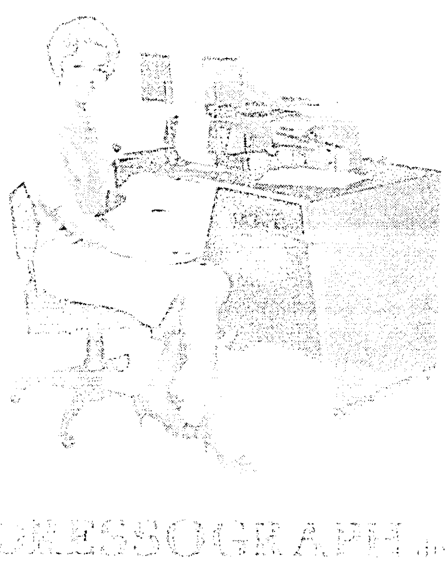
NEW TAPE TRANSPORT DESIGN ANNOUNCED

An innovation in tape transport design has been announced by Newell Associates Inc., Sunnyvale, Calif. Already licensed to Borg-Warner, IBM, Memorex, and other manufacturers, its main interest here may lie in instrumentation applications. Its capabilities include tape speeds of "several thousand" inches per second, bandwidth of 10 mHz with direct recording, and more than 40 channels per inch of tape.

The diagram below is a comparison of the conventional and Newell transports. The results, it is claimed, include the rigid spooling of tape, a self-threading feature, very low power requirement, and the ability to handle tapes with a quartermil base. Of interest to hi-fi fans is a Newell-developed reel of tape with the equiva-



Now, an all-new method designed to expand the capabilities of a computer or punch card system



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CIRCLE 44 ON READER CARD

lent of an LP album (44 minutes of playing time) that measures only two inches in diameter.

Newell Associates was formed in 1960 by "Ches" W. Newell, formerly with Ampex, and was incorporated in '63.

CIRCLE 131 ON READER CARD

TIME-SHARING SERVICES OFFERED NEWSPAPERS

The recent demise of the New York *World Journal Tribune* (a product of a three-paper merger last year) underscores the importance of finding ways to ease the rising, prohibitive costs of newspaper publishing. One service aimed at this goal in production is the recently announced United Press International computer service for hyphenation and justification of locally-produced copy. Two New Jersey papers, *The Record* of Hackensack and the Paterson *Morning Call,* are now transmitting unjustified copy on paper tape over telegraph lines to UPI's RCA 301 in New York. The 40K-character system processes the copy according to font, column measure, and special instructions, and retransmits it to paper tape at the newspaper for direct use on a linecaster. Before the end of the year, UPI will be using a specially developed multiplexer which will split a private voice-grade channel into 40 telegraph lines, reportedly making the service economically feasible at cross-country distances.

The 301, which has backup and does not use tape or random access storage, can now handle 40 I/O channels. UPI has developed its programs from the original RCA SNAP-2 system, adding capabilities for handling all the special newspaper requirements such as box and handling indents, tabular, classified and other formats. The program can handle an unlimited number of unit cut fonts/sizes and 12 different column measures.

SHOW BIZ PAYROLLS STUDIED BY MELLONICS

The software arm of Litton Industries, which got its start in the field with the Air Force satellite tracking programs, is increasing its activities in the commercial dp field. Still working on the SAS Airlines reservations system, the Mellonics Systems Div. recently announced completion of an analysis of a gross payroll computation system for the major motion picture and television studies.

A highly complex process, payroll computation is still being performed manually. Not only are the contracts of 31 craft unions involved, but some 60% of the people must be paid daily. Thus, an operating payroll system becomes the start toward a management system, keeping track of production expenses on a daily basis. The 10 studios, members of the Assn. of Motion Picture and Television Producers, now have the option of having the programming done by Mellonics or elsewhere. Two are doing it in-house. Equipment installed comes from Honeywell, RCA, and IBM. Paramount, we hear, is evaluating IBM and Univac.

Mellonics, formed in 1961 in Arizona, became a part of Litton in '64. It is headquartered in Sunnyvale, Calif., where there's also a service bureau with a CDC 160A, 1604A, and a 3800 due in August. The division is headed by Frank Druding.

MORE SUMMER COURSES OFFERED BY COLLEGES

Univ. of Santa Clara, Calif.:
Aug. 14-25, Computer Models and Mathematical Techniques for Power System Engineering, $300.

Univ. of California, Los Angeles:
Aug. 21-Sept. 1, Computer Control Systems Technology, $300.

Washington Univ., St. Louis, Mo.:
Sept. 5-9, Current Trends in Automatic Control Theory.

short lines . . .

The price of the SDS 940 time-sharing computer has been raised by some 8%, or $80K for a "typical" configuration. The increase affects both purchase and fixed-term leases . . . An add-on contract awarded to Bailey Meter Co., Wickliffe, Ohio, will result in a $1,325,000 control system for the world's largest steam-electric generating unit. Currently operating at the TVA's Paradise Steam Plant are a Bailey 760 digital control system for cyclone burner management and a 721 analog unit for combustion control. To this will be added an 855 on-line process computer, an IC unit announced earlier this year . . . A patent has been issued to IBM for a program interrupt feature in a computer. The invention has a simultaneous overlapping feature, which permits a program to continue operating after requesting I/O data. The invention is incorporated in U.S. patent number 3,319,230, originally filed in 1956. Credited by IBM for this development are Dr. Morton M. Astrahan, Bennett Housman, Hrand L. Kurkjian, and Vernard L. Sarahan, now with Pre-Search Inc., Silver Spring, Md. . . . Recognition Equipment Inc., Dallas, Texas, has formed two wholly-owned subsidiaries. Its Docutel Corp. will develop devices to accept currency and vending documents that are suitable for optical scanning. And Corporation S will perform software and systems studies on a contract basis for users of the Retina reader. William Pickerell, ex-sales manager for McDonnell Automation Center of Texas, has been named vp and general manager of Docutel . . . The Telemax computerized travel reservation system is on the air. Most of the 500 Quality Court motel chain and the entire Marriott motor hotel chain are on-line, with the National car rental and Master Hosts motels to follow. Telemax Corp was established as a subsidiary of Maxson Electronics Corp. in the fall of '64 . . . The service of generating an OS/360 system to customer specs is being offered by Computer Usage Development Corp. The generation is done on CUC's 360/40 . . . For on-line users who prepare microfilm copies of CRT images, IBM has developed a process that produces reversed (white on black) film images. And the number of processing solutions required for this has been cut to four. From initial exposure to a finished picture, the time is 13.5 seconds . . . A 2.7-million-bit, 900-nanosecond cycle time core memory system recently produced for a government agency computing system is reportedly the largest submicrosecond system yet made by Electronic Memories Inc. It uses 30-mil cores.

At Montreal's Expo 67, IBM is demonstrating the use of an infra-red light beam for data transmission . . .

● Varian Associates, Palo Alto, Calif., has acquired Decision Control Inc. and its subsidiary, Data Machines. An initial payment of 100,000 shares of Varian, valued at some $3.5 million, is to be followed by payments that depend on the performance of DCI. Decision Control and DMI, in Newport Beach, Calif., make core memory systems and computers. They have annual sales of about $5 million. Varian's '66 sales were $145 million, estimated to rise to $160 million this year before this acquisition.

● Sperry Rand and Honeywell are involved in litigation over the latter's alleged infringement of Sperry's patent on the ENIAC computer. Legal action has been reportedly brought by both parties.

What is RCA doing about computer time-sharing?

RCA's new Spectra 70/46 now makes it practical to have a time-sharing computer on your own premises. It's the first general-purpose system that lets you do interactive programming, local batch processing and remote batch processing, *all concurrently.*

With the Spectra 70/46 you can use all your existing Spectra 70 software and program libraries, as well as all the new, specialized RCA time-sharing software such as conversational FORTRAN, terminal command language, text editing, and language processor syntax checking, among others.

Concurrent with local batch processing, dozens of remote users can work with the 70/46 and each feels that the computer is at his personal disposal. The close man/machine dialogue that this permits, means more imaginative and efficient use of the computer than ever before.

If you want more information on how Spectra 70/46 can give you in-house time-sharing capability, call your nearest RCA EDP office, or write to: RCA Electronic Data Processing, Camden, N. J. 08101.

RCA SPECTRA 70

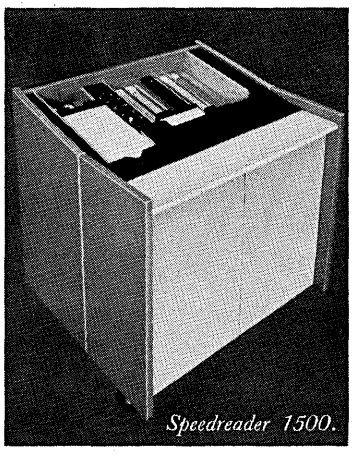
Introducing the Spectra 70/46 with time-sharing capability.

RCA The Most Trusted Name in Electronics

CIRCLE 45 ON READER CARD

Do not fold, staple, mutilate, tape, chew, butter, glue, nip, dip, cut, wear, mayonnaise, tear, fray, alter, grease, or oil this card.

MUTILATION WAS ONE OF OUR CUSTOMER'S CUSTOMER'S SMALLER READING PROBLEMS


Speedreader 1500.

Redemption of almost a million soap coupons per day has to be fast and accurate or grocers stop honoring them. And redemption reports to marketing management must be, too, or plans fail.

When IBM sold Procter & Gamble a SYSTEM/360, Model 30, they included Uptime high-speed card readers in their proposal to handle punched card coupons that would arrive in many unusual post-kitchen conditions. Despite the unbelievable condition of these 20-column cards, the Uptime Speedreaders are reading 70,000 of them per hour under complete computer-programmed control.

Our business is built on solving reading problems for OEM's. Occasionally we work directly with system owners. At all times we strive to merit a continued reputation for superior performance and economical service. May we help you help your customer today?

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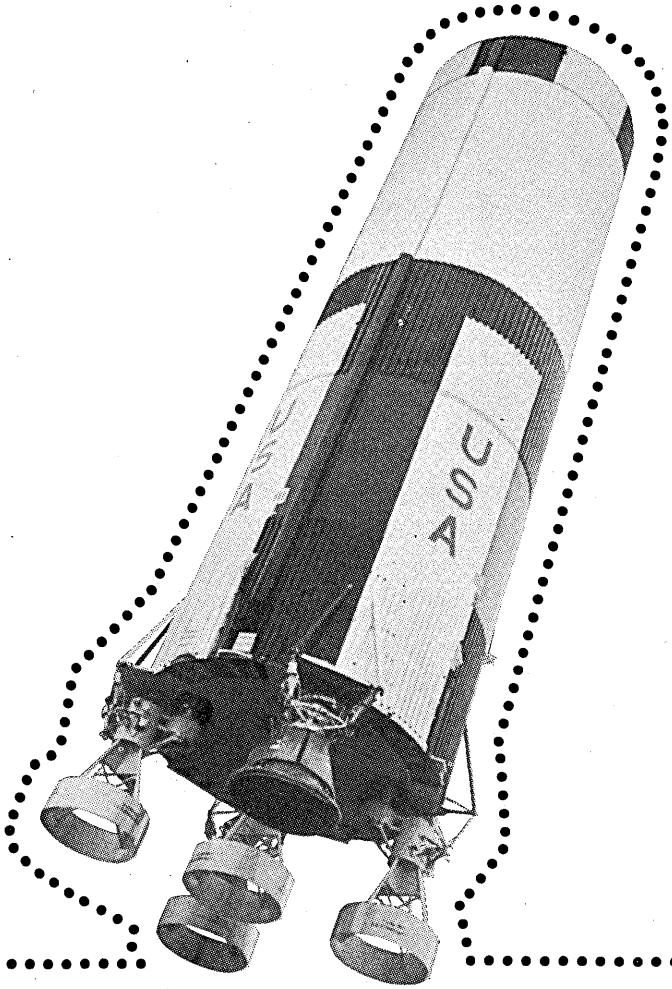
Computer openings on Apollo/Saturn V and other Boeing programs



Boeing's deep involvement with the nation's major space and missile programs provides immediate career opportunities for computer specialists at Huntsville, Alabama, and Seattle, Washington.

The company is a major mission-support contractor to the National Aeronautics and Space Administration on the Apollo/Saturn V program, and is building the first stage of the Saturn V launch vehicle. Boeing also is weapon system integrator for the U.S. Air Force's advanced Minuteman II ICBM, prime contractor for the NASA Lunar Orbiter, and system integration contractor for SRAM, the new USAF Short-Range Attack Missile.

Immediate openings exist on the Apollo/Saturn V program at Huntsville for computer programmers in scientific digital programming and analog and hybrid applications. Minimum requirements include a B.S. degree in an applicable discipline, plus programming experience with hybrid analog or digital computers.

Positions are also available in Seattle on the Minuteman, Lunar Orbiter, and SRAM programs. Assignments include data processing software (analysis and programming), information systems research, and product computing systems. Minimum requirements include a B.S., M.S. or Ph.D. in an applicable discipline, plus two to five years experience.

Salaries are commensurate with experience and educational background. Moving and travel allowances are paid to newly employed personnel. Boeing is an equal opportunity employer.

Please fill in and mail the coupon to the location of your choice and qualifications. A Boeing representative will get in touch with you.

I'm interested in a Boeing career; please contact me with details.

Name_____

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City_____ State_____ Zip_____

I'm usually home between_____ and_____ (hours) on_____ (days)

Degree/Field of Interest_____

Please mail to the location of your choice and qualifications: HUNTSVILLE: Mr. John Hall, The Boeing Company, P.O. Box 1680-CAE, Huntsville, Alabama 35807. *SEATTLE:* Mr. R. R. Laurie, The Boeing Company, P.O. Box 3999-CAE, Seattle, Washington 98124.

BOEING

SPACE DIVISION
MISSILE & INFORMATION SYSTEMS DIVISION

Other Divisions: Commercial Airplane • Vertol • Wichita
Also, Boeing Scientific Research Laboratories

Step ahead with NCR

NCR operates in one of the most challenging and constructive of all business fields. Our chief effort is directed toward helping business operate more effectively. This is accomplished through providing better and complete data processing systems.

NCR's new product releases during the past year averaged more than one a month, and ranged from a major new computer family to a new line of cash registers. The development of **NCR's** "Total Systems" concept has contributed substantially to the company's growth.

As worldwide sales continue to increase, many different skills are presently in demand at **NCR** for the installation of total data processing systems. Current requirements are in Dayton.

Vocational Specialists—If you are interested in the development of systems installation procedures and providing guidance to **NCR** customers, you will find an opportunity and challenge in one of our Vocational Support groups. General requirements include programming and systems experience.

Management Sciences—If you, as an experienced Fortran programmer, are interested in becoming associated with a rapidly expanding area here at **NCR,** then you will find the challenge of designing and implementing new Fortran compilers for conversational and real-time systems an excellent opportunity to further your career.

Software Development Programmers—Will be significant in the creation of real time, on-line major projects for commercial institutions. This involves the design of complete packaged software systems.

Software Engineer—Will carry responsibility for assisting in the formulation, specification, and evaluation of new **NCR** systems and equipment. This will also include the complete development, preparation, and evaluation of software.

If you are interested in a sound future with a growing concern, and have the necessary formal education and related experience in any of the areas mentioned.

Contact: Mr. T. F. Wade
Executive & Professional Placement
The National Cash Register Company
Dayton, Ohio 45409

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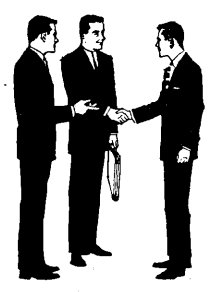
NCR

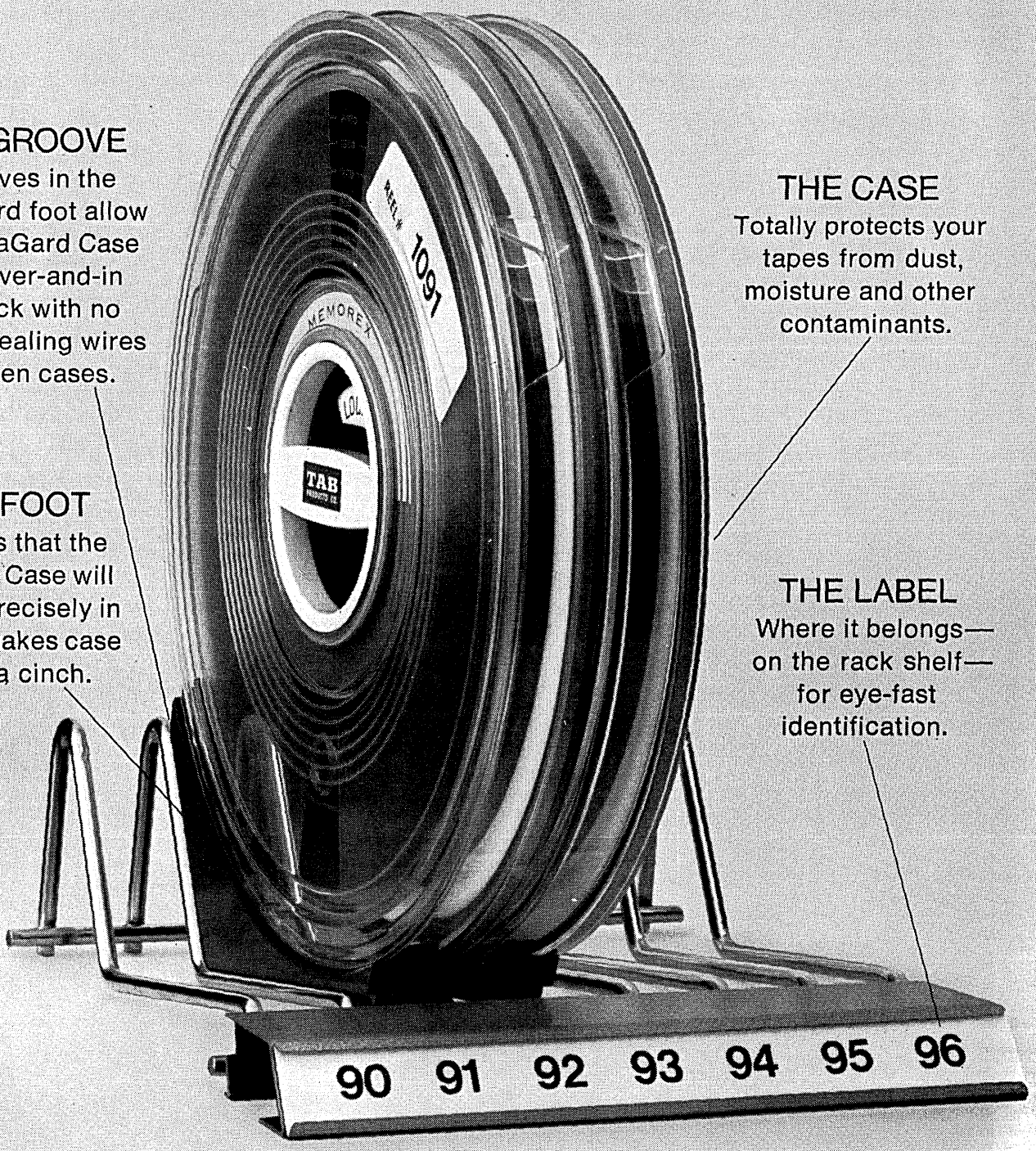


THE NATIONAL CASH REGISTER COMPANY ®

DAYTON, OHIO 45409

CIRCLE 302 ON READER CARD

New DataGard System: Suddenly you have 40% more space.



THE GROOVE
Grooves in the DataGard foot allow the DataGard Case to fit over-and-in the rack with no space stealing wires between cases.

THE FOOT
Assures that the DataGard Case will always fit precisely in the rack; makes case removal a cinch.

THE CASE
Totally protects your tapes from dust, moisture and other contaminants.

THE LABEL
Where it belongs—on the rack shelf—for eye-fast identification.

If you can use 40% more space you owe it to yourself to investigate the new DataGard Case. Call your nearest Tab representative. Or write us for full information at TAB Products, P.O. Box 2630, San Francisco, Calif. 94126.

TAB PRODUCTS CO.

CIRCLE 48 ON READER CARD

washington report

EDUCATION OFFICE LOOKS AT DP SCHOOL ACCREDITING

Office of Education's Accrediting Review Committee meets July 24 to determine if dp training schools need an accrediting agency. There are two candidates and both could be approved: The Natl. Assn. for Trade and Technical Schools and the Accrediting Commission for Business Schools: NATTS wants an OK as accrediting agency for technical schools, such as those training edp maintenance people. ACBS is older and already recognized by OE in other areas. It is interested mainly in schools producing programmers for business such as already accredited CEIR's Automation Inst. in Chicago and Omaha. OE's recognition would qualify many students for federal training grants, others for bank loans insured by the government. Both require attendance in accredited schools. A dp accrediting agency might also help drive out fast-buck operators with phony certificates.

COMPUTER MAKERS ALSO FEEL IMPACT OF VIETNAM

The Pentagon expects bids this month for about 200 computers to keep track of thousands of repair parts for field equipment. Bids are expected on the NCR 500, Univac 1005, IBM 360/30, maybe others. Meanwhile, the 7th Army in Europe will test a computer that will help the field commander by plotting the tactical status of his troops against the enemy's and test alternate tactical plans. Same computer will perform fire control and logistics functions. Over in the artillery department, Army's Tacfire scheme has moved into the engineering phase, with production approval yet to come. Finally, ARPA's Robert Taylor flew to Saigon recently to help Gen. Westmoreland over some data management problems and recommend a computer for his own use.

BROOKS, PASTORE HEARINGS START THIS MONTH

Cong. Jack Brooks starts hearings July 18 to review progress in government computer management since his bill became PL 89-306 in Oct. '65. He'll push for more savings while reviewing education of federal edp types, the FCC computer/communications study, and patenting and copyrighting of computer programs. Brooks may dwell longest on recent plans for extending edp to colleges and high schools, such as the Pierce report to the White House in February, which called for an increase in government funds for computer sciences, services and research. Also on July 18, Sen. Pastore opens hearings on early vote predicting on TV and radio via computers. FCC and network reps lead off the witness list. Privacy hearings by Cong. Gallagher and copyright hearings by Sen. McClellan have both been delayed.

SUITS OVER ENIAC PATENT FILED

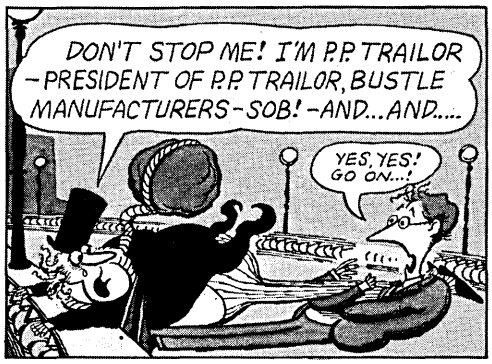
Sperry Rand and Honeywell filed suits against each other over the basic Eniac patent in June. Sperry owns the patent, says Honeywell infringes it; Honeywell says Sperry shouldn't have it. Most computer makers have signed licensing agreements via Sperry's Illinois Scientific Developments, Inc., but Honeywell balked.

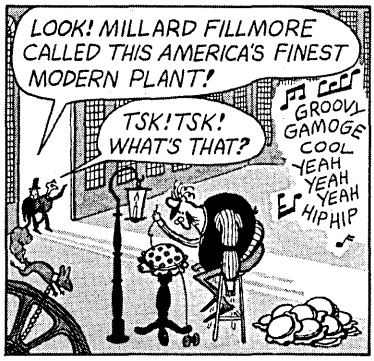
CAPITOL BRIEFS

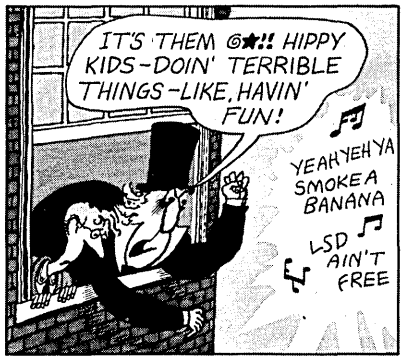
SDS is talking to GSA about placing its separately marketed COBOL in the Federal Supply Schedule for '68. SDS wants to compete for large Defense contracts, which require COBOL. ... The IRS computer in Martinsburg, W.Va., now has a three-year tax record for every one of us.

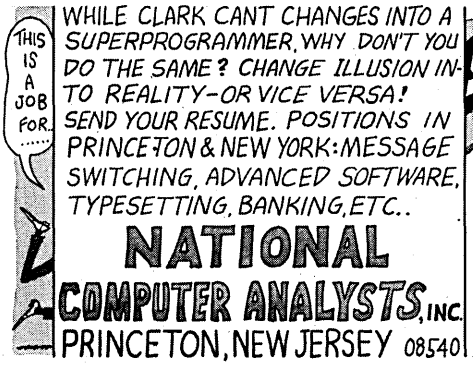
THE FURTHER ADVENTURES OF SUPERPROGRAMMER

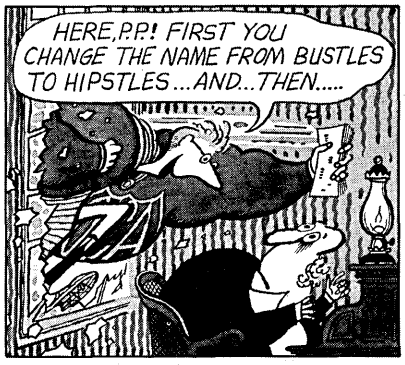
IN HIS EVERYDAY DISGUISE AS MULLED-MANNERED CLARK CANT, SUPERPROGRAMMER CHANCES ON A DRAMATIC SCENE ON LOSER'S LEAP BRIDGE:

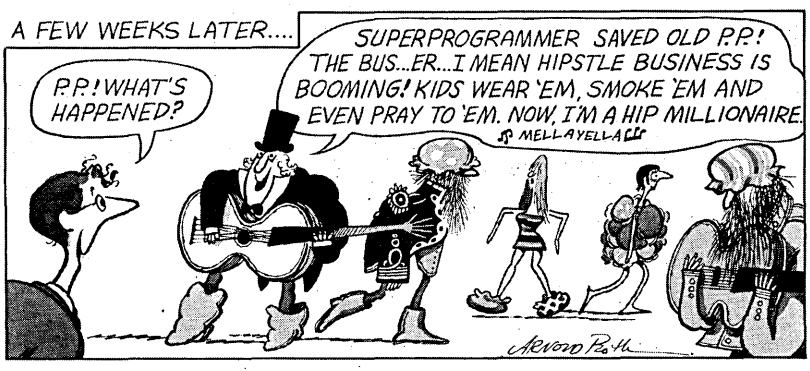












[illegible] ideas

[illegible] Processing

[illegible]

[illegible] Institute For Medical Research . . . with Engineers, Chemists, and Microbiologists [illegible] . . . with marketing, distribution or sales staffs of the Squibb Pharmaceutical Company or The Squibb Products Company . . . or accounting and finance divisions. Many of the projects you will take from start to finish [illegible]

[illegible] is great. We're looking [illegible] a challenge.

[illegible] Send a re[illegible] Processing Center, [illegible] East Brunswick, [illegible]

SQUIBB

[illegible]

[illegible] knowledge of COBOL [illegible] level language [illegible]

[illegible] ANALYSTS

[illegible] commercial and non-computer systems. College degree essential. An advanced degree and/or a degree in Industrial Engineering or Computer Sciences highly desirable. Prefer 5 years application experience (any applica-[illegible]

[illegible]

College degree [illegible].

BIOSTATISTICIANS

[illegible] or Ph.D. Will bridge our research [illegible] activities, design [illegible] data analysis. Should have been involved in data processing for several years.

[illegible] ANALYSTS

[illegible] programming background. B.S. degree required, advanced degree [illegible]. Minimum 2 years direct data processing exposure.

MATHEMATICAL ANALYSTS

B.S. in Life or Physical Sciences. M.S. in [illegible] with a Ph.D. highly desired. [illegible] research, linear [illegible] scheduling and applied mathematics along with assisting our scientists in the use of the computer.

An equal opportunity employer

The new, small DECdisk provides 32K words extra memory for the PDP-8 for $6,000. Additional 32K DECdisk units cost $3,000 each. Since a basic $18,000 PDP-8 computer has 4096 words in core, with four DECdisk units, that could give you a high speed computer with 135,168 12 bit words for $33,000!

DECdisk is compatible with the $10,000 PDP-8/S, too. Adding four DECdisk units gives you a slightly slower computer with 135,168 12 bit words.

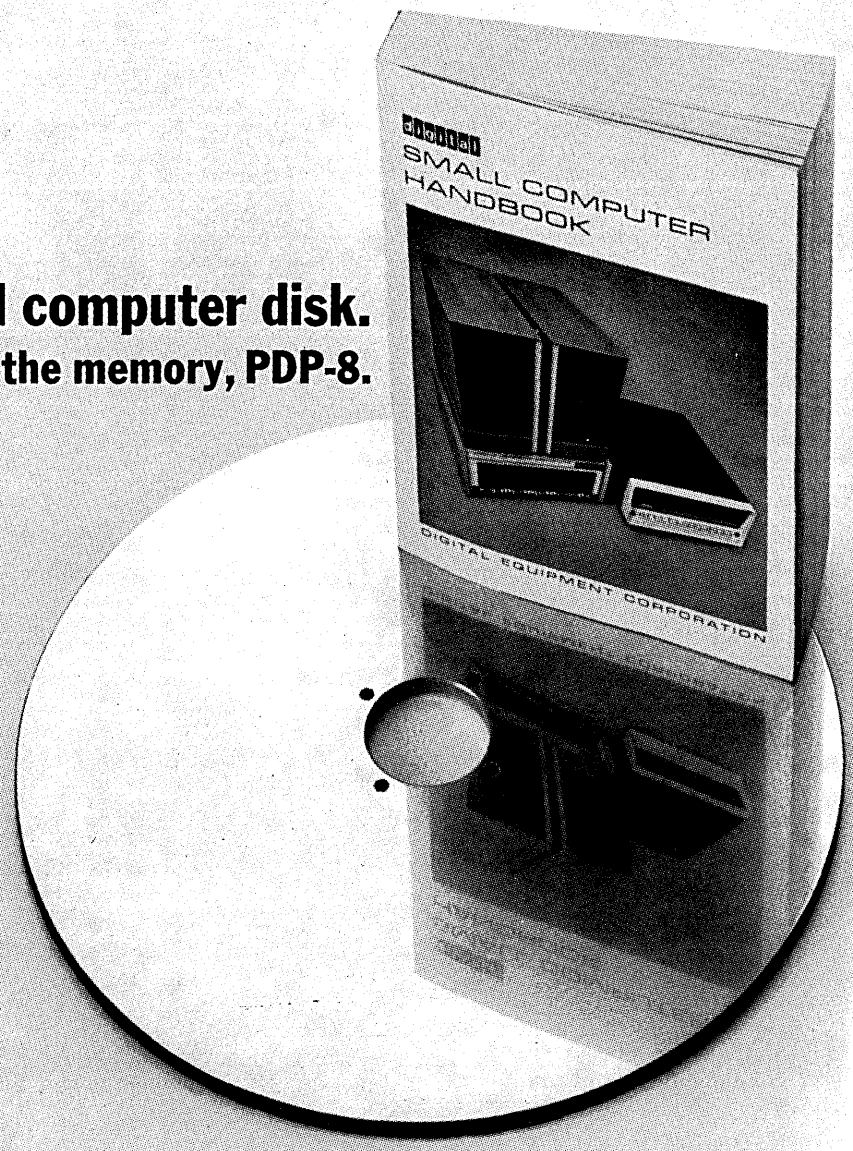
More memory for less cost than any other computer.

At last count, more than 700 PDP-8 computers have been sold to scientists and equipment manufacturers. The PDP-8 is, by far, the most successful and proven on-line, real time, small computer in the world. And that was before DECdisk.

DECdisk was developed, like all DIGITAL peripherals, to customize a basically inexpensive computer to special applications. Yours. DECtape was developed the same way. The unique 3½" reels of magnetic tape not only provide low cost storage, but permit you to carry your program library in your pocket. And displays — did you know that DIGITAL was the first computer manufacturer to put a CRT on a computer?

Computer manufacturers who worry about what the customer needs, worry a great deal about peripherals. DIGITAL has one of the largest lines of peripherals in the industry. Write, and we'll send you a free "Small Computer Handbook" and tell you all about our peripherals.

New, low cost, small computer disk.
Thanks for the memory, PDP-8.



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CIRCLE 49 ON READER CARD

world report

UNIVAC INCREASES EUROPEAN SCORE

Odds are in favour of Univac pulling off its biggest coup in Europe (a hat-trick in the oil industry) with another twin 1108 system. Earlier in the year the mighty Dutch corporation Shell International plumped for big Univac systems. Last month a joint distribution agency in the U.K., Shell Mex and B.P., ordered two 1108's for replacement of Leo 326's. Now it looks as if the other partner, British Petroleum, is going to follow suit. The British Petroleum group is expected to place its order through CEIR Ltd., London, in which it bought controlling interest two years ago. At the end of last year CEIR disclosed plans for setting up a big time-sharing service on a Model 67 — a plan which suffered a setback with IBM software slippage. With another plum customer slipping from its grasp in the oil industry, rumour hath it that "numero uno" is ploughing a $30,000 budget into retaining the CEIR account.

U.K. TIME-SHARING NETWORK UNDER WAY ...

Univac is also listed as the candidate for International Publishing Corporation's $20 million venture into a computer utility service. As the world's biggest newspaper, women's magazine, and trade and technical publisher, International Publishing also holds a 76% interest in Computaprint and 25% in Intinco. Both these operations were the brainchild of Charles Ross (former NCR banking and finance sales manager) and Michael Gassman (former financial journalist and investment analyst). The first company provides a computer typesetting service using a high speed Photon Zip filmsetter for compilation of jobs such as auto-spares catalogues. Intinco provides an on-line stockmarket analysis and portfolio valuation direct to 50 stockbrokers and analysts' offices based on a service called Scan which uses a Univac 418. IPC is to take over complete control of both operations and consolidate their activity.

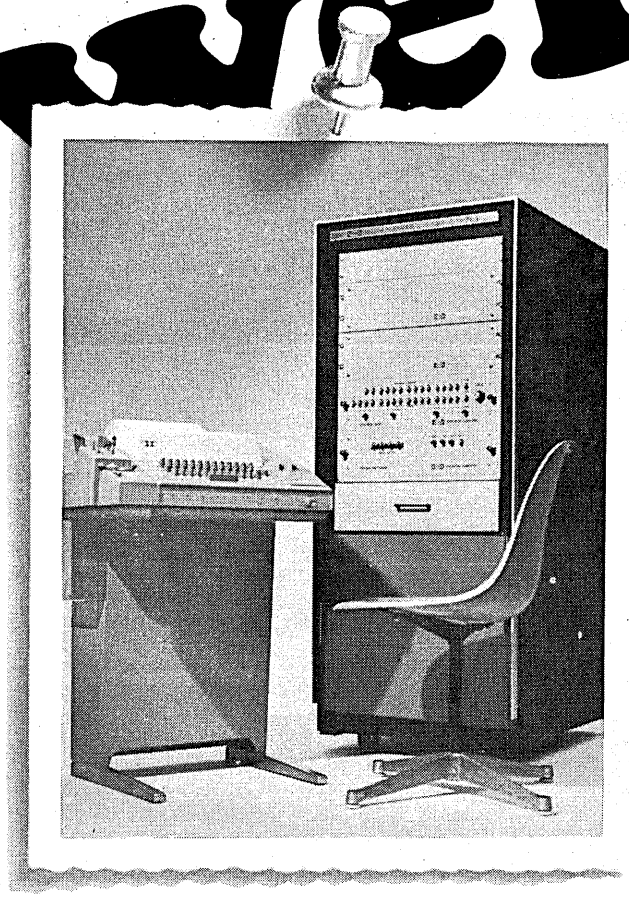
In its new guise, Intinco will build a nationwide time-sharing service using the dial telephone network and two or three 1108's. The object is to provide a management information service both for IPC and commercial customers. The Scan service will be extended to other applications. Long term, the newly formed Intinco organisation is expecting up to 10,000 terminals. Discussions have also started for taking the Scan service to the States.

... BUT THE POST OFFICE PUSHES OWN PROPOSAL

The International Publishing scheme has come at an awkward time for the British Post Office, which is trying to get Government approval of its proposals for a national data processing service. The special Parliamentary Committee working on the Post Office (Data Processing) Bill is inundated with amendments to ensure that a GPO-run system would not become a monopoly of the service bureau business and would not enable the administration to put restrictions on private corporations that attempt to set up time-sharing systems to compete with the State service.

(Continued on page 101)

Price & Power



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

RAYTHEON

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

FOR $15,000, YOU GET:

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

YOU CAN HAVE:

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

WE WILL SEND YOU FREE:

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

CIRCLE 51 ON READER CARD

(Continued from page 99)

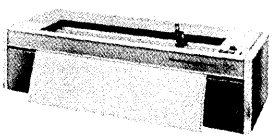
Defending the Post Office's proposals in Parliament at the end of June, the Assistant Postmaster General, Joseph Slater, said there was a risk of an overseas computer giant moving in if the Post Office did not act (no names mentioned, but who could he have been thinking about?).

BATCH SYSTEMS ALSO SEEK THE SMALL USER

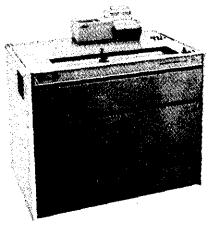
As all the arguments on time-sharing rage, one of the smaller bureaus is expanding into a chain of small batch systems for on-the-spot customer services. Mills Associates, Monmouth, has ordered a first batch of nine 1901's costing $2.3 million from ICT to go into new centres in Bristol, Cardiff, Nottingham, Merthyr Tydfil, and Southampton; with Cheltenham, North London and Worcester listed as provisional locations. The hardware order has been switched from Univac because discs were not forthcoming on the 9000 series.

BITS & PIECES

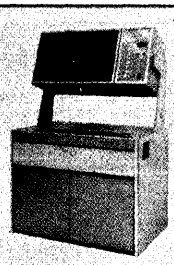
After five years' wrangle, the British Computer Society has opted for professional qualifications, and has laid down grades for entry. First examinations through universities and colleges will be held in 1969. ... ICT has responded to Elliott Automation's big machine paper tiger (Datamation, June, p. 91), with its own design called Project 51. As ever, its future development depends upon Government backing. ... France's Plan Calcul takes another step further with details released on a new factory at Toulouse, where the state computer group CII will manufacture. Intra-European discussions on collaboration have taken little steps further. French policy is reported to be against cooperation with other countries in the first two years of the plan. Germany is hesitantly pushing forward with plans from its Ministry of Science for a network of data centres that could be used as models of perfection for user emulation. However, feeling is strong within the industry that if Europe is to cooperate, then the initiative must come from the machine makers in persuading governments of the needs and urgency for intra-Europe collaboration. ... Berliner Kraft und Licht (gas and electric utility) has installed a Univac 491 costing $1 million. ... Another Anglo-American software house has been set up in the formation of KRJ and Partners, as a subsidiary of Information Development Co. ... Honeywell continues to improve its market position in Australia. In recent weeks, Honeywell has announced two new orders. They will supply the Victorian Electricity Commission with a Honeywell 20 digital control system. The system will feature a central processor with remote control and monitoring for an open cut mining operation. The installation will cost $370,000. One of Australia's biggest paint companies, British Paints (Australia) has placed an order for a Honeywell 120. ... Sydney Univ. has completed installation of a large computer complex. It consists of an IBM 7040 coupled to an IBM 1401. Costing more than $1 million when new, the computers were first installed in 1964 at the Atomic Energy commission's establishment in Sydney. The system was donated to the University by IBM following an upgrading in the AEC's installation.



ON-LINE 305



CARD INPUT DELTA



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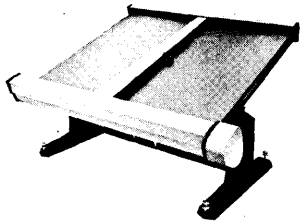
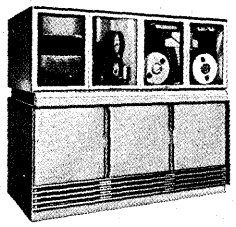
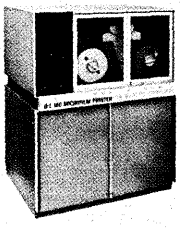


DIGITAL DRAFTING SYSTEM



B-L 120



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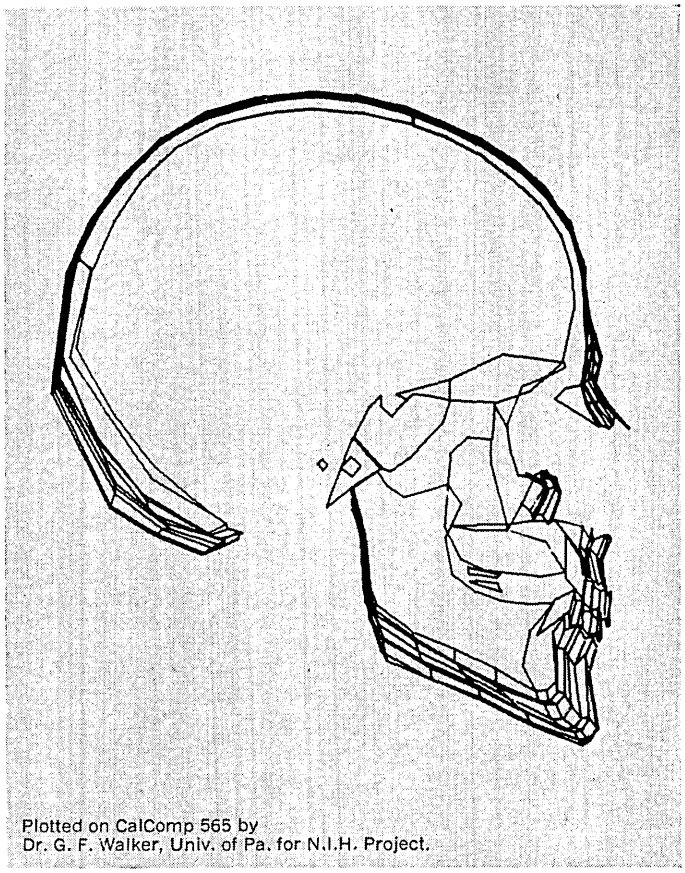

Plotted on CalComp 565 by
Dr. G. F. Walker, Univ. of Pa. for N.I.H. Project.

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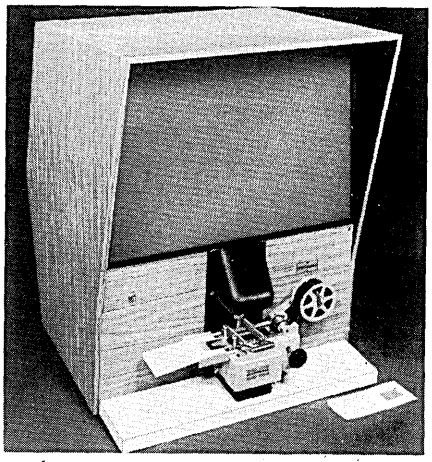
new products

aperture card reader

A reader for 35mm film aperture cards has a screen size of 18 x 24″ with a 15x magnification. The inserter for cutting and inserting microfilm into the aperture cards is furnished separately. The reader is equipped with optional attachments for viewing film already in the cards, or 16mm and 35mm roll microfilm. MICROSEAL CORP., Skokie, Ill. For information:



CIRCLE 100 ON READER CARD

plotter software

The SCOPLT (Scope Plot) software package will transfer IBM 2250 graphic displays used with System/360 into an equivalent plot tape record for any CalComp plotter, including the electronic Model 835. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif. For information:

CIRCLE 101 ON READER CARD

analog simulation software

MIDAS-24 is an adaption of the MIDAS program (Modified Integration Digital Analog Simulator) for use with 24-bit machines such as the DDP-24, DDP-124 and DDP-224 computers. The program is written in FORTRAN IV and includes a scan/sort and execute phase. It is available in two versions, both requiring a minimum of 16K words of memory; one version is designed for any I/O configuration—a special version is for systems for card readers and line printer options. MIDAS-24 includes 160 operations elements, 255 symbols, 30 integrators, 10 function generators and 30 points for each function generator. It can be used to calculate derivatives and integrals, solve systems of differential equations and perform linear or quadratic interpolation and function generation. HONEYWELL COMPUTER CONTROL DIV., Framingham, Mass. For information:

CIRCLE 102 ON READER CARD

rack-mounted computer

The BIT 480 desk-top computer is now available in a rack-mounted version with a panel height of 10.5″, a depth of 22.5″, and weight of 65 lbs. The memory system has a panel height of 10.3″, a depth of 17.2″, and weighs 65 lbs. The entire system fits standard 19″ racks. Slides are provided. The 480 processors are available with memories ranging in size from 1,024 - 65K characters, with either 8 usec or 2 usec memory cycles. BUSINESS INFORMATION TECHNOLOGY, INC., Natick, Mass. For information:

CIRCLE 103 ON READER CARD

modified memory system

The FX-14/C core memory system has organizations of 8K (16-bit) words or 16K (8-bit) words in a single unit, due to modifications of the timing circuit in the FX-14, a 4K (32-bit) memory. Cycle speed of the 14/C is 8 usec, and the unit has flexible interface capabilities. FERROXCUBE CORP., Saugerties, N.Y. For information:

CIRCLE 104 ON READER CARD

job control system

The Job Estimating and Control System consists of three separate systems that allow service center management to evaluate business proposals, schedule jobs already contracted, monitor daily performance, measure costs and make bid estimates. The system is available to users of Honeywell 200 equipment, and requires a minimum

PRODUCT OF THE MONTH

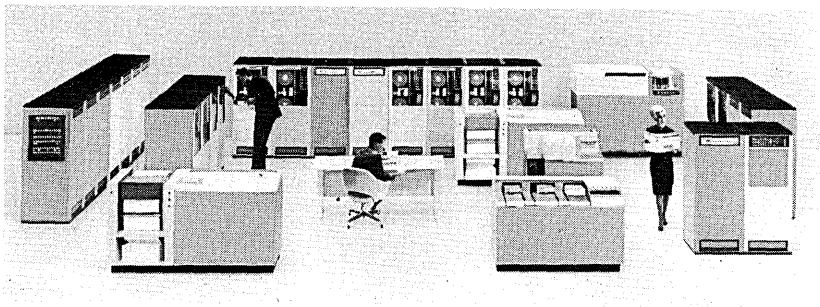
The Spectra 70 model 46 is a medium-scale time-sharing system for users who would be content with having 12-15 terminals operating in the t-s and batch modes. But up to 48 terminals reportedly can be handled. The 70/46 processor is similar to the 70/45, the changes including more efficient handling of I/O data transfers, increased transfer rate, and a 1,024-byte (300 nsec access time) memory used to translate virtual addresses to actual addresses.

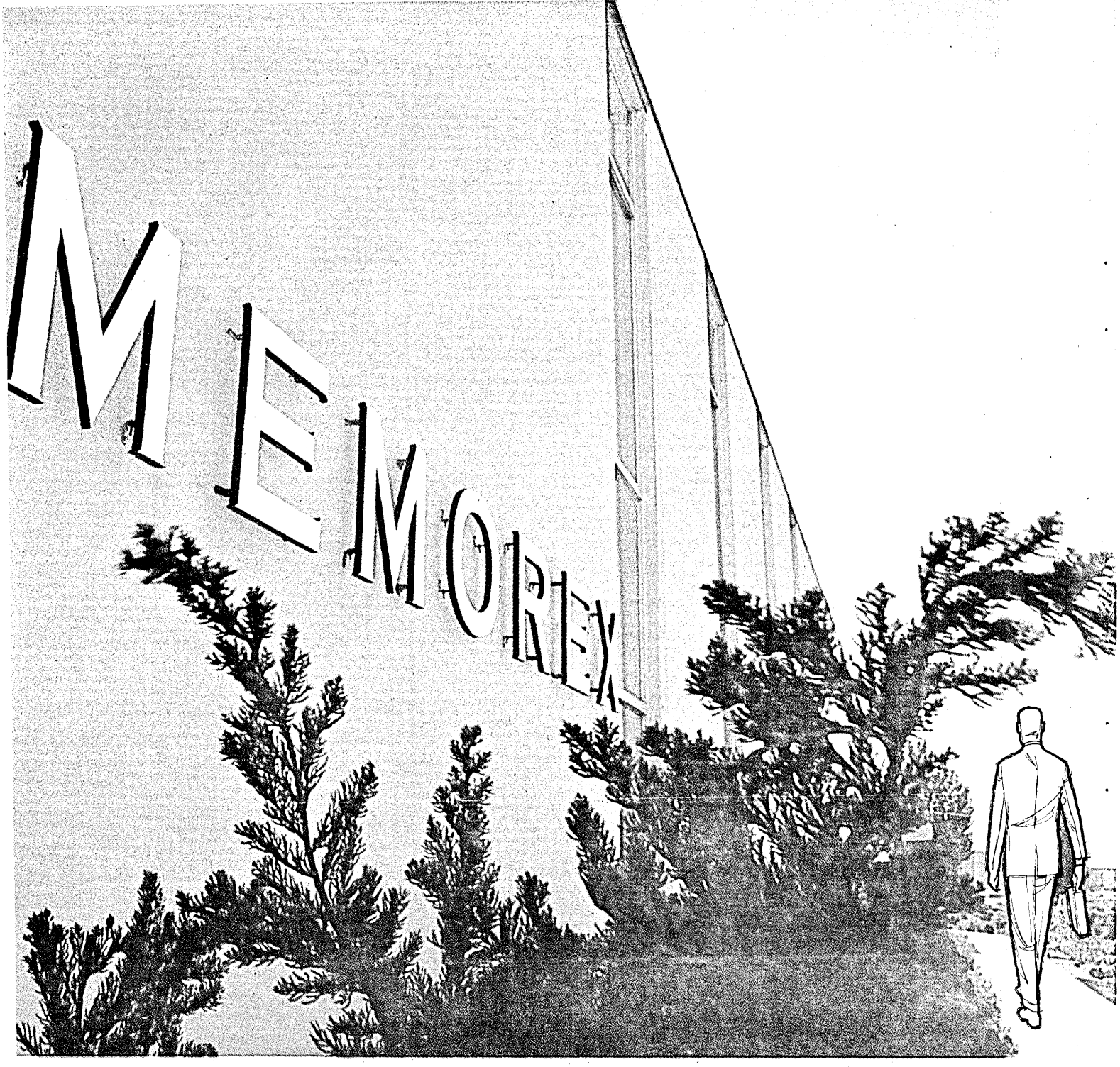
The virtual memory up to 2 million bytes is divided into eight segments, each with 64 pages. A page can be 2K or 4K bytes. There's also a potential for 32 segments. The system reserves its two read-only memories for resident software, which means there is no emulation on the mod 46. The main core memory comes in modules of 262K bytes, and has a cycle time of 1.44 usec.

Multi-accessing and multiprogramming are handled by the Time-Sharing Operating System (TSOS), which is compatible with the Tape os (TOS). It allows interaction with executing programs, handles batch processing, and includes storage management and file management facilities. It constructs a single task queue from multiple input sources, concurrently executes as many as system resources allow, and enters nonconversational tasks into the queue from remote terminals. Software includes FORTRAN, COBOL, conversational FORTRAN, and an assembler.

A typical system will rent for about $25K per month. RCA EDP, Cherry Hill, N.J. For information:

CIRCLE 105 ON READER CARD





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CIRCLE 306 ON READER CARD

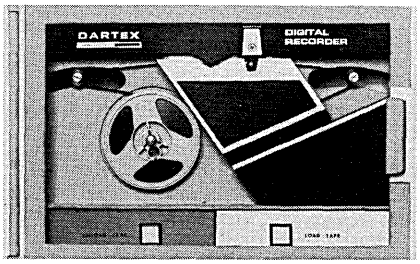
new products

16K memory, four tape drives and card reading and printing units. The three components are Manage, consisting of a critical path network based on PERT; Autotime SC, which produces timing data on individual job runs; and Autolog, automatically producing operating statistics. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 106 ON READER CARD

incremental recorder

The Dartex 1020 is a mag tape digital I/O incremental recorder that asynchronously records and reproduces 8-bit parallel characters at any rate up to 120 characters per second. Operating in a synchronous mode, the unit will record or read at a rate of 1600 cps. Buffering is provided on a removable 3″ diameter reel of ¼″ mag tape. Applications include data transmission, control mechanism for machinery, data acquisition terminals, and auxiliary storage for displays. TALLY CORP., Seattle, Washington. For information:



CIRCLE 107 ON READER CARD

graphic reproduction system

System G, composed of two input consoles, a modified Photon 713 phototypesetter, and programming package, is said to produce final engineering drawings and designs in 15-20% of the man/hours required manually. The system can be used with any g-p computer with at least 65K bytes of storage. The input consoles consist of a large drawing table on which the rough drawing is placed, and a Friden keyboard with paper tape output. A digitizer or stylus mounted on the drawing table is pointed at end-point line information on the drawing and symbols and alphanumerics printed on a separate sheet. When the stylus is positioned, the operator punches the appropriate button on the 11-button control panel to trigger transmission and indicate the kind of data being sent to the paper tape. The keyboard is used to punch lengthy *a-n* data. Once the symbol is transmitted from either device, the stylus is used to point out its location on the drawing.

Paper tape produced is fed the computer which creates a final tape to drive the 713. At 40 cps, the 713 outputs film or the schematic drawings in five minutes or less. The programming is done in FORTRAN IV. Software can be also be modified to include printout of parts production lists and such. The human engineering design of the input devices was done in cooperation with Tufts Univ. PHOTON INC., Wilmington, Mass. For information:

CIRCLE 108 ON READER CARD

graphics processor

The Mark 8 Universal Graphics Processor consists of an automated plotting table on-line to a general-purpose digital computer. It may be operated in any of three modes. As an input tracing digitizer, the unit utilizes a tracing stylus; as an output digital plotter, the tool holder allows scribing tips for use with coated plastic materials or pencils and pens; as a simultaneous input and output system, the operator uses the manual input to point to various features and the computer does the drawing. The computer has a storage capacity of 4K (12-bit) words, provides on-line computation, and acts as a buffer interface to other equipment. An ASR 33 Teletype is connected to the computer. Software includes special programs for point-recording, line-tracing, plotting and executive control. CONCORD CONTROL, INC. Boston, Mass. For information:

CIRCLE 109 ON READER CARD

disc memory

The model L110 head-per-track disc memory is for applications such as process control, display, and inventory control. The unit has storage capacities up to 276,480 bits. Access time ranges from 8-25 msec. LIBRASCOPE GROUP, GENERAL PRECISION INC., Glendale, Calif. For information:

CIRCLE 110 ON READER CARD

mag tape terminal

The MT-3000 series magnetic tape terminal is for the transmission and reception of tape data over both standard telephone lines and wide-band Telpak. The terminal transmits up to 4,800 bits per second on voice-grade lines and is capable of handling any 8-level code. The new system writes, reads and checks digital data in IBM 9-level 360-compatible format with densities of 200, 556, and 800 bpi. Transmitted data may be used to make punch cards or paper tape, to duplicate another mag tape, or to produce hard copy. Record size is up to 8,192 characters per record. ULTRONIC SYSTEMS CORP., Pennsauken, N.J. For information:

CIRCLE 111 ON READER CARD

time-series analyzer

The TIME/DATA 100 time-series analyzer provides real-time analysis for oceanography biomedicine, geophysics, aerospace. A two-channel, all-digital processor, the unit provides pushbutton selection of the basic set of algorithms for Fourier transformation, auto and cross spectra, auto and cross correlation, convolution, amplitude and time histograms, ensemble averaging, and real and complex multiplication. The 100 is a wired-program machine that can produce a 2000-point Fourier transformation in less than 1.5 seconds. Standard features include built-in A/D and D/A conversion, manual keyboard and digital interfaces. Results are displayed in rectilinear of phase-plane form, and are available for readout onto oscillographs, *x-y* plotters, computers, digital tape. TIME/DATA CORP., Palo Alto, Calif. For information:

CIRCLE 112 ON READER CARD

paper tape readers

The model PRT80 paper tape reader will operate at 200-500 characters per second synchronously, or 200 cps asynchronously. A variable tape guide permits the use of all standard tape sizes between $1\frac{1}{16}$″ and 1″ widths. The unit also features 5- to 8-level reading through individual and separate amplifier channels. Options include 6-level advance feed-hole reading and 50-cycle operation.

The PTR90 paper tape reader reads up to 1,000 cps synchronously, and up to 225 cps asynchronously. GENERAL ELECTRIC CO., PRINTER-READER BUSINESS SECTION, Philadelphia, Pa. For information:

CIRCLE 113 ON READER CARD

two-color display tube

The SC4689 two-color information display tube uses red "rare earth" europium-activated phosphor and green phosphor, and can be read under high ambient light conditions, and used in airborne or surface electronic systems for air traffic control

new products

where flight planes could be clearly defined. The tube does not have a shadow mask or the combination phosphor dot pattern common to color TV tubes, and this factor reportedly allows greater brightness and finer resolution. Tubes range in size from 1″ to 27″ in round or rectangular versions. SYLVANIA ELECTRIC PRODUCTS, INC., Seneca Falls, N.Y. For information:

CIRCLE 114 ON READER CARD

stepping drum programmer

The Series 200 stepping drum programmer is a pulse-actuated, motor-driven switching device which automatically sequences operations according to a preset program. The program pattern is established by inserting switch-actuating plugs in the drum. The system utilizes end-point program control which allows each step to occur only in response to a deliberate pulse signal, supplied by an external source. Combinations of drum and frame sizes are available to allow programs of 30, 60 or 100 steps with 8-32 valves, or in pneumatic or electrical combinations with up to 85 combined output elements. TENOR CO., Milwaukee, Wisc. For information:

CIRCLE 115 ON READER CARD

process control system

The Steam Electric Evaluating and Recording (SE/ER) System records day-by-day power plant performance data; the package consists of operating programs and hardware equipment, which the company says will reduce definition time for functions such as scanning, logging, alarming, turbine diagnostics, performance calculations; and provide deterioration information on plant components. Computer is the GE-PAC 4020 i.c. system capable of scanning up to 140 inputs per second and alarming out-of-limit conditions. The CPU has a 12K (24-bit) memory, stall alarm, line frequency time, 7-bit ASCII code and a 12-bit binary I/O buffer. System also includes an automatic program interrupt module, I/O channels that will accommodate 16 peripheral devices. Cycle time is 1.6 usec; add time is 3.2 usec.

Additional memory is provided by a 40K drum that can be expanded to 262K in blocks of 8K. Video display equipment is optional. Available software includes a compiler and an assembler; SE/ER is a preprogrammed system.

Price of a typical configuration is

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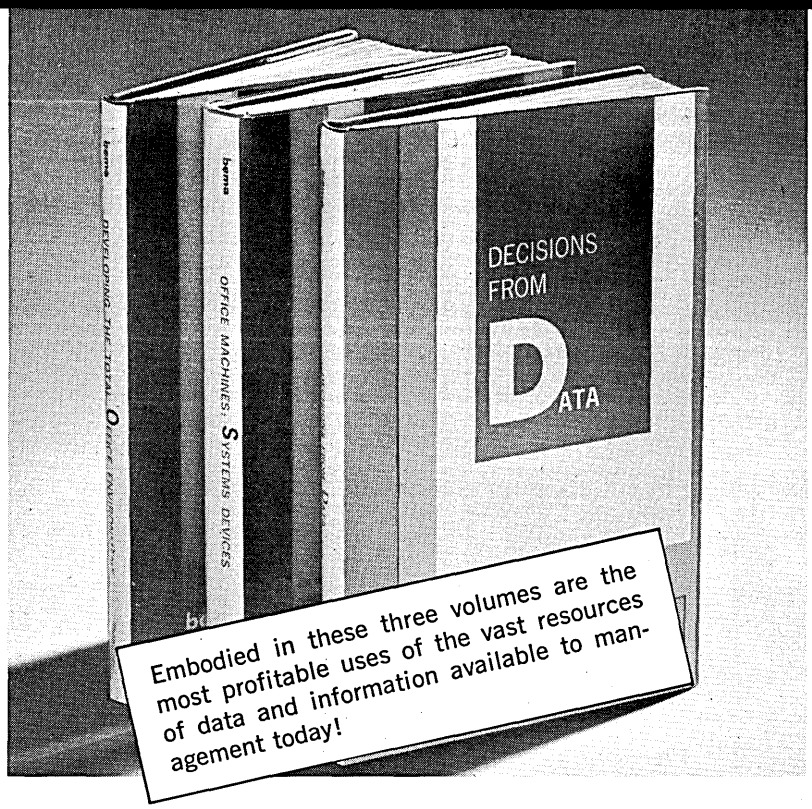

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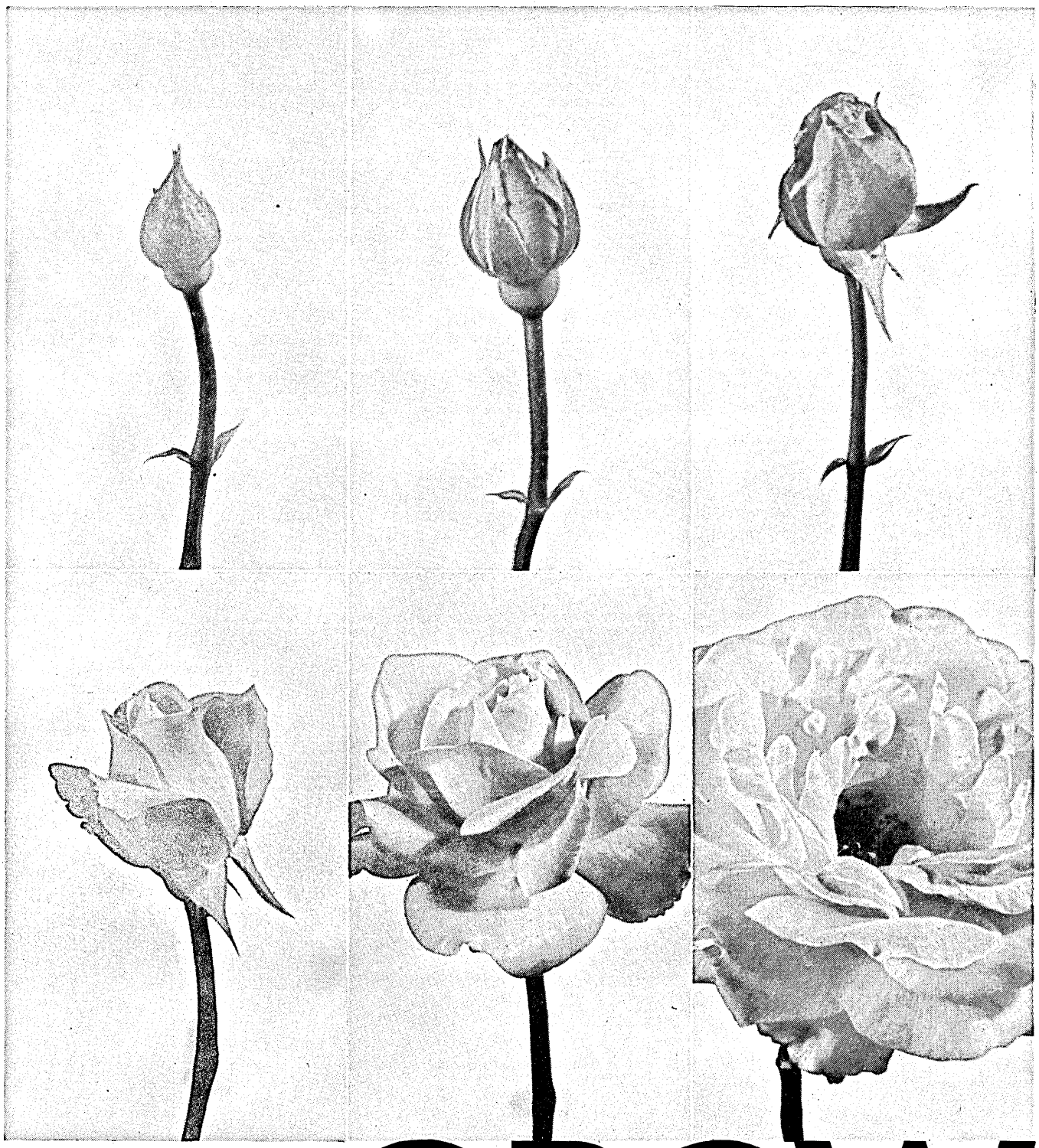

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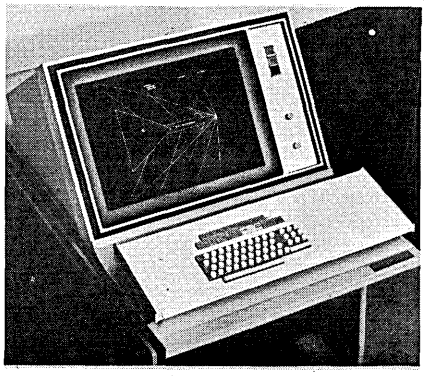
under $300K. GENERAL ELECTRIC PROCESS COMPUTER SECTION, Phoenix, Ariz. For information:

CIRCLE 116 ON READER CARD

display system

The Series 9000 modular display system will accept analog or digital input or a combination of both, and dynamic data can be presented against a static background. The system is a self-contained console with typewriter and CRT display; modules may be added at the sides. No software is available—each customer designs his own—and interfaces are cus-



tom-made: ones for the Sigma 2 and Sigma 7 have already been made.

The display allows an operator to produce line drawings and words on the screen; he can also edit, update, delete and retrieve stored information, and, via the display, monitor and control programs. TASKER INDUSTRIES, Van Nuys, Calif. For information:

CIRCLE 117 ON READER CARD

premium evaluation programs

Computer programs for gross premium evaluation instruct a computer to analyze all factors related to profit in an insurance company. The computer develops and prints an overall profit evaluation of present and future insurance on the books at any time, and management information which aids in isolating profit or loss contribution of each business factor analyzed. The programs use existing information available to any insurance company; minimum configuration requires a 12K memory. The programs are currently available for punched card systems. BOWLES, ANDREWS & TOWNE, Atlanta, Ga. For information:

CIRCLE 118 ON READER CARD

sort software

The KS-2 program is for the sorting, selection and summarizing of data being transferred from punched cards to tape. When used with IBM 360's and 1401's, the program will reportedly save up to 20% of the computer time while running the problem, and 80-90% of operator's time, when compared to a mechanical card sort. KS-2 provides for any combination of tape, punched-card or print output. Minimum configuration requires an 8K memory, four mag tape drives, a card read-punch, and an on-line printer. Maximum output record block for an 8K memory is 1,000 characters; 12K, 2,000 characters; 16K, 3,000 characters. Total sort data field may be up to 40 characters. ESSCO INC., Walnut Creek, Calif. For information:

CIRCLE 119 ON READER CARD

braided memory system

The braided transformer read-only memory is modular: there are three compatible modules for interrogation and a Memory Pac for storage available at standard DTL levels; the Memory Pac has a capacity of 65K bits. The system can be organized to form a read-only memory of any number of words or bits per word. It is hard to radiation, and may be used in space and military applications, as well as commercial applications. Cycle time is 250-300 nsec. MEMORY TECHNOLOGY INC., Waltham, Mass. For information:

CIRCLE 120 ON READER CARD

remote monitoring system

The DATATRAN remote monitoring system uses standard telephones and telephone lines, and consists of two components, the transmitter and the receiver-indicator.

The transmitter is located at the remote measurement site where it converts transducer instrumentation output to a proportional frequency that is suitable for transmission over voice-grade lines. Series 100 transmitters are for remote monitoring of potentiometric transducers; series 200 are for DC voltage signals; series 300 monitors switch equipped transducers. Transmitter impedance is matched for a nominal 600 ohm transmission line.

The receiver-indicator is located at a central monitoring station. It receives the incoming proportional frequency signal and converts it to a normalized dial display that is calibrated for a continuous 0-100% reading. Model ATR-100 is a dual mode device that can be used with either leased or private line service,

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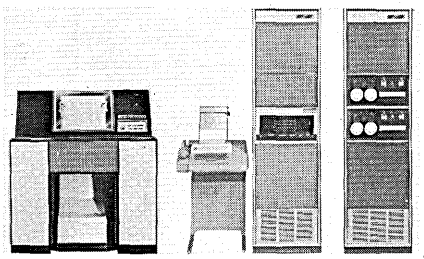
or with regular telephone service. Model AR-100 is for use with a transmitter-phone in regular telephone service. Applications can include tank contents gaging, alarm systems, process control and inventory control. ENGINEERING MEASUREMENTS CO., Boulder, Colo. For information:

CIRCLE 121 ON READER CARD

water production control

The Water Utility Management System can control water production and distribution and handle administrative and engineering functions. On-line functions are concerned with monitoring and controlling the water utility's pumping operations in accordance with fluctuations in demand. Off-line functions include customer billing, accounting, simulation of water system expansion, and the monitoring of meter performance to determine which meters need repair. Off-line, the system consists of a Teletype punched-tape reader and punch, a digital computer, mag tape transports, control units, and a line printer. For on-line functions, it is combined with supervisory control equipment. BADGER METER MFG. CO., Milwaukee, Wisc. For information:



CIRCLE 122 ON READER CARD

digital field summation

The SUM-IT System adds up seismic field records in preparation for use in computer input. It performs this digitally in the field as the original data is recorded. In a typical field operation, a surface source generates waves of energy, which are reflected by various strata in the subsurface to produce seismic signals. The signals are picked up by surface instrumentation, digitized and recorded on the storage memory of the SUM-IT System. As each new wave of energy is generated and reflected back to the surface, the signals are added to the previously recorded signal. After a programmed number of additions, the digitally summed signal is transferred to a tape transport which records the data on ½" tape in format for computer processing. Buffering by a core memory preserves the time fidelity of the summed data with respect to the source signal.

The system can digitally add up to 32 sequential seismic recordings, each of which may contain at least 24 data channels.

SUM-IT operates in three general modes: record-manual, record-discontinuous, and record-continuous. Input requirements are a maximum level of ± 10 volts, and a source impedance of 1K ohm or less. MANDREL INDUSTRIES, INC., DIV. OF AMPEX CORP., Redwood City, Calif. For information:

CIRCLE 123 ON READER CARD

message composer

The DATACALL Message Composer stores, organizes and transmits repetitive data at the touch of a button, through the use of a proprietary mag tape recording technique; the unit can be operated from its own control board. Each interchangeable mag tape cartridge can hold 40,000 alphanumeric characters. Applications include composition of shipping and billing information, storage and transmission of computer inquiries, and data input to computer-controlled CRT display systems. DASA CORP., Andover, Mass. For information:

CIRCLE 124 ON READER CARD

new literature

DP MANAGEMENT: Reprint of five articles, designed for the practical manager, cover insurance for dp, safeguarding tape-stored data, in-house mag tape rehabilitation, the used computer market, and floors for computers. DATAMATION, Los Angeles, Calif. For copy:

CIRCLE 140 ON READER CARD

GP COMPUTER: Brochure introduces the SEL 840A computer, with 24-bit, 4K memory, hardware index registers, hardware multiply and divide, and a Teletype I/O typewriter with paper tape reader and punch. Available software includes a mnemonic assembler and FORTRAN IV, library of sub- and utility routines, real-time monitor, diagnostic programs, and applications programming. Peripheral equipment is listed and applications in such areas as rolling mill process control, aircraft brake and wheel testing, space vehicle vibration testing, and jet aircraft simulation. SYSTEMS ENGINEERING LABS., Ft. Lauderdale, Fla. For copy:

CIRCLE 141 ON READER CARD

EDUCATIONAL SPENDING: 56-page report analyzes the educational technology market in context of government spending programs. Historical sales and projections are shown for 18 items. Each product is examined in detail and information on producers is listed. Expenditures for teaching devices is expected to increase from $26 million in 1965 to $570 million in 1975. Cost: $150; on subscription basis, four quarterly studies for $325. PREDICASTS INC., 10550 Park Ln., University Circle, Cleveland, Ohio 44106.

MILITARY AEROSPACE MEMORY: Specifications, timing charts, interface connection data and interface circuit types for SEMS 5 are listed in six-page brochure. ELECTRONIC MEMORIES, Hawthorne, Calif. For copy:

CIRCLE 142 ON READER CARD

FILMS: 20-page brochure lists films in data processing, systems and automation field. Films are available from both manufacturers and independent producers. Listed are addresses and rental costs and contents according to subject. DATA PROCESSING MANAGEMENT ASSN., Park Ridge, Ill. For copy:

CIRCLE 143 ON READER CARD

BIBLIOGRAPHY ON FLUID AMPLIFICATION: 179-page book includes directions for using the bibliography, glossary of terms, patents and disclosures and other applicable contributions to fluidic, flueric technology. Cost: $3; microfiche, $.65. AD-647-974. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

ELECTRONIC PEN AND TABLET: Four-page brochure describes DT-1 Data Tablet, which consists of a hard stylus that senses the coordinates of signals impressed on transparent conductive film sandwiched between layers of glass. A ballpoint pen can be fitted into the stylus to produce hard copy as data is fed simultaneously into a computer. Pad of paper up to ½" thick can be placed on the tablet without interfering with electronic coupling between the conductive surface and sensor. SYLVANIA ELECTRONIC SYSTEMS, Waltham, Mass. For copy:

CIRCLE 144 ON READER CARD

AEROSPACE TELEMETRY AND DATA HANDLING SYSTEMS: 40-page book discusses electrical and mechanical design, system packaging and reliability and microcircuit packaging techniques. SYSTEMS DIV., RADIATION INC., Melbourne, Fla. For copy:

CIRCLE 145 ON READER CARD

APPLICATION SYSTEM: Eight-page brochure describes Scientific Inventory Management and Control (SIMCON) developed for the 400 series computers. Charts compare economics of classical square root with SIMCON economic quantity considerations. GENERAL ELECTRIC INFORMATION SYSTEMS MARKETING OPERATION, Phoenix, Ariz. For copy:

CIRCLE 146 ON READER CARD

NUMERIC INSTRUMENTS: Kit contains data sheets on three models—Series 1969 single wheel counting module, 1993 predetermining counter, and

new literature

1994 manually actuated, single pole, 10-position switch. Description, installation instructions and current price lists are included. VEEDER-ROOT, Hartford, Conn. For copy:

CIRCLE 147 ON READER CARD

DIGITAL PLOTTING SYSTEM: DPS-6, a display system which includes an *x-y* plotter, is described in 12-page brochure. Plotting system includes vertical or horizontal plotters, 30″ square plotting surface on both models, alphanumeric symbol printer of speeds up to 366 cpm (optional). Input is from mag tape, on-line digital computer, punched paper tape, punched cards, manual keyboard and analog computer. Software includes standard Milgo FORTRAN subroutines or specialized subroutines. MILGO ELECTRONIC CORP., Miami, Fla. For copy:

CIRCLE 148 ON READER CARD

DP STANDARDS: 12-page pamphlet describes application of standards with which to measure the effectiveness of data processing operations. BRANDON APPLIED SYSTEMS INC., New York, N.Y. For copy:

CIRCLE 149 ON READER CARD

REAL-TIME CLOCK SIMULATOR: Four-page booklet details time base specifications, I/O data structure, command structure, visual display and manual control of model 300, designed to interface with Univac 490 and CP 642B computers. DATAMETRICS CORP., Hollywood, Calif. For copy:

CIRCLE 150 ON READER CARD

CONVERSATIONAL PROGRAMMING SYSTEM: 50-page book describes an algebraic language for on-line use with a graphical I/O console device. Computational aid for the casual user, the system requires a minimum of experience or instruction, and provides basic facilities for graphic and numeric input and display, on- and off-line program preparation and storage, and hard copy presentation of results. Cost: $3; microfiche $.65. AD-646 857. CLEARINGHOUSE, U.S. DEPT. OF COMMERCE, Springfield, Va. 22151.

MANUFACTURING CONTROL: Eight-page brochure describes system which provides computerized central monitoring, collection, display and communication of data on production operations for management review, decision-making and action during work stoppage, parts shortages, machine breakdowns, overloads, rush jobs. Illustrated case histories of existing installation are presented. Descriptions of the Telecontrol 2100 and 4100 systems are included. TELECONTROL CORP., Old Greenwich, Conn. For copy:

CIRCLE 151 ON READER CARD

BUTTON SWITCH: Data sheet gives information on the TEC-LITE SBS Series with N. O. momentary contact. Device is designed to conserve panel space on instruments, computers, industrial control and missile guidance systems. Measurements are .360″ diameter by .468″ long. One-fourth-inch installation holes can be on mounting centers as close as ⅜″. TRANSISTOR ELECTRONICS CORP., Minneapolis, Minn. For copy:

CIRCLE 152 ON READER CARD

SERVICE CENTERS DIRECTORY: 100-page book lists centers in Australia, Brazil, Canada, Denmark, Eire, Great Britain, Japan, Mexico, Netherlands and the U.S. (according to states). Cost: $1. ASSN. OF DATA PROCESSING SERVICE ORGANIZATIONS INC., 947 Old York Rd., Abington, Pa. 19001.

MEMORY CORE HANDLERS: Eight-page brochure includes basic design and operating principles of handlers, shows photos of the various models offered in

new literature

each category and lists mechanical and electrical specifications on all models. Applications include AQL testing, incoming inspection and laboratory analyses, high speed machines for production test of medium and fast switching cores and machines (1,000 cores/minute) for mass production testing of cores ranging in sizes from 12 to 50 mils. O.D. COMPUTER TEST CORP., Cherry Hill, N.J. For copy:

CIRCLE 153 ON READER CARD

PROGRAMMER OPPORTUNITY TRENDS: Brochure includes 1966 computer salary survey but doesn't give information on sample on which statistics are based and also covers elements of the dp function and computer opportunities in 1967. SOURCE EDP., Chicago, Ill. For copy:

CIRCLE 154 ON READER CARD

AIRBORNE TAPE RECORDERS: Six-page brochure describes specifications and operating characteristics of the DS-4100 series. Dimensions, vibration and RFI characteristics are outlined for the recorders available in ¼- and ½- inch tape with two, four or seven tracks in either digital or analog configuration. I/O characteristics for analog and digital signal handling are included. Application areas are commercial aircraft, military avionics systems, industrial process control and mobile field data collection systems. SANDERS ASSOC. INC., Nashua, N.H. For copy:

CIRCLE 155 ON READER CARD

CARD CONVERTER: Brochure details system which has standard keysort unit record input; output can be either Hollerith cards or punched tape that are fed directly to in-house dp facilities or transmitted by mail or over wire to service bureaus or centralized installations for final processing. Applications in hospitals, manufacturing, education, government and communications are detailed. McBEE SYSTEMS, DIV. OF LITTON INDUSTRIES, Athens, Ohio. For copy:

CIRCLE 156 ON READER CARD

MEMORY EXERCISER: 12-page brochure describes Model 3602, designed for laboratory development and production testing of core memory systems, which generates up to 65,536 addresses of 40-bit words with cycles of 400 nsec to 500 msec. Brochure gives design, operation, specification and interface data. HONEYWELL INC., COMPUTER CONTROL DIV., Framingham, Mass. For copy:

CIRCLE 157 ON READER CARD

books

Introduction to Data Processing, by Robert Arnold, Harold Hill, and Alymer Nichols, John Wiley and Sons, $6.95.

Basic Data Processing, R. W. Lott, Prentice-Hall, $6.75.

Introduction to Computing, T. E. Hull, Prentice-Hall, $6.95.

It is said among musicians that although a man can perform on an instrument with an acute sense of pitch, tone, and timing, when it comes to social dancing, the musician, more than anyone else, is missing the beat, constantly getting out of step and in general doing very badly at something that should be "a natural." After reading two of the three books listed above, one wonders whether or not a similar parallel could be drawn with businessmen and mathematicians writing about data processing. A man knowledgable in his field, a lecturer on data processing perhaps, a success, a man who knows his business, sets out to write a book for beginners in data processing. This should be "a natural;" technical facts and theoretical knowledge are at his fingertips, and for some years he has been introducing people on all levels to data processing. But the book this successful mathematician or businessman produces is not necessarily good. And unless he knows how to write, it is necessarily bad in several respects.

Writing in the literary sense is certainly different from writing in the technical, factual, data processing sense, but a poorly organized text for edp can miss by just as wide a margin as a poorly written novel. The growing, changing field of data processing is complex enough by itself without books that are complex due mostly to lack of organization.

Fortunately, *Introduction to Data Processing* by Arnold, Hill and Nichols is an excellent book. It is written in such a style that it can be recommended to anyone who wishes to become acquainted with the rudiments of business data processing; business college students, company presidents, junior programmers, managers or supervisors who never received a formal introduction to data processing, machine operators, even the host of secretaries and keypunchers who occasionally ask "what computers are all about" would find this book helpful and interesting.

The organization of the book is careful and complete. That the authors discuss the scope and significance of data processing and then devote a chapter to its history (beginning with clay tablets as examples of manual data processing), is indicative of how carefully their book is written. The reader is taken through subsequent chapters on sources of data, manual and mechanical data processing, the function of punched cards and associated equipment, electronic data processing programming, integrated data processing and, finally, systems study and design.

Throughout the book, terms are carefully defined and the relationships are clear. Relationships are particularly stressed and make for the strength of the book. For example, "receiving report" is not mentioned simply because someone in data processing might find it useful, but because it is part of a chain of events (purchasing, receiving, stockkeeping, production, etc.) that occur involving certain portions of the business structure which are directly concerned with data processing problems.

Illustrations are profuse and complementary to the textual material. Review questions, a glossary and an index are provided, but considering the broad scope of the book, a bibliography and suggestions for further reading could have been included.

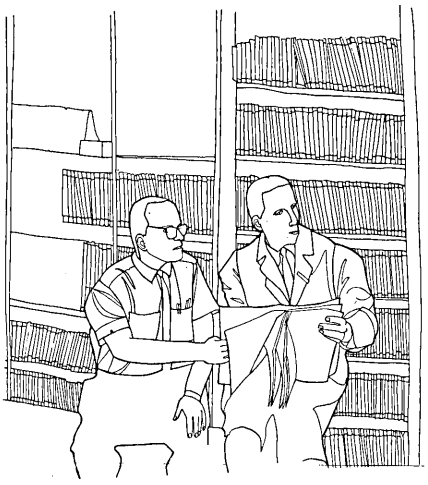
Basic Data Processing by Richard W. Lott seems to try to do what the above book does, only with a result much less successful. A sentence like "A computer doesn't have any 'magical' instructions" causes one to wonder just what level of reader the book is being written for. The author generally projects a grade B approach to learning which could be paraphrased: Whenever we are con-

fronted with a problem, we must always stop and ask ourselves the 4 W's: When, Where, What and Why. Often so much time and space is devoted to such questions that the material presented is superficial rather than basic. To describe a "typical" computer, if such a thing exists, would be difficult, and viewing so much of data processing as typical, the author tries to touch on too many things at once. Thus, systems principles, FORTRAN, management, etc. are discussed in a haphazard, superfluous manner.

The organization of the book is particularly bad in placing the discussion on debugging in the middle of a chapter on computer installation, and in sandwiching a chapter on Decision Tables between Data Control and Documentation. The result is that the student is confronted with a jumble of concepts and a confusion that doesn't advance Mr. Lott's purposes at all. The English used throughout the book is occasionally slightly embarrassing, with incomplete sentences and an avoidance of necessary commas cropping up to further confuse things. There are a good many illustrations which are clear and relevant, but for the beginner, some unnecessarily complex flowcharts are included which tend to overexplain the point to be made. At the end of each chapter, exercises and suggestions for additional reading are given. Many of the exercises are good, but others would require extra reading to answer and are of questionable relevance for the beginner: for example, "What is the best hour and day to hold a meeting to advise top management of your progress in designing a system? What should its maximum length be?" These questions come at the end of a three-page chapter on documentation, which contains no information on meetings.

Introduction to Computing by T. E. Hull is a book dealing with algorithms, how they are translated and used by computers, and how computer logic affects problem-solving. The scope of this book is, of course, much narrower than either of the other two, and would be of interest to a smaller group of readers. The only thing that mars Mr. Hull's presentation is, again, organization, but this is fortunately limited to the preliminary chapters of the book.

The first sentence in the first chapter is "A rigorous definition of the term algorithm is presented in Chapter 15." This is an example of the constant cross-referencing that plagues the reader in earlier chapters. The author probably means to establish meaningful relationships by cross-referencing, but he provides enough good examples, problems, statements, etc. that relationships are often fairly obvious. In part of Chapter 5, Chapters 1, 2, 9 or 10 are referred to in every paragraph, and one tends to spend a lot of time in a kind of "hunt and peck" method of reading. Basic terms such as subroutine, word, and address are not always smoothly introduced and could have been clarified by a glossary. The book is not lacking in detail, but footnoting a lot of the peripheral (but necessary) material would have relieved the cluttered appearance of paragraphs, and perhaps have made a clearer distinction between concepts and examples of concepts. Mr. Hull at times seems



at a loss as to what to describe first, and describes two things at once. For example, flowcharting, instruction codes, and preliminary algorithm problems receive rather scrambled explanations.

But the body of the book is concerned with a very good description of FORTRAN IV as used with algorithms. The cross-referencing tapers off and comprehensive chapters on FORTRAN constants, expressions, statements, subprograms, etc. follow, with examples of numerical methods, numerical applications and simulations. A sample chapter is Fortran Input Output Statements. The chapter is divided into: Standard Input Output Statements, Format Specifications, Format Statements, Lists of Specifications, Scale Factors, The Use of Input Output Statements, Variable Format Specifications, Namelist Statements, and exercises. One must be familiar with mathematics at the college level to get through this ma-

terial, but the author carefully names his machines (either 7090/7094 or 7040/7044), defines the limits of his discussions, gives the form of statements, and provides many examples. The final chapters on simulations and the idealized Turing machine are particularly interesting, and show that the author after all is quite capable of writing well.

Data processing is difficult for the beginner to grasp because material to be learned is conceptual as well as factual but, in any event, the material presented must be clearly explained and well-organized. Good books are needed for potential employees as well as for those in the general population who share the growing interest in electronic data processing. Mr. Lott's work can't be described as a "good book," but the combined efforts of Arnold, Hill and Nichols are to be highly recommended, and Mr. Hull's presentation can be recommended to algorithmists with a little patience. —SALLY STORY

book briefs

(For further information on the books listed below, please write directly to the publishing company.)

Programming Language/One, Frank Bates and Mary L. Douglas. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1967. 375 pages. $5.95 (paperbound).

One of the Prentice-Hall series in automatic computation edited by George Forsythe, this book is intended to explain techniques of using computers through examples in PL/I. Program listings and results are reproduced directly from computer printout.

FORTRAN for Physics, Alfred M. Bork. Addison-Wesley Publishing Co., Inc., Reading, Mass. 1967. 85 pages $1.95 (paperbound).

Intended as an introduction to computers for the physics student early in his career. Explanation is based on classical mechanics.

Advances in Computers, edited by Franz L. Alt and Morris Rubinoff. Academic Press, New York, N.Y. 1966. 303 pages. $14.00.

Volume 7 in a series, contains sections on highly parallel information processing systems, programming language processors, computer-assisted copy editing and typesetting, programming languages for computational linguistics, and computer-driven displays.

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To design and implement control supervisors and scientific applications programs for real-time monitoring and analysis systems. Also, to develop a large-scale remote access, time-sharing system, involving information storage and retrieval, display systems and techniques, and computer-aided design. Technical degree and 2 to 7 years of related experience required.

DATA SYSTEM PROGRAMMERS / ENGINEERS:

To evaluate, design and implement computer-based systems for real-time acquisition and processing of telemetry and instrumentation data. Prefer several years' experience in computer programming, system design or logic design for telemetry, instrumentation, or communications applications. Degree in physcis, mathematics or engineering is required.

ADVANCED APPLICATIONS PROGRAMMERS:

To solve problems in the design of computers, electronic components and physical subsystems, using the digital computer for simulation. Many of the problems will involve the use of modern on-line graphics. Requires degree in mathematics, engineering, physical sciences or operations research.

DATA PROCESSING AND ANALYSIS PROGRAMMERS:

Problems include all phases of scientific, engineering and medical data processing and analysis. Current areas of emphasis: range tracking, anti-submarine warfare, medical information retrieval and statistical analysis. Requires degree in engineering, mathematics or the physical sciences with a minimum of 2 years' programming experience.

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We need Programmers . . . with a degree in engineering, science or math . . . a minimum of one year of programming experience . . . three to six years of experience for senior positions . . . your experience should include real-time systems, executive system development and scientific programming . . . you must have the desire and ability to create.

Excellent starting salary, full company benefits, an intellectually stimulating working atmosphere and a picturesque, suburban Philadelphia setting are just some of the reasons you will enjoy growing with us here at Leeds & Northrup. We're people too. Send complete resume with salary requirements to Mr. Wayne L. Besselman, Coordinator of Technical Employment, Leeds & Northrup Company, Dept. T-1, Sumneytown Pike, North Wales, Pa. 19454, or call collect (215) 643-2000, Ext. 773, 4, 5.

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APOLLO
Business Data Processing and Space Exploration

Mr. C. Kenneth De Witt
Manager, Management Data System Department
Houston Aerospace Systems Division
Lockheed Electronics Company

Man is going to the moon, and he is going beyond the moon to planetary exploration, and orbital laboratories in which literally "far out" research will be undertaken. Each one of these undertakings will be supported by a vast complex of business data processing applications of the most exciting kinds.

The logistics problems of the Apollo man-to-the-moon program are uncompromisingly unique, just as are the problems surrounding the processing of data received from tracking stations scattered in a ring about the surface of the earth.

Configuration management of the hardware of spacecraft extends beyond that attempted in any other discipline of aircraft or electronics manufacture; and the problems of testing the hardware can only be solved with real-time computer applications which, once again, are unique in the present day world.

Most significant of all—all these applications must be tied together into an integrated management information system that permits split-second decisions by the highest levels of NASA and industrial management.

Lockheed is in the process of developing business data processing systems at the Manned Spacecraft Center in Houston, Texas for which there are no prototypes anywhere else in the nation. The problems described above are only a few of those which our analysts and programmers are working on daily.

The task is huge—we need analysts and programmers who can call upon both their experience and their imagination to convert these problems to workable solutions. We are constructing the organization from which man will explore the universe, and, incidentally, we are being forced to invent the data processing principles of the Twenty-First Century.

Care to come along?

As for hardware, the Manned Spacecraft Center has seven complete computer systems, including large, third-generation digital, analog and hybrid computers available for the support Lockheed is performing for MSC.

Your work in Houston will permit you to undertake evening graduate courses through the doctorate level. And the family living is hard to beat. An attractive community with fine schools, sailing, fishing, golf, and lovely homes has grown up around the Manned Spacecraft Center. Theaters, museums, and all the other cultural and entertainment advantages of a large metropolitan area, are a few minutes drive away in Houston.

If you are a programmer or analyst, drop me a note today outlining your experience and qualifications. Or, if you prefer, telephone collect to my associate, Mr. R. K. Glasgow at (713) HU 8-0080. We will be glad to supply you with whatever further information you may want.

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CIRCLE 326 ON READER CARD

look ahead

(Continued from page 19)

Reportedly, IBM feels that nobody meets that requirement. Nevertheless, we understand that IBM, which couldn't do business with California if it didn't accept this clause, has softened its position, and will now accept it or something like it.

The clause has driven one vendor to withdraw his winning bid in California, and Michigan has already included it in one of its RFP's.

GAO PHASE II REPORT DUE; NEW INVESTIGATORS INTERESTED

The GAO report on the big AF Phase II award to IBM is due around August 1, we understand, and at this writing a subcommittee of the Senate Military Operations committee was supposed to be getting ready to get into the act with hearings. One loser we talked to thinks there's "a chance" the judgment will be upset. Another says, "There's zero chance it will be awarded to somebody else, but there's a high chance it will be set aside."

GE REVEALS (ALMOST) ALL

GE says the real skinny on its Valley Forge time-sharing activity (see May, p. 17) is that the commercial accounts for that T-S center have been shifted out of the Valley Forge Missile & Space Div. to the nationwide Information Service Dept. Three 265's were re-assigned. This leaves two 265's at M&SD, brings to 21 the total of 265's in ISD, headed up by Paul Leadley. GE won't reveal ISD's dollar volume, but claims it's the nation's largest and most widely-used T-S service bureau.

RUMORS AND RAW RANDOM DATA

The announcement of outspoken Herb Grosch as Director, Center for Computer Sciences & Technology at the Nat'l. Bureau of Standards created the to-be-expected range of reactions. We understand that Grosch has promised to try to be a good boy, mollify his allegedly critical approach to standards in a post that calls for coordination of government standards efforts. ... Bob Head, well-known edp expert, has left CSC to establish a new firm, Software Resources Corp., which will serve as a software exchange for debugged and documented programs, to be marketed on a royalty basis. HQ are in L.A., with another office in NYC. ... Electronic Memories is buying Janus Research, Bay area disc maker, will float a $2.5 million debenture issue for financing. ... Some 360/67 buffs are feeling they may survive after all: Michigan's Bernie Galler says TSS is improving; a Carnegie Tech source says the 67 is compiling, albeit slowly. The encouragement may save some university 67 orders, although we hear that Buffalo and Purdue have switched from the 67 to CDC's 6400. Cornell and Penn have reportedly gone to the mod 65. ... There's big interest in Informatics' Mark IV file management system, with firm orders for more than 50 installations. ... Rumors, enhanced by fierce security measures, indicate that there's a Burroughs 8500 at McDonnell Automation. ... The surprising suggestion that ACM might want to change its name to something like "Informatics" was met by an even more surprising reaction that the company of the same name might just go along ... changing their name to, say, "Informatics Systems." ... The latest industry button, evidently out of Univac: "360/67 is alive and well in Argentina." ... Wall St. rumor: NCR to acquire Lundy.

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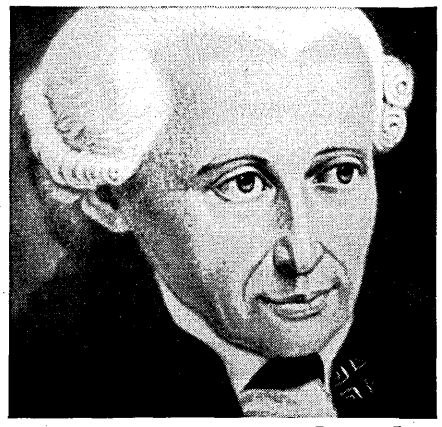

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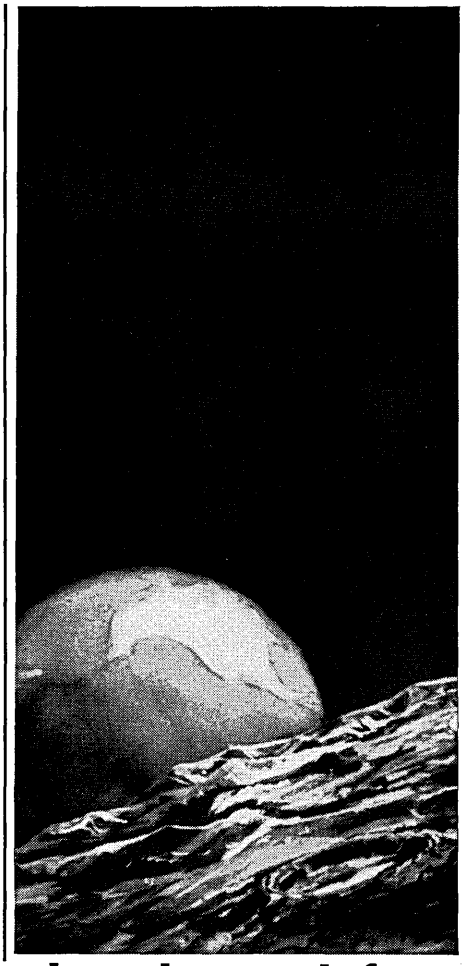

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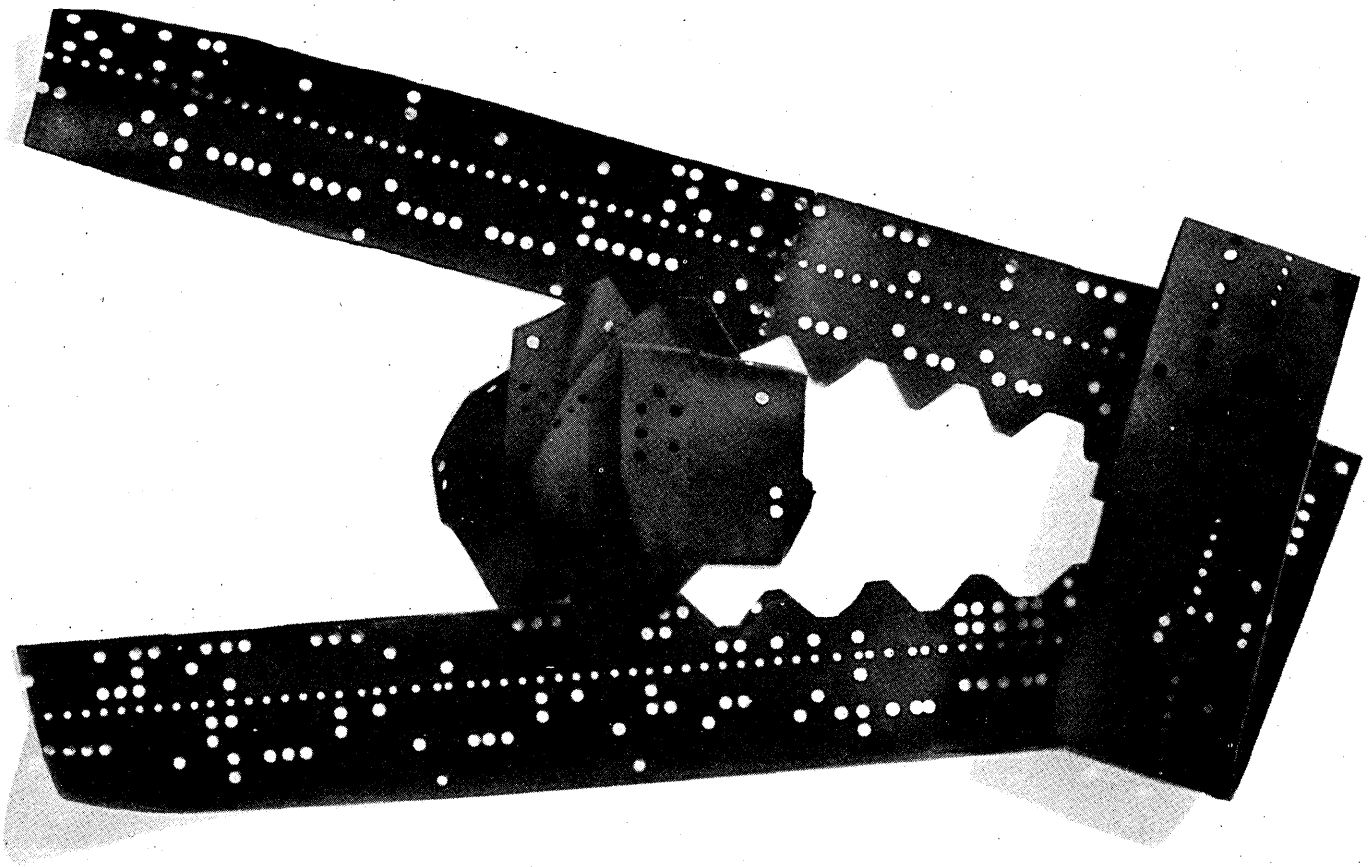

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■ Guy H. Dobbs has accepted the position of vp and technical director, Herbert H. Isaacs Research and Consulting, Inc., Los Angeles. He was most recently director of the computer center dept. at System Development Corp., Santa Monica, Calif.

■ William F. Foss has been named president of Fabri-Tek Inc., Edina, Minn. He was formerly president of Minneapolis-Moline Inc., Hopkins, Minn. Current president of Fabri-Tek, M. F. Mickelson, becomes chairman of the board.

■ Eugene S. Gordon, former head of field operations dept. at SDC, Santa Monica, Calif., has been appointed head of computer center dept.

■ Gene M. Amdahl of the IBM Corp. in San Jose, Calif. has been elected to the National Academy of Engineering. Dr. Amdahl was designer and project engineer of the IBM 704, and manager of architecture for the IBM System/360.

■ Seymour D. Schwartz has been named director of programming, Systems Engineering Laboratories Inc., Fort Lauderdale. He was previously manager of project programming at Scientific Data Systems.

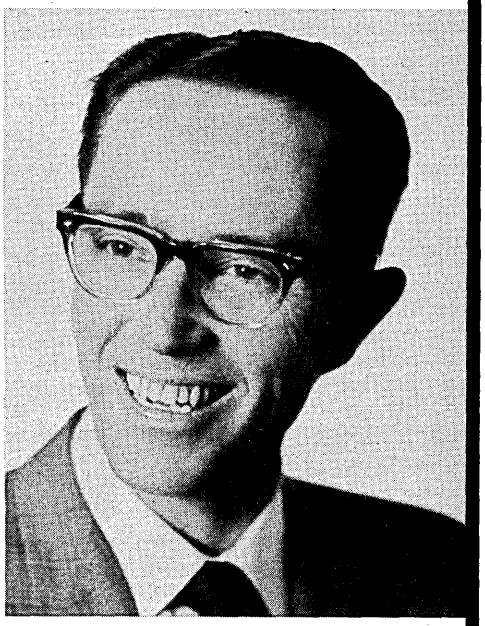
■ Ralph E. Montijo has joined Planning Research Corp. as director of advanced systems planning in the computer systems div. He was formerly special programs manager, RCA EDP.

■ Robert G. Dee, vp at Computer Sciences Corp., has joined University Computing Corp. as president of the newly-established computer industries div.

■ Carl Diesen has joined the U.S. Geological Survey as chief of the computing system. The USGS system consists of an IBM 360/65 linked via telecommunication lines to smaller 360's in Colorado, Arizona, California and Missouri. Mr. Diesen was formerly manager of scientific information processing at Ling-Temco-Vought, Dallas, Tex.

Los Angeles

meet



Bob Davis

Bob Davis is a computer professional

As with all our staff, Bob's computer background is extensive. He brings to our firm eleven years of proven and varied computer experience. As IBM's District Systems Engineering Manager for the southwestern states, Bob was responsible for recruiting, training and career planning for the systems engineering personnel of ten branch offices. His assignments as Special Representative to the Aerospace Industry in the western United States and as Program Administrator to IBM User Organizations throughout the world further underline his scope and perspective in all aspects of data processing. Bob's formal education includes B.A. and M.Ed. degrees from UCLA.

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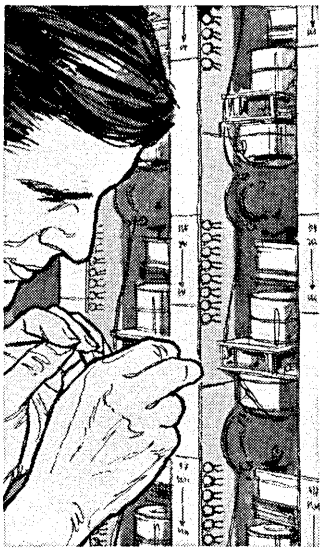

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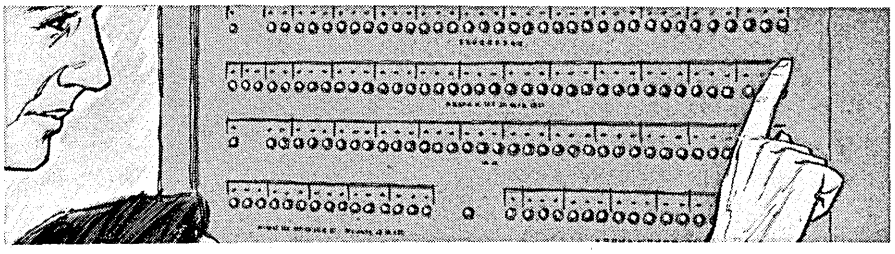

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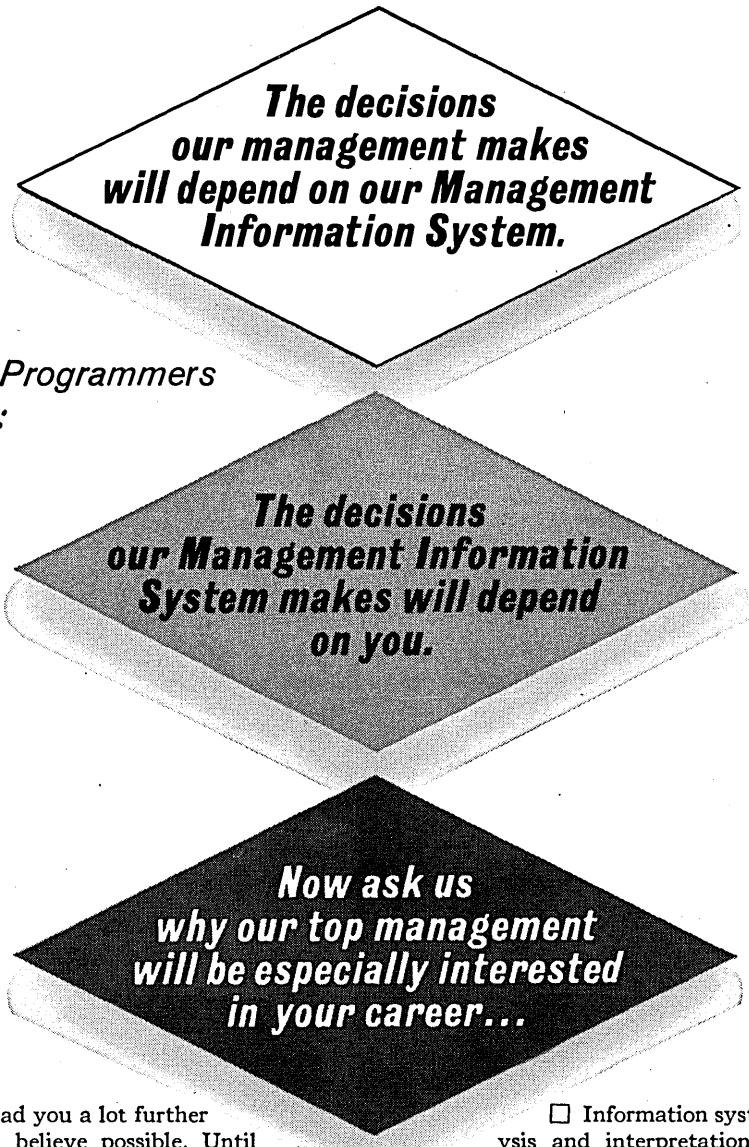

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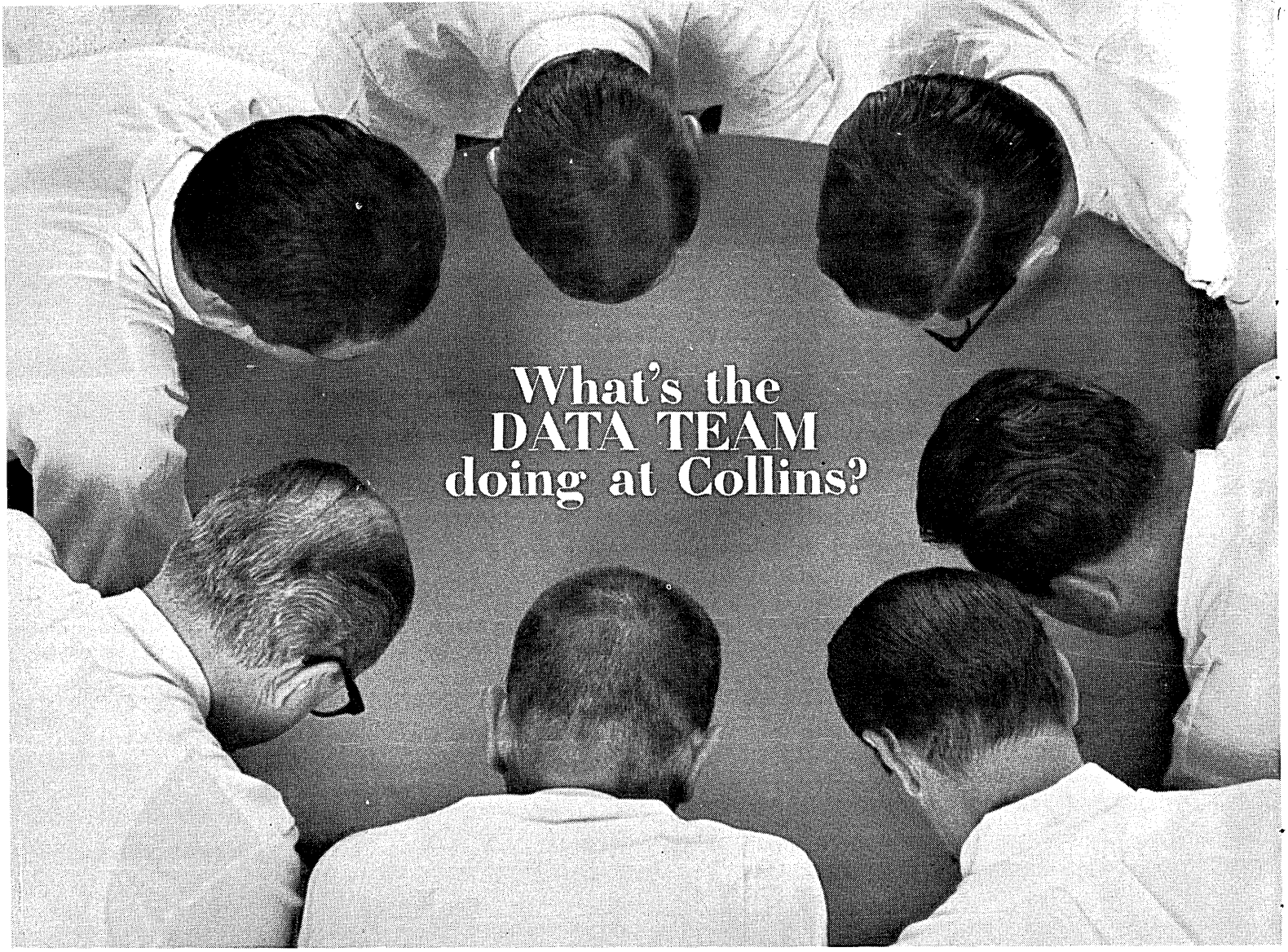

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the forum

The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

CONTROLLING PROGRAMMING COSTS

A summary comment on the ways in which programming costs are controlled in industry today is that while controls continue to be relatively loose, there is an increasing awareness of this inadequacy and an increasing amount of thinking about how to improve the situation. The best evidence of this growing awareness can be found in the build-up of literature concerned with the problems of controlling program development costs. This includes substantial portions of at least three recent books, a graduate thesis, and numerous articles and reports. Unfortunately, though, the level of management responsible for the commitment and control of programming project dollars is not generally conversant with the approaches and techniques that have been developed and described in the literature. Nonetheless, the subject is receiving more and more attention and the fact that a few progressive organizations are seeking to apply more effective control standards may be regarded as a portent of the future. All signs point to an improvement rather than a relaxation in control over the programming process, assuming that the basic process itself remains relatively stable.

The fundamental problem confronting those who seek better managerial controls over programming is how to impose production-like standards on a process that is, in some measure, creative. One company in the transportation field, committed to an ambitious real-time system project, stresses the importance of a judicious balance between control and individual freedom in the interest of fostering team spirit and encouraging the programmer to identify with the project. A highly regimented working environment or an obtrusive cost accounting system may inhibit productivity by engendering resentment, loss of morale, and high turnover on the part of the more creative programmers. Thus, a mean must be found between ultra-strict industrial engineering and accounting type controls on the one hand and rampant permissiveness on the other. Clearly, at least in large commercial installations, the days of the highly individualistic programmer who keeps his own counsel (and hours) and documents when he feels like it are passing into history.

Some time back, the U. S. Air Force came up with some fascinating statistics on programmer productivity:

> As a rule of thumb, 200 instructions per man-month is sometimes used to cost operational applications that are larger than 10,000 instructions. However, in the 465L system, the SAC Command System, output is 92 instructions per man-month. The Central SACCS program is about 650,000 instructions in length, and when programs reach this size, the cost of programming goes up as the square of the number of instructions. This means that jobs which are three times as difficult to perform will cost nine times as much. It also means that errors in initial estimates of job difficulty can be prohibitively expensive, because factors such as programmer communication and coordination contribute to the costs as much as the increased complexity of larger interrelated programs does. The price of each instruction in the SACCS is $32.00. This exceeds the price of the memory element that holds the instruction. The memory, of course, is a one-time expense.*

Though their projects are of lesser magnitude, most commercial data processing managers could undoubtedly cite equally dismal figures. But unfortunately, even though the problem is recognized and bemoaned, what is *not* generally recognized is that the systems department manager is himself all too often part of the problem. This is principally because the systems manager in most companies has not had the benefit of "hands on" programming experience or, if he has had, it has been so long ago that his technical perceptiveness has long since been eroded. The systems manager tends, therefore, to control at the *project* level in terms of estimates and costs, accepting at face value estimates generated by his project leaders. The manager may know the hourly rate of the programmers assigned to a project and how much time they have expended, but often he does not know specifically what these people actually *do*.

To cite one example, there needs to be more managerial awareness of the interrelationships between developmental and operational efficiency in programming, of the possible tradeoffs between resources, such as programming time versus computer running time. Recent studies confirm the judgment that in most installations even fundamental estimating strate-

*Terhune, C. H., address to the 1963 Fall Joint Computer Conference, Las Vegas, Nevada, November 12, 1963.

gies are not systematically employed.

There is a need also for increased managerial understanding that in cost estimating and control two distinct classes of estimates must be derived, i.e., those having to do with:

1. The scope and complexity of the program to be produced.
2. The amount and duration of the effort required to produce it.

Most companies do attempt to estimate the latter but usually these estimates are based upon an *implicit* rather than explicit estimate of scope and complexity. Unless program type and complexity can be categorized in some standard fashion, the estimating and subsequent control approaches will continue to be imperfect instruments of management.

Certainly, it is possible to overcontrol a project, to impose too onerous a bookkeeping burden on the programmers and to generate an inordinate record-keeping task for programming management. Nonetheless, a more detailed classification and quantification of project phases and tasks within those phases is essential. Otherwise, the industry cannot progress beyond the type of control now generally in effect: control at the project level, with gross manpower estimates generated by the project leader (usually not in accordance with any commonly understood and agreed-upon standards) to cover the entire project. Under these circumstances, the systems department manager, possessing no measurement tools of his own, finds himself completely at the mercy of his project leader's judgment.

Some programming organizations have begun to use PERT as an aid in planning and control. One company, having gained experience with PERT, rejected it as unduly cumbersome for the benefits received, and substituted a PERT-like program which they themselves wrote, tailored more exclusively to programming methodology. This program uses standard activities and events for various classes of programs and various elements of the programming process, an interesting approach to classification and quantification. In contrast, another company PERTs its software projects because this is an "in" thing to do and makes a nice impression during management presentations. Generally speaking, the benefits of using PERT in commercial data processing work have not yet been clearly established.

One of the most consistent and significant sets of answers obtained from a recent survey of programmer productivity was in response to the following hypothetical question:

> If there were *no* externally requested changes in the system definition after the inception of the project, how much of an improvement in programmer productivity could be expected?

No respondent felt immune to external pressure for configuration change and the estimates on percentage improvement both in man-weeks and in calendar time expended ranged as high as 300%. Even those organizations, such as banks, with a less volatile systems environment indicated a marked degree of improvement. It seems evident that almost anything that could be done to "freeze" the system definition would contribute dramatically to programming productivity.

System development, of course, by its very nature contains many feedback loops which cause the original system definition to be modified as the details of system design and programming unfold. However, much of this kind of unavoidable pressure for change is internally generated by the systems department itself. External demands for change from the line organization should be more amenable to control and reduction.

Virtually every respondent to the aforementioned survey noted with some satisfaction that the line departments "sign off" on all system definitions affecting their operations. It might be profitable to speculate as to whether this emphasis on communication with the operating departments is all to the good. Perhaps there should be somewhat *less* emphasis on gaining the concurrence of the line people. Obviously systems can't be designed in a vacuum, but it may be that some systems groups are over-solicitous of the desires—and indeed the whims—of the operating departments.

All in all, it is remarkable that, with expenditures for software now totaling in the billions, more progress has not been made toward developing a disciplined methodology for the prediction and control of programming costs.

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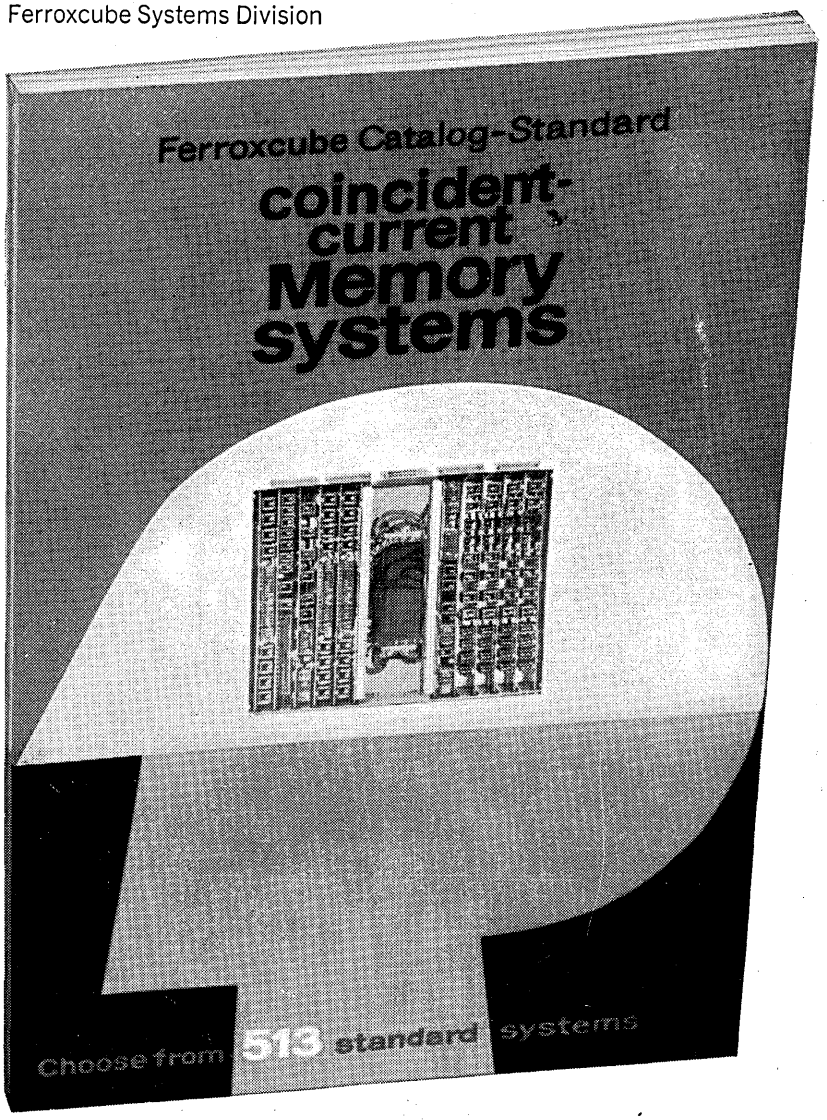

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