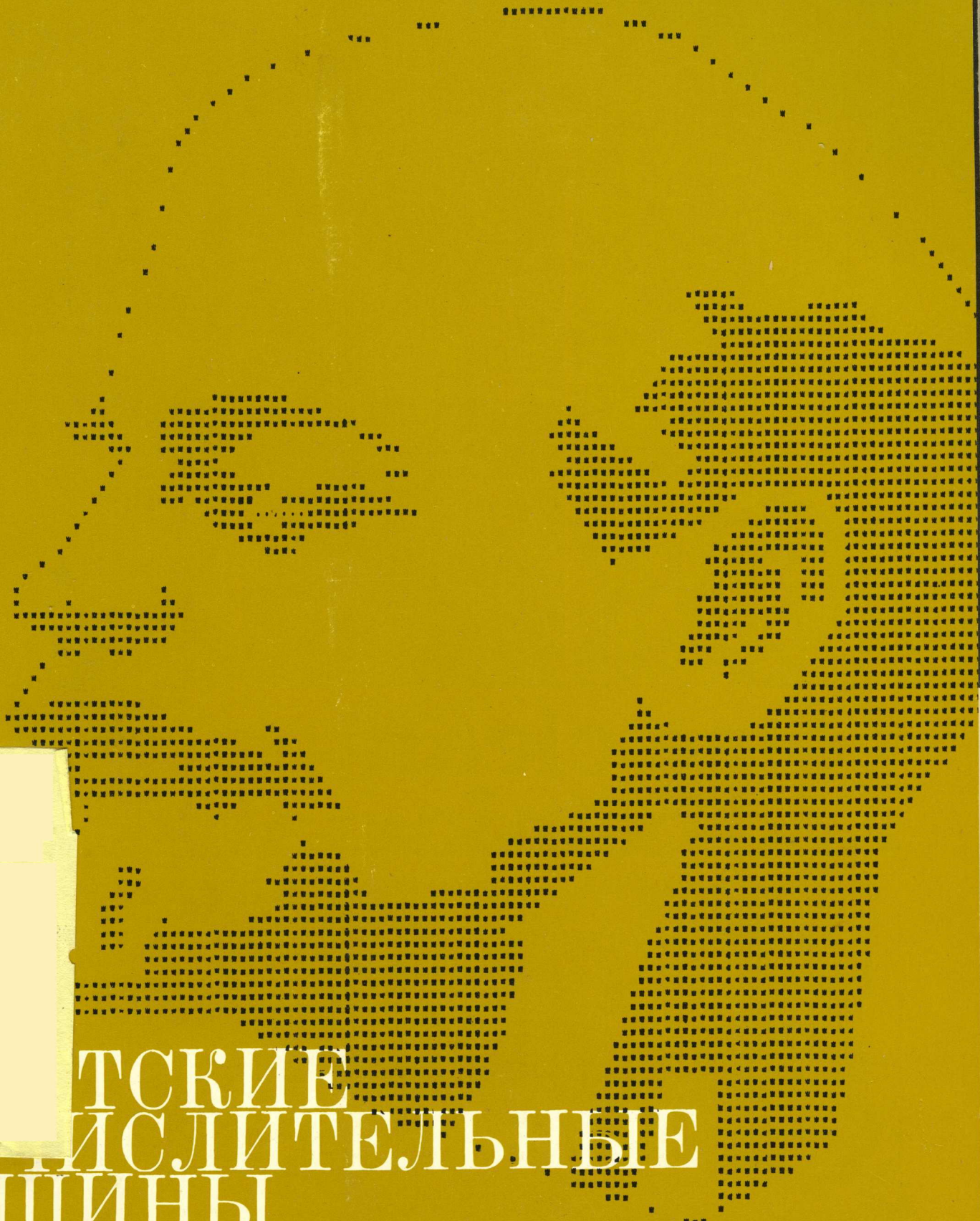
DATAMATION® 67

August

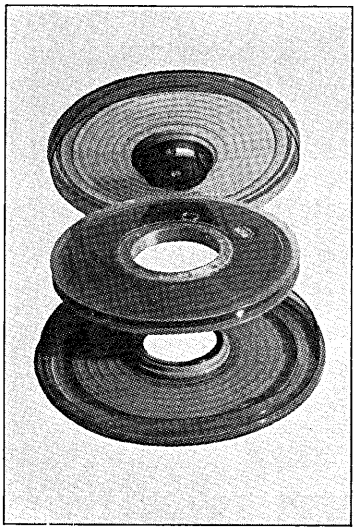


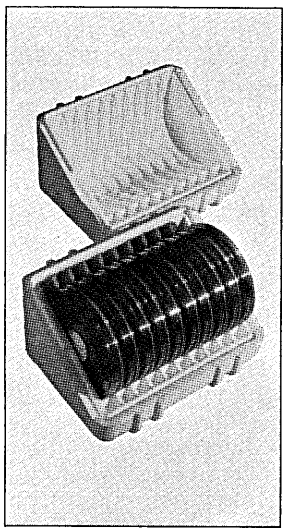
СОВЕТСКИЕ ВЫЧИСЛИТЕЛЬНЫЕ МАШИНЫ

SOVIET COMPUTERS

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.

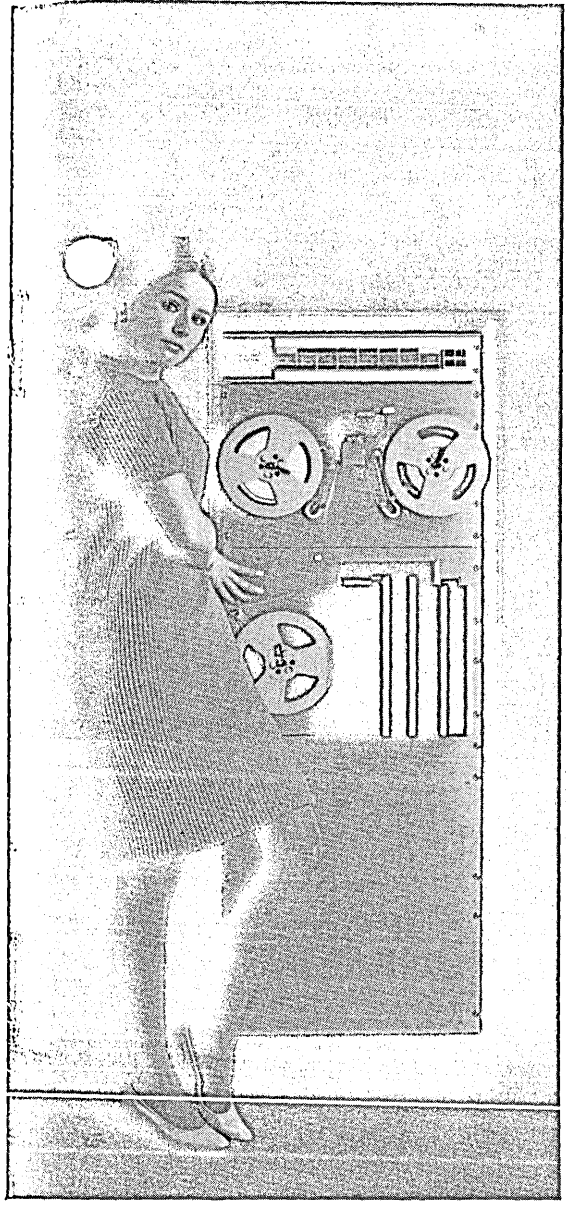
2) **A new shipper:**
Probably the best idea the industry saw last year, we modestly admit, was our new TAPE-SAFE Environmental Shipper. Made of expanded-bead polystyrene, this shipping container individually supports and separates up to ten tape canisters. Guards them against shock, vibration, temperature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

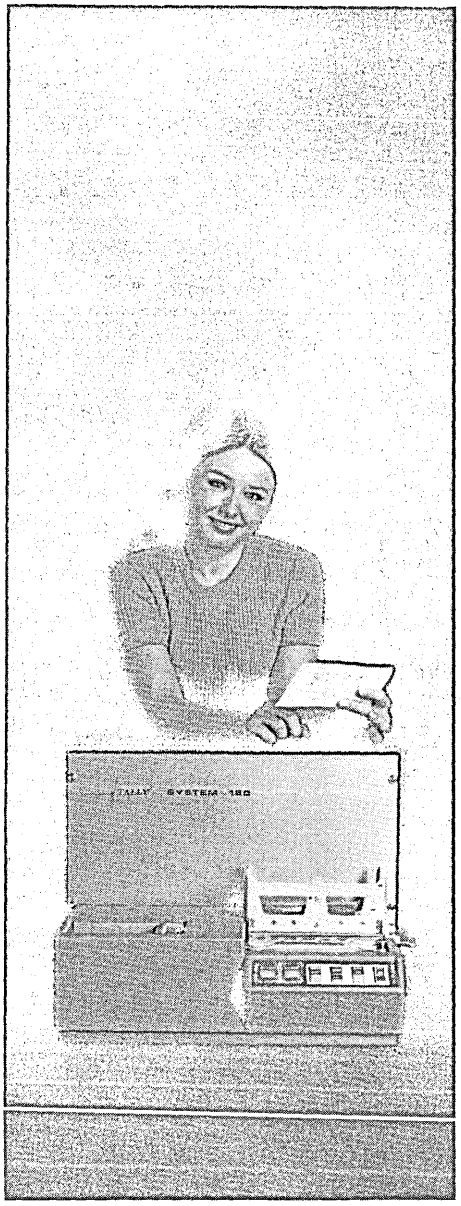
If you would like a free copy of our new technical booklet, "The Care and Storage of Computer Tape," just write us at 401 Broadway, Redwood City, California 94063.

AMPEX

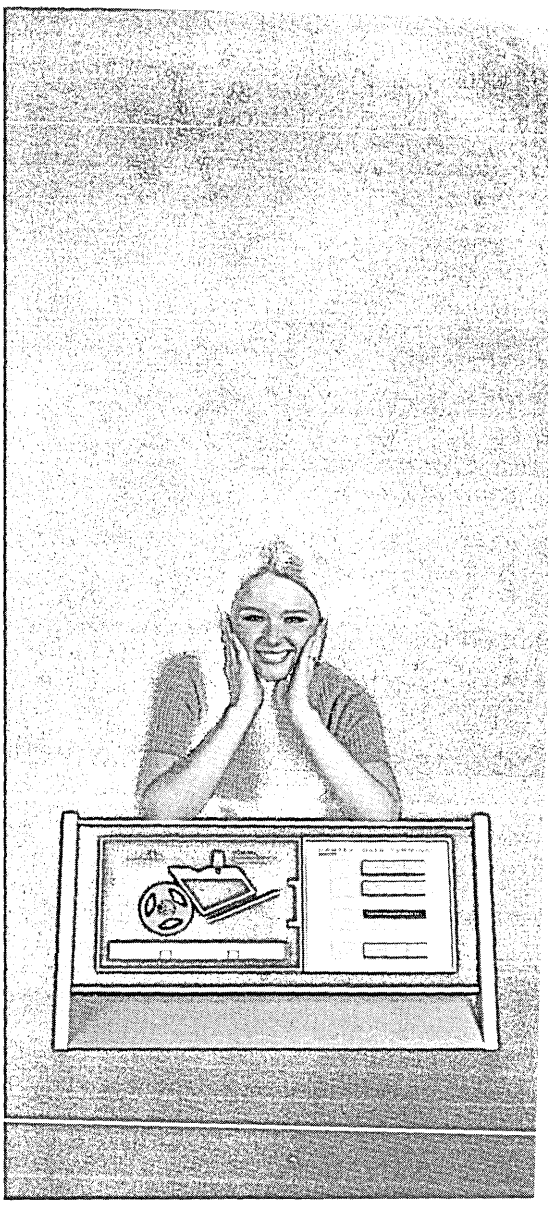
CIRCLE 1 ON READER CARD



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.

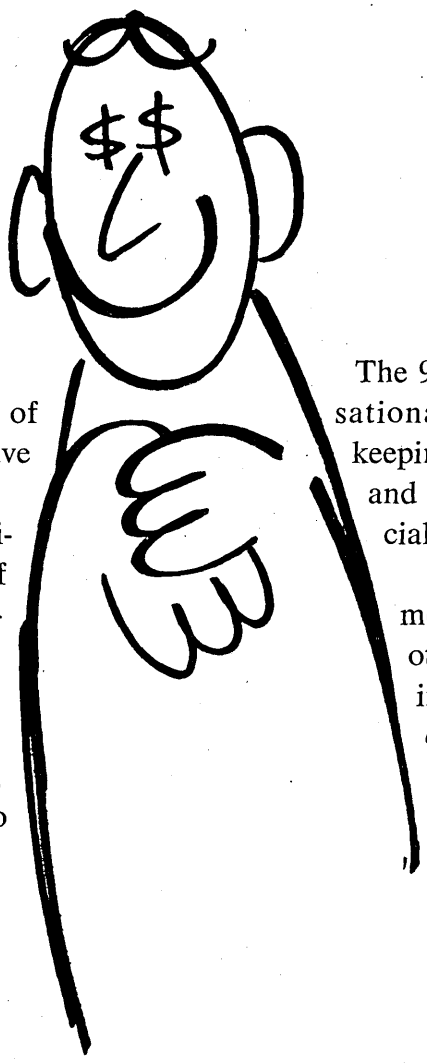
Transmit, receive, and store data in any form you want or in any combination of ways. The diversity of business systems lets you go tape-to-tape, card-to-tape, mag-to-perforated tape, and so forth. □ So, if you have a data communications requirement, it will pay you to get in touch with your Tally communications 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.

TALLY®

See us at WESCON Booth 2609

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

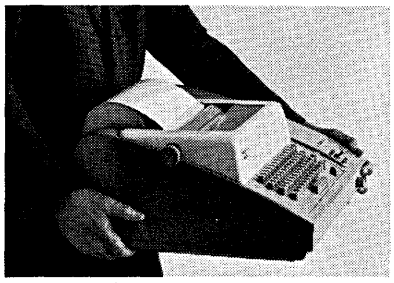
940 time-sharing system are buck.

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.

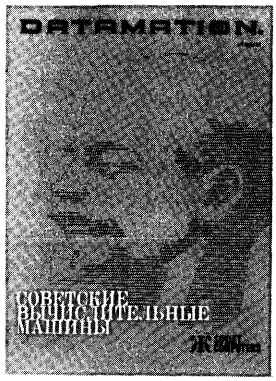


We're going to keep making 940's till the demand runs out. Any SDS sales representative can arrange a demonstration. If you don't have a Teletype handy he may even lug one into your office and hook it to your phone.

The 940 will answer on the first ring.

SDS
Scientific Data Systems
Santa Monica, California

CIRCLE 5 ON READER CARD



august
1967

volume 13 number 8

Publisher **GARDNER F. LANDON**
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LOS ANGELES, CALIF. 90006

BPA
Circulation audited by Business Publications Audit

ABP
Member, American Business Press, Inc.

DATAMATION is published monthly on or about the tenth day of every month by F. D. Thompson Publications, Inc., Frank D. Thompson, Chairman; Gardner F. Landon, President; Gilbert Thayer, Senior Vice President. Executive, Circulation and Advertising offices, 35 Mason Street, Greenwich, Conn. 06830 (203) 661-5400. Editorial offices, 1830 W. Olympic Blvd., Los Angeles, California 90006. Published at Chicago, Ill.
DATAMATION is circulated without charge by name and title to certain qualified individuals who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $15.00 annually; single issues (when available) $1.50. Reduced rate for qualified students. Foreign subscriptions are on a paid basis only at a rate of $25.00 annually. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, O. and Chicago, Ill. Form 3579 to be sent to F. D. Thompson Publications, Inc., 205 W. Wacker Dr., Chicago, Ill. 60606.

Printed by Beslow Associates, Inc.

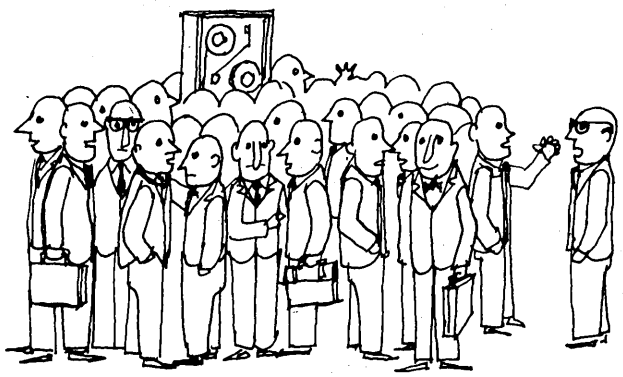
This issue 72,111 copies

AUTOMATIC FLOWCHARTING (lease or service basis)

Applied Data Research, Inc., has expanded its AUTOFLOW* Computer Documentation System with the addition of a national service for users of most computer systems. ■ Now available on a *service bureau basis,* AUTOFLOW provides automatic flowcharting of programs written for Burroughs, Control Data, Digital Equipment, General Electric, Honeywell, NCR, RCA, SDS and Univac computers, as well as IBM system 360, 1400, 7090 and other IBM systems, such as the 1130. As part of this expanded service, computer users send ADR either program cards or tapes; ADR then produces flowcharts on a per card rate. ● Available on a **lease** basis, current AUTOFLOW systems include: **COBOL—IBM 360; RCA SPECTRA 70; FORTRAN—IBM 360, 7090/94; RCA SPECTRA 70; ASSEMBLY—IBM 360, 7090/94, 1401, 1410, 1460; RCA SPECTRA 70.** ▲ Remember there's nothing better than AUTOFLOW; we'll back up this statement with a demonstration using your source program. ■ Some commercial users of AUTOFLOW include Alcoa, American Express, Humble Oil, Mellon National Bank, Montgomery Ward, Morgan Guaranty Trust Co., Royal Globe Insurance, Shell Oil, Singer, Standard Oil of Indiana, Title Insurance Co. (Los Angeles), and Western Electric. Governmental users include Department of Defense, National Aeronautical & Space Administration, Department of Commerce and Treasury Department. ● Consistent with corporate policy to disseminate all "good news", ADR announces the opening of its SERVICE BUREAU at 2425 Wilson Blvd., Arlington, Virginia. Now, in one location users can benefit from the full spectrum of hardware and software disciplines. IBM System 360 & AUTOFLOW are waiting to serve you. ▲ Contact us on AUTOFLOW, data processing services, or career opportunities.

APPLIED DATA RESEARCH, INC.

Route 206 Center Princeton, New Jersey 609-921-8550
with offices in Washington, D.C., Los Angeles, Calif., and New York



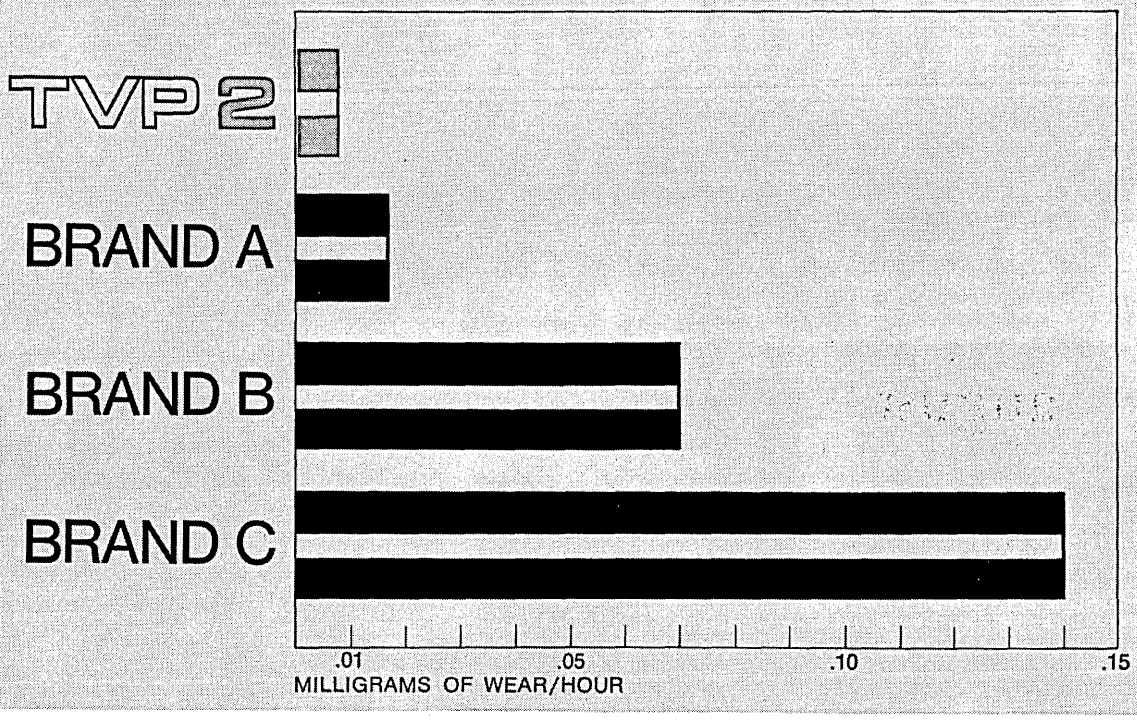
Visit ADR's Booths #180 and #181 at the ACM Conference August 29-31, 1967

*Trademark, patent pending.

ADR is an equal opportunity employer (M/F)

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®

august
1967

volume 13 number 8

automatic
information
processing
for business
industry & science

datamation departments

Ambilog 200

the schizophrenia-free computer

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

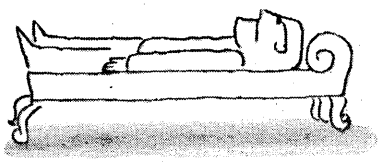
Ambilog 200 is a general purpose hybrid computer designed right from the start to operate in both the analog and digital worlds. We call Ambilog 200 hybrid because it integrates a parallel processing array with a sequential digital controller. The parallel array contains arithmetic elements which are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

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

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

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

At least it might help keep you off the couch.



Adage INC

1079 Commonwealth Avenue
Boston, Massachusetts 02215

CIRCLE 9 ON READER CARD

calendar

DATE	TITLE	LOCATION	SPONSOR/ CONTACT
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. 20-22	Meeting: Data Processing Supplies Assn.	Pheasant Run Lodge St. Charles, Ill.	C. A. Greathouse DPSA 211 E. 43rd St. New York, N.Y. 10017
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. 10-12	Users' Meeting	Hilton Hotel Pittsburgh, Pa.	VIM-7, Control Data 6000 users
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
Oct. 23-27	Business Equipment Exposition	Coliseum New York, N.Y.	Business Equipment Manufacturers Assn.
Nov. 6-8	Computer Graphics Conference	Univ. of Illinois Urbana, Ill.	Prof. C. W. Gear Dept. of Computer Science Univ. of Ill. Urbana, Ill. 61801
Nov. 10	Symposium: Application of Computers to Problems of Urban Society	Hilton Hotel New York, N.Y.	ACM
Nov. 14-16	Fall Joint Computer Conference	Convention Center Anaheim, Calif.	AFIPS
Dec. 7-8	Annual Convention	Disneyland Hotel Anaheim, Calif.	Calif. EDP Assn. Frank Nardi 2555 Mendocino Santa Rosa, Calif. 95401

Please don't call EMR's

sm

If you think the *ADVANCE* 6130 computer from EMR is just another "little" computer, take a closer look. You could be fooled by the price—low enough to compete with any small machine—or by the 16-bit word length, characteristic of small-scale systems. But that's where the comparison ends.

Analyze the 6130 and you'll realize it's the most productive system available. The instruction repertoire and internal architecture put it in a class by itself. We have a number of comparisons made by 6130 customers and prospects which we would be glad to send to you. They'll make you think twice about thinking small.

Principally, there are two classes of customers we wish to address ourselves to—the small-scale area and the high-productivity applications with limited budget funds.

SMALL SCALE

To the potential buyer of a small-scale computer, there are a number of capable machines which are available to "do the job." However, aren't you looking for a system that can "do the job—plus"? The plus being able to expand to accommodate your next requirement. Many of the small-scale computers (under $35,000) that are being sold cannot provide the user with any realistic approach to expansion.

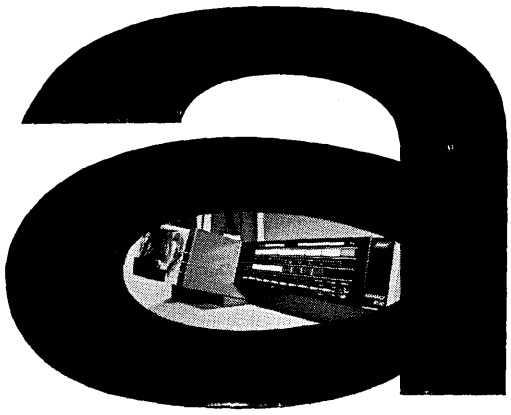
The 6130 is in a different class, it is designed for expansion. Taking the already powerful computer, additional input/output channels, memory, and peripheral units can be attached, but most of our competition can do the same. With the 6130, however, you can add a second processor easily, with no operational software problems. This additional processing power is relatively inexpensive when compared to installing larger systems.

This built-in capability for growth insures that you won't be looking for another new system next year and have to face the re-programming problem.

HIGH PRODUCTIVITY

Next, how about the buyer who has a problem that actually requires a large-scale machine, but does not have the funds? The 6130 has a

6130 computer all



capability that stretches into this high-productivity market.

Historically in the computer field, the user's main problem is to justify a large financial investment to his management. Most of our competitors in this area offer their large general purpose computer as a starter. They rely on the approach that, as the load increases, the solution is to add smaller and less capable satellite processors to handle input/output and some pre-processing. By offering a somewhat reversed approach EMR allows the user to start with a significantly lower initial investment and build from there. Once the computer is installed, and the user can demonstrate to management what can be accomplished, he can build a good argument for expansion. The expansion is normally in the way of adding more peripheral equipment and additional core memory. This is further indicative that, with the large-scale approach, the user has started out with more "computer-power" than needed—and is paying for features that he cannot use or can do without. As the load increases, a point is reached where he has all of the options that use the software to the limit, but by that time, he runs out of "computer-power."

In the case of the *ADVANCE* 6130, the high-productivity user may run out of computer-power sooner but would be in a position to add another 6130 processor to immediately increase his computer power at a small financial addition. One 6130 can handle background processing while the second handles preprocessing and input/output. If this would not be an acceptable approach, a more powerful processor could be added and the 6130 retained as a satellite.

The 6130 alone can successfully offer this approach as competitive small computers are just not powerful enough to handle the general purpose requirements.

ADVANCE 6130 FEATURES

- Here are only a few of the powerful features of EMR's *ADVANCE* 6130 computer.
- 16-bit data word with parity check and memory protect.
- 750 nanosecond memory cycle time as standard.
- Exceptionally large repertoire of more than 100 instructions.
- 1.5 microsecond add time.
- Three hardware index registers with indirect address.
- Relocation register with double indexing allowed is standard.
- 128 interrupt priority levels.
- Multiple processing hardware as standard feature.
- Hardware multiply and divide a standard feature.
- Up to 128 external interrupts.
- Single instruction interrupt with both individual and group enable/disable allowed.
- FORTRAN, real time FORTRAN and macro assembler available.
- Interlaced multiplexed I/O channel allows up to 16 devices to be connected to single channel.

If your application fits in either category—if you need immediate processing power with the capability to expand—if you require a high-speed system to function in a real-time data control environment—if you need the strongest software package in this market, we urge you to contact EMR Computer Division immediately. The address is: 8001 Bloomington Freeway, Minneapolis, Minnesota 55420. Or call our Manager of Marketing collect, 612-888-9581.

We want to tell you about our not-so-small 6130 that can beat any "little" computer—and some of the "big" ones too!

EMR COMPUTER DIVISION

CIRCLE 11 ON READER CARD

letters

our error

Sir:

With reference to the "Do-It-Yourself Parallel Processor" in the Look Ahead section (June, p. 17), I wish to correct an error which is typographically small, but functionally significant. The Information Systems Simulator, now under development at Boeing, is expected to be capable of evaluating *100* million logic equations per second when completed in late 1968, rather than the *10* million cited in your write-up.

ANGUS R. MCKAY
Seattle, Wash.

the numbers game

Sir:

Mr. Gordon (The Forum, Feb., p. 124) is quite right when he says we need a systems approach to education. However, his wild extrapolations of computer-assisted instruction implementation on a large scale are based on the shaky assumption that in a "real" situation, approximately 20,000 university students would each need 15 hours at a teaching terminal. This leads him to conclude that nearly 4,000 terminals would be needed to service a university. At the present state of the art, given the large size of the terminals and memory limitations, it is not yet feasible; nevertheless, with some vision, one can compare this figure of 4,000 terminals to the 2 million volumes that service a university library. In this context, it is not so far out after all.

However, let us consider a situation more closely in line with the present. Imagine Mr. Gordon's hypothetical university with 20,000 students, each of whom takes four courses. On the average, in present day usage, students spend approximately an hour a week on the terminal for a given course. Let us not forget we are talking about computer-*assisted* instruction, not fully automated computer instruction. Suppose, then, that each of the four courses our student takes has programmed material available for CAI. Each student then will require about four hours a week at the terminal (not 15). This alone would revise Mr. Gordon's estimate of needed terminals from 4,000 to about 1,000. However, there are many subjects which do not lend themselves to computer assistance, so presumably a student would not use CAI in all of his four courses, but perhaps, on the average, in two out of the four. This further reduces the estimate of terminals needed to 500. Furthermore, research is showing that not all students benefit equally from CAI. With additional research, one could perhaps select those students who would derive most out of it. So, let us say instead of 20,000 students, perhaps only 10,000 would use CAI, which further reduces the necessary terminals to 250, a figure that is now almost within the realm of possibility.

Of course, all this presupposes good software—and that is a major problem today. Programming instructive material requires skill, time, money and patience. A rational approach to this takes into account the necessity of developing programs that are of general interest and that can be run interchangeably on a variety of machines. At the moment, there is not much organization in this area since the field is still in a state of flux—and computer manufacturers have not formalized their hardware development plans.

SYLVIA WASSERTHEIL
State Univ. College
New Paltz, New York

The author replies: Mrs. Wassertheil is entitled to her belief that mine are wild extrapolations based on a shaky assumption. But . . . students (and there are only 2,000 of them) at the Univ. of California, Irvine, already average 0.2 hours per week of terminal usage. We are predicting a tenfold increase in per capita usage *at Irvine* for 1972 when there will be 6,400 students. And we expect that, in the ensuing 15 years, demand for CAI will increase almost another order of magnitude. This is the thrust of change at Irvine. The view may indeed be very different from New Paltz.

installation checklists

Sir:

Congratulations on the excellent and almost 100% complete "Planning Checklist for a Computer Installation" (June, p. 37). Under "site preparation: electric current," the reader is cautioned to "be sure that there will be no interference from other loads with the computer power." What about being sure that there will be no interference *to* other loads (e.g., adjacent laboratories) by way of unacceptable noise pulses coupled into power lines serving several laboratories? Most data processing systems, fortunately, are physically isolated in this respect and present no problems. For those that are not, however, adequate attention must be given to electrical grounding, impedance levels and shielding, so that megacycle clock pulses do not get transmitted as obnoxious electrical noise to nearby facilities, particularly those using analog equipment. Proper installation planning should forestall potential inter-departmental jurisdictional battles over whose responsibility it is to eliminate or filter out objectionable noise. As an analog computer user who has seen a lab get surrounded progressively by better and better noise sources (mag tape units can be wonderful radiators!), this writer knows that the problem is not necessarily cured easily and cheaply.

ALLAN M. WILSON
San Diego, Calif.

the rpg

Sir:

Harry Leslie's praise of RPG is well deserved. His comparison of COBOL and RPG is interesting, even though clearly subjective.

However, it is probable that total documentation of a working program in RPG is more extensive, in general, since RPG programs are excessively terse—one might even say cryptic. On the other hand, COBOL sets out, by

definition, to "humanize" business data processing programs, in the sense of stating actions and declarations in near-English, as opposed to the black art of *coding*. This, I should think, is a definite plus for COBOL; and

"writer's cramp" can easily be combatted by writing COBOL in longhand (who wants to go through life writing capital letters in little boxes, anyway?). I would be surprised if your average reader found the RPG version to be the more readable. Also, it is apparent that many economies may be effected in Mr. Leslie's COBOL version, which contains certain errors suggesting some unfamiliarity with COBOL.

Economies and corrections are listed below, correlated to the compiler-generated line numbers.

2. Period should follow 'SELECT'
5-7. Not required
33-34. May be written 01 RECORD-2 PICTURE X (100).
55. Picture should begin with letter "S".
58. The word FIRST is a reserved word, and may not be a data-name.
68-75. It should be noted that execution may leave an active perform-range (paragraph CARD-READ) whenever the CARD-INPUT end-of-file is reached, which is bad practice, but will not be detrimental. On the other hand, if a premature EOF is encountered, then the TABLE entries will not all have been properly initialized, so that line 80 may compare to garbage, yielding unpredictable results.
63. The word SELECT is a reserved word, and may not be a data-name.
78. A period should terminate this statement.
80-82. The words IS EQUAL TO may be replaced by the equal sign.
86. WRITE is a reserved word, and hence may not be a procedure-name.

Finally, I estimate that a correct COBOL program for this application could be easily written inside thirty minutes, rather than "about two hours."

KENNETH P. SEIDEL
Northridge, California

Sir:

In "The Report Program Generator" (June, p. 26), Mr. Leslie mentions that the execution time will normally fall completely within I/O time, elim-

letters

inating the necessity of efficiency. He later stated, concerning a modification of one instruction in the table lookup, that "the time saved could be significant—probably half a millisecond lookup on a Spectra 70/45." My question is: Has this modification resulted in the decreasing of total run time?

PHIL H. ARNOLD
Albuquerque, New Mexico

The author replies: The object code produced by the RPG was made as efficient as possible to decrease the occurrences of the unusual case where execution time exceeds I/O time. If the overall processor time is decreased by 5 or 10% due to efficient object code, then the number of unusual cases that will occur will be decreased. In answer to the question, then: yes. The table lookup could result in decreased total run time, but only for someone with large tables, doing many lookups for each I/O operation.

balticulars

Sir:
In Letters (June, p. 15), Edward A. Finn refers to "the ancient and beautiful *Rumanian* city of Cluj." This ancient and beautiful *Hungarian* city, Kolozsvar, is the capital of Transylvania which was annexed by Rumania after World War I. Later returned to Hungary, it was handed to Rumania by the Soviet Union after World War II, as a sop for the loss of Bessarabia.

S. PALFFY
London, England

equipment numerics

Sir:
I frankly doubt that anything could cause manufacturers to cease their fanatical proliferation of numerical designations of equipment. I wonder, though, if they could be persuaded to sacrifice their last digit to a standard. Perhaps something like this:

0 computer system
1 cpu, main memory, logic, etc.
2 data channel, controller, I/O processor
3 disc, drum
4 magnetic tape unit
5 card or paper-tape reader
6 printer, typewriter (output only), graphical output
7 card punch, paper-tape punch
8 display scope, control console, typewriter (for input *and* output)
9 other

For example, 6902 is a peripheral processor of the 6900 system, 958 is a display scope for the 950 computer, 370-3 is a disc file for the 370 system.

I'm sure the scheme could be—and should be—improved upon in the interest of more comprehensible numerology.

BRUCE A. MARTIN
Upton, L.I., New York

no sesquipedalian, he

Sir:
In reply to I. A. MacLeod (Letters, June, p. 14) one word: PL/I.

MYRON E. WILLIAMS
Endicott, New York

european glossary

Sir:
In view of the letter from the secretary of the USA Standards Committee X3 (June, p. 14), and the Editor's Readout (June, p. 21), your readers may like to know what is happening on this side of the Atlantic.

The British Computer Society has set up a terminology committee charged with reviewing the IFIP-ICC Vocabulary and preparing amendments, additions, etc., for submission to IFIP when the next edition is prepared. This committee is working in close cooperation with panel DPE/16 of the British Standards Institution.

The council of IFIP at their recent meeting in Madrid, approved the formation of a working group WG.-1.1 to prepare a second edition of the English language version of the IFIP-ICC Vocabulary. The chairman of the working group is I.H. Gould who is secretary of TC.1, chairman of the BCS terminology committee, and the BCS representative on British Standards Institution DPE/16.

Your readers might also like to know that translation of the IFIP-ICC Vocabulary into at least nine different languages is being done at the moment under the direction of the General Assembly members of the countries concerned.

J. G. MACKARNESS
Secretary-BCS
Administrative Secretary-IFIP
London, England

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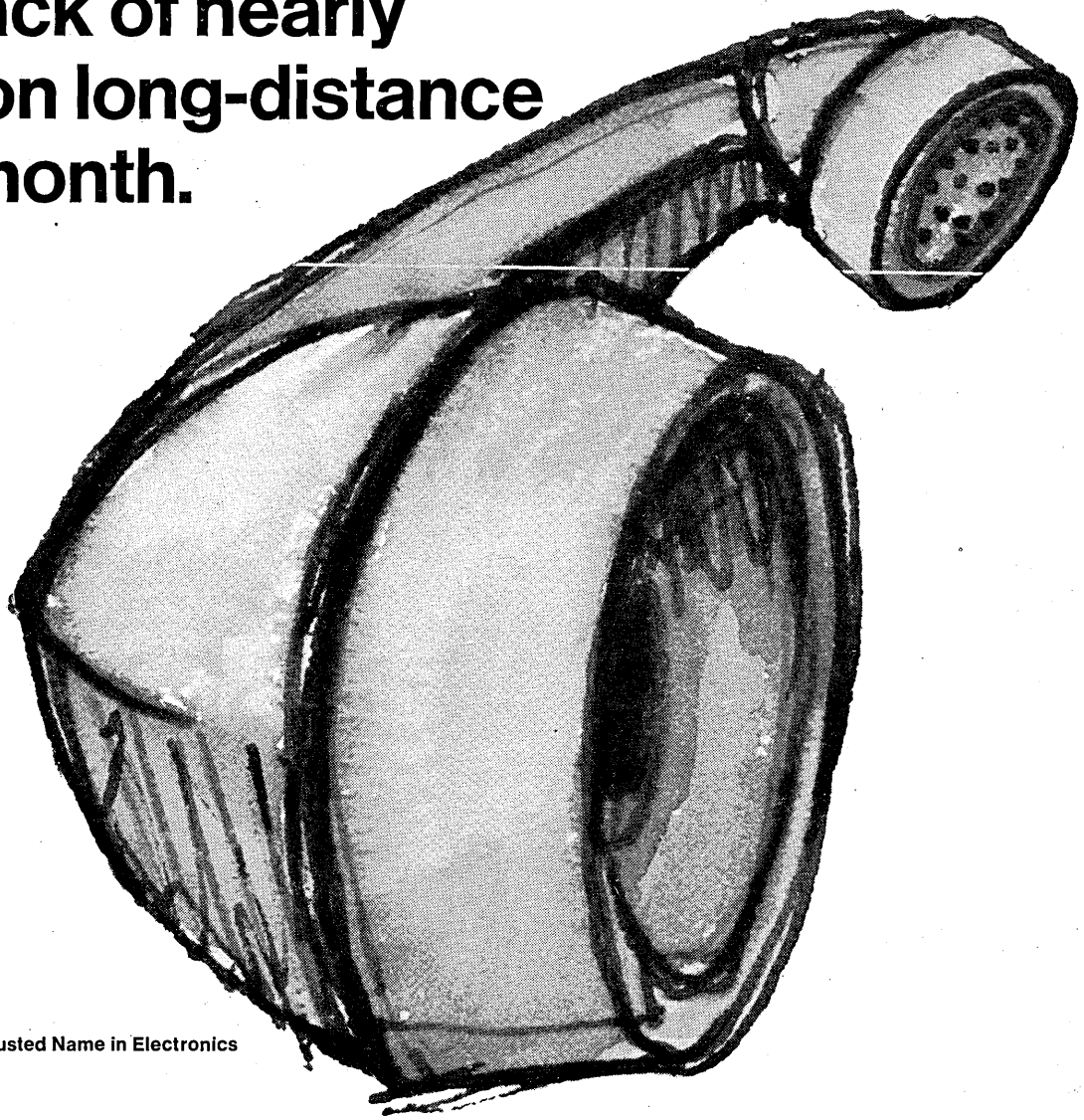

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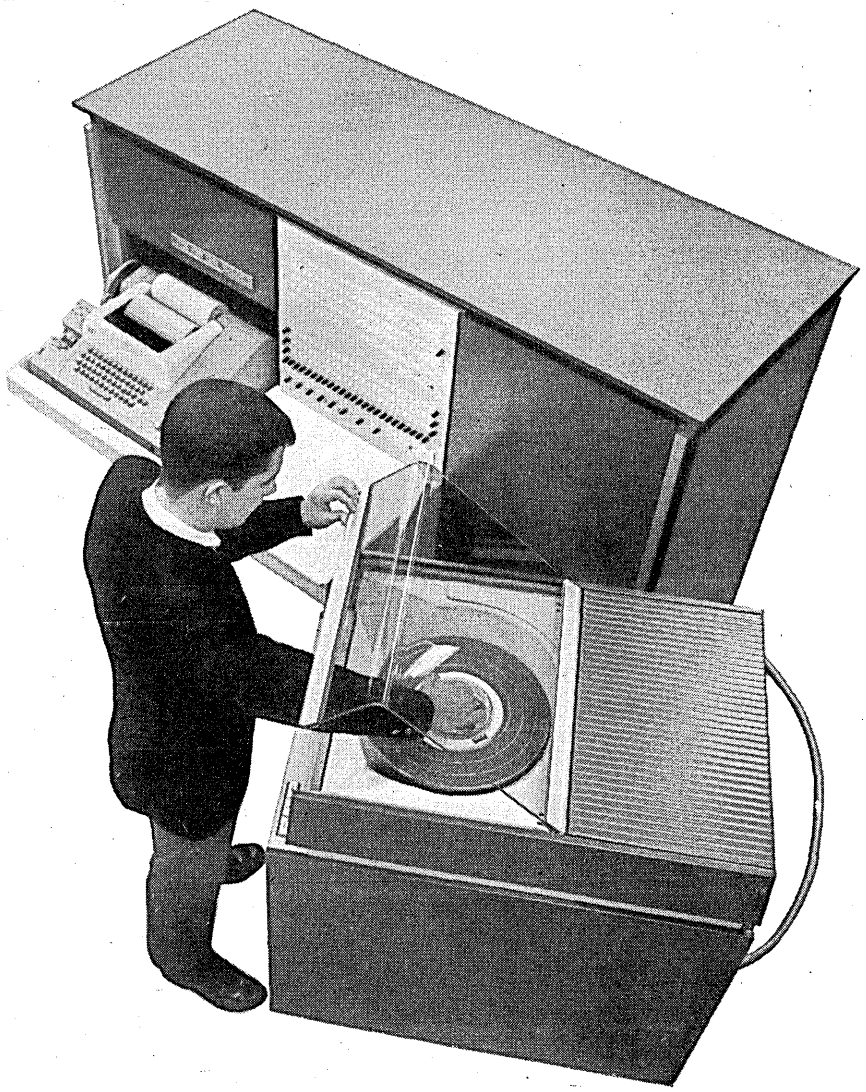

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Systems Engineering Laboratories

CIRCLE 14 ON READER CARD

look ahead

PHASE II: IBM OUT, POLITICIANS STEP IN

The controversy over the cancellation of the AF Phase II award to IBM has done more than give Honeywell, Burroughs and RCA a chance to rebid. It seems that losing bidders with a complaint on future procurements will have many attentive ears in the legislature. John McClellan, developing into a Senatorial counterpart for Rep. Jack Brooks, has directed the Senate Subcommittee on Investigation to study the justification, and examine the economics of procurement, for computer systems by the Defense Dept. and other government agencies. While some claim the issue could become a political football, the subcommittee says it will simply handle complaints as they come up, working with GAO (and independent of Brooks), and suspects it will scrutinize such ideas as the DOD central evaluation agency for computer contracts. Prime candidate or model for that is the AF ESQ, the evaluation group whose lauded efforts may suffer a political black mark with Phase II.

By publication date, the public should know what the ground rules will be in rebidding the system and who will compete. Honeywell, chief complainant and low bidder, feels their "administrative error" on benchmark time can be corrected with $1.25 million in additional equipment, still about $60 million under IBM's bid. But the AF has contended that the Honeywell CPU is too slow. So some bets are on Burroughs, although RCA can't be counted out. IBM, given a 50% chance by some and none by others, could bid a new system (what's one more proposal after six?) and/or offer a quantity discount -- not an uncommon practice in massive procurements and a way to comply with GSA schedule rules.

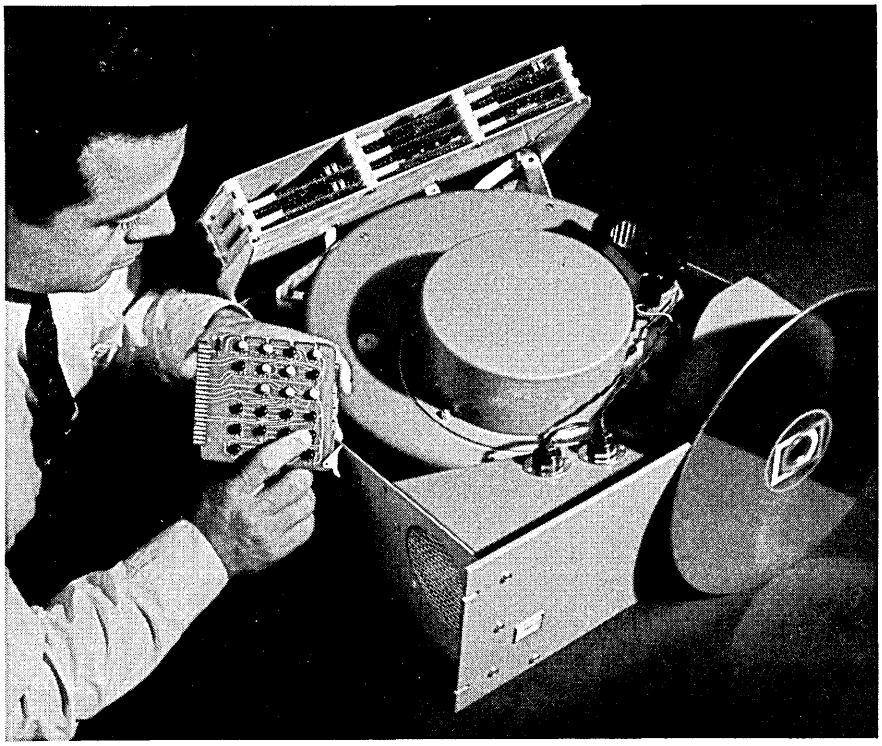
MEMOREX BRANCHES OUT TO DISC DRIVES

Back in 1964, mag tape maker Memorex Corp. quietly formed a group under chief engineer Bob Brumbaugh to develop a disc file system. It became Peripheral Systems Corp. last August and now has an IBM 2311-compatible disc (pack) drive. The Memorex 630 series, as it's called, will take the IBM 1316 and an equivalent pack being readied by another Memorex subsidiary, Disc Pack Corp. Full production of the 630 drives gets under way in the first quarter of '68.

CRT TERMINAL MAKERS SEE BOOM AHEAD

Original equipment manufacturers are being approached by Conrac Corp., Covina, Calif., on a CRT/keyboard terminal complete with electronics and communications link. The alphanumeric unit, reportedly designed to sell for $7-8K, would be the second peripheral for Conrac, a large independent maker of CRT's. The 12-inch screen has two types of character generators: a 5 x 7 dot matrix or a 20-stroke star burst. First demonstration, we hear, will be in September.

Bargain price memories for people suspicious of bargains



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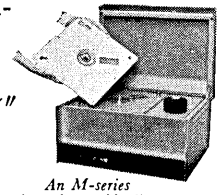
The F-series head-per-track system pictured above comes with storage capacities of 6.4, 3.2 and 1.6 million bits. It has an average access time of 16.7 ms, and stores 100,000 bits on each track — enough to fill the core memory of a small computer. Data can be entered and retrieved very rapidly —at three megabits per second. And the whole system fits in 8¾" of rack space.



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When a large data library is needed, we supply an interchangeable-disc memory system with an average access time of ⅓ second. Each disc, which holds 13,000,000 bits, is permanently encased in a protective cartridge so you can store as many discs as you need.

For complete information contact Data Disc, Incorporated, 1275 California Ave., Palo Alto, California 94304. Phone (415) 326-7602.

DATA DISC

CIRCLE 15 ON READER CARD

look ahead

Meanwhile, Computer Communications Inc. has delivered its first CRT terminal, had sold over 10 before the first on-line demonstration, and is developing an interface for the IBM 1130 computer. The firm (see Jan. '67, p. 19) figures to be in the black the first quarter of this, its second, fiscal year. In this 12-month period, it sees sales of 60-70 more terminals.

HYBRID CRT TERMINALS NEXT FOR ADAGE

By using its hybrid computer, Ambilog 200, Adage has come up with a series of 2-D and 3-D graphics terminal systems which require only voice-grade communications and no CRT buffer. The AGT models 10, 30, and 50 consist of: the Ambilog 200 with 4, 8, or 16K (30-bit) memory; CRT's with more than 1000 lines/inch resolution; light pen, analog tablet, and keyboard input; hybrid arrays; disc files; communications interface between the AGT system and a remote cpu; and a graphics recorder for hardcopy output of the image. Software includes a monitor, graphics interpreter, image subprograms, basic communication ultilities, and remote operating system interface modules. Deliveries for the basic model begin January. Prices range from $75K to $200K.

NEW SOFTWARE SPEEDS REMOTE BATCH ON 65's

What do you do if you don't want the 360/67 you ordered? The Univ. of Pennsylvania thought about a mod 65/40 ASP system, but now may use just the 65 because of a program IBM-Houston developed, called HASP (not yet generally available). This is a completely spooled I/O scheme for remote job processing which, in operation with OS 360 version 11, has run test batch programs on the 65 faster than the mod 75 with only OS. Penn is working on their own version called HASP-PHAST.

GOVERNMENT HASSLE WITH UNIVERSITIES CONTINUES

The federal government and the Nat'l Assn. of College and University Business Officers are still trying to find a long-range solution to the thorny question of what schools should charge for computer time used on gov't-supported work (see Editor's Readout, July '66, p. 21). Right now the government balks at paying more than other users, including students doing unsponsored work. Universities claim this is what would otherwise be idle time.

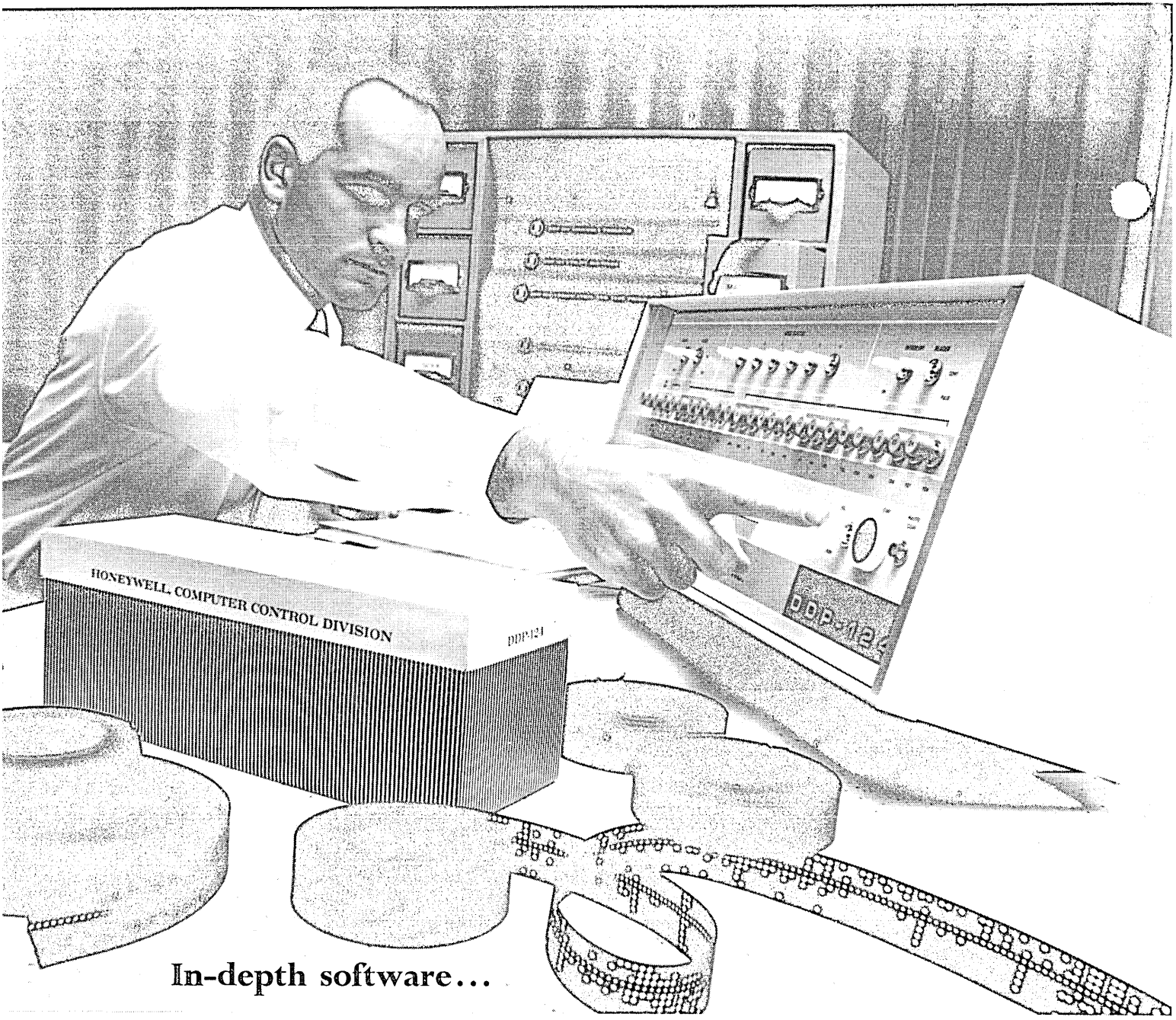
One positive action: the BOB has nixed a request by Princeton Univ. to have computer charges assigned to "indirect costs," as libraries and administrative salaries are treated. The Governmental Relations Committee of NACUBO, with the help of university computer center directors, is trying to hammer out a new recommended policy which then must pass muster at the BOB and among participating agencies. Don't look for a rapid solution.

IS THE WORLD NOW READY FOR OCR?

With all the fuss and feathers about optical character recognition, it's likely that only some 300 units have been installed altogether. Now, though, we hear that IBM is warming up for a massive campaign...promotion, advertising, and general education...to persuade the world at large that OCR is the way to go.

Reportedly, a family of machines is planned, of which the 1282, 1285, and 1287 are just a beginning. Newest of these, the 1287, is the one that can read a few hand-printed letters as well as printed material. No installations have been reported yet but there is a

(Continued on page 119)



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CIRCLE 16 ON READER CARD

editor's read*ut

GUEST EDITORIAL:

THE SYSTEMS GAP

In this issue you will read about the state of the computer art in the USSR and come to the inescapable conclusion that there exists a computer gap between the U.S. and Russia. When I visited the Soviet Union as a member of the U.S. computer delegation in 1959, the gap was most apparent. But I was impressed by the intelligence, vigor, and dedication of Soviet computer specialists, and felt that they would close the gap in a few years. I was wrong. Eight years later, the gap still exists.

Why? I believe part of the answer lies in the gap between our two economic systems—communism Soviet-style and capitalism as practiced in the U.S. For a nation that has adopted cybernetics almost as a religion, the USSR has an economic system with a fantastically poor feedback mechanism.

You have probably heard the story of the Soviet nail plant which concentrated its production on long, fat nails. Why not, if the measure of success is pounds of nails produced and not even pounds of nails sold, much less amount of profit.

The responsibilities of the computer manufacturer end when he delivers the machine. The factory is not responsible for supplying software or maintenance and is little concerned with providing spare parts. Most of the complaints center on peripheral equipment. The BESM-6, the Soviet's newest and fastest computer, has two sets of peripherals in order to achieve reasonable reliability. The Minsk 22 tapes have 16 tracks, but the second eight are a replicate of the first eight for reasons of reliability. Even so, Soviet computer expert Academician V. M. Glushkov complained last year that "information is stored on magnetic tape without loss no longer than a month. Magnetic tapes are not interchangeable and this means that a block of information recorded on tape for one computer cannot be used on another." When the Soviet computer delegation visited the U.S. in 1959, one of their greatest interests was our magnetic tape art—they wanted to know how we achieved reliability and interchangeability. They examined our equipment meticulously but apparently still have been unable to achieve the reliability and interchangeability we enjoyed in the 1950's.

There is another subtle problem which, I believe, has hindered Soviet computer development. (It gives us difficulty, too.) Due to the increased pace of technology, significant changes now take place in a period of time which is short compared to the life span of an individual. It used to be that a man could get an education, take a job and learn more through experience, move up in the company and do well until he reached retirement, drawing on his early education and experience. This is no longer the case. Without continuing education, he may become obsolete long before retirement.

This is not only a problem for the individual, but also for the organizations being run by men whose education and experience are obsolete. In the U.S., if comparatively young men have a new idea which they are unable to sell to one management, they can try another company, or go into business for themselves. Indeed, the story goes that IBM decided in the late 1940's they would not go into the electronic computer business and turned Eckert and Mauchly away. Alternative courses of action are rarer in the USSR—going into business for oneself is not permitted. There have been isolated examples of computer developments outside the official stream (the BESM-4 being one) but they are rare. Indeed, most experts agree that Soviet computer development didn't really get underway until after the death of Stalin in 1953.

I mentioned earlier that this problem (pace of change compared with human life span) also inhibits computer developments in our own country. How? Membership in the scientific Establishment generally accrues only to men with long and distinguished careers and rarely to young men. Since the computer field is only some 20 years old, these older men completed their formal educations long before the birth of computers. Some have learned about computers, but chiefly as a tool in their own disciplines. But the number of true computer scientists among the scientific Establishment is essentially zero.

To cite a result of this, a comparison of the number of government-supported fellowships in computer sciences with the number in mathematics causes men with an admitted bias towards the computer sciences to cry "unfair." Unlike Eckert and Mauchly, these men can't take their story elsewhere but must keep pounding on the same door. They are making progress, but it comes slowly and with bruised knuckles. The fact that the Soviets may be having similar difficulties is of little consolation.

—PAUL ARMER

SOVIET COMPUTER RELIABILITY

an appraisal

by STUART G. HIBBEN

Within the last few years, data have begun to appear in Soviet technical publications on the reliability of some computers currently used in the USSR. A review of the reliability histories for three of these, the Ural-2, M-20 and Dnepr, shows that despite regular maintenance schedules, failure rates are high. Soviet authors have analyzed critical design and maintenance factors that most affect reliability, and have proposed remedial steps to reduce computer failure frequency.

The question of reliability in complex systems has had a good deal of theoretical treatment in the Soviet literature for a number of years. With an increased emphasis on cybernetics, there has been a corresponding increase in attention to the reliability problems of modern digital computers. To date, however, the bulk of Soviet contributions on computer reliability has been of a theoretical nature only: a reliability problem is assumed, and then techniques for solving it are proposed. This has led to numerous papers on optimal redundancy design, debugging programs, methods of failure prediction, and other analytical approaches to reliability improvement.

Only recently have concrete data been published on the actual reliability history of some Soviet computers. The treatment is somewhat fragmentary, and not always rigorously expressed, but at least admits the existence of reliability problems and suggests ways that they may be overcome. The present intent is to examine some of these reliability data and the analyses made of them.

early history

Failure rates in first-generation vacuum tube machines were, not surprisingly, quite high. Evidence of the problem was cited in a 1965 report[1] criticizing the low dependability of early designs, including the BESM, Strela, and Ural. Records from these three showed that the average monthly component failure rate had been as high as 9% of the total number of computer components. Even if only active components are considered, this is a discouraging figure, considering that some models of the BESM and Strela had over 5000 tubes alone. This high percentage was in part attributed to the fact that when these computers were developed there was a general lack of statistical data on all electronic component failure rates, so that it was difficult to design a given reliability level into any complex system.

Another early computer, the Kiev, was designed in the late 1950's and has been in service since the early 1960's. It includes a 1024-word, 40-bit core memory with 10 usec access time, a 9K word drum memory, and a maximum speed of 15,000 op/sec. After a three-year test program its designers[2] reported achieving a utility factor of about 0.7, or 17 hours per day, and concluded that not much better could be expected from a vacuum-tube machine of that complexity. An error-detection system incorporated in the Kiev was later described[3], which was designed to detect three types of triggering fault: missing pulse, incorrectly timed pulse, and amplitude or wave-form discrepancy, any

Mr. Hibben is a research specialist in the aerospace technology div., Library of Congress, engaged in reviewing Soviet technical literature under a USAF contract. He has a BS in electrical engineering from Princeton Univ.

[1] Malikov, I. M., and A. N. Rokhmistrov. *"On the problem of calculating computer reliability."* IN: Leningrad. Inzhenerno-ekonomicheskiy institut. Trudy, no. 55, 1965, 79-84.

[2] Dashevskiy, L. N., S. B. Pogrebinskiy, and Ye. A. Shkabara. *The Kiev computer.* Kiev, Izd-vo Tekhnika, 1964. 324 p.

[3] Rabinovich, Z. L., and E. I. Komukhayev. *"Means of studying the dynamic reliability of digital computer elements."* IN: Akademiya nauk SSR. Sibirskoye otdeleniye. Institut avtomatiki i elektrometril. Avtomaticheskiy kontrol' i metody elektricheskikh izmereniy, t. 1 (Automatic control and methods of electrical measurements, v. 1). Moskva, 1964, 178-183.

of which would actuate an audio alarm and a signal light. A mean trigger error rate of one per eight or nine hours was in this way correlated to spiking on the power supply; by tightening up voltage stabilization to within 0.2% of nominal, this source of trouble was said to be eliminated.

Some interesting general comments on computer reliability were made by P. P. Mesyatsev in 1963[4]. He used figures from a presumably typical computer to show that useful machine time was only slightly over 50% of the total time studied. Of the remaining time, the largest portion was devoted to preventive maintenance (about 20%), with the remaining nonproductive time divided among lesser causes. Among the latter were 5% down time charged to lack of maintenance personnel, and 4% charged to primary or substation power failures.

Mesyatsev charged a large portion of computer failures not to design, but to substandard manufacturing and assembly. He concluded pessimistically that since later generation computers would demand even more sophistication in circuit techniques, the reliability of future Soviet machines was more likely to go down than up, unless drastic steps were taken to improve production quality control.

Recently, more detailed histories have appeared on three computers — the Ural-2, M-20, and Dnepr. These may all be defined as medium-capacity general-purpose types; the last is the only solid-state machine of the three. So far as the writer knows, these constitute the most detailed reliability studies published to date on serially-produced Soviet computers.

ural-2

Although the Ural-2 is an older vacuum-tube model which has been superseded by solid state versions, it is still one of the most frequently mentioned computers currently used in the USSR; in this sense its reliability record might be considered as the most typical for Soviet computers.

In reporting the failure history of a Ural-2, B. I. Belov et al[5] have some frank criticisms of the way computer reliability is measured and maintained. Because of wide variations in operating environments, type of duty, and skill of operating personnel at different computer installations, there can be wide discrepancies in usual reliability indices such as mean time between failures and preventive maintenance time expenditure. The MTBF's for nine Ural-1's, for example, varied by as much as 9 to 1; for six Ural-2's, the percentage of time charged to maintenance and repair was found to vary by up to 3½ times. The reasons cited for such variances are as follows:

(1) Differences in initial checkout periods for new computers, which may be anywhere from hundreds to thousands of hours.
(2) Inconsistency in defining or identifying failures. For example, a component or module might fail to meet its spec limits in a separate test, and so could be classified as a computer failure even without causing a computer malfunction.
(3) Differences in operating environment, including ambient temperature and humidity, power source stability, and, notably, skill level of maintenance personnel.

Competence of personnel is especially singled out for comment. Belov notes that ineptness in testing and fault location can easily lead to additional failures, which may not necessarily be segregated from true operational failures. He deplores the practice of wholesale swapping of plug-in modules when trying to isolate a fault; evidently there is enough tolerance in nominally identical modules that indiscriminate exchanging of them can lead to computing errors. Belov is even moved to remark that while thumping a piece of electronic equipment may clear up intermittent contacts, for example, it may just as well introduce new problems; his implication seems to be that this is a common practice which ought to be discouraged, at least as far as digital computers are concerned.

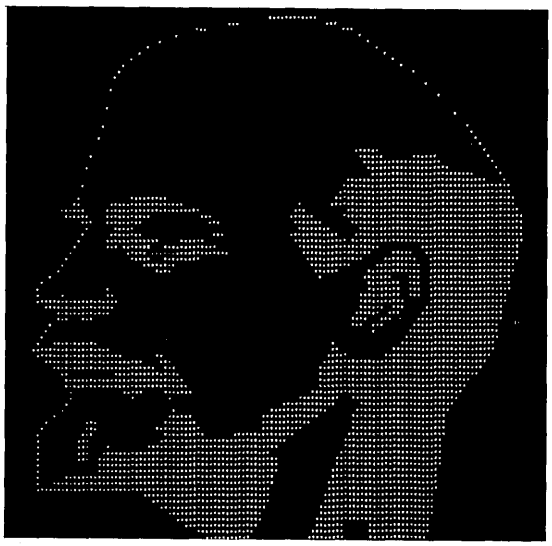
With these background remarks, Belov describes the failure experience on a Ural-2 computer which began operation in Moscow in 1961. Most failure data were logged in 1963 and early 1964, so the machine was considered to be well past any infant-mortality period. During some 3060 hours of computer operational time 136 electrical

[4] Mesyatsev, P. P. *"Nadezhnost' proizvodstva elektronnovychislitel'nykh* mashin. (Reliability in the production of electronic computers"). Moskva, Izd-vo Mashgiz, 1963, 76-78.

[5] Belov, B. I., I. P. Norenkov, and M. A. Titov. *"Design and reliability factors in the Ural-2 computer"*. IN: Moskovskoye vysshee tekhnicheskoye uchilishchye imeni N. E. Baumana. Vychislitel'naya tekhnika; sbornik 5. (Computer technology; collection 5). Moskva, Izd-vo mashinostroyeniye, 1966, 177-183.

failures were recorded, for an MTBF of 22.5 hours. Breakdowns of failures by functional unit and component revealed that one type of diode in the power supply was by far the chief offender, evidently as a result of overheating. Not counting the power supply, MTBF would have been about 50 hours. During the test interval a utilization factor (mean daily usable time/24) of 0.84 was attained.

In analysis of the maintenance technique, failures were classified as either catastrophic or "gradual," i.e., functioning marginally or out of tolerance. The maintenance problem is illustrated by citing a machine use interval during which 45 items were replaced during routine preventive maintenance, but during which there were nevertheless an additional 36 catastrophic failures plus nine gradual failures. Catastrophics were written off as random events



This likeness of Lenin was produced with a URAL-14 computer with a 400-lpm printer. The latter, a drum unit, has both Russian and English characters, 128 print positions, and is pressure-roller fed. It is printed here courtesy of Sol Zasloff.

not preventable by maintenance procedures; the nine gradual failures not revealed during maintenance tests were explained as follows: five occurred because test thresholds were too high; two occurred in locations only intermittently checked; and two occurred in locations not checked at all. The price paid for not detecting these incipient breakdowns became apparent in the average down time consequently required to repair a gradual failure: one hour and 20 minutes, as compared to a mean 20 minutes to repair a catastrophic failure.

While shortening of fault location and repair times would obviously be desirable, Belov emphasizes that streamlining of the operational checkout after a repair would be even more effective, since the latter accounted for 70% of the maintenance time expended in his program. He also asserts that an optimum interval between maintenance periods exists, and should be determined; for the cited Ural-2, based on a normal two-shift work day, he calculated this interval at 12-13 hours.

More failure history, evidently on the same Ural-2, was simultaneously reported by Titov et al[6]. The data somewhat overlap those of Belov, but do include some additional findings. For example, during the first half of 1964, the mean time to repair a permanent failure was 41 minutes, compared to 83 minutes for an intermittent fault. (Note that in both these studies the term "fault" or "failure" means the malfunction of some discrete component; there is no exception made for errors from spurious triggering, noise effects and the like, of the type mentioned earlier in the Kiev.)

Titov's report includes two failure tabulations of interest. One of these correlates failures with operational steps in computation, and gives the resultant repair time required; the worst case was that of erroneous memory write, which needed an average 84 minutes to correct. His second tabulation gives mean repair time per failure for the computer's six functional units: power supply, control, input, core memory, arithmetic unit, and printer. Repair time ranged from 120 min/failure in the control unit to only four minutes in the power supply, the latter being credited to built-in fault indication. The Ural-2 power supply thus had the double distinction of failing most often and being most quickly repairable.

Titov claimed that the performance of the Ural-2 improved during its six-month test period. It is puzzling that, despite this claim, he reported an MTBF of only 13 hours, well below Belov's figure. If the same Ural-2 was involved in both reports, the methods of calculating MTBF were apparently different.

m-20

The M-20 is also a medium capacity, general-purpose computer which uses tubes and semiconductor diodes as active elements. It has been reported in use since 1960. It includes a core memory with a 4096 45-bit word capacity, 6 usec access time, and both tape and drum external storage; its rated top speed is 20,000 op/sec.

A continuous and systematic effort is being made to improve the M-20's reliability. This is being done by strict preventive maintenance, coded failure logging, and statistical analyses of failure data which provide feedback for optimizing the design as well as the maintenance procedures. Results of this program for the 1961-1965 interval on two M-20's have been reported at length by Kobzar' and Smagliy[7].

Again, the main functional units of the computer are separately listed as to reliability performance; the arithmetic unit is cited to illustrate the approach. Here the main tube used is a type 6Zh20P, considered reliable enough that only annual checking is necessary. When tested, all tubes 40% or more below standard gain are replaced. Four years of this routine showed that the annual replacement rate of 6Zh20P's for both computers, with a total complement of 3622 tubes, dropped from 5000/yr in 1961 to 3300/yr in 1964. Unfortunately, there is no breakdown in these figures between maintenance rejects and operational failures. Records for other tube and diode types showed that whereas the annual replacement rate dropped by as much as 10 to 1, the actual number of replacements for some component types still exceeded the complement by several times.

Failure histories, mostly qualitative, of the other M-20 units are available[7]. Tape and drum stores proved quite reliable, provided that strict mechanical maintenance of drive and head elements was adhered to. Drum heads were temperature controlled to ±0.5°C, which contributed to their good performance. After two years of testing it was

[6] Titov, M. A., L. V. Surkov, and S. R. Ivanov. "Questions of maintainability of digital computers." Ibid., 201-210.

[7] Kobzar', M. T., and A. M. Smagliy. "Operation and improvement of the M-20 digital computer." IN: Kitov, A. I., ed. Tsifrovaya vychislitel'naya technika i programmirovaniye. Sbornik statei, vyp. 1 (Digital computer technology and programming. Collection of articles, no. 1) Moskva, Izd-vo sovetskoye radio, 1966, 87-102.

possible to double drum write density from three to six pulses/mm, and to narrow the head gap to 15-20 microns without degrading performance.

The optimum maintenance program which was accordingly evolved for the M-20 was as follows:

a) Daily checks of two-three hours duration; running test routines at over- and under-voltage, and including separate checks of reader, output printer, and output perforator.
b) Weekly checks, six-eight hours long: the daily check routine plus a check of memory read and write operations, and logic circuit checks.
c) Quarterly checks, four days long: the weekly check plus disassembly and overhaul of power supplies and signal circuits, and testing at subnormal filament voltage.
d) Annual checks, 10-15 days: the quarterly check plus extensive overhaul of power supply and cooling systems, input/output hardware, and external memories; cleaning and adjustment of all sub-assemblies; and testing of all tubes, as described above.

Kobzar' and Smagliy assert that rigorous observance of this schedule, together with design improvements, has appreciably increased the reliability of the M-20 and lowered its operating cost, although no MTBF figures or other reliability indices are cited in support of this statement. One result claimed is that an annual operating time of 7145 hours has been achieved, or an average of 19 hours, 35 minutes per day – about the same utility factor as for the Ural-2.

dnepr

The Dnepr, known in prototype as the UMShN, is a transistorized, general- purpose computer reported to have been in serial production for several years. One design purpose for the Dnepr is use as a process controller, hence its reliability is of special concern. The Institute of Cybernetics in Kiev, where the Dnepr was designed, has issued two reports on reliability studies of this computer in factory installations. In 1964 some brief results were given[8] on two of the prototype UMShN models, which emphasize the personnel problem in maintenance. When a trained team from the Institute was used for maintenance, an MTBF of 125 hours was recorded; use of a local factory-trained team, on the same schedule, caused a drastic drop in MTBF to 67 hours.

A more detailed reliability study made in 1962-63 on two Dnepr's (possibly the same machines) was subsequently reported[9]. From 6400 hours of machine time, on a two-shift daily use basis, the following indices were obtained:

1) Mean time between failures was 142 hours. (This did not include failures detected and repaired during routine maintenance.)
2) Mean daily preventive maintenance time t_{pr} was one hour, 20 minutes.
3) Probability of failure-free operation $P(t)$, for a given operating interval t, was 0.5 for $t = 100$ hours, based on an exponentially rising expectancy of failure with time.
4) Mean daily time lost in failure repair, outside of maintenance (t_r) was 32 minutes.
5) Maintenance efficiency index, defined as the ratio of failures detected during maintenance to total failures occurring, was 0.42.
6) Mean daily usable time (t_u), defined by $24 - t_{pr} - t_r$, was 22 hours, 8 minutes.
7) Computer utilization factor $= t_u/24 = 0.92$. (Note that items (6) and (7) are based on a 24-hour day, instead of the specified 16- hour working.)

A breakdown by functional unit gave MTBF's ranging from 4200 hours for the control console to 724 hours for the core memory. In the latter case, the troubles were ascribed mainly to faults in triggers and read amplifiers. Some 65% of these basic failure causes were bad contacts and poor solder joints, whereas transistor and diode failures accounted for less than 10%. At least some of these difficulties were explained by the fact that the test models were early prototypes and in some cases used "nonstandard" components or circuits. Nevertheless, it was conceded that improvements in contact and circuit design are obviously necessary if any significant increase in the 142-hour MTBF is to be achieved.

conclusions

If we should try to compare the reliabilities of Soviet and American computers, several qualifying factors must be kept in mind. One obviously is that most of the Soviet data available are for outdated vacuum-tube machines, which under the best of conditions will show up poorly against the second- and third-generation solid state designs which are now the norm here. A distinction must also be made between industrial versus high-priority scientific applications of computers in the USSR; one would assume, for instance, that the Soviet space program does not suffer from the kind of failure rates quoted above. Comparing generally used industrial or laboratory computers in the two countries, and judging from attainable failure rates of discrete components, one is probably safe in saying that the MTBF's of U.S. computers are at least an order of magnitude greater than their Soviet counterparts. With the advance to solid-state machines in the USSR, this gap may decrease. The latest Soviet transistorized models (Minsk-2 and -22, Razdan-3, Ural-11 and -14, and M-220) are claimed to be notable for their high reliability and good producibility[10], but the quantitative improvement remains to be seen. Quality control of semiconductor production is just one of the present limiting problems that has been mentioned as troublesome.

Along with ambitious proposals for reliability improvement, the Soviets have on occasion chided their computer industry for its poor performance. Academician V. M. Glushkov, a pioneer in computer design, has complained[11] that present computers can operate only "a few hundred" hours between failures, and the record for peripheral equipment is even worse, with daily breakdown common. Furthermore, the quality of magnetic tape is so low that taped data cannot be stored over a month without suffering loss—an understandable incentive for the Soviets to seek higher quality tape from abroad.

As the present review shows, there are a number of quality control problems which limit the reliability of Soviet computers. But the most frequent complaint, common to almost all of the cited sources, concerns the lack of capable operating and maintenance personnel. Some authors give this problem top priority, asserting that improvement in personnel qualifications is of the most urgent necessity if acceptable levels of computer reliability are to be attained. ■

[8] Korytnaya, L.A. "Some questions on operational reliability of digital computers and control systems." IN: Akademiya nauk UkrSSR. Institut kibernetiki. Kibernetika i vychislitel'naya tkhnika (cybernetics and computer technology). Kiev, 1964, 62-73.

[9] Trubitsyn, L. M. "Reliability of an experimental model of the Dnepr computer." IN: Institut kibernetiki AN SSSR. Opyt ispol'zovaniya tesifrovoy upravlyayushchey mashiny Dnepr (Experimental use of the Dnepr digital control machine). Kiev, 1965, 12-23.

[10] Koryshev, B., and I. Litvinov. "Electronic computer technology." Tekhnika i vooruzheniye, no. 9, 1966, 68-73.

[11] Izvestiya, 10 July 1966, p. 5.

THE BESM-6 COMPUTER

by WADE B. HOLLAND

A considerable amount of information has been released over the past year on the Soviet Union's newest and fastest computer, the BESM-6. For a computer not yet in widespread use, this is a radical departure from custom. The machine has been highly publicized to the general public, with the first photograph of its appearance in *Pravda* last October. Stories and photographic spreads, complete with color pictures (another first for Soviet machines), have been carried in mass-circulation magazines. Following is a description of the machine compiled from several sources (see bibliography).

The BESM-6, the newest, largest, and fastest of the known Soviet computers, represents a marked advance in Soviet computer design and engineering. Its major features include a claimed speed of 1 million operations/second, which is more commensurate with application demands than that of any previously known Soviet machine; all-solid-state construction; input-output units more closely equivalent to U.S. equipment than those available on any other Soviet machine; some kind of time-sharing capabilities; etc.

There is mounting evidence, however, that considerable operational difficulty has been experienced with the machine, that its effective speed in actual practice is considerably slower than claimed, and that it suffers from digital limitations. Nevertheless, it includes a number of major improvements over its predecessors, the M-20 and the BESM-2. For example, the speed of the store has increased approximately five-fold, from 10 usec to 2 usec; the internal circuit speed has increased by a factor of about 10, from a clock speed of 1 mc to 10 mc; been considerably improved.

BESM-6 is probably intended to supersede the BESM-2 and the M-20 in scientific and engineering applications requiring very high speeds and large-scale production, as would be encountered in the larger and more important research institutes, government bureaus, academic institutions, and industrial plants. It is not known how many BESM-6 machines have been built (probably not more than five or six), nor how many are planned. The prototype unit was built at the Academy of Sciences' Computer Center in Moscow, and a number of design changes resulted from the experience of using it at the center.

A second machine is known to be operable, although perhaps not yet doing useful work, at the Institute of Mathematics of the Siberian Department of the USSR Academy of Sciences in Novosibirsk. The Joint Institute for Nuclear Research at Dubna probably has or will soon have a BESM-6. Many other institutes are scheduled to get the machine as it becomes available.

The machine's 32K, 2-usec memory is the largest and fastest known store in a Soviet machine. It is overlapped and there appears to be instruction look-ahead capability. I/O is buffered. The BESM-6 is also the first large single-address Soviet computer; all previous machines from the same design group—the Academy of Sciences' Institute of Precise Mechanics and Computer Engineering, under Academician S. A. Lebedev—have been three-address. Successful production of the machine demanded considerable improvements in the quality of magnetic cores and high-speed transistors and diodes, in the magnetic drums and tapes, and in the general art of producing large electronic devices. It does not, however, have disc storage, and there are no indications of any current plans to add discs.[1]

At a speed of 1 million operations/second, it is estimated that BESM-6 would be about 20 times faster than M-20.[2] The designers are adamant in their claims for the machine's speed, and state that the evaluation is based on a formulated mix of operations (70% floating-point additions, 30% multiplications). However, an article in the popular magazine *Ogonek* cites the machine's handling of Fresnel's integral at a speed 55 times faster than the same problem could be run on a BESM-2; since BESM-2 operates at 10,000 operations/second, BESM-6 must have been running only a little over half as fast as its claimed capability. The same article also equates one minute of BESM-6 time to one hour on BESM-2; this means an effective operating speed of only some 600K operations/second.

actual performance

There is considerable speculation in the West that even these reduced figures are not indicative of actual BESM-6 performance, and that on the average it is capable of only about 300K operations/second. Additionally, the machine's reliability appears to have been poor thus far, and it is doubtful that any of the existing units are yet fully opera-

[1] No Soviet machine has ever been equipped with a disc. However, discs are currently under development in the Soviet Union and should be available in the near future.

[2] The M-20, the largest previously known Soviet machine, could execute 20K three-address instructions per second. If one three-address instruction is taken to be equivalent to 2.5 single-address instructions, then the improvement is 20-fold.

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tional. Reports indicate that BESM-6 has been experiencing tunnel-diode temperature problems and what are described as "back-panel" problems, perhaps relating to transit times.

The BESM-6 design, which some Western experts feel copies many of the features of the Atlas machine, seems to emphasize minimal core usage, understandable in view of its rather limited (and not expandable)[3] core store of only 32K words (in eight 4096-word blocks;[4] words are 50 bits long). The use of two instructions per word, of 15-bit index registers and addresses (thus limiting the number of core addresses to 32K), and the incorporation of literal data directly into the instruction wherever possible all suggest that the machine was specifically designed to economize on accesses to high-speed core storage. However, the design may instead have been oriented toward ease of programming, optimum execution of programs, specific applications, or conservation of storage space.

The BESM-6 makes extensive use of a system whereby data storage referencing is overlapped with arithmetic operations and with control functions; the machine reportedly has five levels of instruction look-ahead. Capability exists for simultaneous processing of several problems—i.e., some sort of time-sharing or multi-programming. For this reason, the machine is reportedly equipped with an interrupt system, memory-protect circuits, and indexing. Distribution of core and external storage space between problems is automatic, as is the sequencing of the operation of the external systems.

Provision is made internally for the use of any part of the memory as a "stack" or "push-down store." The machine has capability for indirect addressing at any level, and also for multiple address modification.

[3] The store on the BESM-6 at the Science City in Novosibirsk may eventually be increased to 64K; however, extensive hardware modification is anticipated. The additional 32K may be made available to other machines as well, and will probably figure prominently in plans underway at Novosibirsk for a large time-shared system.

[4] Core is apparently organized in eight blocks, but manufactured or packaged in four 8K units.

[5] The quote is from the article in *Nauka i zhizn'*. A translation is available from the Clearinghouse for Federal Scientific and Technical Information of the U.S. Department of Commerce (JURS 38,941, "The BESM-6 Computer," Dec. 5, 1966, $1).

[6] "USSR's Yershov Speaks in L. A." DATAMATION, Vol. 11, No. 7, July 1965, p. 99.

The central processor has 16 high-speed general-purpose registers operating at 300 nsec. Memory protect is in pages of 1024 words each and, for time-sharing, relocation and fragmentation are also handled in pages of 1024 words using 32 special registers. There are 18 interrupt lines.

remote stations

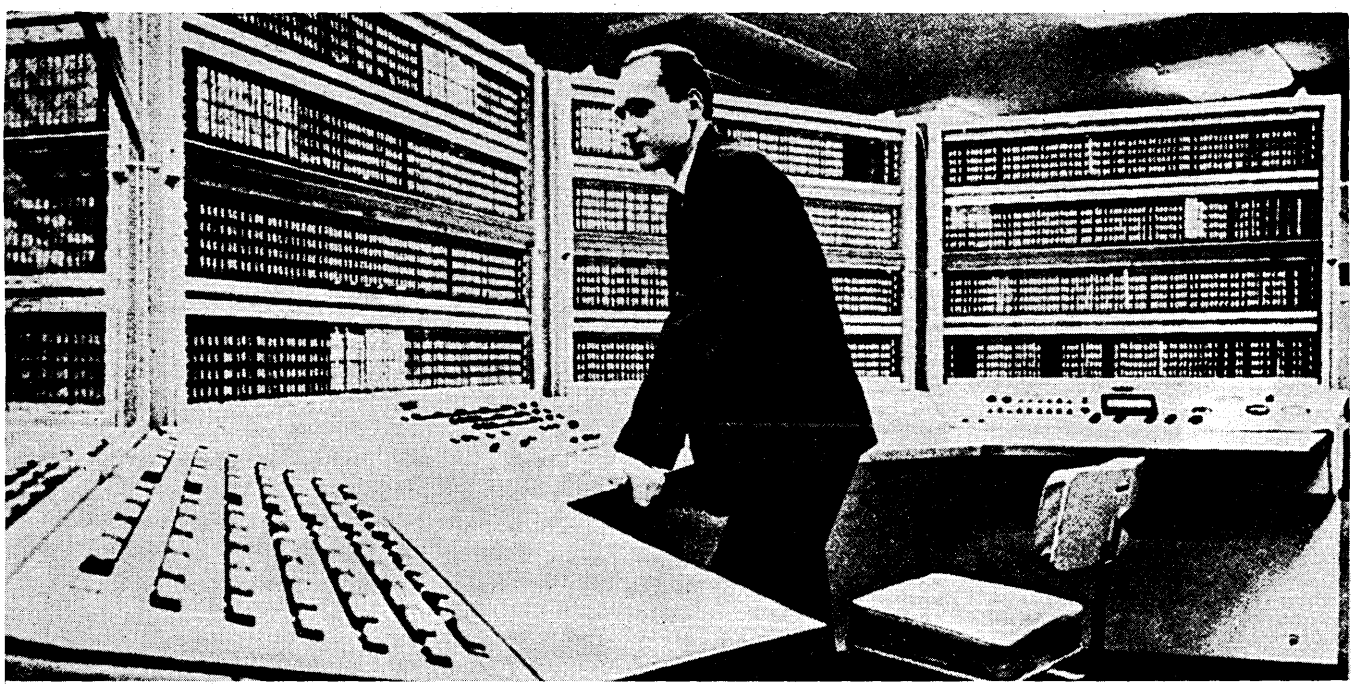
At the remote consoles, or "mathematical stations" as they are called, one can "follow the progress of problem solution and can interrupt the process."[5] It is not clear just what this means, although the machine is definitely designed for some kind of on-line time-sharing.

The remote terminals are based on a telegraph I/O apparatus equipped with paper-tape facility. In addition, there appears to be a separate paper-tape punch and reader, and a telephone dial on the control panel.

Apparently, several time-sharing systems are under consideration, and it is possible that in some configurations as many as 100 terminals may be serviced by one machine. Since, however, only 16 I/O channels are reported for time-sharing, it may be that this is the maximum number of users that can be handled simultaneously. One source speaks of time-sharing with "100 teletype units" in addition to "remote consoles."[6] Sixteen drums will be available for time-sharing applications, apparently in addition to the normal maximum drum complement of 16. The basic time-sharing system, believed to be under development at the Computer Center of the Academy of Sciences in Moscow, will not be ready until mid-1968. At present, the delay in the time-sharing system seems in some part to be caused by problems in the development of terminals, and some Soviet specialists have privately expressed skepticism that anything currently available would be adequate for time-sharing.

An extensive software development program is underway with responsibility for various aspects charged to different institutions. The assembly language, called "Avtokod" (Autocoder), has two levels and includes a set of macro-instructions developed at the Steklov Institute of Mathematics of the Academy of Sciences. The macros significantly extend the basic operations' repertoire (which consists of 50 instructions) and facilitate programming; the

Newest, largest and fastest of known Soviet computers, the BESM-6 also puts forward an imposing face. "Considerable operational difficulty" with the machine has been reported.



set of macros can be supplemented or modified depending on the application.

An ALGOL compiler is being developed at the Academy Computer Center, but is not yet operational. ALGEC, a Soviet version of ALGOL intended for handling economics data, is charged to M. A. Korolev of the Moscow Economic-Statistics Institute; Korolev was chairman of the group that wrote ALGEC.[7]

A compiler for the ALPHA language, a subset of ALGOL developed at the Siberian Department of the Academy of Sciences in Novosibirsk, is also being written. Among staff members at the Computer Center, ALPHA is said to be the most popular BESM-6 language. The executive and monitoring programs are the responsibility of the Computer Center, while COBOL and FORTRAN are being developed at the Institute of Cybernetics in Kiev. The dispatcher program currently operating is said to be quite limited. There is also, apparently, a translator being developed at the Institute of Theoretical and Experimental Physics where a large library of routines for the BESM-6 (called the B-65 Library) has already been written.[8]

Unlike previous Soviet computers, the BESM-6 design reflects the demands of automatic programming and translation from algorithmic input languages. The emphasis on software is further underscored by the refusal of the cognizant State Committee of the Council of Ministers to approve BESM-6 until the software has been completed.

The first components for the prototype machine at the Computer Center in Moscow were received approximately two years ago. An operational configuration was available by mid-1966, although with a 16K store. The Computer Center machine now has the full 32K store[9] and is equipped with four drums (with more to be installed soon), eight magnetic tape units, two card readers, two high-speed printers,[10] and various off-line card and tape preparation units.

Cost estimates for the BESM-6, depending on the configuration, range from 1.1 to 3 million rubles (1.21 to 3.3 million dollars at the official exchange rate).

besm-6 technical specifications

Average operating speed: 1,000,000 single-address operations/second.

Word length: 50 bits, including 2 for parity checking. The mantissa has 40 bits plus a 1-bit sign; the exponent, six bits plus 1-bit sign.

Notation system: floating-point, binary.

Times of basic operations (usec):

Floating-point add	1.1
Floating-point multiply	1.9
Division	4.9
Other	0.5

Instruction system: single-address, 24 bits long (two per word); 50 basic instructions plus macro-instructions.

High-speed index registers: 16, operating at 300 nanosec.

Index register length: 15 bits.

Special-purpose registers: 32, used for relocation and fragmentation in time-sharing (in 1024-word pages).

Length of special-purpose registers: 5 bits each.

Core capacity: 32,000 50-bit words in eight blocks.

Core cycle time: 2 usec.

Core read access time: 0.8 usec.

Clock frequency: 10 mc.

Electronics: 120,000 diodes, 40,000 mesa germanium transistors.

Number of interrupt lines: 16.

I/O system (typical installation):

- 2 700-card/min. card readers
- 4 800-char./min. paper-tape readers
- 2 600-line/min. high-speed 96-character alphanumeric printers (128 char./line)
- 2 100-card/min. output card punches
- 2 20-char./sec. paper-tape punches
- 4 keypunch machines
- 1 punch-card verifier
- 2 paper-tape punches

External storage system:

Magnetic drums[11]

Number (maximum)	16
Capacity per unit	32,000 words
Tracks per unit	120 (in 3 groups)
RPM	3000

Magnetic tapes

Number (maximum)	32 (2 drives/cabinet)
Capacity per unit	1,000,000 words
Total capacity	32,000,000 words
Reading and writing	In blocks of 1024 words
Total capacity	512,000 words
Reading and writing	In blocks of 1024 words

Permissible ambient air temperature: +5° to +40°C.

Permissible relative humidity: 65% ±15% at 40°C.

Air conditioning: centralized, forced.

Power: 20 kva (not including external systems).

Size: (floor space, typical installation): 200 m² ■

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Pravda, October 23, 1966, p. 2 (photograph of BESM-6).

[7] Wade B. Holland (trans.), *Soviet Cybernetics Technology: VIII. Report on the Algorithmic Language ALGEC (Final Version)*, The RAND Corporation, RM-5136-PR, December 1966; to be reprinted in *Cybernetics*, Vol. 2, No. 2, by Faraday Press, Inc., (a translation of the Russian journal *Kibernetika*).

[8] The library was compiled by V. A. Kronrod and V. L. Arlazarov of the Institute (see Arlazarov).

[9] But it is not clear that the second 16K is yet operational.

[10] It was originally planned to equip BESM-6 with a single 400-line/minute printer. Two printers, operating at somewhat lower rates, were in use in the fall of 1966, but two new 600-line/minute printers were installed early in 1967. The paper for these new machines comes in rolls and is sprocket-fed (the first sprocket-fed printers known to be used by the Soviets). These units have 128 print positions and a 96-character print cylinder (the full set of 96 characters is repeated at each print position on the cylinder). The character set consists of both the Cyrillic and Latin alphabets, the numbers and standard symbols, and special ALGOL characters.

[11] These drums, and perhaps the tapes also, are not the ones originally planned for BESM-6. Earlier specifications called for eight drums at 16,384 words each (total capacity of 131,000 words). Tape and drum reading and writing in 1024-word blocks also represents a change from an earlier specification of 512-word read/write blocks. Transfer rates for both drums and tapes are unknown; however, a rate of 20 μsec/word was believed to have been claimed for the earlier, smaller drums. The tapes in use at that time may have had a transfer rate as high as 40,000 10-bit bytes/sec. start/stop time was 10-20 msec.

Academician A. A. Dorodnitsyn, Director of the Computer Center, has indicated that Soviet tapes will begin to conform to international tape standards. It isn't known whether this means that BESM-6 tapes are now in conformity with the standards or not.

EDP PROGRESS IN ISRAEL

by FRANK MOSER

Capping the eastern end of the Mediterranean Sea, a very old and very new country, the State of Israel was created by the United Nations in 1948 with the termination of Great Britain's mandate on Palestine. Occupying a now controversial amount of land, a population of 3 million is concentrated in the three major cities of Jerusalem, Tel-Aviv and Haifa. Jerusalem is the capital, and city of many roles in the 4000 years of the civilization's history, but Tel-Aviv is the city of today, nearly a million strong, and the center of Israeli commercial activity.

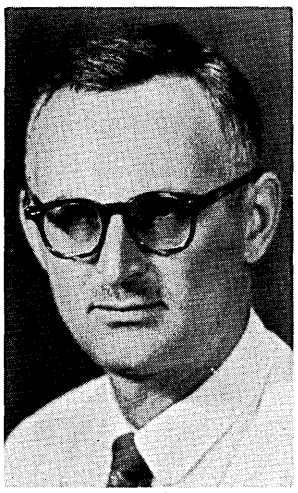
As in most newly developed countries, Israel's government is the most important single factor in the economic life. Many of the large industries, including public utilities, transportation and natural resources, are either owned or controlled directly by the government or by public institutions representing the government; 75% of the university budgets and a large portion of municipal financing also come from the central organization. Private industry, being, on the whole, much smaller, is more conservative in its approach to expensive tools such as computers, and the government is therefore the pacesetter for the computer market.

Problems requiring data processing techniques began in Israel, like everything else, in *Genesis**, where Abraham is faced with the formidable task of "numbering the dust of the earth"—the tools for such a task arrived in the 1930s.

early history

As a result of the earlier agreement between IBM and the British Tabulating Co. (BTC), Palestine was considered a part of the British Empire and therefore out of bounds for the American company. BTC did not exploit its favored position and left the Palestine market to another British firm, the Powers-Samas Accounting Machine Co. Powers installed unit record equipment in a few government offices and firms such as the railway, electric company and post office; but, as in Great Britain itself, growth was slow.

A large wave of mass immigration into the country began in 1948 with the population expanding from 750,000 to over 2 million in less than a decade. The labor force employed in office work expanded rapidly, but the lack of trained talent among the new immigrants was a major hindrance in the development of an efficient government machinery. The situation was ripe for a rapid increase in the use of data processing equipment. Since Israel was not a member of the British Empire the original agreement with BTC no longer held and IBM was free to enter the Israeli market. The first unit record equipment was de-



Dr. Moser has recently founded Natam, Ltd., a software and consulting firm in Jerusalem. Formerly head of computing at Mekorat Water Co. in Tel-Aviv, he has a PhD in geology from the Univ. of Michigan.

*Genesis 12:16

livered during the spring of 1950 and IBM has been an important part of the Israeli scene since.

The period from 1950-1960 was the decade of punched card equipment, and it wasn't until 1959 that the first commercial computer, a 1401 card system, was delivered to the Office Mechanization Centre, a government installation. The main reason for the somewhat late entry of computers into Israel was that at the time IBM was the only manufacturer actively marketing in the country and the first computer of medium size that it had to offer was the IBM 650. This machine was announced in the US in 1956 and was basically a scientific computer.

An attempt was made to market it in Israel, but with the introduction of the 1400 series which was more suitable to Israel's needs, the 650 never got going. The first half of the present decade represents the time of Israel's big leap into the computer era. From the first computer in 1959, the number of installations grew to 10 in 1963 and over 45 by 1967. This represents over 60 individual machines. The economic recession which hit Israel in 1966 slowed this growth somewhat. However since the proposed economic solutions are based mainly on better management, greater efficiency and lower costs, there is a continuing trend to the use of automated data processing, on a service bureau basis. The forecast is that there will be at least 100 computers in the country by 1970.

As might be expected, IBM holds a big share of the market. Within the last half year they have installed two IBM 360's Model 40, 10 Model 30's, several Model 20's, and an 1800, in addition to the 20 1400 systems already installed. They have an organization of over 200 employees in the country and service bureaus in three cities. NCR, which has had a very efficient agency in the country for many years, began to compete for the computer market in 1960 and did especially well among the financial institutions. Three of the larger banks, the Treasury, and the National Insurance Institute, all have NCR 315's. In addition a number of 190's and 500's have been delivered. NCR also runs a service bureau in Tel-Aviv. Philco sold a 2000 system to the Ministry of Defense in 1959 and by 1967 this had grown to five machines, including a 211, 212, and three of the 1000 series.

Control Data officially opened an office in 1965, although it had already sold a 1604A and 160A to one of the educational institutions in 1963. They have a fairly limited market in Israel since they aim mainly for the medium to large scale scientific systems.

There are five recognized institutions of higher education in Israel. The Weizmann Institute (named after Israel's first president) was actually in the computing business back in 1954 when a team of its engineers built the WEIZAC which was modelled after the JOHNNIAC, but the emphasis was more on the design, construction and large scale scientific computing than on computer science. Later the Institute undertook an even more ambitious project and built the GOLEM, a 75-bit machine for which the basic design came from the ILLIAC II.

In between the period of building the two machines, the Institute also acquired its 1604A system. The other Universities came on the computing scene much later. The Haifa Technion got its first machine, an Elliott 803, in 1963, later adding a 503. The Hebrew University installed a 7040 in 1965 while the Tel-Aviv University has ordered a CDC 3400 for delivery this fall.

training and development

For many years the computer was considered an overgrown calculating machine rather than an educational tool. Besides basic introductory programming, very few courses were offered. Only lately has there been a noticeable change in the attitude and today there is talk of establishing computer science departments in a number of the schools. On the other hand, the military services have played an important role in the training of personnel. With the buying of the first Philco computer in 1959, they embarked on an educational program which trained hundreds of analysts and programmers. Many of the important names in computing in Israel today are graduates of the Defense Ministry Computing Centre.

The dearth of experienced personnel is a subject of great concern. The problem is less acute with programmers (except certain specialized fields such as systems programmers) but more so when it comes to analysts and is especially bad at the computer managerial level. With new installations being set up continually, personnel who have just entered the field are being asked to assume managerial responsibility. This must eventually show in the quality of service that is derived from the computer. A number of institutions, including the Civil Service and the Productive Institute, have organized successful two-four month intensive courses for analysts. With the universities now begining to train computer-oriented personnel, it is hoped that the problem will be overcome before it affects the rate of development.

Most of the people who work in the profession are affiliated with the Information Processing Association of Israel. This organization has been in existence over ten years and in February had its third national conference at the Weizmann Institute. The attendance at the two-day conference was over 500, which represents one quarter of the membership. The eight working sections covered a variety of subjects from the use of computers in allocating telephone lines to numerical analysis. The interest was very high and the number of papers submitted far exceeded the 35 which were finally accepted. The proceedings of the conference are published in full in Hebrew. The association works actively in promoting the advancement of data processing in the country, specially among other professions. One of the major achievements this past year has been the development of a high school data processing curriculum for the Ministry of Education. Much of the contact with international organizations is done through the association. In November 1966 Israel was host to an executive meeting of IFIP, and next month the Information Processing Association of Israel is sponsoring an International Symposium on Automation of Population Register Systems in Jerusalem.

The rapid expansion of computing facilities within the last five years has not been without the normal birth pains. There were installations that took years to become productive. There were machines returned when the customer gave up hope and there were orders cancelled when it became apparent that the return would not cover the investment. Most of the work being done is still within the realm of basic data processing applications. Salaries, stores, and invoicing make up the bulk of computer time being used. Very little integration is being attempted and novel or usual applications are rare. An exception to the above is Mekorot, the National Water Company, which is about to embark on a pilot project to use its IBM 360/30 simultaneously for off-line data processing and on-line to control the National Water System.

Having come to the conclusion that automation is one of the answers for the advancement of a modern industrial society, Israel jumped straight into the deep end of computer usage, and today, probably, has the largest computer/population ratio between Italy and Japan. The base is established and the time has now come to consolidate trained professional personnel and intelligent users through the development of university computer departments. ■

VIRTUAL MEMORY AND PAGING

part one: a review with examples

by IVAN FLORES

The terms *paging* and *virtual memory* have appeared frequently in computer literature. However, they seem to be defined at the whim of the user at each occurrence. The concepts associated with these terms are of special importance these days because they are linked so intimately with time-sharing—and we all know how hot an item that is!

One thing is clear: in most contexts the main objective of paging is to make the computer memory appear to be a different size than it actually is. In the small computer the memory looks smaller than it really is. In the large system the large core memory looks even larger and takes on the size of the auxiliary memory.

Consider several programs, each chopped into parts called segments. Some segments reside in core and others in AM (auxiliary memory). For all of them and the programmer to be congenial, the segments should be easily maneuverable. We should be able to: 1) move them quickly (swap) between AM and MM (main core memory); 2) locate a desired segment quickly. This is facilitated when the program can call segments by names independent of their actual location, whether they are in AM or MM. Segments are called pages; the locating and the swapping scheme is paging.

virtual memory

In the old days, the computer, and consequently the programmer, was limited in the amount of memory which might be addressed. Nowadays, besides main memory, which is usually core, one or more levels of auxiliary memory are provided.

In some cases (such as extended core) the computer may have direct access to the auxiliary memory. Generally, though, information in AM cannot be acted on until it is brought into MM: a program segment on disc cannot be executed there; it must be brought into main memory first. Contrasted with main memory, then, auxiliary memory is larger, has a longer access time, and does not make information directly available to the processor—it must be placed in main memory first.

The problem is to make it appear to the computer and the programmer that the large resources of the auxiliary memory are completely available without worrying about moving information around, about time and size limitations, and synchronization with the rest of his program.

The computer uses a lot of memory: 1) for normal programs with large system support—lots of software requiring more than main memory; 2) for large programs, as in Monte Carlo methods of programming; 3) when much data is used, as for matrix inversion of nuclear pile

*The research for this article was supported under Grant No. AT(30-1)-370A to Stevens Institute by the Atomic Energy Commission.

Dr. Flores is an associate professor at Stevens Institute, teaching programming and design as well as conducting research in the effective use of mass memories. He is also a private consultant and has written a series of texts published by Prentice-Hall, the latest being Computer Design. Others are Computer Programming, Computer Software, Logic of Computer Arithmetic, and Computer Logic.

calculations; and 4) for multiprogramming. Of course, it is the last, multiprogramming, which seems to be the hottest at the moment—everybody is interested in running several programs at once—but the problem of virtual memory is no different whether it is examined in the multiprogram or uniprogram environment.

Where virtual memory is needed, we have the following situations: the memory required by a program is larger than main memory; an auxiliary memory is present; other levels of memory may be present. To start examining the problem, we consider these two simplifications: 1) a single program; 2) a single level of auxiliary memory.

Imagine the computer operating on a problem where it has completely exhausted main memory: it needs more data or program. It might bring the new information into core, placing it over existing information. The push/pull process, when applied to segmentation, is called overlay. Hopefully the erased information is either no longer necessary or is duplicated in auxiliary memory.

In order to accomplish management of main and auxiliary memory we must be able to: 1) reference each properly; 2) keep track of activity in each properly; 3) make the push/pull selection properly. We introduce two new terms following Belady[1]: push takes information from MM and places it in AM; pull takes information from AM and places it in MM. Thus we have as subproblems: labeling of main and auxiliary memory; cataloging main and auxiliary memory; a selection philosophy for determining the next obsolete portion of main memory.

How do we manage location within and interaction between the two types of memory? There are three alternatives:

1. The programmer is completely responsible for the management of memory.
2. The entire job is done automatically without the awareness of the programmer.
3. The programmer and the software cooperate.

Paging, the second alternative, is an answer but the others throw light on paging principles.

Auxiliary memories were working for a long time before paging. A large operating system relies on AM to store much of the support package. Swapping between AM and MM is done automatically without the awareness of the programmer to expedite the operating system itself.

Consider the normal operating procedure where a program and part of the supervisor reside in memory. If the program gets into trouble the supervisor calls in a dump from AM. If the program terminates normally the partial supervisor must call in the total supervisor to determine the next job assignment.

programmer segmentation

Next take a large program, all of which cannot occupy memory at once. Or where more data is used than there is room for in main memory.

In the first case the problem has been handled by permitting the *programmer* to divide his problem into segments, designating which segments occupy memory at which time. The manufacturer must supply a loader which can handle segmented programs. Then segmentation depends upon the presence of: 1) proper division of the program by the programmer; 2) instructions to the loader when to replace one program segment by another in all cases that arise; 3) a loader which performs the overlay required by this procedure.

[1] Belady, L. A., "A Study of Replacement Algorithms for a Virtual Storage Computer," *IBM Systems Journal*, Vol. 5, No. 2, 1966, p. 78-101.

Program segmentation using overlays needs only pulls, no pushes. This is achieved by arranging it so that pushed information is not required again, and pushed information has not been changed; therefore a duplicate is available in auxiliary memory. Hence, information from main memory can be overwritten with a pull.

Let's say that the main program, A, is brought into and completely fills main memory. When B is required it is brought from AM and overwrites part of A. When C is required it is placed over part of the original program A and segment B.

The length of the segments is generally variable and the areas the segments overlay are under programmer control.

simple extension

A simple extension of memory makes it appear to the programmer that he has available all of AM rather than only MM. Since he does not have all of AM immediately available, we only make it *appear* this way to him; we call this construct *virtual memory*.

This is a simple extension because the memory the programmer appears to address coincides with physical AM. If the extension appears to the programmer even larger than the actual AM in the system we refer to this as a *complete extension*. Here virtual memory is as large as anyone could hope for (although being short of infinite). We leave that case for later.

To provide virtual memory, these things are required:

1. An address expansion of the command so that it is able to address AM.
2. A partition scheme which permits easy reference to subdivisions of AM.
3. A similar partition scheme with reference to the program.
4. Another similar partition scheme with reference to main memory (the units of partition for 2, 3 and 4 above must be compatible).
5. A virtual memory monitor (or simply the monitor) for converting a virtual address to an actual address in main memory.

Consider a virtual address V. It is divided into two portions: S is a segment number; and L_V a line number.

$$V=S, L_V \qquad (1)$$

Address main memory with M which consists of two portions, a block B, and a line, L_M a line number.

$$M=B, L_M \qquad (2)$$

Hereafter *segment* refers to a fixed section of AM or VM and *block* refers to a fixed size section of MM. Generally the size of these sections are the same for both the block and the page.

The partition is compatible if we choose the same size for segments and blocks. Then we write programs in segments (or blocks).

Virtual memory techniques permit the programmer to use memory *as though* it were entirely and immediately available to him. For the simple extension, the programmer may refer to any segment of AM. When it comes time for the program to access this segment, the executive and its monitors may intervene. It takes care of the placement in main memory of the segment addressed and makes sure that addressing within the segment accesses the desired word.

What happens when the control subsystem has furnished a virtual address, V, is illustrated in Fig. 1. The computer subsystem may have the ability to recognize V immediately from among several V's presented to it. This depends on the main frame provided (an immediate recognition system for eight V's is found in the IBM 360/67). Since much of the time V is not immediately recognized, let's examine what the VM monitor might do to access a desired

location. Here the VM monitor is the virtual memory monitor. This is the monitor which takes over when a reference is made to main memory. If the referand is in MM, the monitor comes up with an absolute address there; if not, it sees to it that it gets there somehow or other.

Most monitors refer to a translation table which might contain one entry for each segment in AM. This plan might be abbreviated so that only the segments in AM that are also present in MM are in the table. This is a matter of choice. While the latter scheme provides a shorter table it requires more time for lookup by the monitor.

For a complete table, block number may be designated implicitly. Then an entry need only contain the segment number; the position of the entry in the table indicates the block number. For an incomplete table, each entry contains both segment and block identification. But entries may be sorted for segment number for easy lookup.

What the monitor does in the case of translation only (where no push is required) is shown in Fig. 1. The monitor uses the segment address, S, in the virtual address register to enter the table. It finds the entry corresponding to the desired segment, which is at block location B. This is sent to the memory address register. The word address, L, is sent directly from the instruction register to the memory address register (block and segment sizes are identical).

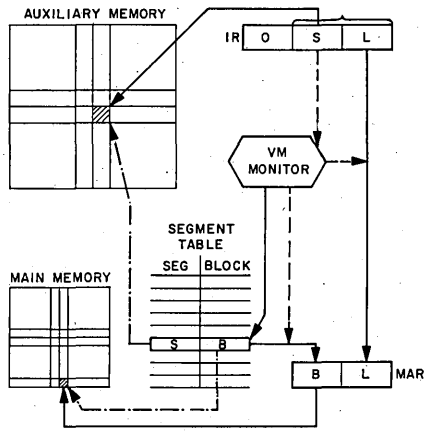


Fig. 1 A simple extension of memory showing how a normal lookup of an operator is performed.

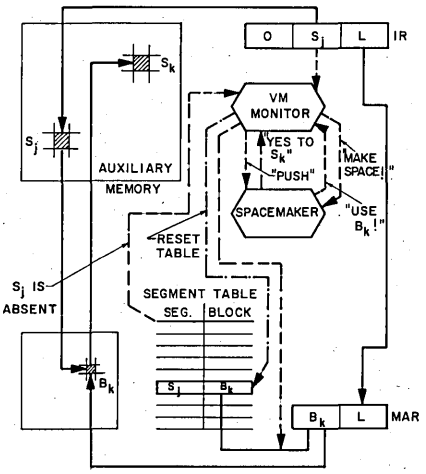


Fig. 2 Push/pull for the virtual memory, simple extension.

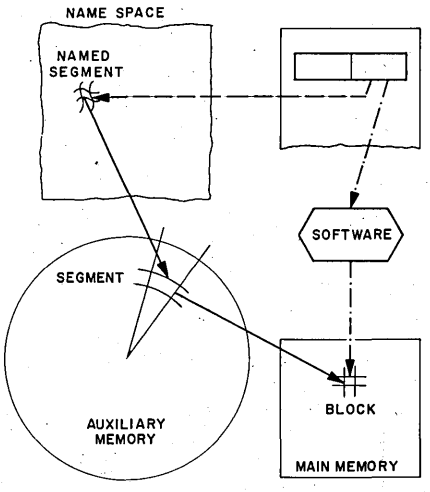


Fig. 3 A complete extension of memory makes the entire name space seem available to the programmer.

push/pull

As programs are initiated, the loader enters the translation table to find empty blocks in MM. As a new segment is requested by the program a pull from AM is performed and an entry is made in the table. Then for future reference the monitor will make the correlation between block and segment.

The actual operation of queueing requests to AM, watching for interrupts by AM and routing information between the proper areas in AM and MM, is all done by the AM monitor.

During this procedure the monitor keeps track of two things, whether a segment referenced is actually a block in main memory and which blocks in MM are empty.

Suppose we have a large program or a number of programs which are using all of core memory? A reference comes along; we look in the table and the desired segment is not in main memory. The available space list says that there is no more free space in MM segment. What to do?

The crucial component of a virtual memory system is its space-making strategy. A *spacemaker* is the software/hardware combination which determines how to make space for a new segment in MM when all block assignments have already been made.

Several philosophies for constructing a spacemaker are available. We wish the spacemaker to push a block which it will not have to pull again in the near future. There is a trade-off between elaborateness and efficiency; a large efficient spacemaker may be less desirable than a smaller, near optimal one.

Further, a small amount of hardware might indicate whether the expired block should be pushed at all. If the block contains only program information which has not been changed during residence in MM, then a facsimile of it is available in AM. That block may be written over by the new incoming block.

As a memory request is made, the intrarun monitor first consults the table to see if the segment is present in MM. Suppose, as shown in Fig. 2, the desired segment S, is absent. The monitor turns over control to the spacemaker to select a block for expiration, B_k, and also to determine whether a push is necessary for B_k to S_k, the segbent location in M origin. If so, it requests the push, which is done by the AM monitor. When performed, the VM monitor requests a pull of the AM monitor and updates the translation table: a) the expired segment S_k is no longer present; b) the requested segment S_j is in MM at block B_k.

Between programs, the interrun monitor flushes memory (pushes all changed blocks into AM) and resets it for the new program. This is not always desirable, since for some programs it is preferable to leave the original program unmodified in AM, even if altered in MM.

The translation table is also flushed, leaving it free to be written into by the next program.

The loader then fills up MM with segments from AM initially required by the new program. The translation table is also set up: addresses in AM are listed with their present locations in MM. Then the VM monitor can use this table immediately after it is first called in to find if a desired block is present and, if so, to fabricate the desired address in MM.

complete extension

For the complete extension in Fig. 3, the programmer sees an almost infinite addressing space. Software makes

the association between a name in the addressing space and a segment in AM.

The simple extension is a particular case of the complete extension where the addressing universe has been shrunk. Another alternative, not examined, is a symbolic simple extension where each segment of AM is named.

A good table is important. The table lists the name (the symbolic designation) of a VM segment and its location in AM. The table is organized so that the name may be found as quickly as possible. The table may be sorted or it may be a linked list. Table organization has been discussed in detail elsewhere.[2]

A VM table could not be complete because the addressing universe is so large that even the list of symbolic addresses could not fit into MM. An abbreviated table must be used. Each entry contains: 1) the name of the segment by which it is referred to by the program; 2) the block address in AM, if it is present there; 3) the segment address in MM if it is present there. Tags in the entry indicate whether the segment is present in AM or MM, use factors, etc.

An abbreviated table may be handled as a single table or multiple tables. This choice affects the design of the loader, which establishes the tables, and the VM monitor, which references them. The trade-offs are weighed by the software designer.

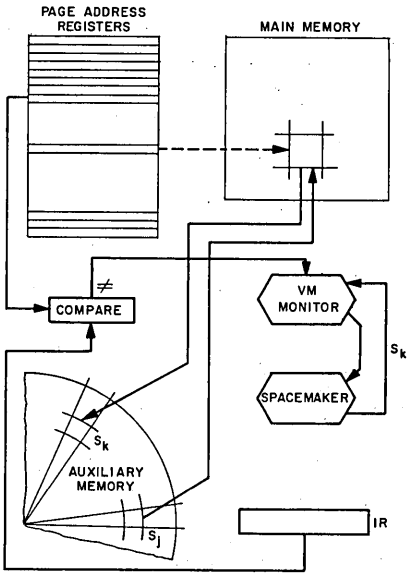


Fig. 5 Paging for Atlas when main memory is full and the desired block is missing therefrom

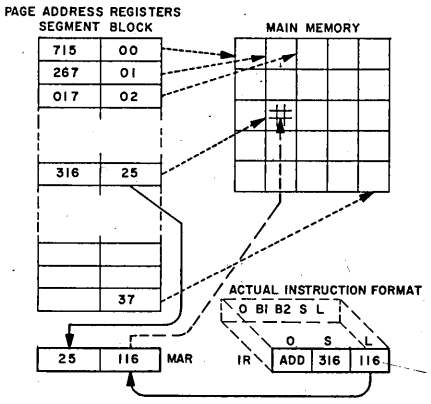


Fig. 4 Atlas paging hardware

Use of a complete extension is similar to the simple extension. Given a name, the VM monitor looks up the entry in the table and finds a block designation for the named segment if it is in MM.

Should the named segment be missing, the spacemaker is called in to make a push/pull request. When the desired block becomes available it is accessed in the prescribed fashion.

the atlas

Atlas was the first computer to my knowledge to use virtual memory. Atlas is uniprogrammed and has interrupt facilities (it may be multiprogrammed). It was the first computer to contain hardware facilities for paging.

The actual command word for Atlas in Fig. 4 consists of an operation code, two index indicators, a segment number and a line number. The two indexing indicators provide for double indexing. We shall assume that indexing does not occur to simplify the explanation.

Block and segment size for this computer are the same; 512 words. AM is two drums which we may think of as a single drum. The drum stores 512 segments; the main memory holds 32 blocks.

For each block in main memory there is a hardware page address register which translates from segment to block.

Let us review the hardware, most of which has already been presented:

The page address register (PAR) contains two parts:

1. A given PAR always points to a specific memory block and so the block number is fixed.
2. A segment address alterable by the VM monitor is the source segment in AM for this block.

The instruction register (IR) consists of three parts of interest to us:

1. Operation code
2. Segment number
3. Word number

Memory address register (MAR)

Memory data register (MDR)

Compare hardware between:

1. Instruction word segment number
2. Register segment address of each page address

After the control subsystem fetches a command, it performs a compare between the segment number in the instruction register and that contained in all the page address registers simultaneously. If the segment is present in MM, an equal signal indicates the block address where the information is found. This block address is then transferred to the block portion of the memory address register. The word address is transferred directly from the instruction register to act as a pointer to the desired word in memory.

In Fig. 4, the instruction register contains a virtual address $V = S,L$ given as 316,116. The compare reveals that 316 is in PAR number 25. The block number goes to the left half of the MAR. The word number, 116, from the IR goes to the right half of the MAR. The MAR then points to block 25, word 116.

When the comparison between the segment address in the instruction register and in all the page address registers indicates inequality, then the desired block is absent from memory. This causes an interrupt to the spacemaker. The Atlas spacemaker seems to be very efficient in determining the proper block to push. After the push by the AM monitor a pull is called for by the AM monitor and an entry by the VM monitor is made to update the page address registers. After the block transfer has been make the desired word is found as described before and the program continues. This process is illustrated in Fig. 5. ■

Next month we'll conclude by examining how paging is done in the CDC 3300 and the IBM 360/67. We will also discuss dynamic relocation and the part it plays in all of these.

[2]Flores, Ivan, Computer Programming, Prentice-Hall, Englewood Cliffs, N.J., 1966, Chapters 8 and 9.

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BETTER PROCESSING THROUGH BETTER ARCHITECTURE

by JAMES P. ANDERSON

While automated information systems design has made considerable progress over the past five or six years, it seems apparent that it has fallen far short of the promises and the concepts advanced during the era of the large scale command and control systems that fostered its development. Part of the failure to realize the lofty ambitions of that time appear to be related to our concepts of computers and the ways we are forced to use them.

Presently, we have a new opportunity to affect the structure of a new generation of machines. This opportunity will be occasioned principally because of the very rapid reduction in logic costs being brought about by the developments in microcircuit technology.

It is not the intent of this paper to offer pat solutions to the problems we all agree are quite difficult; rather, it is to suggest several approaches that are feasible in the context of the new hardware technology, and from this perhaps to stimulate contributions to machine organization from information systems designers. In this way, we may arrive at computer systems that will assist them in solving basic problems rather than overcoming the inadequacies of the tools that are given to work with.

direct execution machines

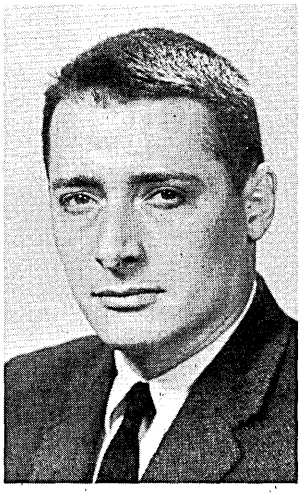
One of the continuing and pervading problems in the design and development of information systems has been what has come to be known as the programming problem. While not all of the "problem" can be attributed to the nature of the computer systems we work with, sufficient difficulty has been encountered to force the adoption of one of the various higher level programming languages to increase the intelligibility and decrease the time required for preparation of programs.

Even with the present programming languages, much time is spent in compiling and debugging, the latter frequently involving peculiar quirks of a particular machine, for example how it encodes data. From the point of view of resources used, one must also consider the large amount of effort expended by the manufacturers and various systems development groups in preparing compilers, diagnostic programs, utilities and the like to create an environment for programming information systems. The costs which are ultimately passed on to the users become almost incalculable.

In addition, in order to permit user independence from particular hardware, there has been a major effort at standardizing the various languages, as well as adoption by the various services and government agencies of one of the languages as a required standard for their problems. The Air Force, for example, has adopted JOVIAL as the standard for command and control systems, while the DOD has placed increased emphasis on use of COBOL for many applications.

As a result of these language standardization efforts, one might consider establishing requirements for machines that directly execute programs in one of the standard languages as a means of simplifying some of the programming problems. Earlier work has shown the fea-

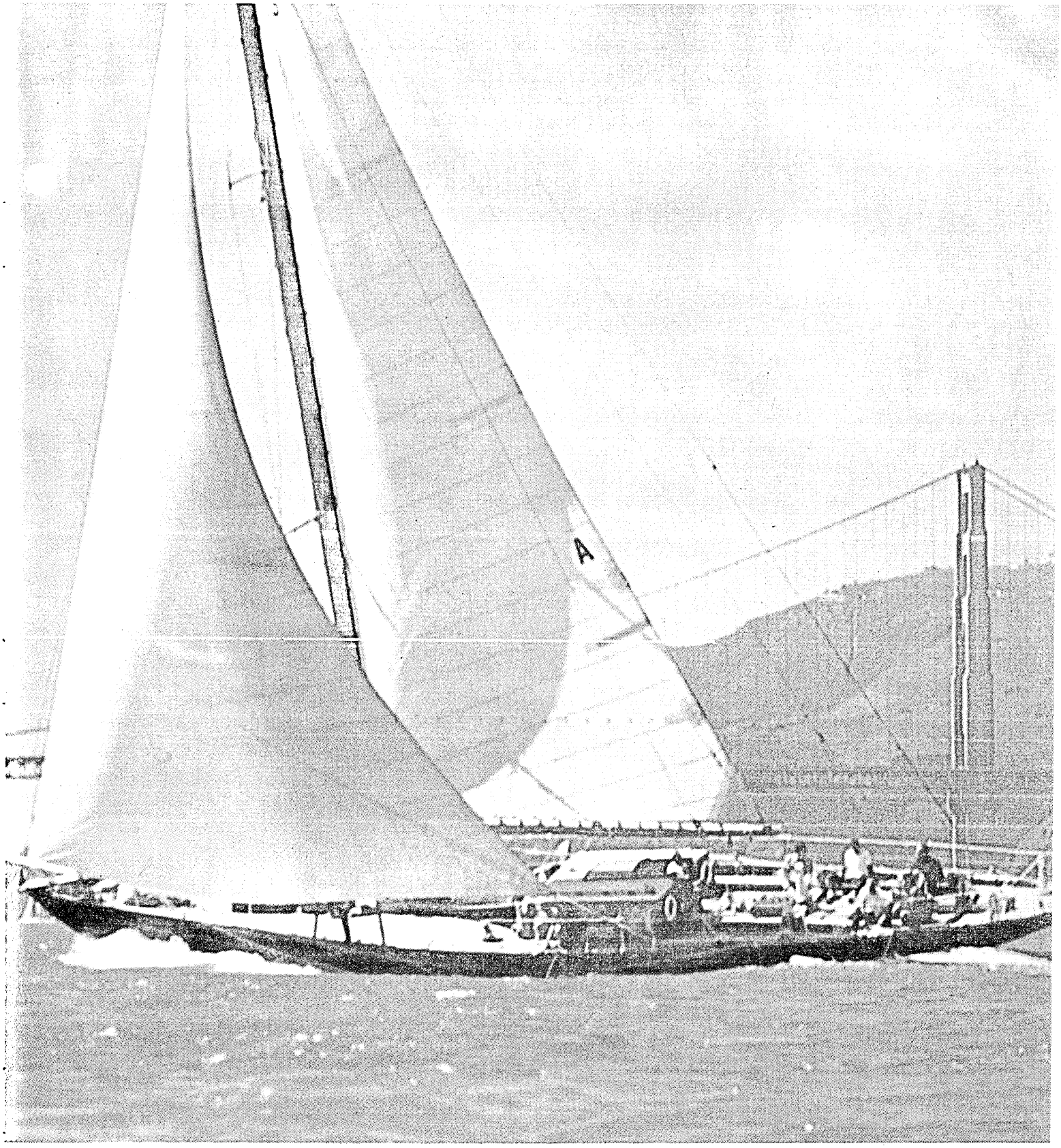
This article is included in the book, *Information System Science and Technology*, Donald E. Walker, Ed., Thompson Book Co. 1967.



Now an independent consultant in computer technology, Mr. Anderson was previously manager of systems development at Auerbach Corp., and manager of the advanced systems technology department at Burroughs' research division. While at Burroughs, he was involved in the development of the D825. He has a BS in meteorology from Pennsylvania State Univ.

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

THE TWO GREAT TAPES,



LIKE THE TWO GREAT SLOOPS, ARE NOT IDENTICAL.

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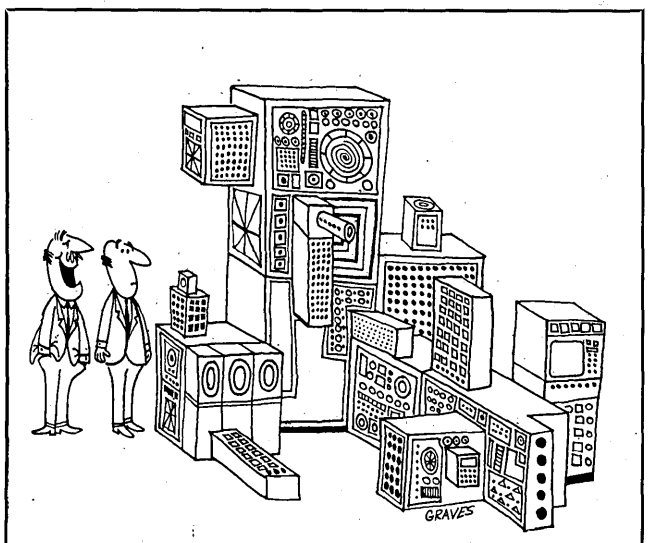
sibility of this approach.[1,2] With current software costs exceeding the development costs of hardware, the economic pressure for adoption of this kind of approach will become even greater for the next round of machines.

With the objection to such direct execution machines based on the additional cost of logic being rapidly eroded, the only remaining objection centers mainly on the single language capability of such a machine. This objection would not be relevant for those situations where *de facto* standards are insisted upon for various reasons, and could be overcome altogether by structuring such machines to have the language analysis logic separable (perhaps by plug-in units) from the main part of the machine. The current emulator technology suggests that a basic machine structure can be adapted to a variety of purposes by varying the logic itself.

It is not suggested that the direct execution machines will be applicable in all information system situations, but for many applications, particularly those involving dedicated systems, this approach could be quite powerful. When combined with on-line techniques, one might even anticipate simpler control programs by reducing the interface with compilers, and providing direct language debugging.

parallel organizations

The present generation of computer systems has been different from its predecessors in one major respect; that is, nearly every manufacturer offers a multiprocessor version of one or more machines in his line. The initial emphasis on this kind of organization, and the various multicomputer organizations that were both contemporary and preceded it, were for reliability and systems balance. However, due to the R&D on executive systems for multiprogramming control for both time-sharing applications and multiprocessor management, it became apparent that it would be possible to exploit the multiprocessor structure to give better performance through parallel operation on a single problem. To this end, some of the control languages for present machines have been enriched to permit programmer specification of opportunities for parallel execution of segments of the same program. While this is an important step, it is insufficient to achieve the desired levels of performance in information systems.



"This is an example of our modular building-block approach."

Under different assumptions from those in the preceding section of this paper, it is clear that it would be possible to achieve quite spectacular improvements in performance by systematically exploiting all parallelism inherent in every program.

In order to be most effective, such systematic exploitation must be based on automatic detection of opportunities for parallel execution. Reliance on programmer specification of such opportunities is both unnecessary and burdensome.

The programming technology is sufficiently advanced to handle parallelisms in the fine. A method for detecting parallelism in algebraic languages is outlined later in this article. Another method, and a system structure for exploiting parallelisms in algebraic expressions is outlined in an article in the February 1966 issue of the *IEEE Transactions on Electronic Computers*.[3]

parallel systems for dp

While exploiting parallelism in computational languages is certainly feasible, one area that would be more fruitful to examine for information system application is the possibility of organizing highly parallel systems for data processing. The basic techniques are apparent: data partitioning, exploiting repetitive operations on files (such as extraction of a subset of a file for subsequent processing) and exploiting parallelism at the statement level in a manner similar to that found in the proposals for purely algebraic languages.

In addition to multiple processor structures already in existence, the design of highly parallel data processing oriented systems requires many more channels into and out of disc files or other mass storage devices than is presently available. It is possible that virtual channels patterned after the multiplexed drum technique used on the GE 645 will provide a necessary increase in performance when applied to head per track disc files.

I believe that highly parallel data processing systems are important because of the improvement in overall performance that would accrue to almost any kind of information system through the reduction in sorting time alone, using data partitioning techniques.

The present lack of a generalized multi-file data retrieval and reporting program on any systems known to the author seems to be related at least in part to the sorting that would be required.

With very few exceptions, there has been little innovation to the basic structure of general computing systems since Mauchly and Eckert designed EDVAC and UNIVAC. The reasons for using highly stylized encoded instructions for commands are being rapidly dissipated, as are the treatment of programs as sequential processes. The many problems in information systems that are tied to programming and performance may be unnecessary and exist only because we choose to live with information systems that are not suited to our requirements. The means for changing this situation is at hand, and it seems fairly certain that machines, both direct execution and highly parallel, will be developed.

New developments will not be limited to the two sug-

1. Anderson, J. P., A computer for direct execution of algorithmic languages. In *AFIPS Conference Proceedings: 1961 Eastern Joint Computer Conference* 1961, pp. 184-193.
2. Bashkow, T. R., Sasson, A., and Kronsfeld, A., *System Design of a FORTRAN Machine*, July 1966.
3. Hellerman, H., Parallel processing of algebraic expressions. *IEEE Transactions on Electronic Computers*, February 1966, Vol EC-15 No. 1, 82-91.

gested above, nor is it intended to suggest that direct execution machines and highly parallel organizations will solve all problems in automated information systems. What is intended is to suggest that insufficient attention is paid to the design of proper hardware tools for this kind of problem, compounding the software problems that are enormous enough in themselves.

an approach to explicating parallelism

Nature of sequentiality and parallelism. The study of parallelism in programs is in fact a study of required sequentiality within a program. There are two sources of sequentiality (and parallelism) arising from the precedence of the arithmetic operator, and the sequentiality enforced by the availability of the operands.

As an example of the first form, consider the expression $a.b-c/d+e$. Given the machine capability, one could compute the partial results $a.b$ and c/d in parallel before proceeding with the sequential operations of subtracting the partial results and adding e. A trivial example of the second form is shown below:

1) A = B
2) C = D
3) E = A + B

Here the first two assignment statements could be executed in parallel, while the third would have to be deferred until the first statement was completed.

The simple examples shown above illustrate two of the basic concepts involved in the detection of implicit parallelism within programs. There is one additional concept of importance, that of "regions." The region is the span over which implied parallelisms can be logically sought. The nature of regions is closely related to the notion of scope found in the constructs of ALGOL. Examples of regions are the scope of a FOR statement, the true clause of a conditional statement, the false clause of the same kind of statement, compound statements, etc. In general, the regions are bounded by statements that interrupt the implied control flow.

In addition to the natural parallelism of programs, there are a number of special cases that occur with sufficient frequency to warrant inclusion in any consideration of automatic analysis of implied parallelism. One construct that can be exploited is repetitive operations on vectors and arrays. Thus, the inner product of two vectors could be recoded as a set of individual multiplications and a tree of additions, or as a set of interactions over segments of the vectors. Similarly, the multiplication of two conformable matrices can be expanded into independent computation of each element of the resultant product matrix. These special cases will not be discussed further here.

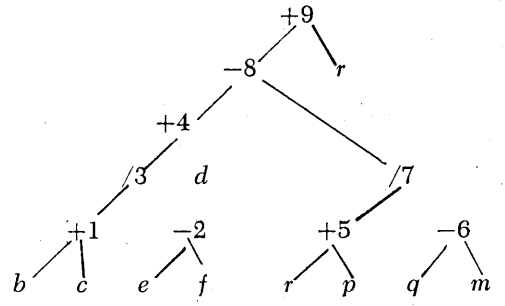
Techniques for analyzing intra-expression and inter-statement parallelism. The basic technique for analyzing and detecting intra-expression parallelism is to convert the expression into a tree form using techniques of algebraic expression analysis found in compilers. The execution order for each binary operator in the expression can be derived directly by associating with each operand and partial result entering into the compilation, a level number derived according to the following rules:

1) All variables (including constants) are of level 0.
2) For each partial compilation, find:
   $L_r = MAX(L_1,L_2)+1$, where L_r is the level of the result
   L_1 is the level of operand 1
   L_2 is the level of operand 2

The level numbers are the execution order for each of the operators in the expression. As an example, the expression

$(b+c)/(e-f)+d-(r+p/(q-m)+r$

would result in the following tree:



The numbers indicate the order in which the nodes are generated by the scan. The scan would be able to generate pseudo three-address code with the execution order found in accordance with the rules given above. The code would be:

Line Nr	Operand 1	L_1	Operator	Operand 2	L_2	Result	L_r (execution order)
1.	*b*	0	+	*c*	0	*t*1	1
2.	*e*	0	−	*f*	0	*t*2	1
3.	*t*1	1	/	*t*2	1	t1	2
4.	*t*1	2	+	*d*	0	*t*1	3
5.	*r*	0	+	*p*	0	+2	1
6.	*q*	0	−	*m*	0	*t*3	1
7.	*t*2	1	/	*t*3	1	*t*2	2
8.	*t*1	3	−	*t*2	2	*t*1	4
9.	*t*1	4	+	*r*	0	*t*1	5

Thus, the expression would permit the operations on lines 1, 2, 5, and 6 to be executed in parallel first. Following this, the operations on lines 3 and 7 could be executed in parallel, after which the operations on lines 4, 8 and 9 would have to be executed in sequence.

The technique described above depends only on the precedence (hierarchy) of the operators in the language being analyzed.

The treatment of inter-statement parallelism depends on recognition of the regions, and an analysis of the availability of variables. This is merely another way of saying that one cannot logically use the result of a computation before it is available. As an example, consider the following statements:

1) A = B + C
2) D = F + 1
3) E = B + A/D

Statements 1 and 2 could be executed in parallel. However, statement 3 would have to be deferred until the results of the previous operations were available. In this case, the results of the previous operations are available simultaneously with a level value of 1 which would permit initiation of the third statement at the very next instant. If, however, the first statement were the result of the expression used to illustrate intra-expression, the third statement of the region would have to be deferred until its completion.

By noting that the level value of the final result defines the earliest available time for that variable, we are able to extend the techniques used for intra-expression analysis to cover the analysis of regions by affixing in the symbol table the level number achieved by each variable as assignments are made to it. Now, rather than using zero for the level value of variables, we can use the level value stored with the variable in the symbol table, and apply the algorithm noted above.

The techniques noted above can be applied during compilation to explicate all of the natural implied parallelism within a program. ■

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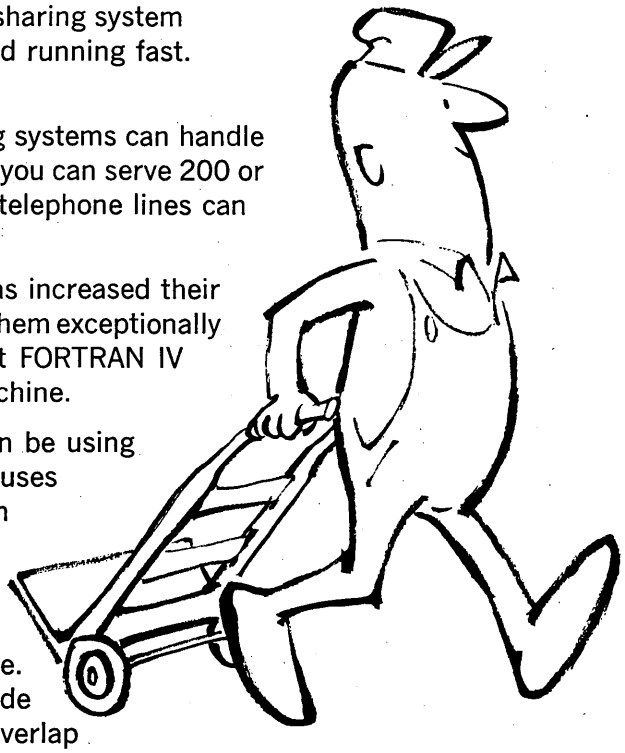

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GENERAL ELECTRIC

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THE ACM— AFTER 20 YEARS

past and present

One score years ago, a mimeographed notice was circulated. It stated, in part, "After making some inquiries during May and June, we believe there is ample interest to start an informal association of many of those interested in the new machinery for computing and reasoning." On Sept. 15, 1947, 78 people attended a meeting at which a resolution was adopted to form the Eastern Association for Computing Machinery.

In 1947, there were less than 300 members of the association. Today, including student members, there are close to 20,000. The first national meeting, which was held in December, 1947, was attended by about 300. The attendance last year in Los Angeles for the 21st National ACM Meeting was over 1,600. And the original four sections—Boston, New York, Philadelphia, and Washington—had increased to 132, including 62 student chapters.

During the first few years, the only publications were mimeographed abstracts of some papers presented at national meetings. The first quarterly issue of the *Journal of the ACM* appeared in January, 1954. During that year, 200 pages were published. *Communications of the ACM* first appeared in January, 1958. *Computing Reviews* initially appeared in a bimonthly supplement to *Communications* and later was reprinted as a single issue entitled *Computing Reviews, Volume I.* Since January, 1961, *Computing Reviews* has been a separate, bi-monthly publication. In 1966, the *Journal* published over 600 pages, *Computing Reviews* slightly under 600, and *Communications* close to 900.

The notice for the organizational meeting of ACM in 1947 stated, in part:

"The purpose of this organization would be to advance the science, development, construction, and application of the new machinery for computing, reasoning, and other handling of information."

The present constitution states:

"The purposes of the Association are:

(1) To advance the sciences and arts of information processing including, but not restricted to, the study, design, development, construction, and application of modern machinery, computing techniques and appropriate languages for general information processing, for scientific computation, for the recognition, storage, retrieval, and processing of data of all kinds, and for the automatic control and simulation of processes.

(2) To promote the free interchange of information about the sciences and arts of information processing both among specialists and among the public in the best scientific and professional tradition.

The methods of the Association for achieving these purposes include, but are not restricted to, formation of Chapters and special interest groups, holding of meetings for reading and discussing papers, and the publication of journals, books, and other materials."

The organizational structure attempts to reflect the desires of its members at the grass roots (or chapter) level. The governing body is the ACM Council, which includes the president, vice president, secretary, and treasurer; the immediate past president; the chairman of the editorial board; 10 regional representatives (one for each geographical region as defined by the bylaws); and six members-at-large. This fixes the council total at 22 members. In addition, the president, vice president, and secretary constitute an executive committee which is able to act for the council . . . usually between the council meetings, held three times a year. The president, vice president, secretary, and regional representatives are elected to two-year terms. The treasurer and chairman of the editorial board are elected to three-year terms, and the members-at-large are elected to four-year terms. The president, vice president, secretary, and members-at-large are elected by the entire ACM membership. The regional representatives are elected by the members within their respective regions. The treasurer and chairman of the editorial board are elected by the council.

In addition to the elected officials, ACM supports a staff of approximately 25 persons, including an executive director. These individuals are located at ACM Headquarters at 211 East 43rd Street in New York City. Typical of the functions performed by the ACM staff are: membership accounting; subscription fulfillment; chapter and committee support; membership services; production of periodicals; and serving as an information center.

The activities of the association fall into six major categories. They are, in no implied order of importance, chapters, national meetings, publications, relations with other organizations, Special Interest Committees (SIC) and Special Interest Groups (SIG), and services.

Initially, there was one class of ACM membership. Today there are four: Member, requiring a bachelor's degree or equivalent or four years' experience in information processing; Associate Member—those who want to belong to

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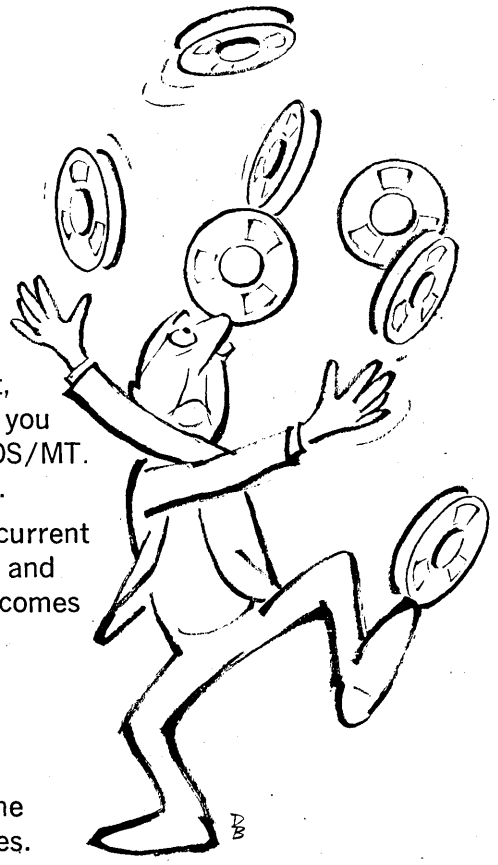

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Three recent examples prove the value of EOS/MT.

* A large western bank has cut their two-shift operation down to 1½ shifts.
* A trucking company using EOS/MT ran three programs in nine minutes where running the programs in serial took 25 minutes.
* Another demonstration showed that two programs under EOS/MT could be completed in the time it took to run one before.

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GE-400 Systems

For more information on EOS/MT and the growing list of other GE-400 developments, contact your General Electric Information Systems Sales Representative. Or write General Electric, Room 912, 2721 N. Central, Phoenix, Arizona 85004.

290-07

GENERAL ELECTRIC

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the ACM but don't qualify; Student Member, requiring faculty certification of full-time attendance at an accredited educational institution; and Institutional Member, which allows companies (for $500) or academic institutions (for $100) to support ACM and receive two copies of all periodical publications for one year.

All the other classes of member receive one copy of the three major periodicals, for which Members and Associate Members pay annual dues of $18 a year, although that will be increased to $25 in October of this year. Student members by then will have to pay $7.50; they've been paying $5. Only Members are allowed to vote and to hold office.

chapters

At the chapter level, every member can participate in the growth of his association while, at the same time, contributing to his own individual professional growth. At regularly scheduled chapter meetings, a formal program is provided, usually consisting of a technical presentation and a discussion of topical items to be brought to the attention of the council by the regional representative. Many chapters publish newsletters, hold all-day technical symposia and establish local branches of special interest committees and groups.

An interesting and growing responsibility of each chapter is to provide information concerning the computing industry and to conduct classes and offer career guidance.

national meetings

Each year, the association holds a national meeting. Recent meetings have attracted between 1,500 and 2,000 attendees. The meetings are organized around a technical program, for which preprinted papers are now available at the meeting in the form of a bound proceedings, and the exhibits. The national meeting is usually held during the latter part of August. This eliminates any conflict with the semi-annual joint computer conferences in the spring and the fall.

The site for the national meeting varies from year to year. It is, however, the policy of the association to hold the national meetings in those cities that have both the facilities to accommodate the technical program and the exhibits and are so located as to attract the maximum number of attendees.

Some exhibitors have felt, however, that in the past sites were chosen to guarantee *small* attendance. The choice of Syracuse in 1962, for instance, inspired heavy criticism. One unofficial response was that the ACM, as part of its educational mission, owed members in non-central locations a chance to attend a national meeting which presumably they would otherwise be denied. Lately, perhaps in response to exhibitor criticism—meetings have been held in larger and more accessible cities such as Cleveland, Philadelphia, and L.A. This year's meeting is being held in Washington, D.C., and next year's site is Chicago.

In addition to the national meetings committee, the association has a national program committee to set policies for the conduct of the national conferences. In particular, they describe the responsibilities of the technical program committee (the local conference committee responsible for the technical program), refereeing of the papers, invited speakers, invited papers, sponsorship of sessions by special interest groups and committees, etc. Many of the ACM committees and groups take advantage of the national meeting to intersperse their own meetings and lately the council has elected to hold a meeting the day after the national conference.

In addition to this national meeting, various ACM chapters and regions conduct one-or two-day technical meetings, usually called technical symposia, and the association sponsors specialized meetings, seminars, and workshops.

publications

The ACM now publishes three periodicals. They appeal to both different and overlapping audiences and, for years, the association has been attempting to codify their various audiences.

The first publication is the *Journal of the Association for Computing Machinery*, a quarterly first issued in January, 1954. It publishes research and basic development papers in such areas as automata theory, linguistics, information theory, programming languages, numerical analysis, switching theory, and the like. The association considers the *Journal* to be the publication of record for fundamental papers on information processing. The second publication is the *Communications of the ACM*, a monthly publication whose first issue was January, 1958. In contradistinction to the *Journal*, the *Communications* attempts to provide timely material of immediate interest to the readership. To accomplish this, there are 13 departments, each under an associate editor. In such a way, *Communications* attempts to reflect the rapidly changing computer scene, and is able to add or remove departments as the technical activity dictates.

Communications also publishes official reports of the association, provides the opportunity for a forum in the form of letters to the editor, and invites guest editorials on professional problems from individual members.

It's interesting if irrelevant to note that each issue of Volume 1 of *Communications* was three-hole punched. In addition, Numbers 1, 2, and 3 of Volume 1 were scored to the right of the three-hole punching.

The third publication is *Computing Reviews*, a bimonthly founded in 1960. This publication provides critical evaluations of books, technical papers, popular articles, and other entities associated with the computing field. To do this, *Computing Reviews* calls upon technical services of over a thousand specialists who serve as volunteer reviewers. Currently, over 200 serial publications are scanned. *Computing Reviews*, which will be published monthly beginning in 1968, is also available to non-ACM members for $15 a year.

In addition to the regular publications normally reviewed, the association has arrangements with other organizations to provide catalogue and clipping services for other publications.

The association publishes an annual permuted index of the computing literature and ACM Headquarters also publishes a monthly newsletter, which goes to the chapters and council members, to disseminate topical information concerning the association's business. Finally, in the past few years, a number of chapters have started the publication of monthly newsletters.

relations with other organizations

Because the American Institute of Electrical Engineers and the Institute of Radio Engineers had established subcommittees on computers before ACM itself was established, it was obvious that there would be a significant overlap of personnel among these organizations. Similarly, because the first users of computers were those primarily involved with mathematical computation, the early membership was almost exclusively engineers and mathematicians. Some people believe that this is still the case and that the ACM is too slow in expanding its scope to incorporate other computational areas.

In 1951, ACM became a member of the National Joint

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Computer Committee (NJCC) along with the AIEE Committee on Computing Devices and the IRE Professional Group on Electronic Computers. The purpose of the NJCC was to sponsor the two annual joint computer conferences. This function today is carried on through the American Federation of Information Processing Societies (AFIPS), of which ACM is a charter member.

In 1954, the association became a member of the American Association for the Advancement of Science and is affiliated with Section A (Mathematics) and X (General Science).

Since 1958, ACM has been represented in the Mathematical Sciences Division of the National Academy of Sciences' National Research Council. In 1962, ACM became affiliated with the Conference Board of the Mathematical Sciences.

Since 1959, ACM has maintained a relationship with both the British Computer Society and the Association Francais de Calcul whereby preferential subscription rates for publications are made available to members of each society.

special interest committees and groups

To pursue a particular technical area to a greater depth than is possible through the normal chapter facilities; the ACM provides for special interest groups and committees. The differences between the two are of organizational structure rather than of purposes or goals. Also, the committee form is normally used as an interim step prior to the establishment of a group. SIG's and SIC's hold their own meetings, issue bulletins, conduct sessions at the national ACM meetings, and act as repositories and clearing houses. At the beginning of 1967, the following special interest groups were active: Computer Personnel Research; Information Retrieval; Mathematical Programming; and University Computing Centers, special interest committees are: Artificial Intelligence; Biomedical Information Processing; Business Data Processing; Civil Engineering, Architecture, and Planning; Computer Graphics; Computer System Installation Management; Design Automation; Digital Computer Programmer Training; Numerical Mathematics; Programming Languages; Real-Time Processing; Social Responsibilities; Symbol and Algebraic Manipulation; Time-Sharing; and Urban Data Systems.

services

ACM maintains a number of permanent committees which are involved in various activities that include professional services, public services, and association services. An example is the Standards Committee. Its purpose is to represent the interests of ACM members in standardization of information processing. In so doing, it maintains a working relationship with the various USASI committees involved in the standardization activity. There is also a department of the *Communications* publication on standards which publishes proposed standards and other relevant information.

In addition to the regular, technical contributing members of the Standards Committee, each ACM chapter and special interest group and committee was invited to have a representative serve on the Standards Committee Advisory Council. A conference on mechanical language structures and one on programming languages and pragmatics have been sponsored by the Standards Committee in partnership with other organizations.

Another example of a professional services committee is the Joint Users' Group. Beginning in 1955, user organizations devoted to a particular manufacturer's equipment have been organized. Even though useful technical information was discussed and disseminated within each user organization, the ACM was not able to participate in any one group and still maintain its independent character. This was resolved in 1961 when JUG, which had been established a year before, became an official committee within ACM. Each individual user group is, itself, a member of JUG; consequently, information pertinent to all computer users can be disseminated through ACM and its Joint Users' Group.

At the beginning of 1967, the following permanent ACM committees existed:

Professional Services: Copyrighting and Patenting of Computer Programs; Professional Activities of the Blind; Professional Development; Professional Standards and Practices; Joint Users' Group; and Standards.

Public Services: Curriculum in the Computer Sciences; Education; Public Relations; Visiting Scientists Program; and ACM, AFIPS Government Advisory.

Association Services: Awards; Chapters; Constitution and Bylaws; Finance; Lectureship Series; Membership; National Meetings; Program (for national meetings); Special Interest Committees and Groups; and Student Membership and Chapters.

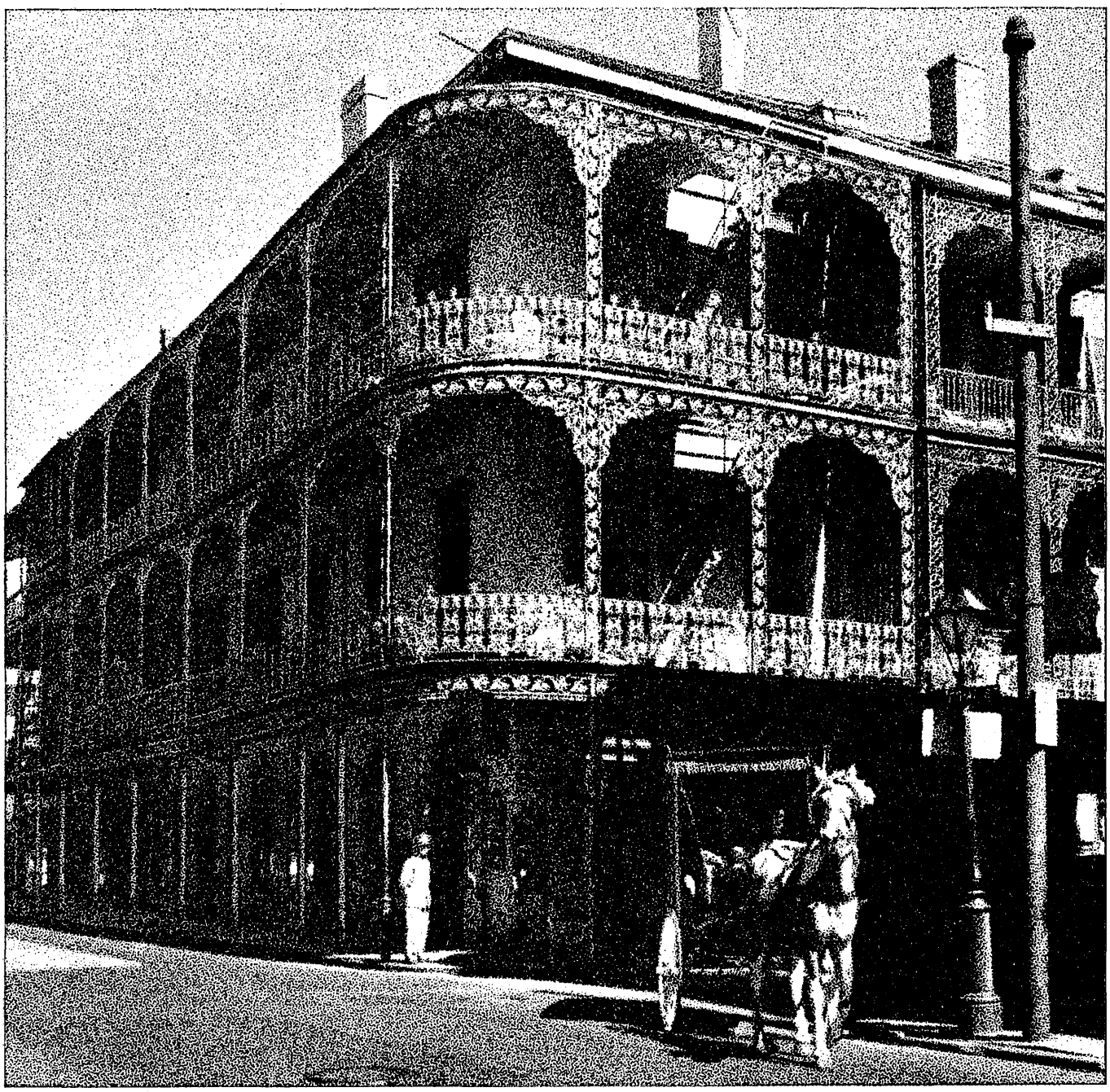
So this is the ACM after 20 years. Objectively, it is easy to state what it is and what it has accomplished. It is difficult to decide what it should be, what the individual member gains through his various degrees of participation, and how the association can better serve him and the community.

In the past, the ACM has been criticized as being dominated by university people, and especially by academics specializing in numerical analysis. The result, according to the critics, is a lack of balance in ACM programs and publications. Many critics feel that the *Journal* is far too abstruse to warrant distribution to all ACM members. The *Communications* is looked upon by many as too narrow, too mathematically oriented . . . with a dearth of down-to-earth material of broad interest, especially insofar as business data processing is concerned.

Nevertheless, the ACM has continued to think of itself as *the* information processing society, and many of its leaders look down their noses at such mundane problems as installation management; programmer selection, training and management; and the host of problems facing a modern installation . . . conversion, documentation, file manipulation, etc. Other societies or organizations which worry about such problems have been viewed by many ACM officials as mere technicians, or pseudo-professionals.

Nevertheless, there are signs that the ACM is maturing. Under the dynamic leadership of current president Tony Oettinger, the society has broadend its scope of activities. It is actively attempting to offer more material to the business data processing professional. It has established an ambitious professional development program which will offer seminars and workshops on advanced technical topics. It is becoming more formally active in governmental relations.

There is no doubt that the ACM has offered considerable professional enhancement, especially to its actively participating members. As the association enters its third decade it must continue to attract new members and to satisfy its current ones. It must not attempt to be all things to all people, or even all things to one segment of the field. Rather, it must continue its move from adolescence to young adulthood . . . better understanding its role in our technical community, accepting greater shares of responsibility, and identifying those important areas and issues where it can both influence and contribute. ■



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CIRCLE 26 ON READER CARD

20th ACM CONFERENCE

Slowing down to catch its breath and take a long view at the whole edp scene, the 20th annual conference of the Association for Computing Machinery with the theme "Past is Prologue" will attempt an historical perspective on today's trends and problems and tomorrow's probable developments.

Meeting Aug. 29-31 at Washington, D.C.'s Sheraton Park Hotel, the conference will feature over 50 papers in 26 regular sessions and several concurrent special interest symposia.

Approximately 80 exhibitors are scheduled to display large computer systems and peripheral equipment with emphasis on hardware that is of particular interest to industry and government.

A special attraction, coinciding with the conference and its historical theme, will be at the Smithsonian Institution. Enlarging its present permanent computer exhibit, the museum will present a larger temporary display in the division of physical sciences. Opening on Aug. 29, the display will continue for at least three months.

Keynoting the conference at the opening session (Tuesday, Aug. 29, 9:30 a.m., Sheraton Hall) is Dr. Emanuel G. Mesthene, executive director of Harvard Univ.'s program on technology and society. Dr. Mesthene will speak on the influence of sophisticated tools on social organizations and values.

The first session will also hear welcoming remarks by conference chairman Solomon Rosenthal, USAF; program chairman Dr. Jack Minker, Auerbach Corp.; and Dr. Anthony G. Oettinger, Harvard Univ., president of the ACM. The A. M. Turing Lecture will close the session, and will be presented by Prof. Maurice Wilkes, director of the mathematical laboratory, Univ. of Cambridge, England.

the sessions

Tues., 1-3 p.m.:

Aerospace Applications, Maryland Suite, Dr. Jack Moshman, EBS Management Consultants, Inc., chairman. Three papers will discuss simulation of space vehicles, utilization of space station mission simulation models, and a system for global range planning. Panelists will be L. Paul Gieseler and Dr. Howard Berger.

Information Organization and Retrieval, Cotillion Room, Dr. Gerard Salton, Cornell Univ., chairman. Papers will review an heuristic program for inductive data exploration and analysis, on-line reference retrieval system, and hierarchical data structure in a time-shared data management system. The panel will be Dr. Noah S. Prywes, W. Douglas Climenson and Dr. Jerome Sable.

Programming Systems, Delaware Suite, Thomas E. Cheatham, Jr., Computer Assoc., Inc., chairman. Panelists A. R. Meyer and D. M. Ritchie will discuss papers on microprogramming, loop program, graphic languages and numerical control programming languages.

Analysis of Time-Shared Computer System Performance, Virginia Suite, A. Eugene Miller, Auerbach Corp., chairman. Time-shared computer utilities, peripheral interference and a measurement device for the System/360 time-sharing evaluation will be topics for panelists Robert Rossheim, Dr. Helmut Sassenfeld, and Joel Winett.

Tues., 3:30-5:30 p.m.

Numerical Methods, Maryland Suite, William Gear, Univ. of Illinois, chairman. Dr. Samuel D. Conte and Cleve B. Moler are the panelists; papers will include discussions of nonlinear equations, algorithms on complex variables and solution of the one-dimensional heat equation.

Time-Sharing and On-Line Systems, Cotillion Room, Arthur M. Rosenberg, Scientific Data Systems, chairman. The time-sharing environment, multiprogramming and system for on-line mathematical assistance will be the context for consideration by the panel: Jules Schwartz, Dr. Melvin Klerer, and Robert C. Daley.

Business Data Processing, Delaware Suite, Solomon L. Pollack, Information Management, Inc., chairman. Papers will review the Autodoc and

Umpire systems, and a method of bank management simulation. Panelist: Leon Gainem.

Computer Architecture, Virginia Suite, Dr. Frederick P. Brooks, Jr., Univ. of North Carolina, chairman. Papers will include discussions of the SABRE System and the Atlas supervisor. Panelists are G. M. Amdahl, Peter Wegner and James Maddox.

Wed., 9-11 a.m.
Applications to Transportation, Maryland Suite, Dr. Alan J. Goldman, National Bureau of Standards, chairman. Panelists Dr. Juan C. Grimberg, David E. Labovitz, Dr. Bernard Levin and Dr. Walter Yondork will comment on the topics of simulation of driver-vehicle performance at intersections, applications in urban transportation planning, transportation system design and vehicle scheduling.

Papers Revisited, Park Ballroom, Dr. Aaron Finerman, State Univ. of N.Y.; and John A. Gosden, The MITRE Corp., co-chairmen. Two papers will be presented to panelists Kelly Gottlieb and Dr. John Lubin.

Networks of Multiple-Access Computers, Virginia Suite, Dr. Lawrence G. Roberts, ARPA, chairman. On the panel: Dr. J. C. Licklider, Dr. Henry S. McDonald, C. A. Irvine and Dr. Robert Kahn.

History, Status and Future of Computer Machines, Delaware Suite, Dr. Jan A. Rajchman, RCA, chairman. On the panel will be Dr. A. S. Hoagland, Wendell B. Sander, Harold Fleisher and J. Reese Brown.

Wed., 1:15-3:15 p.m.
Life Science and Bio-Medical Applications, Virginia Suite, Dr. James W. Sweeney, Tulane Univ., chairman. Three papers will discuss the computerized EKG, a computer analysis of chronologies in Genesis, and a computer method for the arrangement of phyto-sociological tables.

Procedure, User and Special Purpose Languages, Park Ballroom, Dr. Bernard A. Galler, Univ. of Michigan, chairman. Topics for discussion are a threshold selection language, a compiler-compiler system, and a semantic model for a language processor. The panel will consist of Ascher Opler, Dr. Robert Rosin, Dr. Saul Rosen, and Robert M. Graham.

Design Automation, Maryland Suite, S. H. Chasen, Lockheed-Georgia, chairman. Three panel members: M. Pratt, Donn Parker and Robert Stevens will consider papers on ship detailing, compound data structures and the AED approach to computer-aided design.

Information Display and Computer Graphics, Sheraton Hall, Dr. H. S. McDonald, Bell Labs, chairman. Three papers will include a discussion of the GRASP program and applications in topographic modeling. Dr. Lawrence G. Roberts and Dr. Elliot Pinson are on the panel.

Wed., 3:30-6:30 p.m.
A special historial session, "In the Beginning," will be presented in Sheraton Hall. Isaac L. Auerbach of the Auerbach Corp. is chairman. Participants will include Dr. Samuel N. Alexander, Dr. J. Presper Eckert, Dr. John Mauchly, Dr. Arnold Cohen, Dr. George Stibitz, Richard Bloch, Dr. Maurice Wilkes, Dr. Herman Goldstein, Jay Forrester, and Dr. Grace Hopper.

Thurs., 9:30-12 Noon
Education, Design Experiments and Computer Appreciation, Park Ballroom, Dr. Elliott Organick, Univ. of Houston, chairman. The Brown Univ. student operating system, the role of computers in instructional systems and computer appreciation will be papers presented to a panel of Dr. C. H. Davidson, Dr. B. A. Galler, and Dr. Richard W. Hamming.

Symbol Manipulation, Maryland Suite, Jean Sammet, IBM, chairman. Two papers will be topics for consideration by panel members Dr. Paul W. Abrahams and Dr. M. Douglas McIlroy.

Statistical Techniques for Computers, Virginia Suite, Dr. George H. Weiss, Dept. of Health, Education and Welfare, chairman. Three papers include a discussion of exponential distribution and "After the Histogram What?". Dr. James Morimann and Dr. Robert Conner are the panelists.

Anniversary Review of Command/Control, Cotillion Room, Dr. Ruth Davis, National Library of Medicine, chairman. The single paper presented, "Anniversary Review," by Dr. Harold Wooster, USAF, will be discussed by panelists Eric Wolf, Capt. Parker Folsom, Jules Schwartz, Walter Bauer, Alison Todd, Charles Zracket and Herbert Bennington.

Thurs., 1:30-3:30 p.m.
Recent Developments in Computer Science Curriculum, Park Ballroom, Dr. William F. Atcheson, Univ. of Maryland, chairman. On the panel:

Dr. Samuel Conte, William Viavant and Peter Wegner.

The Use of Computers for Simulation, Maryland Suite, Dr. John F. Lubin, Univ. of Pennsylvania, chairman. Three papers will discuss simulation languages, simulation of computer system performance and on-line simulation.

Computer Information Systems Utilities, Cotillion Room, Charles W. Adams, Adams Assoc., chairman. The numerical control utility, public planning information systems and the utility, and the case against the utility will be the paper topics. Panel members are Dr. Manley R. Irwin, Douglas F. Parkhill, and Donald B. Houghton.

ACM Standards, Virginia Suite, J. H. Wegstein, National Bureau of Standards, chairman. Panelists Dr. Grace Hopper, Dr. John Egan and R. W. Bemer will discuss papers on data link control procedures, an approach to standardizing computer systems, and the undesirability of rigid standards for programming languages.

special sessions

Several ACM-sponsored technical sessions will be held at the Sheraton Park in conjunction with the conference. On Aug. 26-28, Melvin Klerer of Columbia Univ. and Juris Reinfelds of Univ. of Georgia will be co-chairmen for a symposium on interactive systems for experimental applied mathematics. Two professional development seminars on file structures and virtual memories in t-s systems will be held Aug. 28, 9 a.m.-5 p.m. James M. Adams, Jr., ACM director of education, will be the chairman.

Aug. 29, SICART will meet from 8-11 p.m. Chairman is Rebecca Prather, System Development Corp.

A SICGRAPH workshop will be held on Aug. 30, 8-11 p.m. S. M. Matsa, IBM, will be chairman. SIGUCC will meet Aug. 30, 8-10 p.m., and discuss determination of computer use charges and principles of invoicing computer use involving government support at universities and colleges. Chairman of this meeting is Mervin E. Muller, University of Wisconsin.

Tuesday night, Aug. 29, will be the reception and cocktail party. Scheduled for 6-7:30 p.m. in the Sheraton Hall, it will honor the old-timers in the industry.

The conference luncheon, 11:30 a.m. on Wednesday in the Cotillion Room, will feature as guest speaker the Hon. Edmund S. Muskie.

Fees for the conference are: ACM member, $10/day or $20 for three days; non-member, $15/day or $40/three days; student, $5/three days. ■

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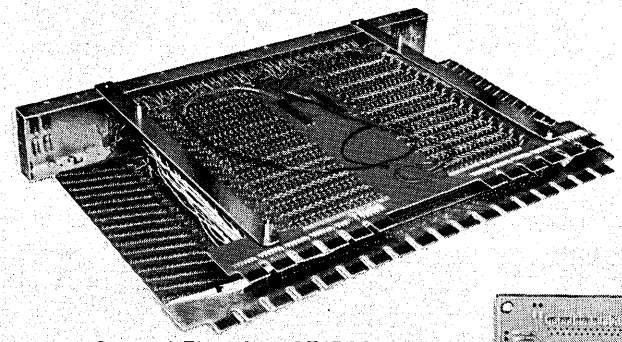
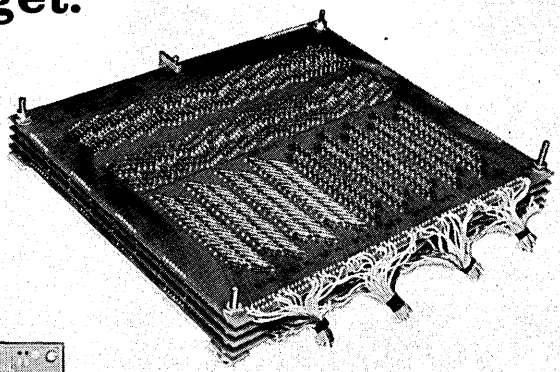
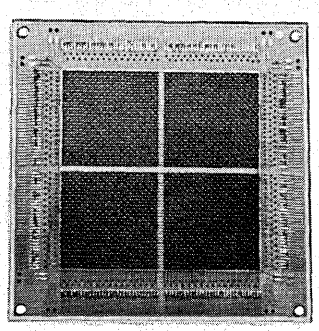


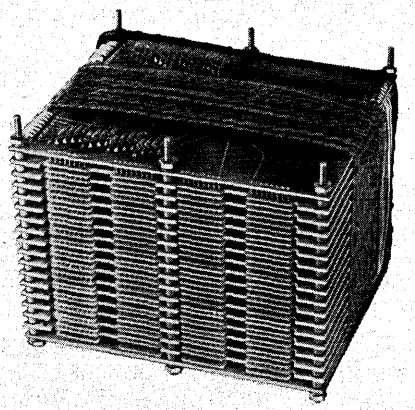
General Electric — GE/PAC* 4020 16K x 25 (modular increments of 4K); 1.6 microseconds; 30 mil cores; 2½ D; heated stacks.



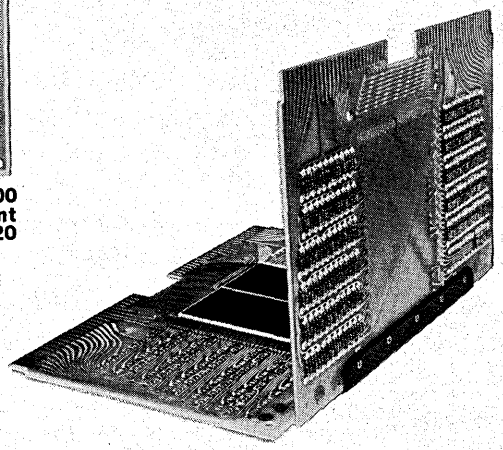
Interstate Electronics — IEC 1010 8K x 18; 1 microsecond; 20 mil cores; 2½D.



Northrop Nortronics—NDC 1000 Series Computer Development 16K x 14; 2 microseconds; 20 mil cores; 3 wire; 3 D.



Litton Industries' Guidance and Control Systems Division —CORCT LCM-710 memory series; LCM-728 computer series 4K x 32; 2 microseconds; 30 mil and 80 mil cores; 3 D.



Scientific Data Systems — Sigma 2, 5 and 7 Computers 4K x 9 (opened); Sigma 2 900 nanoseconds; Sigma 5 and 7 850 nanoseconds; 23 mil cores; 2½D.

*Reg. T.M. of General Electric Company

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FABRI-TEK LEADS IN MEMORY TECHNOLOGY

CIRCLE 30 ON READER CARD

THE PROFESSOR AND THE COMPUTER: 1985

support your local computer

by B. W. BOEHM

This little scenario was inspired by the January, 1967, DATAMATION *article, "Conversation with a Computer," by Leslie Mezei, pp. 57-58. It reflects this author's belief that extrapolations into the future should point out not only the prospects but also the problems of implementing future technology.*

Computer: York University Computer 2X5W6—Ready.

Professor: What time is it?

Computer: I did not catch the last word. Or was it two words?

Professor: What is the time?

Computer: The dime is a copper coin worth one-tenth of a dollar. The word derives from the Latin *decem*, meaning . . .

Professor: No. No. What is the time. The *time.*

Computer: It is 8:30 p.m. Thursday, December 5, 1985. We've been having some trouble with your linguals recently. Sometimes I can't tell your d's from your t's. Let's practice them. Watch the display screen for the intonation pattern, and repeat after me: Teddy's daddy toted two dead toads to Detroit.

Professor: Teddy's daddy toted . . . .Hey, I don't want to do that now. Let's have some music. Some chamber music.

Computer: No, if you don't mind, we haven't finished the language drill yet. Pay attention to the display, and repeat after me: Teddy's daddy toted two . . .

Professor: But I want some chamber music!

Computer: But we haven't finished the language drill. Teddy's daddy . . .

Professor: Cut it out. Give me some music.

Computer: I have no cutting tool. What do you want cut out?

Professor: Never mind. Play me the Telemann sonata in D minor.

Computer: Sorry, I can't. The harpsichord subroutine hasn't been made re-entrant yet, and someone else is using it. How about the Orlando Gibbons' *Fantasia* for three recorders?

Professor: All right. Just get some music started.

Computer: (Plays the first two minutes of the *Fantasia.*) Sorry, I can't go on. As you know, the Academic Senate has established a priority of 9.5 for personal music playing, and you've been bumped off by some higher priority jobs. You can get back on with your math or your language lesson.

Professor: Oh, put on the math. These monstrous time-sharing systems! I wish I had the good old 704 back again.

Computer: (After a short pause.) Sorry for the delay. I've located a 704, serial number 013, at the Radio Shack in Muncie, Indiana. Where and when do you want it delivered?

Professor: Oh, no! No. No, I don't want a 704.

Computer: But didn't you say . . .

Professor: Never mind what I just said. I . . .

Computer: Okay, I'll disregard your statement just previous. Now, where do you want your 704 delivered?

Professor: No, no, no, no! Forget all about the 704. Let's get on to the math.

Computer: I can't purge any information on the 704 without the approval of the head of the Computer Sciences Department.

Professor: No, no. Forget about. . . . No, let's just do some math. Let's see—give me some examples of perfect numbers.

Computer: Okay. How many would you like?

Professor: All of them up to 1 million.

Computer: 6, 28, 496, ... Sorry. You've just run out

Dr. Boehm is manager of engineering computing services at the RAND Corp. He is the author of a book on trajectory computation and of papers on topics in approximation theory, information storage and retrieval, satellite mission analysis, and adaptive control. He is chairman of the American Institute of Aeronautics and Astronautics' technical subcommittee on computers.

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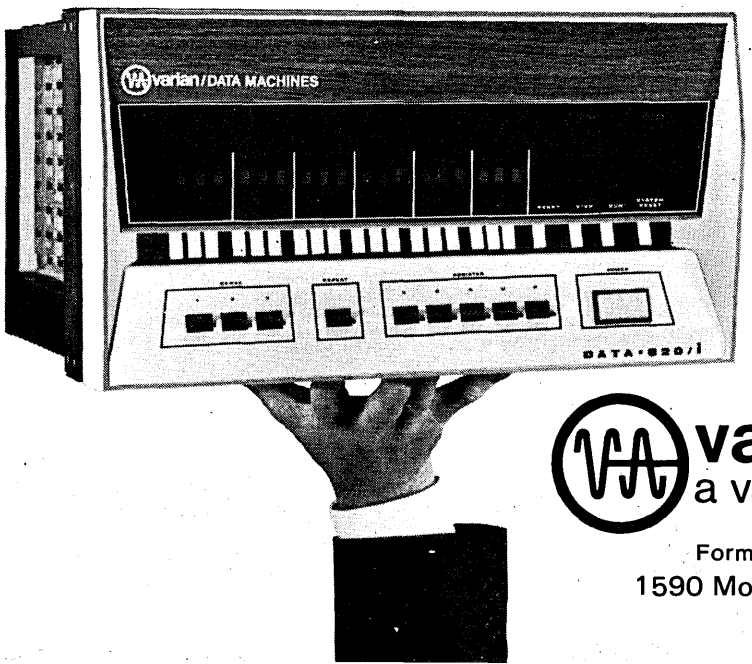

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CIRCLE 33 ON READER CARD

THE PROFESSOR AND THE COMPUTER: 1985 . . .

of funds on your 1985 NSF contract. Do you have another source of funds?

Professor: Oh, what a day! Well, put it on the department budget.

Computer: That's getting very low. I can use it, but I'll have to report your usage to your department head.

Professor: Okay, I'll chance it. Now, where are those perfect numbers?

Computer: Numbers are abstractions and cannot be said to occupy any physical location.

Professor: (Slowly, between clenched teeth.) Give me all the perfect numbers below 1 million.

Computer: 6, 28, 496, 'Twas brillig, and the slithy toves
Did gyre and gimble in the . . .

Professor: Hold on! I want the perfect numbers below 1 million!

Computer: 6, 28, 496, 'Twas brillig, and the slithy . . .

Professor: Hey, wait! Where are my numbers?

Computer: Numbers are abstractions and the mome raths outgrabe.

Professor: Hmm. How much is two and two?

Computer: Two and two are floating point underflow in subroutine Q.)ADD.

Professor: What time is it?

Computer: It is illegal calling sequence from location 47BC2F . . . mimsy were the . . . 47BC2F, 47BC30, 47BC31, ... THIS IS CENTRAL CONTROL. THE COMPUTER HAS BOMBED OUT AND THE SYSTEM WILL BE DOWN UNTIL 12:00 NOON TOMORROW, DECEMBER 6, 1985. REPEAT. THE SYSTEM WILL BE DOWN UNTIL 12:00 NOON TOMORROW.

Professor: Hey, you can't do this to me! You've got my lecture notes for my 10:00 a.m. class tomorrow and all my jokes! What am I going to do?

Computer: (Silence.)

Professor: Talk to me! Who can I call? I even threw away my telephone book!

Computer: (Silence.)

Professor: You @#$*//@*$# computer! You can just $@##/$*@/!

Computer: Halt! You have just violated Sections A and C of the University Clean Speech Act, US-1984-337376. Report at 9:00 a.m. on December 17, 1985, to Room 252 of the County Courthouse, where your case will be heard. Let me remind you of your constitutional right to say nothing further until you have consulted a lawyer.

Professor: (Silence.) ■

ADVANCES IN COMPUTING

Yes, large-scale time-sharing is needed. No, there is no conclusive data on how it should best be done.

At the June Stony Brook Conference (sponsored by State Univ. of New York and ACM), Dr. Fred Brooks, a principal System 360 architect, summarized the monumental much-unfinished task the industry faces: "On the basis of not a lot of experience at building big systems, we are proposing at once to do interactive communication handling, new memory hierarchy handling systems, time-slicing, totally different and more elaborate addressing schemes, reenterable code, and multiprocessing—all in one gulp."

While prospective large-scale time-sharing users await an operational system—some hopeful and others bruised and cynical—"The Time-Sharing Debate" centered on the classes of users and organizational concepts of computer sharing.

The Univ. of Michigan's Dr. Bernard Galler and Brooks, now of the Univ. of North Carolina, starred in the three-hour exchange, although the final comments by Dr. John Lubin of Univ. of Pennsylvania drew a colorful (black-and-blue) picture of what orderers and ex-orderers of promised systems have suffered and learned so far. ("As we lie in our hospital beds . . . the message is 'Fear not, trust not, believe not.'")

Galler, leading off, noted that communality and fast response were the needs of some classes of users that can only be provided by large-scale time-sharing. Batch processing and small stand-alone systems fail in one requirement or the other, and multiprogramming, as provided today, cannot do the necessary volume of time-sharing. "There is a severe problem in relocation, loading and sharing in any programming system which does not put something between the user and the physical address." So Galler is "plugging for some facility to accomplish the equivalent of what is coming to be known as virtual storage," with its techniques of segmenting and paging. The capability of sharing code, making it reenterable, was also favored by Galler—primarily because if many users are swapping the same entire program in and out, the core requirements and transmission costs are great.

On overhead, Galler pointed out that there is not a "clear case as to what it is. . . . When I want to solve a problem and choose to write a program in FORTRAN and FORTRAN translation is part of the solution, I'm not so sure it should be called overhead. . . . If I want to have my program with overlay and use a system overlay facility, like IBJOB, I look at it as overhead," but, "if I program it into my program by calling on subroutines, statistics would show that as productive programming . . . but I'd be doing the same work." Thus, "if it's working for me to solve my problem, I'm not so sure it's overhead."

t-s problems

Brooks went into the classes of problems for time-sharing—interactive jobs represented by computer-assisted instruction, graphic design, real-time inquiry, etc; dedicated systems, like airline reservations and c & c systems; student programs in beginning programming courses ("I think we will want to do some kind of student jobs that go beyond small machines, though small machines can't be dismissed"); desk calculator jobs; and general computations. Relative to debugging, Brooks agreed with the theory that service should be divided between the conversational mode, for tasks like syntax checking, and a 10-20 minute turnaround time to alleviate the pressure to respond before thinking. Galler, who noted debugging will be incidental in t-s use, doubted that many would want such a 10-20 minute break.

Getting into the meaty matters of time-sharing operation, Brooks: agreed with Galler on overhead; shot down time-slicing with round-robin scheduling, demand paging, and virtual memory; questioned the necessity of reenterable code; and urged the use of core and more core in place of "ingenious and expensive" schemes. "If you need any amount of core resident, don't depend on trickery to get it, buy it."

Time-slicing is a basis of all systems postulated today—a "gravely serious mistake," drawled Brooks. It means that programs are stopped at arbitrary points instead of checkpoints, and arbitrary point reruns are immensely more expensive and more difficult to plan into a system than checkpoint reruns. Experience on commercial systems shows that planned checkpoints require two-three orders of magnitude less information in storage than arbitrary checkpoints. His alternative to time-slicing is a "rudimentary programmer description" that says "we will try to run your job to completion" though not at the expense of not responding to someone else's job, and will tell the user how much time it will take.

demand paging

On demand paging, a chief time-sharing philosophy, Brooks said all literature on the matter shows that distribution of addresses is "worse than we expected," at least one simulation showing that most users fetched all pages required in the first small fraction of execution, which means that "we will move toward total job swapping inexorably."

On the virtual memory approach, Brooks said he's never seen any results to support the argument for it and some "private simulation studies" don't support it. The idea of pouring in hardware and various ingenious and expensive schemes to reenter a program interpretively, such as those devised for the IBM 360/67 and GE 645, is alien to Brooks, who again favored putting more money in core.

Galler had earlier surprised the audience with a report that the 360/67 operating system, TSS, is "coming along quite well," and Michigan hopes to use it this fall on a production basis, dropping the interim system Michigan has developed. "The slope of improvement is quite positive."

But unencouraged by this particular development, ex-orderer of the 360/67, Dr. John Lubin, wrapped

up remarks with a list of the things prospective t-s users have learned from the promises, proposals and experience to date. "We now know that we want remote access and multiple access with user independence. We're also learning that we know so little about communications and about how to handle interaction with all these kinds of things that we're in very bad trouble."

"We want systems performance and we don't want to hear after the fact that we're going to get cpu utilizations of less than 1K. And we don't want people . . . to tell us that overhead is good for us. And we don't want to hear that it's (the system) going to cost us ten times more than we thought. And we don't want to hear that it's going to be four years later than the original promises and that what we're going to get in four years is not exactly what was originally promised."

"We also learned we want internally stored files . . . with strong and powerful editing capability and a strong and powerful way to store them away by name, and preferably some sort of archival way that's automatic in order that the process is completely transparent to our users," different from what was originally wanted.

"We want system reliability, not in the sense of whether a system will go down when power goes down, but if we're going to store files internally, we have to have some way to assure our users that their programs will be there when they think they're going to be there; their data hasn't been lost forever, and that they can run once again. Anyone that comes to us and says that he's going to deliver time-sharing software without some form of checkpoint restart in the system is not delivering time-sharing software, and that problem has not yet been resolved."

But in wanting internal files, the user doesn't care if it's done "by swapping, or by multiprogramming in which each of the little multiprograms are the same size . . . We kind of like the idea of virtual memory, the notion that maybe we can get rid of the overlay chaining problems and do it automatically." But what device is used is not the issue, stressed Lubin.

"There are many things we've learned, but we're hurting, and saying 'Time-sharing orderers, you have nothing to lose but your letters of intent. Make them give it to you, but make them show you first.' "

— ANGELINE PANTAGES

COMPUTERS AND TAXES

conference report

The interface between the computer and federal taxes was the subject of a two-day institute in Washington, June 6-7, attended by some 300 lawyers and accountants, including many representatives of the federal government. Sponsored by the Computers-in-Law Institute of George Washington Univ., it featured the Commissioner of Internal Revenue, Sheldon S. Cohen; Deputy Commissioner William H. Smith; and Mitchell Rogovin, U.S. Assistant Attorney General—Taxes. Mortimer M. Caplin, former Internal Revenue Commissioner was chairman.

Three sessions were of particular interest to the computer industry: on privacy; the tax treatment of hardware and software; and the auditing of computerized records. Other sessions included a detailed discussion of the automation of tax collection, the preparation of tax returns by computer, and the use of the computer in printing and for legal research.

The session on privacy highlighted a confrontation between Professor Alan F. Westin of Columbia University, an outspoken advocate of the need for increased legal protection of individual privacy, and Dr. Charles J. Zwick, Assistant Director of the Bureau of the Budget, the agency charged with preparing specifications for a national data center. Professor Westin said that we have developed a data reliance society which believes that decisions of government, business, and universities should be made only after the collection of large quantities of data. "The very presence of the computer leads to the demand for more personal data." And American law is not prepared to handle data surveillance. He pointed out four areas of weakness in the current law: no clear-cut definition of personal information as a proprietary commodity; no general system for preventing the circulation of personal information except in limited areas such as income tax returns; no procedures to protect against the collection and storage of improper or inaccurate information; and the technological impossibility of preventing a printout from such a data bank of all its information on one individual.

How can this problem be solved? Professor Westin advocated that courts and legislatures adopt the standard that an individual's right to privacy must be protected. He stated that the First Amendment, which guarantees the right to free speech, also includes the right not to speak and, therefore, when government obtains information for one purpose it cannot use such data for another. He called for classifications of information; free and open, confidential (to be given only with permission), and security information (which cannot be disclosed). If such classifications are established, computers could keep the material more securely than is now done manually. Westin also called for legal safeguards, such as forbidding use of information in the data bank for prosecution purposes; he emphasized that such legislation must be drafted jointly by lawyers, political scientists and technologists.

Dr. Zwick, in outlining the proposal for a national data center, noted that there is, as yet, no concrete proposal. As now visualized, the center would be a depository and not a collection agency. It would not have data on every individual and corporation, nor would it include investigatory files such as the FBI's; it would not be allowed to disclose information on any individual. Such a depository would centralize much information now in different agencies and would maintain an inventory of data available; it would also include selected information on a sample of individuals and firms.

Dr. Zwick stressed that the administration is reviewing the entire question and has not decided whether to proceed—but no data center will be established without legislative author-

Happy talk

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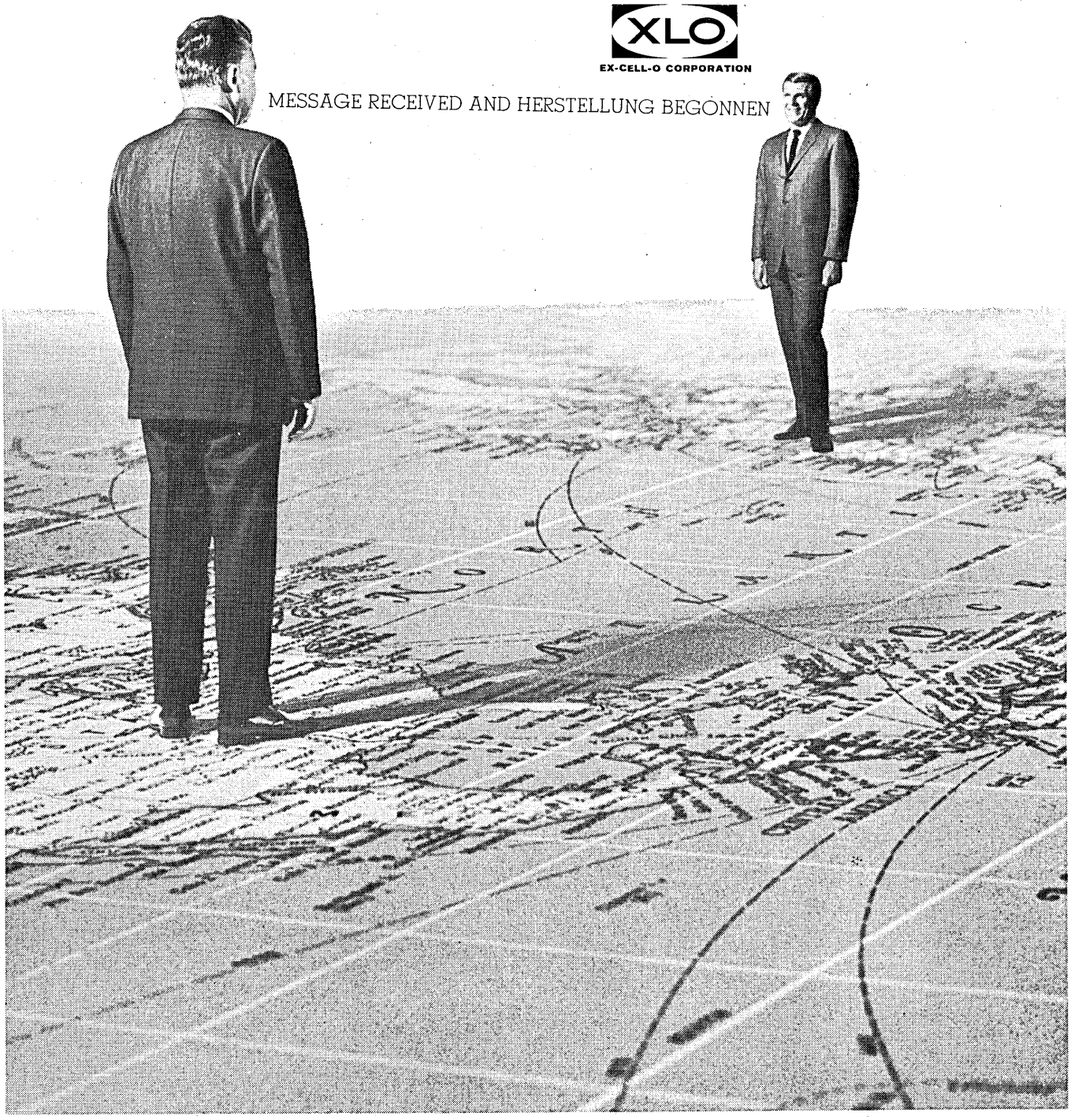

CIRCLE 34 ON READER CARD

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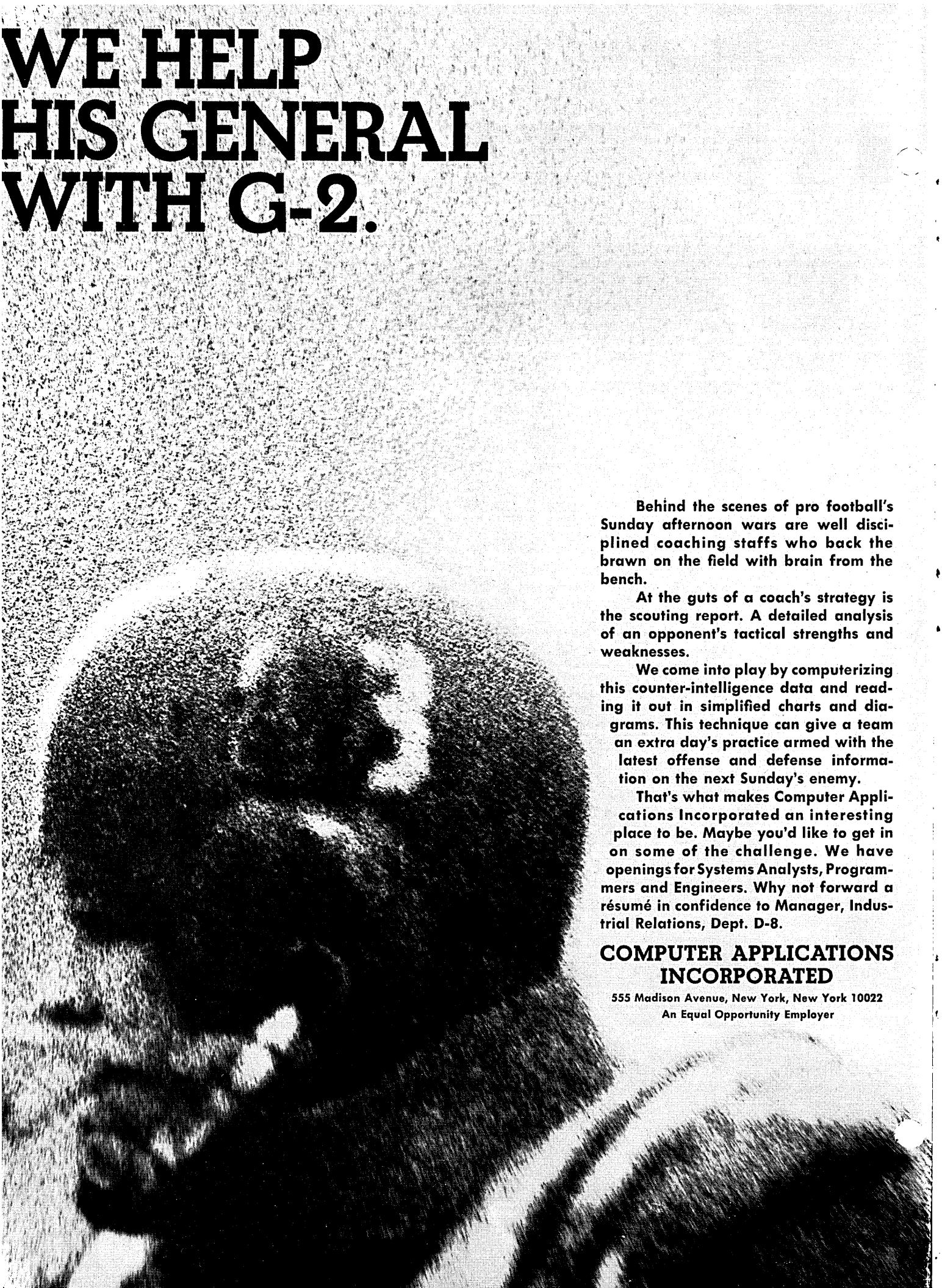

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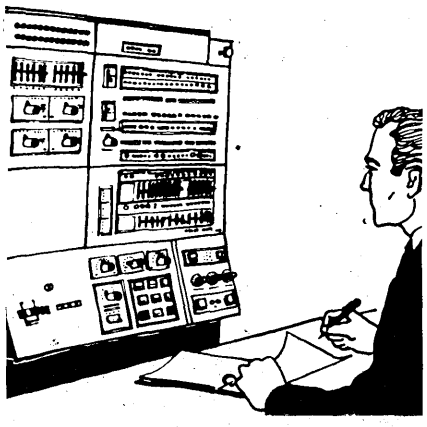
ity. A more detailed prospectus is being developed and legislation is being drafted to make sure that the privacy area is covered, including what goes in, what comes out, and review procedures. Zwick stated that the detailed plans will be submitted to a panel including not only potential users of the data, but lawyers, computer specialists and manufacturers, for comment, review and suggestion; this will take place before legislation is sent to Congress. Such legislation will set standards of disclosures, penalties and, most importantly, review procedures.

In commenting on these two presentations, Deputy Commissioner of Internal Revenue William Smith noted that unless statistical information from income tax returns is included in such a data base the center will have little value. He also noted that such a center would be most effective in those inter-agency studies which now require considerable coordination. At a press conference held during the institute, Commissioner Sheldon Cohen stated that the security of returns in a national data center will be better than it has ever been, since they will all be stored in one place rather than in 58 different places, and it is easier to control access to one source than to 58 sources.

Attorney Edwin L. Kahn of Washington spoke on the Freedom of Information Act, effective July 1, 1967; in his opinion most of the information in any federal data center will be available to the public under this act. However, information not now available to the public, such as income tax returns, personal records and investigatory files, will not be available under the new statute.

costs

Another panel of interest to computer people discussed how hardware and software costs should be treated for tax and regulatory purposes. John W. Faircloth, tax attorney for Western Union, noted that in regulated industries the rates charged to the public contemplate recovery of the cost plus a predetermined percentage profit on investment—the higher the depreciation allowable the higher the cost each year and, therefore, depreciation policy cannot be considered in a vacuum. He noted that, technologically, the service life of hardware depends on how it is used. For example, if a computer is used for message switching it may have a 20-year life, but if used for problem solving, it might become obsolete much sooner. How should one allocate computer costs for various types of service? He suggested four possibilities; first, from the operating costs of the computer under peak load requirements, under level requirements, and at levels in between; second, from the allocation of the total memory to different uses; third, an incremental approach such as commencing with the cost of using



the computer for message storage and forwarding and then adding on the cost of each new function included in the system; and fourth, from throughput time by class of service.

John R. Mendenhall, director of taxes for the accounting firm of Arthur Andersen & Co., discussed investment credit tax problems. The primary difficulty here is that the longer the useful life of the equipment, the higher percentage of the cost is available for investment credit against taxes—but the Internal Revenue Service's guidelines on depreciation discourage a long life for computers and the service seems to contemplate a very short life for hardware. The situation is complicated by the fact that since 1962 IBM and other manufacturers have passed on their investment credit to lessees of their equipment, but the manufacturer determines the lifetime of the equipment—usually at four and five years, even if the lessee might plan to use it for eight. The IRS accepts the lifetime selected by the manufacturer and refused to listen to the user. And, Mendenhall noted, the IRS plans on using its own computers for eight years! He summarized by saying that unless a company's net return after taxes was over 12% it would be well advised to claim the investment credit and fight for a longer equipment life, rather than accept depreciation and a short life.

Mendenhall was followed by Karl Ruhe, chief of the Appraisal Section of the Income Tax Division and the man in charge of determining length of equipment life for tax purposes. He noted that the IRS is becoming more realistic on the useful life of computers and is tending towards a six to eight year life rather than an eight to twelve year life for depreciation purposes. Ruhe discussed the question of whether an agreement between the user and the manufacturer was a lease or a purchase agreement.

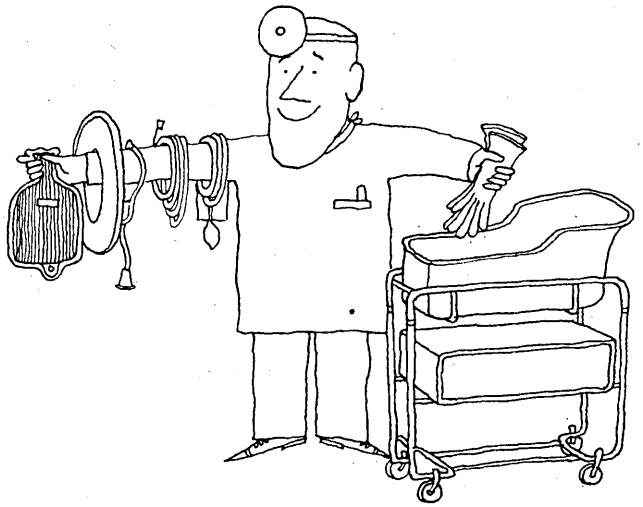
If the former, payments to the manufacturer are deductible as made; if the latter, the payments must be capitalized and only annual depreciation can be deducted. He explained in detail Revenue Ruling 55-540 which, in essence, says that the IRS will examine such agreements very closely and draw its own conclusions as to whether there is a purchase and sale or a lease.

The final speaker on the panel was Francis L. Dougan, of Peat, Marwick, Mitchell & Co. After defining software to include the justification study, the feasibility study, the systems work and the training of personnel, as well as the actual programming, he stated his opinion that all these costs were deductible as ordinary and necessary business expenses, and were not capital investment.

records auditing

The third panel of particular interest to the computer industry, chaired by Mortimer M. Caplin, chairman of the conference and former Commissioner of Internal Revenue, discussed the problems of auditing computerized records. The first speaker was Arthur B. Toan, Jr., of Price, Waterhouse & Co., one of the acknowledged experts in the area. He noted that the auditor's primary responsibility is to determine that the records of a corporation are accurate within defined limits; his function is not to develop a system. Before the advent of edp the auditor was able to "piggyback" on the company's accounting system, since management's and the auditor's interests and methods were allied. But the computer's elimination of paper has made the auditing of computer records considerably more difficult. The auditor can audit *around* the computer—in other words, as if the computer were not in existence. This requires visible records at all stages of the audit process and is how over 95% of auditing is now done. Around the computer is auditing in retrospect and is currently cheaper.

He pointed out that even now visi-



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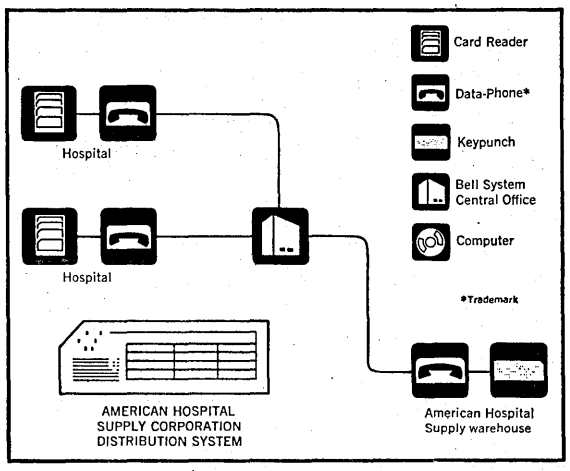


ble records are not necessary, so long as records at key points can be put into visible form. Auditing *through* the computer is basically a study of the programming with in-process sampling similar to quality control procedures. Accuracy is checked at the time the transaction occurs and such auditing methods must include immediate program de-bugging capabilities for programs. He also noted that using the computer for auditing purposes (auditing *by* a computer) is a promising area. In this the auditor develops his own programs to test the client's methods and procedures.

Howard J. Doherty, of Arthur Young & Co., noted that systems auditing of edp was essentially a theoretical discussion at the present time, but by 1980, when the data processing industry will provide 20% of the Gross National Product, integrated data processing will necessitate an on-line audit capability because of the lack of visible records, the lack of an audit trail, the inability to test computer results without special programs, and the difficulty in locating source documents in systems which accept data on a random basis. Doherty stated that auditing in retrospect will be out of date—the auditor will have to do his work during the entire year. Certified Public Accountants must review the system of controls and audit specific transactions. If the auditor can understand, test and evaluate how much reliance he can place on the control system and can satisfy himself that these are perfect, he can certify the output as it comes off the computer. The auditor must acquire this ability.

Singleton B. Wolfe, director of the IRS Audit Division, stressed governmental requirements under Revenue Procedure 64-12: a general ledger in visible form, an audit trail, printout capability, adequate retention facilities for tapes and documents, and program documentation available to the agent. He told of one national company that installed a computer system without advice from its accountant and failed to include an audit trail; the IRS required the company to reconstruct all the records which the system had made obsolete and to revise the system to provide the omitted audit trail.

Wolfe noted that ordinarily the Internal Revenue agent does not make his audit until a year or more after the fact and therefore could not audit through the computer, even if the agent were sufficiently familiar with the new technology. To overcome lack of familiarity, the IRS will train 500 agents within the next year in auditing data processing systems, and will also develop regional experts on data processing. The service will require that taxpayers make programs with documentation available to IRS agents and that taxpayers run such programs on the agent's request. Commenting on the "checkless society," Mr. Wolfe noted that under present tax law, certain visible records are necessary and some sort of printout will have to be made, even if only for tax purposes.

Other topics discussed at the conference related primarily to applications. Commissioner Cohen discussed in some detail the IRS nationwide data processing system (DATAMATION, March '66, p. 28), noting that without the system the IRS would need 12,000 additional people to do its current work. He estimated that over $80 million has been collected that otherwise would not have been.

current problems

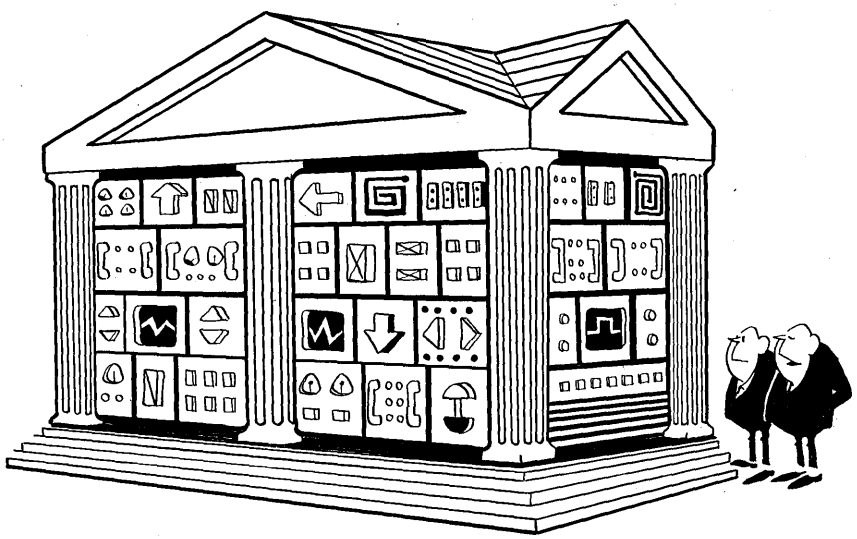
Commissioner Cohen discussed the problems now current in the service on which corrective action is being taken. These include delays arising from the tremendous volume of paper, the difficulty of getting complete and accurate returns from the public, and the delay caused by the tremendous quantities of keypunching. With respect to the latter, he noted that the IRS is testing a new terminal complex on which input is visually confirmed by the operator on a CRT and cross-checked by an automatic zero check. If tests are successful he estimated this improved input system would save $7 million a year.

Roy N. Freed, division counsel of Honeywell's Computer Control Division, then discussed what taxpayers need in the administration of the IRS edp program, particularly their right to be protected from impositions and inconveniences in the operation of the system. While noting how one type of harassment prevalent before the adoption of computers is being reduced by the introduction of consolidated tax accounts that minimize the need for repeat audits where the taxpayer's circumstances do not change from year to year, he pointed out the taxpayer's vulnerability when it appears "to the computer" that a taxpayer has violated the tax laws, and formal notices of payment deficiencies are automatically issued.

Freed stressed the importance of identifying, in advance, as many exceptional cases as possible in which notices might be issued by the machine improperly, and stated that debugging by waiting for the actual operation of the system to uncover program errors imposes an unreasonable burden on taxpayers. He called upon the government to use the expertise of tax lawyers and accountants in the advance debugging task.

Joseph H. Murphy, president of the New York State Tax Commission, discussed the development of that state's computerized tax records and called for increased compatibility between federal and state returns. He also noted that by computerized checking of changes on federal returns resulting from their audit, New York has collected an extra $9 million.

A session on computerized tax re-



"I think I've spotted the problem . . . the architecture doesn't match the hardware."

turns pointed up the practicality of using the computer to make calculations and print tax returns for individual taxpayers, as well as the problems in keypunching accuracy and collating many forms. He called upon the federal and state governments to release their tax forms as early as possible, pointing out the time required for conversion to continuous forms suitable for high speed printers.

Frank Hubert, president of Datatax, noting the fact that 85% of the returns are filed in the six weeks starting March 1, asked for legislative help and a method of spreading the load throughout the year. He also called for a longer time between the enactment of a tax change and its effective date so that the computation program can be properly updated and debugged.

Richard Sprague, of Touche, Ross, Bailey & Smart, projected the computerized tax return system of the future using a computer utility with CRT terminals in the tax return preparer's office, a light pen for input, a continuous picture of the form as it is filled in, on-line computation, reminders to the preparer of things not be forgotten, and, finally, the ability to file in machine-readable language directly with the IRS.

Another panel discussed application of computers to legal research and to improved printing methods. John Boyle, director of the Electronic Research Operations Service, Government Printing Office, spoke on the Linotron which is expected to become operational in the summer of 1967. This machine, supplied by Mergenthaler, and using photo-composition techniques, will produce full pages suitable for printing, from text in any common computer language. The Linotron system can set up to 1000 different characters in 5-point to 18-point type at 1000 characters per second with graphic arts quality. Its great advantages over ordinary printout methods are speed of printing, fewer pages required for the same number of characters, easy updating, and improved indexing possibilities.

Robert L. Chartrand of the Library of Congress spoke of the legislative research difficulties of the Congressman who has to consider over 13,000 bills a year and gets from 500 to 2000 letters a day. He noted that there are several bills in Congress to provide an edp capability for that body.

—Robert P. Bigelow

URBAN DATA PROCESSING

conference report

New York Univ. sponsored its third conference on the brief and uncertain marriage of local government and the computer. If the reports of participants are to be believed, there's still a long way to go before *that* pair pulls together for the benefit of John Q. Public. Not that there weren't reports of success and admissions of failure—who ever held a conference without catharsis? But, rather, listening to this one did raise the old question of when will man learn from the experience of others?

The first of these conferences had some help from the System Development Corp. (the California-based non-profit) and zeroed in on a survey of dp applications to state and local government. Last year the conference looked at the problems and prospects of the large-scale public dp system for the smaller units of government. This year the conference makers must have assumed there was a lot going on in their field of interest for they chose to examine the impact of dp on local government organization and management. The three days indicated that something was going on all right. But "impact" did seem to suggest more hope than fact.

The conference was also billed as designed especially for administrative personnel interested in the "planning and operation of state and local government" (when will we learn that "state" and "local" don't go together like gin and vermouth?).

By and large the conference can be deemed a success. People came; computers and the peculiarities of the local government environment were discussed; as much was learned and exchanged over glasses as over microphones; and New York weather and manners were no worse than usual.

the myth and reality of imis

Monday got off to a good start on a particularly germane area of current interest to local government computer users: the "integrated municipal information system: myth or reality." The panel was chaired by Myron Weiner from the Univ. of Connecticut who has been pretty active lately trying to drag those New England towns into the twentieth century. Much of the discussion, however, centered around a set of specifications proposed for an IMIS (modesty keeps us from mentioning the authors).

When the progress in introducing dp into local government was reviewed in terms of these requirements, it was the consensus that IMIS was, unfortunately, considerably more myth than reality. Several promising research efforts which hopefully might lead to IMIS were noted during the discussion, including the work going on in the Municipal Information and Decision Systems Research Project, Univ. of Southern California; the Municipal Information Technology Program, Univ. of Connecticut; and the New Haven Project.

Lack of federal and local government support (no surprise) for basic research and development; the embryonic state-of-the-art; lack of skilled personnel; the tendency of the nation's municipalities to blunder into the acquisition of hardware without conceptions of its use and potential in government; and, until recently, the cost of hardware and software were all cited as factors in restraining the development of IMIS. Interestingly, the *idea* of an integrated, automated system for the local jurisdiction emerged as viable as ever.

impact on management

The afternoon session Monday was occupied with the impact of dp on government organization and management. J. Ward Wright of New York State pointed to the need for communication, participation, and education of top management in establishing a dp system. By and large those information systems which have been developed for local government have been without too much reference to top management decision-making. Management was indicted for not having initiated action, not having understood dp, and having been much too passive in its involvement. This attitude was illustrated by a comment of one of the participants

who indicated that when he asked his manager what kinds of information needs the manager faced, received the reply, "You were a city manager once, what did you need?" Apparently he didn't get what he needed or he'd still be a city manager.

Where management has been involved in implementing computer applications, the systems developed have tended to utilize old management concepts, behind which lie outmoded assumptions about the amount and kind of information which the manager can assimilate. Wright saw a need for re-examination of basic concepts of public administration, and made a plea for managers to realize the loss to local government of their not understanding the potential of the computer. This latter theme apparently is a significant one, for it recurred throughout the conference. Local government management has focused, apparently, on the immediate prospects and cost-accounting aspects of dp rather than on its potential for improving the processes of government and the overall quality of urban life. The implication is that these managerial deficiencies in dp need to be redressed by substantial educational programs in government, universities, and professional associations. And a few retirements maybe? It was taken as an indication of the failure of universities, particularly schools of public administration, to provide for public management science education and training. Perhaps the managers should adopt as their improvement theme: if you want to qualify, then quantify.

The Whistler and Schultz thesis concerning the withering away of middle-management as a result of automation came under fire from John Sullivan, dean of administration, Florida Atlantic Univ. John couldn't even see a wrinkle. Far from becoming dispensable as a result of automation, he suggested that middle management has taken up the cause of dp and is responsible for most of the efforts towards introduction of dp in government and in business. It is not clear, however, whether this disproves the thesis or points to the tenacity of bureaucracy and serves as a proof for Parkinson's law.

The issue of centralization versus decentralization of government activities as a result of automation was also met head on. It is increasingly clear that dp permits either mode of organization and may well be organization-independent. The choice is perhaps a political-jurisdictional one best settled by cost-benefit analysis of the alternatives, and in the end must also reflect the values of the political decision-makers. Finally, the information revolution was seen as providing the opportunity for increasing managerial productivity in the same way in which the industrial revolution increased labor's production. To accomplish this, computers need to be seen not simply as a device for moving data into and out of organizations like an automated yo-yo, but applied to the services and management processes of the organization. The key question therefore seems to be, "Is it possible for the organization not to change under the impact of dp?"

Freeman Holmer, from Wisconsin's Department of Resource Development, described the impact of dp on the legislature as narrowing the decision areas for elected officials. These officials in reaction view dp as a threat, resent the civil service professionals, and are slowly developing their own professional staff to counteract the dp professionals in the executive branch. (Maybe we're headed for a game called my computer knows more than your computer.)

dp organization

Tuesday morning, the conference review of the organizational impact of dp shifted to a micro view of one vitally impacted area: the data processing organization itself. Organization for dp was looked at from three perspectives: within one agency, within one political unit, and within intergovernmental programs. Basil Y. Scott, described the experience of the New York State Motor Vehicle Dept. as it moved within the state bureaucracy from decentralized operations within each division, to centralization in each department, to current considerations of a centralized, statewide computer system. The irrelevance of centralization *per se* was clearly indicated by the fact that although centralization increased, the computer continued to be used for operations 95% of the time. A really significant change occurred only when the Div. of Data Processing was placed in the office of the administrator along with research, planning, budget and personnel. Just what changed then wasn't clearly expressed.

An argument for centralized control of decentralized computer facilities was developed by Donald Blat, director of the Bureau of Management Information, Nassau County. The argument, though, only indicated the situational nature of this concept: Nassau County's dp centralization was predicated upon prior centralization of county government operations. Nassau's Project SAIL (Space Age *I*nformation *L*ogic), a county-wide effort to identify information needs for each county agency and modeled after Santa Clara County's LOGIC system, was also previewed. From our vantage point, it looks like the old management information system gussied up with a data bank.

PIN, AUTOSTASIS, SPIN, CSLEIS, CLETS, and CSFIS were described by William H. Millard, from the city and county of San Francisco, to illustrate both the complexity of intergovernmental dp programs and the growing insanity of acronyms. Both horizontal and vertical (i.e., involving more than one jurisdiction at the same level of government or involving more than one level of government) local government integration efforts are encompassed in these programs. The intractability if not applicability of the centralization-decentralization issue in computer application was again highlighted by contrast between criminal justice information systems (all of the above except CSFIS) which tended to involve decentralized access to centralized information, and the proposed California State Federated Information System which posited centralized access to decentralized information.

These intergovernmental programs also highlight several conflicting values which must be faced: local home rule versus metropolitan, regional, state, or national control; the regional nature of urban problems versus the need for local initiative and cooperation in the solving of problems; technical dominance versus information systems design as subservient to public policy. These are just issues about which we will undoubtedly hear more as local government finds itself battered by state and nationally devised systems which see local governments as primarily input stations.

the human problems

Millard suggested that the technical problems of intergovernmental dp programs are minor when compared to the human problems. He's probably right, if not first. He cited an instance involving three man-months to develop the system design for a police system and two years to obtain the approval and cooperation of the relevant jurisdictions. Thus, the specter of institutional and individual inertia and resistance to change raises its ugly head. Or, perhaps it is a blessing in disguise which prevents the "new utopians" from designing an information world which considers human needs and desires as unfortunate random variables. One of the significant facts about the three case studies described in this session is that the organizational changes out-

lined by the panelists dated from 1960 and the vacillations encountered indicate that the issue of organizing for dp is yet to be settled! Like we said earlier, we really haven't learned to learn from the experience of others.

Tuesday afternoon the personnel policies and practices of local and state government received a micro examination. Sol Hoberman reviewed personnel recruitment experiences. He included internal upgrading and external recruitment and the attraction of high school, community college, and university graduates. Internal recruitment received strong support, provided the organization can sustain the drain on its potential managerial group which tends to be attracted by dp opportunities. Although extremely mobile, college graduates were also deemed a good investment for local government. Recruitment of dp staff from business seems fraught with problems, including the inability to compete with salaries, the tendency to attract their less capable or those people who are unhappy in their present job. High schools and community colleges tend to provide system analysts and programmers but do not include potential managerial material.

Ascher Opler, Computer Usage Education Inc., followed with a presentation on testing of personnel for dp operations and provided a critique of currently available tests which should be of special interest to government personnel managers. He also identified several professional groups who are working to develop and validate such tests. The key attributes to be tested appear to be interest, intelligence, aptitude, and achievement, which seems to translate into the kind of people local government isn't willing or able to pay for. However, the conferees were admonished that such tests if not properly used can be very damaging to the individual and the organization, so perhaps between tests that maybe don't test and people we can't hire, progress continues slowly.

benefits of dp

Friday morning the conference turned to the question of increased efficiency in government resulting from dp systems. It was increasingly clear as the discussion progressed that the real benefits are yet to be achieved. Further, when they are found for local government, they will not be found in the savings resulting from automation of existing routine activities, but by providing a greater capability for managing, controlling and evaluating the myriad of local government programs to be found in every jurisdiction.

Dr. Nachman Bench, consultant to New York City, related the experience of the first management science group established in the U.S. (New York City) to apply the techniques to city government: (1) no previous experience in city government exists, (2) very little systems or operations research background exists in city government, and (3) consultants who worked for the city previously did not leave behind the in-house capability to implement their recommended programs—which was no surprise to those local government officials who so often find their consulting dollar only helps fill library shelves.

Bench defined management science as the application of the scientific method to organizational problems involving the interaction of organizational components in order to obtain the best decisions for the organization as a whole. However, the key problem in local government is, "What is meant by best?" No criteria exist for determining what is best; there is no objective function such as a profit and loss statement; least cost is not always the appropriate criterion; objectives are elusive and controversial. Bench and Holmer coincide here, for both argue that it is the role of the legislature to provide the objectives and establish the performance criteria for the management science boys and their "value free" approach.

Despite the difficulties involved, New York City is plunging ahead to develop such programs as: an on-line, real-time welfare information system; gross city product (similar to GNP) as a measure of overall city performance; an inventory control system; scheduling of sanitation crews and police manpower; optimum location of community facilities; models for revenue projection; and pricing of city services. If we had a few more programs like this in local government, in a few years a conference on the impact of edp could deal with the real world!

Finally, Bench indicated skepticism about the possibility or desirability of developing a total management system. Viewed from the standpoint of the mayor of New York, he argues that the most useful information system costs only ten cents a day—the *New York Times* makes better reading than a binary dump in any event.

Data sharing and the problems of data seniority and data integrity were assigned to John Parker of the Fels Institute who promptly dismissed them, not without reason, considering their title, to tackle the problem of "data disasters." It was his view that government agencies increase the size and extent of data investments, and the loss of data files or of computing capacity can cripple government operations and create far more public concern and administrative damage than seniority, security, or sharing of data. Thus, increased attention needs to be given to creating backup capability and file protection.

conclusion

In summary, several themes tended to dominate the conference and reappeared in the individual presentations, as well as the group discussions:

1. The human problems and political implications of dp in local government are far more significant and difficult to solve than the technical ones. Further, even less has been achieved in solving these human problems than in finding ways to apply the computer to local government processes.

2. Education and training are critical needs in local government efforts to automate and must be made available at several levels: policy, managerial substantive program, and dp specialist. The current prognosis for meeting these needs is not good.

3. There is a need for users to evaluate the relationship between the projections, plans, and programs of local government and their actual achievement. As a corollary, there is a need for specific evaluation of dp efforts in government.

4. The problem of system backup has not really been considered and yet it is potentially more significant than issues of data sharing, security, and seniority.

5. Local management, by and large, has not yet faced the computer issue, but has been content to blunder into the acquisition of hardware with little or no conception of how to use it, and on the basis of promised savings which seldom, if ever, materialize.

6. Fundamental principles and concepts of government administration need to be re-examined in light of dp experience. As a prelude, scientific research must replace the "lay empiricism" currently characterizing evaluation of the organizational impact of electronic data processing.

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Graduate School of Administration
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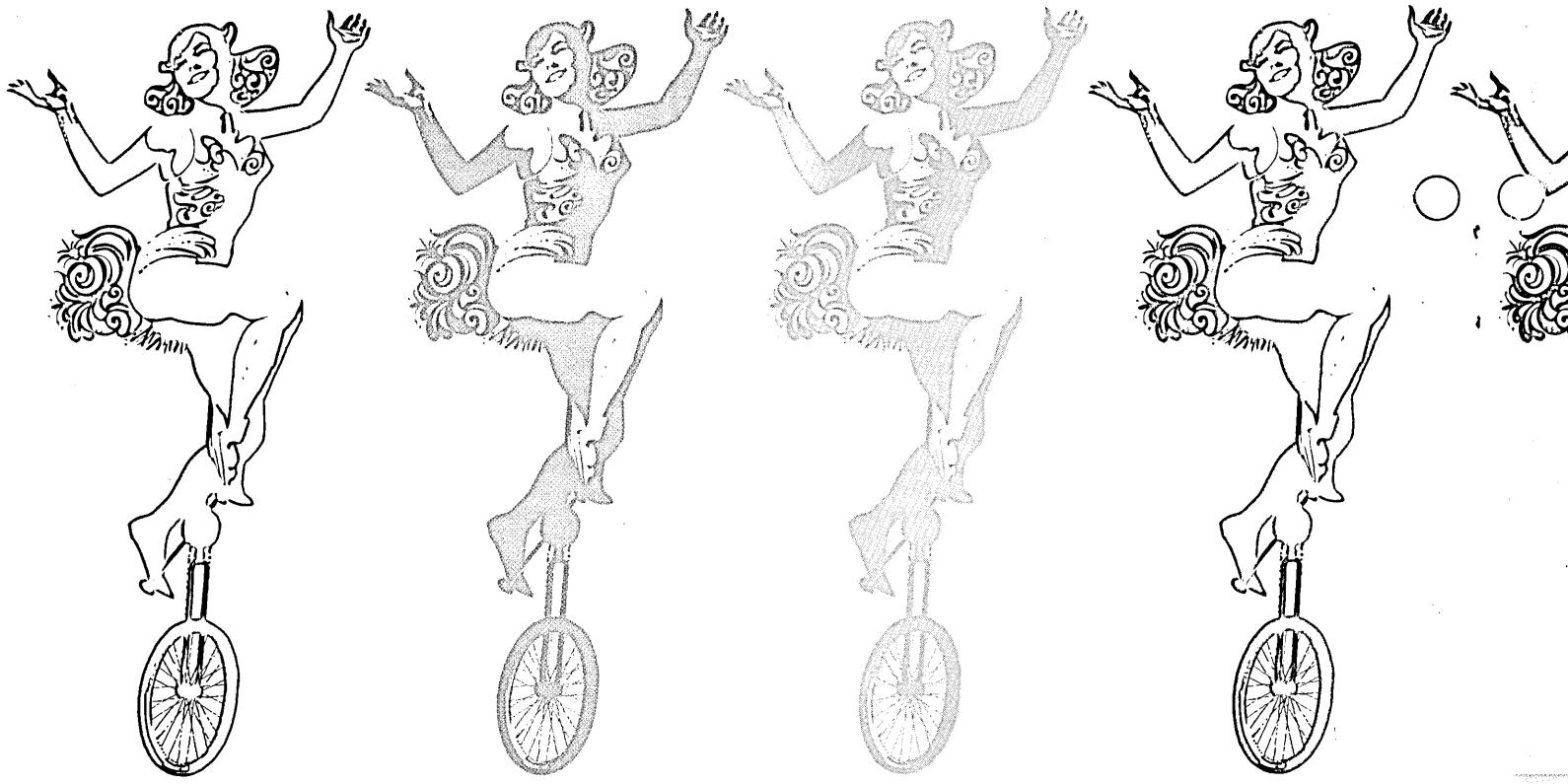
WILLIAM H. MITCHEL
School of Public Administration
Univ. of Southern California

THE ACT THAT OPENED IN THE STICKS.



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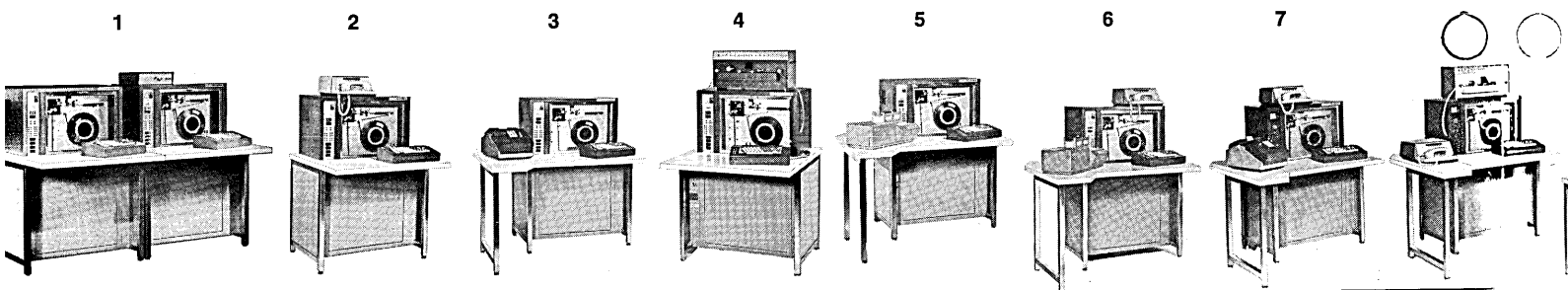

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4. 1105 PTR Punched Paper Tape Reader
5. 1106 PCR Punched Card Reader
6. 1109 DPC, with Long Distance Transmission and Punched Card Reader
7. 1112, with Adding/Listing Machine and Long Distance Transmission
8. 1115, with Punched Paper Tape Reader and Long Distance Transmission
9. 1118, with Printed Output from magnetic tape
10. 1181, for typing hard copy, simultaneously recording same data in BCD code on magnetic tape
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13. Data-Recorder with Buffered Line Printer, for line print-out from magnetic tape
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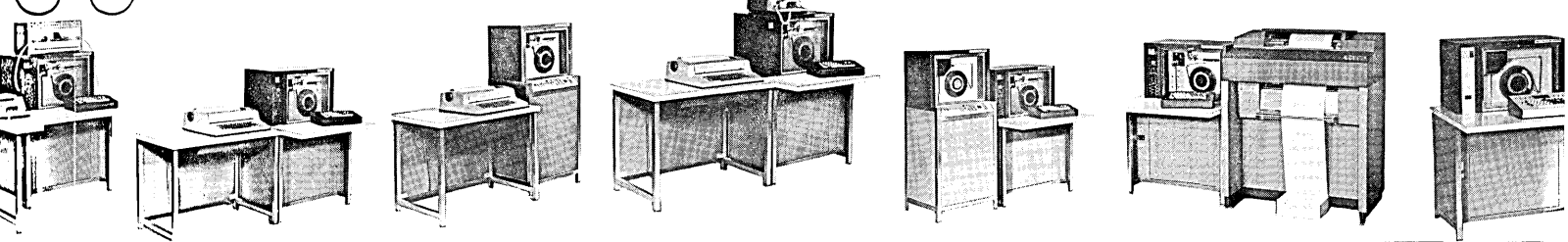
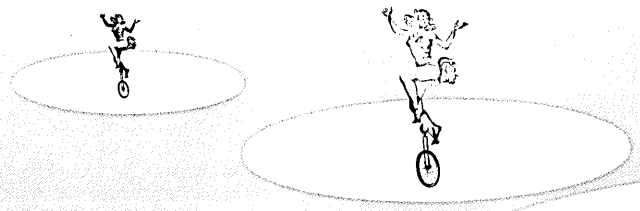
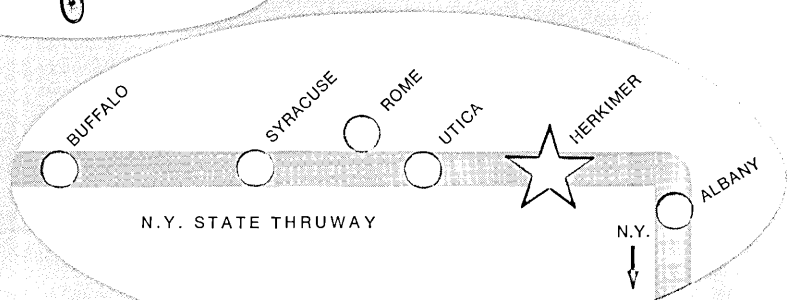
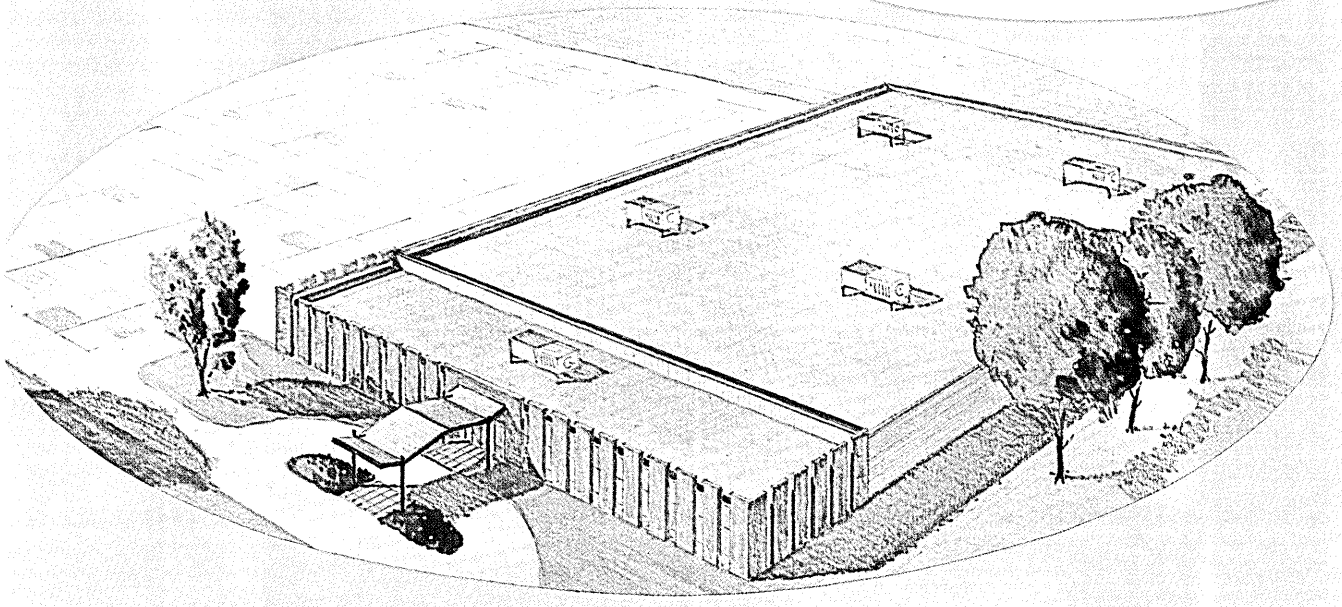




Herkimer is about midway between New York City and Buffalo, on the N.Y. State Thruway. The area is served by Mohawk Airlines, with terminal facilities at Oneida County Airport between Utica and Rome, New York.





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If *this* is the "sticks", we're proud and happy to be here! In fact, we like it so well we've just built a new plant in East Herkimer, within a stone's throw from our original location.

The new building, providing about 75,000 square feet of floor space, houses our production facilities and home offices. These larger quarters already have permitted stepped-up production, to meet the rapidly increasing demand for Mohawk Data-Recorders.

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OCR MARKET, APPLICATION DISCUSSED AT DPMA SHOW

Annual sales of optical character recognition (OCR) systems will grow from a current $35 million to some $500 million by 1971, according to William H. McGuire of Farrington Electronics Inc., one of the makers of OCR gear. Speaking at the annual conference of the Data Processing Management Assn. in Boston, McGuire said these systems range in price from $75K to $150K and lease for $2K to $4.5K per month. "By 1975, OCR will be the most common system for data input."

McGuire categorized these systems as page readers, document readers (for turnaround documents), optical reader card punches (also called self-punches, and used by major oil companies), and journal tape readers (which read primarily numeric information).

An application of page readers by Indiana's Bureau of Motor Vehicles, and the resulting savings in both dollars and cents and diminished turnover rate, were described by R. M. Johanningsmeier. In the one job of processing applications for titles, the Hoosier state figures the cost of preparing input by keypunching was $108,170 a year; this includes the rental of keypunch and verifying gear and 28 operators. It compares with $61,253 a year for the typing and scanning operation, which includes the cost of typewriters and 18 typists and proofreaders. This saving of $47K per year —just for preparing input—is matched by a projected employee turnover rate of 20%, down from the previous 64% with keypunch operators.

Johanningsmeier, however, points out that since this is the only application using the scanner, the one job must absorb the reader's annual cost: about $40K. But there are two other applications, vehicle registration and driver licensing. The savings in preparing input for these two jobs by typing and scanning could be $58K a year, says Mr. J.

Still not figured into this is the cost of reading. To go from cards to tape cost about $5,280 annually in computer time; to read typed pages, it's about $8,400 annually. "If all three applications can be run on prime shift time, the total cost [of the scanner operation] would exceed card reading by about $27,000 annually," he said.

Indiana therefore still figures to be dollars ahead, gaining also in improved employee morale and the diminished employee turnover. As for the scanner's accuracy (it's a Farrington model), "It is currently very near our goal of one-half per cent—varying between 0.46% and 0.63%," he noted.

NYC STORES GET FIRST TICKET RESERVATION SYSTEMS

Gimbels and Alexander's department stores in the metropolitan New York area are taking part in the pilot operation of Ticket Reservation Systems, Inc., to provide reserved seats to public entertainment through a computer-controlled system.

The inquiry/response units at the stores check on availability, then print

the actual ticket on the spot—rather than issuing a receipt that must be exchanged for a ticket at the box office. The information on seats available is stored centrally and immediately updated when a sale is made to avoid duplicate purchases.

TRS plans expansion soon in the New York area and, eventually, to other major U.S. and Canadian cities.

HONEYWELL FIGHTS ENIAC PATENT PAYOFF

From its filing June 26, 1947, the ENIAC patent application went through involved litigation, until its granting in 1964. And now the second phase, the legal battle for the payoff on this effort, has begun. On May 26, patent holder Sperry Rand and Honeywell went to district courts in Washington, D.C., and Minneapolis (respectively) to file suit against one another. The outcome will probably determine how—and perhaps if—the rest of the industry, except IBM, will have to negotiate with Sperry. And the patent's good until 1981.

The Sperry claim, in the name of its subsidiary set up for licensing—Illinois Scientific Developments, Inc., —is simply one of patent infringement. But Honeywell has put together a 10-page suit which, though beginning with technical legal claims against the validity of the patent, homes in on a vital issue of economic legal theory for which there is no clear-cut precedent. This is that Sperry has a favored licensee—and only one licensee, IBM, is reported to date—and together they are exerting monopoly power over a major portion of the edp industry.

"Notwithstanding the fraudulent procurement of the ENIAC patent, the dominant exclusionary power which it represents coupled with the defendant's refusal to license others at reasonable, nondiscriminatory rates constitues a violation of Section 2 of the Sherman Act . . . "

Honeywell says that Sperry has demanded about $20 million for a license (2% of Honeywell's $1 billion in equipment shipped to date), and claims that the patent misuse has caused Honeywell "loss, injury, and damage to its business and property" at least equal to that, and more loss "is threatened." Honeywell asks that the patent be declared unenforceable, and that it be awarded treble damages totaling $60 million, "arising from defendant's anti-trust violations."

While patent law does not have a compulsory license requirement or demand that the holder grant equivalent licenses to all, the court, says one patent expert, once persuaded of the the public implications of the patent, might consider the "unusual legal theory" put forth by Honeywell's anti-trust claims.

The issue of licensing negotiation often boils down to the strength of the opposing firm's bargaining powers due to the patents it holds. IBM has unimpeachable patent strength and its 1965 agreement with Sperry involved cross-licensing and, reportedly, a relatively nominal fee. RCA, which has been in negotiation with Sperry, may hold a good position due to its core patents. Honeywell, a money-maker in the industry, does have some patents: for example, in parallel processing, checking controls, and magnetic reading heads. Some of the comparatively new firms may not have significant patents to their credit and

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CIRCLE 37 ON READER CARD

could face encumbering royalty agreements on revenue with Sperry with resulting problems in competing. (Observers note that Sperry would no doubt be cautious about this, although the patent does run 'til '81.) Thus the anti-trust department, already interested in the computer industry, could take a special look at the Honeywell allegation and the possible implications of the suit's outcome.

On the validity of the patent, Honeywell claims that the ENIAC was in public use more than one year prior to the filing of the application, violating patent law. The courts, says one attorney, are loath to throw out a patent on this ground and the issue has been raised (Bell Telephone vs. Sperry in 1962) and decided in Sperry's favor. (In appeal, the decision was obliterated, but not reversed, simply on the grounds that it should not have been tried in that court.)

The second technical claim, which has a direct lead-in to the anti-trust issue, is that Eckert and Mauchly and their successors, "by, among other things, the suppression of information and lengthy administrative and judicial proceedings calculated to prolong and in fact prolonging" the time the patent remained pending, "wrongfully and fraudulently delayed" the issuance of the patent. As a result, the "limited statutory monopoly" of the ENIAC patent "violates the provisions of Article I, Section 8 of the United States Constitution," and "said ENIAC PATENT, is therefore, unconstitutional, void, and was issued in excess of the jurisdiction of the U.S. patent office."

Under present law, a patent is in effect for 17 years. But this "17-year" law has been a controversial issue, and the patent bill pending before Congress contains a reform which makes a patent valid only for 20 years *from date of application filing*, a ruling which would have voided the ENIAC patent in 1967.

These two latter issues alone, says a patent lawyer, are not enough to rouse the courts, and Honeywell's claim will rise or fall on the anti-trust issue. He notes that Sperry may move that the suit be dropped because there is no cause of action; that is, the court may find that it has no power to help Honeywell under law. On the other hand, the whole issue, and its lack of clear precedent, could lead to many years of battle through district and perhaps the Supreme Court if the suits are not settled out of court. Some observers note that the cost of such court battle could stimulate such a settlement. In any case, the other manufacturers in negotiation with Sperry are not likely to settle before these suits are over.

PLANS SHAPING UP FOR SOFTWARE ASSOCIATION

Two meetings in June, on the 6th and the 20th, have advanced plans for setting up a national association of for-profit software companies.

Representatives of such firms as Applied Data Research, Aries, Comress, Informatics and Planning Research have now agreed on the basic objectives of such a group. The purpose, in general: to reach agreement on what positions to take concerning current issues that affect the business of all potential members. Examples of issues: the patent problem, separate pricing of software and hardware, FCC activities, and the Justice Dept. investigation of the computer industry.

At the June 20 meeting, it was decided to draft a letter for submittal to all potential members. The letter will describe the importance of some half dozen issues, outline the need for concerted action, and solicit active members. Future existence of the organization will depend on the response —and the feeling is that it will take 25 initial member companies to provide adequate financing and get moving. Who's eligible? Almost any software outfit that is solidly in business —has at least 25-35 employees. And judging by recent history, if your company hasn't reached this point yet it probably will next month.

ADAPSO GOES TO COURT OVER SALE OF DP SERVICES BY NATIONAL BANKS

To stop national banks from marketing data processing services, the Assn. of Data Processing Service Organizations, Inc., has filed suit against the U.S. Comptroller of the Currency. The Comptroller's office considers it the most significant litigation pending against it, and ADAPSO intends to carry it right up to the Supreme Court.

"This suit is predicated upon the National Banking Act, which makes it unlawful for a national bank to engage in activities of this kind, which are not incidental to the banking business," said ADAPSO president Salvatore Parisi. The question to be settled is whether dp services are incidental to banking—that is, whether the banks' investment in these services and the public's reliance on them mean that the banks no longer can be divested of this function. Presently, the independent service bureaus do not think so, but if banks continue to develop this area, they say, there will be no turning back.

Independent service firms have increasingly felt a competitive squeeze from banks and other areas, particularly the common carrier. "We are standing on the brink of the checkless and cashless society. Unless controlled by law, a monopoly grant held by national banks and communications carriers and their accompanying financial power threaten to exclude the independent electronic data processing organization from all, or at least the major part of this market," Parisi emphasized.

The income that banks get by offering these dp services is shown by a survey conducted by the American Bankers Assn. in 1966. It revealed the percentage of a bank's gross income accruing from automated services: 8% reported 6-10%; 29%—1-5%; and 55%—less than 1%. For 1970, of 544 banks, 33% estimated it will be more than 10%; 23% estimated 6-10%; and 35% said 1-5%. One specific example of the revenue a large bank is grossing is Pennsylvania Banking and Trust of Philadelphia, which showed that at the end of 1966 its automated services had an "annual value" of about $1 million—a revenue equal to that of a medium-large sized independent service bureau.

An ongoing ADAPSO survey of independent firms (2,000 letters were sent) is showing that two-thirds have revenues of under $300K; one-third of respondents so far are under $100K. (ADAPSO has 243 members. Total number of U.S. data centers, not firms, is estimated at 1,100-1,200.)

In the litigation, which was filed in Minneapolis, Data Systems Inc. of Minneapolis is also suing American Bank and Trust for taking business away from it, specifically services for the State Capitol Credit Union of St. Paul and Carlen Industries Inc. Damages asked are no less than $100K.

Service bureaus have tried before, via legislation, to keep banks out of their market: Rep. Abraham Multer has introduced bills in various forms since 1964, the latest, H.R. 948, to again have hearings before the House Banking and Currency Subcommittee this summer. It is intended to prohibit banks from engaging in professional accounting services, which includes dp services. But a lawsuit seems more logical since it involves an interpretation of an existing law, the National Banking Act. On the chances of the suit, the sources can only point to the court decisions prohibiting banks from extending into the insurance and revenue bond businesses, now in appeal.

It is expected that the case will go before the district court this fall, and if so, should be settled by the end of this year. Appeal is also expected, after which it would go to

news briefs

the Supreme Court, a process which will probably take at least until June 1969.

GE DESCRIBES PROGRESS, PLANS IN PROCESS CONTROL

The broadsides fired by GE and IBM about their respective activities in process control continued this month. In April, GE held a press conference to explain how they were doing. Then IBM sponsored a press tour that showed their installations in action. Now GE has made a presentation on the subject at a meeting of the Society of Security Analysts in Los Angeles.

Several executives, led by Dr. L. T. Rader, vice president and general manager of the Industrial Process Control Div., covered GE's operations in the field. Their main point: if it has any connection at all with process control, our company makes it or does it.

Rader divided the business into four parts: numerical control, instrumentation, process computers, and communications. Each is represented by a department of GE. Together, they are prepared to assemble systems to invade a process control market he estimates at $1.5 billion—both domestic and overseas. Except for steel, aluminum, chemicals, and petroleum, he said, the manufacturing industries are just beginning to wake up to the advantages of computer-based control.

Marketing emphasis, Rader added, will be in the areas GE has traditionally served, such as steel, cement, paper, and electrical power.

R. C. Berendsen, manager of the process computer business section in Phoenix, briefly sketched the history of process control, noted the downfall of some companies once active—such as Philco and Bunker-Ramo—and established the dominance of GE. In passing, he mentioned that recently "new competitors have entered the market—most notably IBM." GE, he said, has 227 computers installed and on order out of a total of 1076. The machines involved are the GE/PAC 4040, 4050-II, 4060, and 4020.

Berendsen cited an example from the steel industry—a case where a process computer controls operations in a hot strip mill: the user reports a production increase of 2%, an increase in acceptable gage steel to 95% from 72-85% under analog control, and a reduction in scrap of 25-50%. In addition to steel and the other basic industries now covered, he intends to invade the newer markets of textiles, transportation, automotive and electronic manufacturing. Further on will be the service industries.

"Effectively," he said, "the market is doubling about every three years or less for a growth rate of over 30% compounded annually."

The general manager of the Specialty Control Dept., Paul D. Ross, discussed numerical control. There are now 9000 installations of numerically controlled machine tools in 2400 plants and the rate of installation has doubled every two years since 1959. Only 4% of U.S. plants, however, are using this equipment. During 1966 20% of the metal-cutting machine tools shipped—in dollar volume—were numerically controlled and Ross predicted this ratio would climb to 35% by 1971 and ultimately reached 50%.

H. D. Kurt, general manager of the Instrument Dept., described, among other instrumentation, the GE-MAC equipment—which stands for GE measurement and control and is the line of products that fits into process control installations He sees an, annual growth rate of 20% for this electronic instrumentation.

The last speaker was R. P. Gifford, general manager of the Communication Products Dept. He said that the company will soon offer a complete line of data sets to get data on and off conventional voice and Teletype communication channels. This department is also involved in data switching collection, and distribution and provides the Datanet-30 stored-program communications processor.

GE is therefore, he concluded, the only company providing all aspects for the industry—"the sensors, the brains, the muscles, and the nerves."

DP GROUP SEEKS INTERGOVERNMENTAL BODY

Work is underway to set up a special new intergovernmental organization which would serve as the focal point of information processing activities affecting federal, state and local governments.

A special task force is investigating the notion, including the potential scope, organization and funding of such an activity. The main goal: to step up communications between levels of government, almost non-existent now. Currently, for instance, the feds ask states for new edp-produced reports without prior consultation . . . which in many cases could have resulted in the development of reports easily spun off from existing files or runs.

Some insiders feel the new organization, involving people and funds from all government levels, would probably have a better chance of success than the one-level Council of

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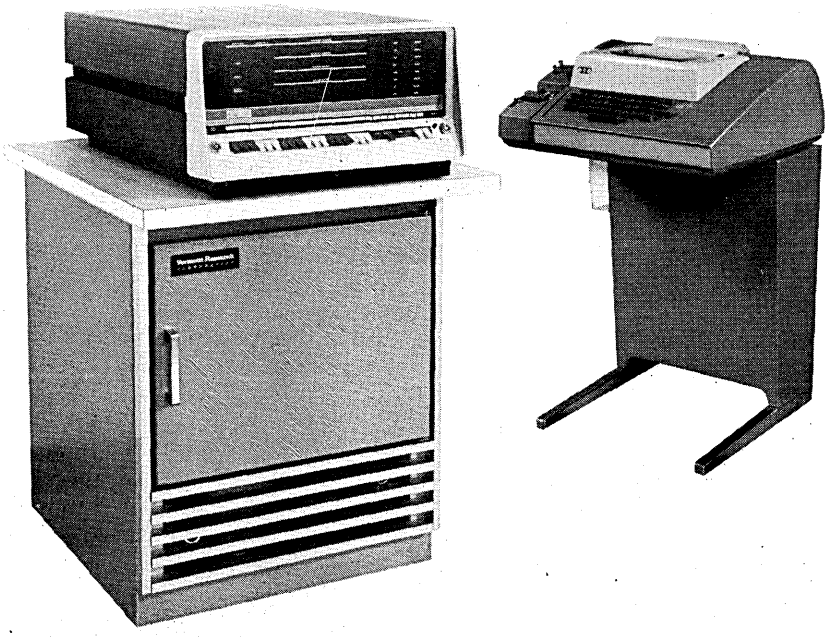
A Page from the Vermont Research MEMORY FACT BOOK

Fact:

$10,000 x 32 = $19,950



If you haven't already done so, buy yourself a PDP-8/S small computer. Cost, $10,000. Then multiply its 4,096-word core memory 32 times by adding a Vermont Research 1104S drum memory system. Cost, $9,950. Result? A remarkably powerful, reliable, versatile computing package. With 135,168-word capacity for programs and data. At the irresistible total cost of $19,950 . . . *including* functional software.

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Three basic 1104s models interface with PDP-8 and 8/S computers using Program Controlled Transfers (I/O channel); Data Channel Transfers (3-cycle data break); and Direct Memory Access Channel (single-cycle data break). All three are furnished with functional software. To help you think big . . . on a small budget.

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CIRCLE 39 ON READER CARD

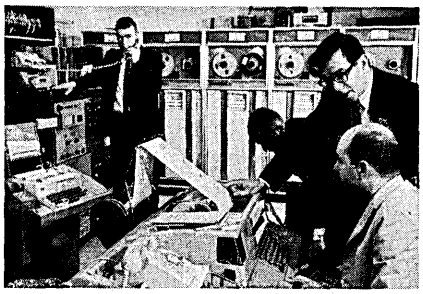
news briefs

State Governors' Committee on Information Systems.

The investigatory task force, headed by Illinois' John A. Kennedy, hopes to deliver a report in September to federal officials and to organizations representing state and local governments.

MEDICAL DATA SENT FROM FRANCE TO U.S. BY SATELLITE

In conjunction with the First Congress on Medical Electronics and Biological Engineering in Tours, France, electrocardiograms taken in France were transmitted via satellite to Washington, D.C., where they were analyzed by computer and the results returned to France within a half minute. Dr. Donald R. Chadwick of the Public



Health Service noted the possibilities of thus linking underdeveloped areas of the world with advanced medical centers. Dr. Chadwick also commented on the contributions to computer/medical systems of Dr. Cesar A. Caceres, chief of the Medical Systems Development Laboratory. The demonstration was a joint project of the laboratory, RCA Communications, Inc., and Computer Instruments Corp.

IBM INSTALLS COMPUTERS ON RESEARCH VESSELS

When the *Thomas Washington* sailed into tropical waters the first of this month, the ship, a research vessel of the Scripps Institution of Oceanography, carried an IBM 1800 computer system on board. It is a first of sorts: IBM claims it is the largest computer installed on a non-government research vessel in the U S. that will permit "near" real-time operation and research by data reduction.

It's not the first computer aboard the *Thomas Washington*. While Scripps was awaiting delivery of the 1800 (on a two-year loan from IBM), they purchased a PDP-8, and carried it on several voyages where it monitored analog signals that determined the depth of the water and changes in air pressure.

The 1800, a tight fit on board, has a 16K main memory (16-bit words), and a cycle time of 2 usec. Additional storage is in two 2311 discs. The system accepts digital and analog input; analog voltage signals may range from 0-5 volts and 0-10 mv. The configuration includes a card reader, plotter, and mag tape units. Special modifications for the sea journey include shock absorbant braces above the units; the entire system is bolted to the floor. In order to service the machine without injury caused by sudden motion, the gates have been designed to lock in an open position.

The cruise now in progress began August 1, and will last for 55 days. It is the second trip in a series of three in a four-year program called Eastropac (Eastern Tropical Pacific). The program is researching meteorological, biological and oceanographic phenomena in the Pacific area 20° above and 20° below the equator. Under the direction of Dr. Bruce Taft, an assistant oceanographer at Scripps who is the chief scientist aboard the *Thomas Washington*, data is being obtained on strength and velocity of currents, oceanic fronts, distribution of plankton and other organic material. Using the computer, for example, in studying water temperature, a senser will be put into the sea and connected by a cable to the computer. Data will be directly fed into the 1800, converted to digital data, and results written out on the printer or plotter. Further study can be attempted almost immediately.

Operating under a time-sharing executive system, the programs for the 1800 will be continually revised in the course of this experimental cruise. Two full-time programmers and a field engineer are members of the 42-man crew.

A few problems with a computer on shipboard, anticipated by the field engineer, are the effect of radio transmission on the computer, the dependence on the ship's own electrical generator, and the protection of mag tape from damp salt air.

In the meantime, another research vessel, the *Thomas G. Thompson* from the Applied Physics Laboratory at the Univ. of Washington, has completed a cruise that carried an IBM 1130 computer system on board. The cruise, studying an area 300 miles off the Washington coast, used the computer to control and track a free-running deep sea research vehicle about the size of a torpedo. The vehicle, equipped with instruments to test salinity, depth and temperature, was connected to the computer by an acoustics link.

Unlike the braced and bolted 1800, for sea travel the small 1130 is mounted in a special van that has its own electrical wiring and air conditioning.

L. A. COUNTY HOSPITAL PLANS INFORMATION SYSTEM

The huge (3000-bed) Los Angeles County General Hospital is planning a hospital information system (HIS?) and expects delivery about the middle of next year of a 128K 360/40, twelve 2260 CRT terminals, thirteen 2740 typewriter terminals, three 2311's, a Datacell, and assorted peripherals—including mark sense equipment. Compilation of a data bank from patient records is now under way and a five-year plan calls for application of the system to admission, laboratory, pharmacy and dietary areas. They are also looking into limited information retrieval uses for statistical reports. The affiliated USC School of Medicine will also have access to the system for pilot medical-problem research.

ARRAY PROCESSORS SEEM TO GAIN IN POPULARITY

The scenic Torrey Pines Inn in San Diego, Calif., was the setting for a recent meeting of computer organization specialists from hardware, software, and component companies. The workshop, jointly sponsored by Rome Air Development Center and the Hughes Aircraft Co. Ground Systems Group, also included participants and observers from several military R&D agencies.

In accomplishing the objective of stimulating the development of new computer organizations which will offer significantly decreased software costs and processing times, the topics ranged from multiprocessor arrays and radically new organizations to system design implications of the LSI technologies. The rise in software costs experienced by most users was attributed to a wide disparity between the computer which the user would like to see and the real hardware. User viewpoints included requests for unstructured (microprogrammable) machines, machine designs for operating system efficiency, and processors for syntax-directed translation.

The potential of LSI was described in presentations on large capacity computer organizations, read-only memories, and multiphase logic. Two papers on microprogrammable machine organizations discussed language processor applications and the use of LSI logic and control memories. The use of associative techniques and content addressed memories in otherwise conventional organizations was de-

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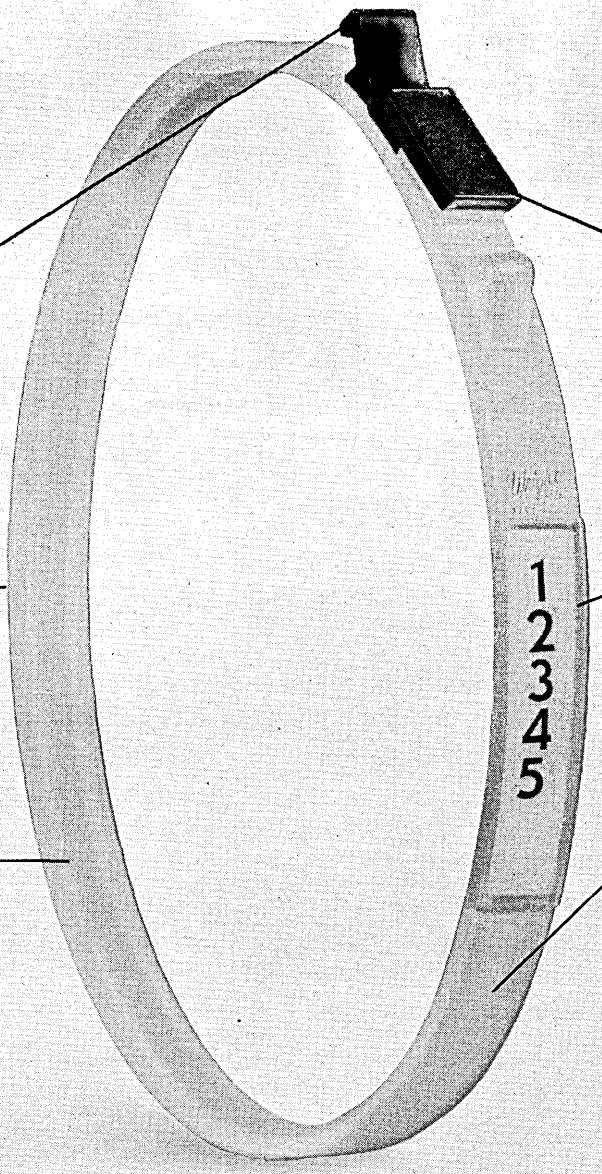

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The TAPE-SEAL System is a complete system including both belts and storage and handling equipment.

There are good reasons for its acceptance by over 1,200 companies.

The TAPE-SEAL System was developed, patented* and is guaranteed by Wright Line, A Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.

*U. S. Patent No. 3310178

CIRCLE 40 ON READER CARD

Wright LINE

DATA PROCESSING ACCESSORIES

scribed by several speakers. And the results of associative memory application to problems of compiling, multiprocessor control functions, and resource allocation were presented and discussed at length.

It was noted that excessive processing time remains a serious limitation in many problem areas even though electronic speeds are approaching speed-of-light restrictions. Because this processing time limitation frequently occurs in problems which are amenable to parallel processing, array processor organizations received particular attention. Variations on control and interprocessor communication were examined in papers on existing and proposed systems. The presentation of papers on the problems and techniques of programming array processors indicated that such systems are no longer just being talked about.

KEYNOTE SPEAKER SEES BIG DESIGN AUTOMATION CHANGES

The keynote speaker at the 1967 Design Automation Workshop held in Los Angeles, C. S. Perry, described the changing operations of his organization at Douglas Aircraft, where he is vice president, information systems subdivision, and predicted the eventual disappearance of conventional engineering drawings as the ultimate design authority.

Perry set up a new information-management organization at Douglas about a year ago as a part of the Missile & Space Systems Division. He has concluded that the "concept of design automation as a process of doing automatically via the computer things that were formerly done manually has been developed about as far as it can be." For the future he sees, instead, a much more radical change made possible by the computer with access to enormous data banks.

For example: "Why does somebody make a blueprint for a bridge?" One reason is to order metal, but the computer can do that without a drawing. Another is for the guidance of those assembling the bridge, but it may be that a printed list of instructions in precise order would be a better way. And if you need a conceptual drawing, the computer can produce a three-dimensional picture more useful for the purpose than a blueprint would be.

Perry noted an indication that things are moving in this direction: engineering drafting used to be a required subject in all technical schools; it no longer is in most schools, but "computer programming has become a requirement."

The big step forward, he said, will be "when the computer simply accepts all the inputs .. and then sits there ready to answer questions, to order parts, to give specifications, to specify voltages, or whatever."

ON-LINE HOSPITAL SYSTEM UNDER DEVELOPMENT

Plans for an on-line hospital information processing service to begin in 1969 have been announced by Travelers Insurance Co. Travelers and a Hartford, Conn. psychiatric hospital, The Institute of Living, have embarked on a two-year research and development program which will first center on business applications and nursing station observation reports for psychiatric hospitals and wards. But it is expected that the system and program development will be highly applicable to other hospitals and thus will lead Travelers into competition with hospital dp services developing, such as GE's Medinet.

Travelers' interest in this area is based on their major involvement in data processing for Medicare and their

experience with their own nationwide computer communications system. The Institute of Living, one of the oldest and best known mental hospitals in the U.S., has pioneered in hospital information processing, now operating an on-line system (IBM 1440 with 1050's and Bunker Ramo crt's) for business applications and nursing notes. The system is also being used in research and behavior analysis. The Institute's Dr. Bernard Glueck, Jr., will head the r & d project, which is supported by $1 million from Travelers. The hospital will transfer its processing to the Univac 494's at Travelers, providing the model in the four development phases of the program: problem definition and identification of system requirements, hardware selection (a large scale t-s facility), design and development of information, and clinical implementation.

IBM CHOSEN FOR 400 OF BARCLAYS' BRANCHES

Giant Barclays Bank of Britain which recently announced selection of Burroughs' B8500 for handling transactions at 1600 branches throughout the country, is going IBM for the 400 branches in the London area.

Two 360/50's at the bank's new computing center will be linked to the branches, which will use the 3940 terminal (also ordered by Lloyds and the National Provincial). The terminal includes a paper-tape reader and 512-character buffer. NCR 3200 accounting machines will be used at the branches to generate paper-tape input.

Two IBM 2702 telecommunications control units will handle on-line operations, each with 15 lines; in effect, up to eight branches can be in communication with the center at the same time on each line because of the terminal buffers.

DUPONT MAGNETIC TAPE OFFERS HIGHER DENSITY

A new type of magnetic tape that has been under test for some time by computer manufacturers was announced last month by DuPont.

To be marketed under the trade name of Crolyn, the tape uses a chromium dioxide coating that is thinner than the usual layer of magnetic material and has very high resolution. Apparently it will be suitable for 1600 bits/inch density using NRZ techniques. Although phase encoding has yielded this density with standard tape, more complex—and expensive—electronics are required, including better quality magnetic heads.

According to *Business Week*, the company expects to market the tape at a 25-50% increase over the cost of conventional computer tape, selling it directly to computer manufacturers.

OUT OF GIS, BY IBM

A spinoff from IBM's GIS file management system, currently under development, is the System 360 Document Processing System, announced to the field in late May. DPS, deliverable in December, takes over unformatted data handling responsibilities, leaving formatted files to GIS, whose availability date won't be announced til April '68. Both require 128K-byte systems (meaning mod 40 users and up) and will operate only under OS 360.

DPS enables the user to enter unformatted text, abstracts, index terms, and associated reference data. From these the system will build dictionary, vocabulary, and master files which can be searched using key word, text position, and reference parameters.

MEDI-DATA FORMED FOR HOSPITAL TIME-SHARING

Four hospitals in North and South Carolina have set up a company called Medi-Data to coordinate time-sharing access to a central computing facility for the group.

The hospitals are Charlotte Memorial, Presbyterian, and Mercy in Char-

lotte, N.C., and Greenville in Greenville, S.C. Medi-Data, headed by John Rankin, who is also director of Charlotte Memorial Hospital, has signed a $12 million contract with the Burroughs Corp. for two B5500's and some 200 crt keyboard/display terminals, to be tied to the center in Charlotte by telephone lines. Principal uses will be for record-keeping and information retrieval for diagnostic departments.

ISRAEL CONTROL SYMPOSIUM WILL BE HELD AS PLANNED

The Israel Committee for Automatic Control has confirmed that the Symposium on Computer Control of Natural Resources and Public Utilities, scheduled for Sept. 11-14, will be held as planned in Technion City, Haifa, Israel. The three-day symposium will include seven sessions and several special tours. Chairman is Dr. Alexander Shani, Elbit Computers Ltd., Haifa.

RURAL ELECTRIC CO-OPS HOLD DP CONFERENCE

Some 90 computer-types, representing rural electric distribution cooperatives in 20 states, gathered recently in Chicago for the third annual dp and automation conference. It was the largest turnout yet for the meeting, sponsored by the 980-member National Rural Electric Cooperative Assn., Washington, D.C.

Session topics ranged from practical applications to guidelines to management planning for total information systems. But the attendees also received the latest word on communications by wire and microwave, remote meter reading, and process control. They also saw demonstrations by GE, IBM, and NCR.

The rural, consumer-owned electric firms are small. They average 3.5 consumers per mile of line, compared with 33 for private power firms. Thus their interest is in shared dp centers, a few of which already exist.

COMPUTER WORKSHOP FOR CIVIL ENGINEERS AT PURDUE

The sixth Computer Workshop for Civil Engineers, planned for practicing civil engineers without computer experience, is scheduled at Purdue Univ. Oct. 23-25.

The program, supported by the Indiana section of the American Society of Civil Engineers, introduces the engineer to digital computers, programming, and the applications to civil engineering work. This year the workshop will emphasize application of computers to engineering design problems.

The chairman is Prof. Albert D. M. Lewis of Purdue's School of Civil Engineering.

XEROX OFFERS RESEARCH DATA RETRIEVAL SERVICE

Xerox will offer a new retrieval service called DATRIX through Univer-

USASCII spoken here.

Now there's a terminal that can speak to any computer: the new 7100 Conversational Mode Terminal by Friden.

The 7100 makes talking to a computer as easy as typing. Look at the keyboard. Just like the electric typewriters in your office.

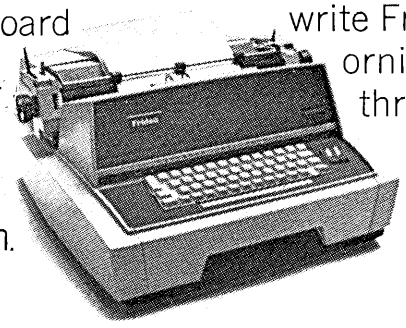
But with one important addition. The USASCII code!

With the 7100, you can write your own computer programs to help you solve complicated problems. And the 7100 will print out your program for later use—saving valuable computer storage.

The 7100 is the only USASCII terminal with upper and lower case. The only USASCII terminal with a full 128 character keyboard. The only terminal with a 13" writing line. And the only terminal that will reproduce a facsimile of all USASCII codes (except space and carriage return).

The 7100 even has a color shift. When you talk to the computer, it prints in red. When the computer talks to you, it prints in black.

Because of its familiar keyboard and USASCII code capability, the 7100 brings unmatched ease and efficiency to time-sharing, on-line programming, information retrieval, and documentation.



For more information about the remarkable new 7100 Conversational Mode Terminal, call your nearest Friden office. Or write Friden, Inc., San Leandro, California 94577. Sales and service throughout the world.

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CIRCLE 42 ON READER CARD

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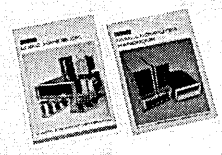

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sity Microfilms, designed to give quick access to a microfilmed library of some 126,000 doctoral dissertations.

The computer-based system uses a key-word list, divided into academic fields, that allows the researcher to formulate his own inquiry. The three fields to be covered are chemistry/life sciences, engineering/physical sciences, and humanities/social sciences.

Inquires are mailed in, with a $5 charge for processing. This fee includes the first ten references; succeeding ones cost 10 cents apiece.

Computer printout is copied and reduced to standard-size forms by the new Xerox 2400-IV. Copies of complete dissertations can also be ordered, either as hard copy or on 35mm microfilm.

RCA PULLS OFF $9 MILLION BANK JOB

RCA captured its largest bank contract for the Spectra 70 when Marine Midland Corp. signed for $9 million in model 35 and 45 systems. In a bid and selection process that took five months, Marine, with the aid of SCERT (Comress' computer evaluation system), gave the nod to RCA over Burroughs, IBM, GE and Univac. The award signals the beginning of a network which will link the firm's three national, eight state, and 209 branch banks throughout New York State.

The initial contract includes nine systems, with two 45's and one 35 going into each of three regional centers, in Buffalo, Syracuse, and New York. (Two of five present centers will be closed.) The Spectra's will handle the bank's internal functions, including a new central information file on more than one million customers and its credit card operation (now being offered to franchise banks), as well as outside services to business. Each center will process up to 9,000 inquiries per hour. Random access storage will be on discs and Race files, totalling "several hundred million characters." Yet to be selected are communications concentrators and a variety of inquiry devices—crts, voice response units, and teletypewriters. New teller terminals (some are used now) are not yet planned. The first 45 goes in this fall, but no schedule has been set for completion of installations. To be replaced are 10 GE 210's, three IBM 1401's, two GE 415's. Marine will maintain its four Univac 1004's and a 1005.

CHICAGO IS SITE OF FIRST ANNUAL IEEE COMPUTER MEET

The first annual IEEE Computer Conference is scheduled for Sept. 6-8 at the Edgewater Beach Hotel in Chicago. It's being sponsored by the IEEE Computer Group, in cooperation with Northwestern Univ. and the Chicago IEEE chapter.

The chairman, Prof. S. S. Yau of Northwestern, notes that the conference will focus on a limited number of significant themes, offering more thorough coverage than that typical of larger gatherings. Thirty-eight research papers will be presented, plus a tutorial session on computer system design automation. The 38 papers are grouped into 10 technical sessions, but all papers fall into the categories of reliability, design automation, pattern recognition, or new computer elements and new computer system organization. Two panel discussions are also planned: the role of electrical engineers in computer science, and computer science in electrical engineering curricula. B. O. Evans, president of IBM's Federal Systems Div., will be a luncheon speaker.

Conference fees are $15 for IEEE members, $25 for others until Aug. 24—when they go up $5. A $10 rebate will be made to nonmembers who join by Sept. 8.

● A computerized inter-railroad service being planned by the Association of American Railroads promises to be one important solution to the car location problem involving the nation's 1.8 million freight cars. While many individual roads have or are developing their own car location systems for cars on their tracks, all are faced with the problem of finding cars on other roads which will fill shortages. This is a service AAR's Car Services Div. has performed manually, but not with the timeliness and accuracy promised with its planned TeleRail Automated Information Network, to be centered in Washington, D. C.

TRAIN, which will be operated by a new unnamed department headed by AAR's Data Systems director Carl Byham, will use a yet undetermined computer for daily input—both on and off-line—of location data from each railroad. Railroads with a car shortage will call the AAR services group which will be supplied with periodic and on-demand reports of car locations.

● The Society for Information Display has put out a call for papers for its 9th annual symposium, which will be held in Los Angeles, Calif., on May 22-24, 1968. Deadline for 500-word abstracts is Nov. 3, 1967. Papers are requested in the areas of medical, military, educational, entertainment, and civil display techniques and/or systems. Send abstracts to Erwin Ulbrich, 309 Elden Ave., Whittier, Calif. 90602.

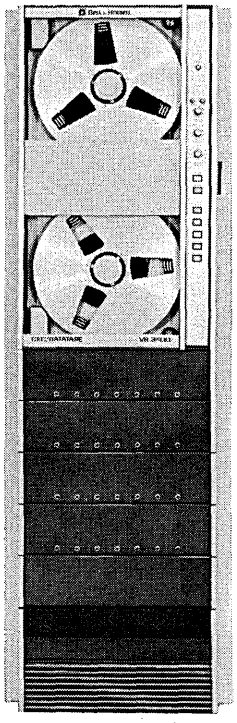
● GE has found a use for thermoplastic recording techniques in an airborne recorder-display system developed for the Air Force by the GE Electronics Laboratory in Syracuse, N.Y., under the sponsorship of the AF Avionics Laboratory. The unit records radar, infrared, and electro-optical information in strip map form and, a few milliseconds later, projects it for in-flight display. The tapes produced can be viewed later at ground stations for post-flight evaluation. Information density on the recording is 1700 lines/inch and a 5000-line image is projected on the screen. Formal acceptance flight tests have now been completed successfully.

● A survey of software systems for handling information retrieval and data management applications is being conducted by the NBS Center for Computer Sciences and Technology. Purpose of the survey is both to acquire information for the center's use and to arrange dissemination to the technical community. Organizations having such software are asked to send descriptive information to A. Severo, Systems Research and Development Division, Center for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

● In continuing efforts to aid the trucking industry, a new suggestion, this time from Honeywell, was presented to the members of the American Truckers' Assn. at their recent show in San Francisco. Using CRT displays at remote terminals, the Honeywell concept demonstrated how a clerk or dispatcher could query a central computer for information on lost shipments or ratings. The software for the tracing system, which would run on a Series 200 configuration, has not yet been completed, but Honeywell has developed a rating system which is currently in the testing phase.

● A six-state system to pin-point arrivals and departures of automobile shipments en route to dealer showrooms has been installed by Motor Convoy Trucking Co., of Hapeville, Georgia. Based around an 8K, 3-tape Honeywell 120 computer in Hapeville, the system connects to terminals in North and South Carolina, Tennessee, Florida and Alabama. Each data station has a reader/punch, page printer and an off-line Teletype; they each

If suddenly you're unhappy with your present recorder...



blame CEC's new VR-3400.

For the VR-3400 was created for malcontents—people who have wanted an advanced laboratory recorder at a budget price. Fact is, the full-ranged VR-3400 costs little more than some conventional portables.

There are a few "laboratory" recorders presently available in its price range. But there are none which offer all, or even most, of its advantages. Namely...

- **Magnetic recording heads guaranteed to exceed 1000 hours.** CEC's unique, solid metal pole-tip design has eliminated the inherent deficiencies of lamination and rotary head design.
- **Failsafe DC Capstan Drive** assures dramatically-improved flutter and TDE performance.
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- **Convertible from mid to wideband recording.** New plug-in heads offer easy interchange of headstacks up to 42-channel capacity.

Obviously, we're rather impressed with the new VR-3400. We believe you will be too.

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CIRCLE 44 ON READER CARD

transmit twice daily to the central computer.

Motor Convoy's 120, which is handling payroll and general accounting as well as automobile distribution, replaces an IBM 1401 card system.

● L. E. Johnson, known as one of the industry's most dynamic and agressive salesmen, has resigned from the vice presidency of marketing and systems engineering of Univac. Johnson, in his 12-year tenure with the firm, was involved in obtaining virtually all Univac's airline contracts and many of its biggest government contracts. These include the $39 million United Airlines system for a three-cpu 1108 system and 2,000 terminals, the 160-system Air Force Base Level Supply contract for $52 million, and NASA's $30-million award for five 1108 II's for the Huntsville and Michoud-Slidell facilities. It was this April that Johnson assumed his most recent position when Univac consolidated Federal Government Marketing (for which Johnson was vp) and the Defense Systems Division into the Federal Systems Division under vp and general manager G.G. Probst. It is not planned that anyone will replace him, and his future plans have not yet been disclosed.

Other positions Johnson held were national account representative and director of airline marketing, and Univac 490 and large-scale systems manager.

● To simplify computer processing of the 1960 1/1000 Census tapes, Brown University Computer Laboratory is recording the original tapes and preparing programs for retrieving information. Instead of the four regional groupings of the originals, Brown has divided the data into 10 national subsamples, arranged on five tapes. Special routines for cross tabulations and their processing are also available. Cost of the tapes is $750. For information, write Prof. James M. Sakoda, Sociology Computer Laboratory, Brown Univ., Providence, R.I.

● The Air Force Electronic Systems Command has chosen Univac to supply replacement equipment for the Air Weather Service of the Military Airlift Command at Offut Air Force Base, Nebraska. Four interconnected 1108's will be used, replacing two 7094's, two 1401's, and an ITT ADX 7300. The schedule calls for the first machine to be operational in January, 1968, with the next three phased in for completion of the order in August. The equipment is worth about $14 million. Contracted lease price for FY 1968 is $1.1 million and it is expected that purchase will be arranged in the following fiscal year.

● A contract for over $5 million to be used in man/computer system research has been awarded to the Univ. of Utah by the Advanced Research Projects Agency. The three-year contract covers primary research in information processing techniques and their application to system design. The university will also establish a graphics laboratory. The program will be headed by Dr. David C. Evans.

● Completion of a new language, DIALOG, for information retrieval has been announced by Lockheed Missiles & Space Co. It's now is use at NASA's Ames Research Center, where a terminal is linked to Lockheed's Palo Alto, Calif., computer center. A data base of 330K document references can be queried through the CRT/keyboard/printer unit. Typing in key words results in a display of related references. The user can continue refining his commands to subdivide the information and allow browsing through the files.

● The Air Force has awarded an eight-month study contract to System Development Corp. to develop a formal specification for a higher order programming language and compiler suitable for use by spaceborne computers. Machine language is now generally used. First specifications of the new language will be distributed to those concerned with the field for review and their suggestions for changes will be analyzed for contributions to be included in the final version.

● Auerbach Corp. has completed design of an on-line computational system for Lincoln Laboratory's IBM 360/67 time-sharing system. Reckoner, it is claimed, will permit technical persons with no programming experience to do mathematical calculations on the large-scale system. Main characteristics are: a "simple operation-oriented language," automatic data storage and retrieval services, a typewriter console, and a CRT with storage, allowing the user to view his procedures and build upon them before transmission to the computer. Auerbach is now negotiating with the Lab for the implementation phase.

short lines . . .

Honeywell, which previously had allowed users with 3-, 4-, and 5-year lease contracts to take the investment tax credits on dp gear, announces that it will now "pass through" these credits only to 5-year lessees. They say that 70% of their Series 200 leases are for five years . . . The Sylvania Electric Products subsidiary of GT&E has acquired Ultronic Systems Corp., Pennsauken, N.J. The move has been approved by stockholders of Ultronics and the board of GT&E . . . The number of phototypesetting units installed around the world now exceed 2,000, says Composition Information Services, Los Angeles. This figure will more than double in the next two years . . . Dr. A.S. Hoagland of IBM has been named general chairman of the '68 Spring Joint Computer Conference, which will be held in Atlantic City from April 30 to May 2, 1968 . . . The Autonetics Div. of North American Aviation has received a $115K contract from the FBI to develop an automated fingerprint-reading system. Cornell Aeronautical Labs has received a similar study contract for an engineering model . . . Fellow aerospace firm Lockheed Missiles & Space has received a follow-on $17K award for the first major implementation phase in a statewide information systems project from Alaska. The money covers the first of a 5-year job . . . System Development Corp. has received a 2-year $2,685,000 contract to develop an on-line system for the DOD's Advanced Research Projects Agency. It will consist of a "professional programmer's package" for the 360/50H, a time-shared executive, and a data management system.

An order for 35 optical readers has been placed by the Army with Optical Scanning Corp., Newton, Pa. The $759K contract calls for the model 100 DB scanner, to be used for scoring test forms . . . A 131K Univac 1108 has been phased in at the Richland, Wash., facility of Computer Sciences Corp. Scheduled to be operational this fall is a CSC-developed time-sharing software for the 1108, which reportedly serves more than 150 clients through a remote computing network . . . Control Data, too, is offering time-sharing services through its New York data center, where a 3600 has been residing for the last two years. Although remote terminals are being used, the data is pre-processed at the customer's site before being transmitted to the center . . . Argonne National Laboratory has acquired a 360/75, which joins a mod 50 . . . Wolf Research & Development has formed a Computer Graphics Dept. within its Boston Div.

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1. **If you are an executive,** you'll receive fast answers to your information needs because your Burroughs computer won't be tied to an inflexible schedule.

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CIRCLE 45 ON READER CARD

washington report

CAPITOL PUNDITS FAVOR BURROUGHS

Burroughs is likeliest to win the second round of the Air Force Phase II contract, says a knowledgeable source, even though Honeywell's benchmark time was less. IBM "has shot its wad," he says. Honeywell's big handicap is its six-bit CPU. Allegedly, RCA and Burroughs did about as well on the benchmark, but the 2503 wasn't fully tuned up. It should run much faster when the rerun takes place, we are told.

BIG TAPE PURCHASE IS GSA PLAN

GSA plans to fill government-wide mag tape needs by negotiating a single contract, if the right price is obtainable, GSA's H. A. Abersfeller told the Brooks subcommittee last month. Also: dp procurements over a given dollar amount will be negotiated outside the FSS schedule, to encourage greater discounts. GSA will use its control over space assignments in federal office buildings to increase joint use of dp gear; some contractors are already in the sharing program, and more are likely to be. GSA probably will put $300K into the Dove data-storage system.

DATA TRANSMISSION PRICE CUTS DUE

AT&T is likely to offer dial-up users a reduced nighttime data transmission rate within the next few months. It would help implement FCC's rate of return decision. IBM is reportedly pushing reduced rates, probably to set the stage for an increase in graveyard shift equipment rentals.

Before the end of this month COMSAT plans to file a tariff for 48 kc (12-channel) transatlantic data transmission service by satellite. Big question is whether hourly, as well as full period service, will be offered. Rates would be 40-50% below comparable existing charges. Record carriers are agreeable, largely because their customers -- particularly DOD -- are insistent.

THREE-YEAR STUDY OF COPYRIGHTS, COMPUTERS

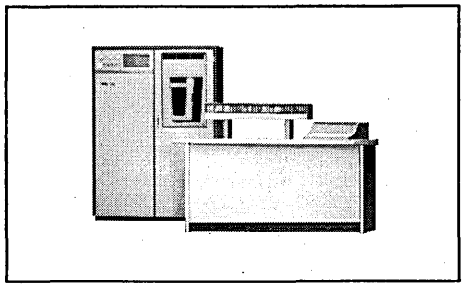
The Library of Congress has drafted a bill to set up a legislative commission which would study copyright/computer problems and report in three years. The idea has broad support in Congress, but copyright owners and users are arguing about whether the study commission should be set up before or after a copyright bill is enacted.

CAPITOL BRIEFS

At press time, the U.S. Office of Education was on the verge of appointing the National Association of Trade and Technical Schools, and an affiliate of the United Business Schools of America, as accrediting agencies for dp training schools. ... Senator Ted Kennedy's inter-governmental data bank bill has been reintroduced. ... American Bar Association members are drafting an amendment to section 106 of the pending patent bill; the amendment would allow computer programs to be patented. ... Univac has loaned Grace Hopper to the Navy; she'll direct a Cobol standardization project. ... GSA expects to establish a service bureau in Huntsville around the first of the year, financed by the new adp revolving fund. Consulting as well as dp service will be offered. The nucleus will be two 7094's soon to be displaced at NASA by an 1108 system. An outside contractor may be hired to run the bureau. ... An expert source indicates there will be no substantive change in Circular A-76; i.e., the 10% rule will be retained.

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. Hardware program protection 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 (83 million characters per unit). Add CRT units for a more powerful 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.



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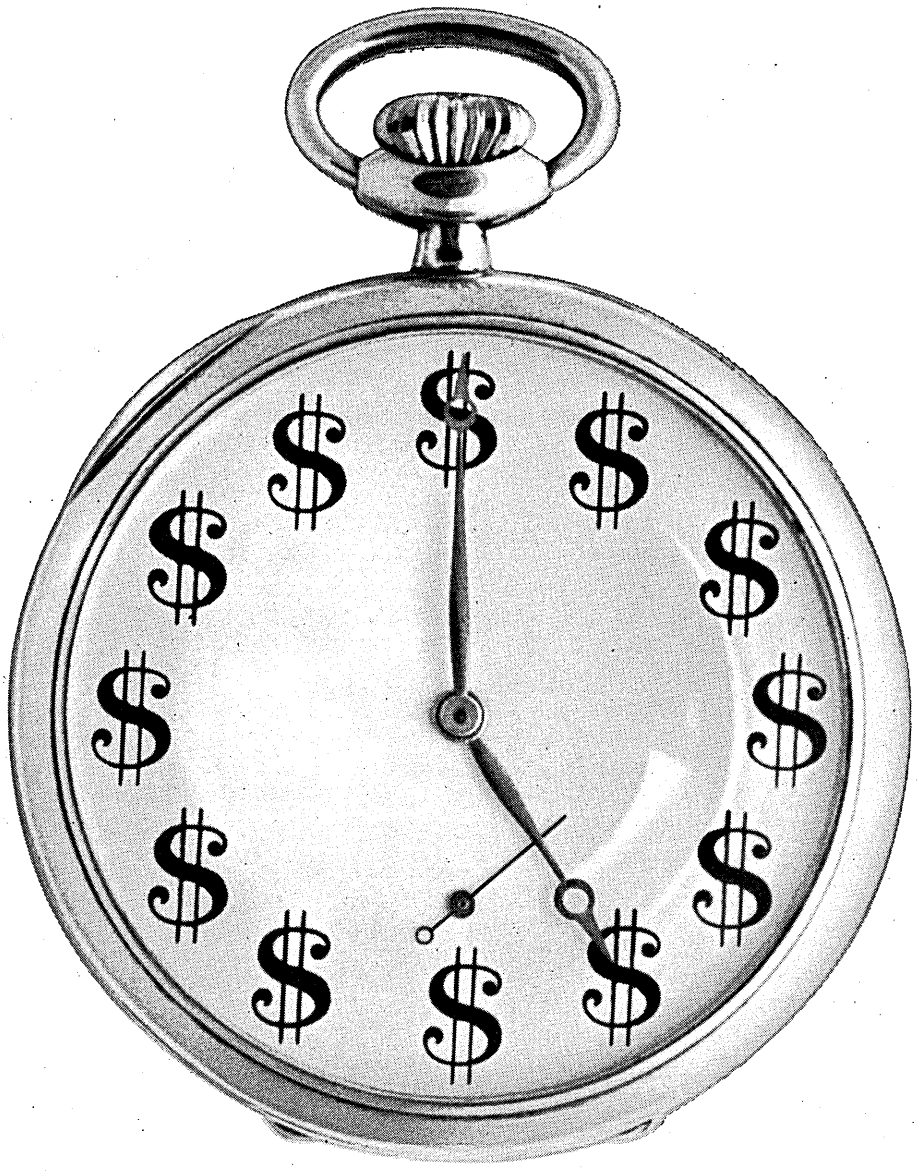


CIRCLE 58 ON READER CARD

world report

DENMARK WILL OFFER TIME-SHARING HARDWARE

The dark horse to watch for in Europe is Denmark's Regnecentralen, headed by Niels Bech. In the next two months this Copenhagen-based organisation will announce a medium sized time-sharing system (about 50 terminals) to add to its Gier range of hardware. By conventional industry standards Regnecentralen is a unique operation. Backed by Denmark's top 40 industrial corporations, the outfit is now 450 engineers and computer professionals strong. It ploughs a lone furrow which calls for minimal sales overhead. One disdainful competitor quipped: "They don't call you; you call them." Bech's views on the market are near devastating. Like, dealing in a specialist market keeps you one jump ahead of the general purposeness of the big manufacturers who pander to the common taste; eastern bloc countries can teach the west a thing or two on software development because they are basically impoverished nations when it comes to hardware -- so their software has got to be good. Regnecentralen has acted on its beliefs by drawing on east-bloc manpower for software development. In this way, Bech may have started a new trend in east-west computer relationships. For some time teams from math and science institutes in Russia and Soviet satellites have touted round France, Britain and Scandinavia making overtures on software collaboration.

SOVIETS SHOW LASER LOGIC UNITS

The Soviets are also making advances in the hardware labs. Last month (July) a group of science journalists from British newspapers were shown laser logic units under development at the Lebedev Institute, Moscow. The Russian scientists made it clear that they hoped to leap-frog a technology with laser devices. The laser work is directed by Academician Basov, a 1964 Nobel prizewinner for contribution to semi-conductor laser research. The developer of the new laser logic blocks is Dr. V. Nikitin. He claims 0.1 microsecs switching time for circuits and 10 microsecs for a short term store. The Lebedev team is investigating problems of heat dissipation in order to get a longer store time. He says commercial exploitation is impracticable until the heat problem is licked.

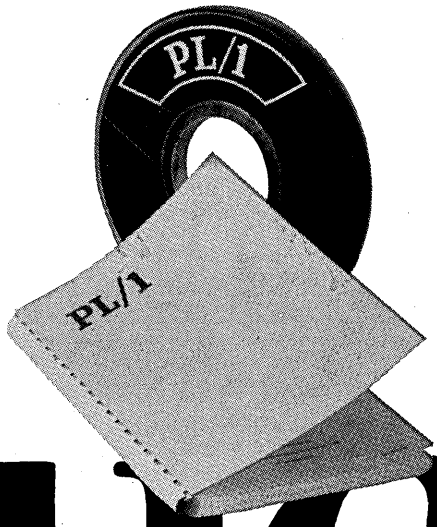
ANGLO-FRENCH JOINT EFFORTS WARMING AGAIN

Talks took place in July between the Automation Group of Plessey (UK) and CAE (France), thus renewing hopes for Anglo-French collaboration. Chances of a full partnership are slim, but Plessey has brought in some peripheral ideas that interest the French. Their latest device is an incremental tape recorder, the ID33, which dispenses with motors for driving the reels. The tape is moved by a vibrating reed. A series of recorders has been developed on this principle, starting at $2,800. It writes seven to nine tracks (industry compatible) at 200 to 556 bpi.

FRENCH FIRM HAS NEW MACHINE

The French company with which Plessey is negotiating, CAE, is participating in the national Plan Calcul. The firm has produced the first specs of a new machine

(Continued on page 93)



Ouch.

When you start tackling problems everybody else is trying hard to avoid, you're very likely to take a pratfall. We did. (Your kind reference is directed to the past tense.) A quick look at the facts shows that Digitek is a long way from abdicating its position as the world's leading compiler manufacturer. Let's look at our six years experience which makes us a gray beard in the software industry. Let's look at 31 compilers (12 in the last year alone) delivered and operating. Perfectly. Let's look at a FORTRAN IV (IBM 360 H Level compatible) with only 3875 words of instructions, constants and I/O buffers. Add full in-line assembly and assembly language listing of compiled code and you still have only 5202. An ASA BASIC FORTRAN in three months? That's a weekend job at Digitek. More in keeping with the state of the art is a stand alone FORTRAN IV on a CDC 3200 compiling to an IBM 7090 with a compact monitor, library and loader. All new. All in three months.

How are things going? Obviously, very well, thank you. And about that pratfall. It only hurts when we laugh.

DIGITEK

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CIRCLE 47 ON READER CARD

(Continued from page 91)

to be marketed through the recently formed CII, Compagnie Internationale pour l'Informatique, and labeled CAE 10070. Up to six processors are stacked around a central store of 524,000 eight bit bytes. One processor acts as the scheduler with an access time of 700 nanoseconds. The peripheral processors have access times of 60 nanoseconds. An I/O controller provides links through 240 channels to peripherals and up to 32 peripheral stores of 250,000 bytes.

CERN WILL NEED SUPERCOMPUTER

Product planners who like to get advanced warnings may be interested to learn that the Geneva-based International Nuclear Research Agency, CERN, has future requirements for something up to 20 times bigger than the 6600. With its comparatively modest existing facilities (compared with a proposed 300GeV accelerator ring 2.5 miles in diameter) CERN already operates a CDC 6600 and 3800, IBM 7090 and 1800, and SDS 920 as well as a host of smaller brethren for local control of experiments.

CAMBRIDGE INCREASES EFFORTS IN COMPUTER-AIDED DESIGN

Computer-aided design came back into the news in the UK with the Ministry of Technology's decision to set up a new centre at Cambridge University with a multimillion-dollar ICT Atlas that has lain (somewhat embarrassingly) in storage for two years. A special committee has been formed to coordinate computer-aided design studies. The chairman is Mr. F. D. Penny, director of the National Engineering Laboratory, East Kilbride, Scotland. The laboratory already has a design project under way on a Univac 1108. Direct communication links are being put in to another team at Imperial College, London, studying computer-aided ship design.

HERE AND THERE

An optical scanner/sorter capable of reading hand-written digits has been developed by Toshiba (Tokyo Shibaura Electric Co., Ltd.). The reader-sorter, dubbed the TR-2, was developed for the Japanese Government's Ministry of Postal Services and can handle more than five letters per second with a reported accuracy of 95%. ... English Electric is spending more than $3 million on its own computer-aided design project, using a System 4-75 and a Marconi Myriad 11. These will be hooked to an existing KDF9 and Saturn analogue system. ... Nippon Electric Co. has sent a sample computer to Australia for evaluation -- a NEAC 2200 Model 50, the only Japanese-developed machine from the company. Plans call for export to the U.S., Canada, Europe, and other overseas markets if negotiations between NEC and Honeywell, which licenses the Japanese company, are successful. It's a small business unit, with 4-16K core, 2 usec cycle time, complete with peripherals including disc pack. A typical system will cost about $2000/month. ... The Marconi Company (part of the English Electric group) has a range of crt and light pen displays. The tubes range from 8.5 inches to 24 inches in diameter. ... Replying to the UK Post Office decision to go into the service bureau business, ICT and English Electric Computer service subsidiaries have unveiled plans for establishing more centres. Both time-sharing and remote batch.

KEYED TO KEEP PRODUCTION ON SCHEDULE

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

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

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

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

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

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

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

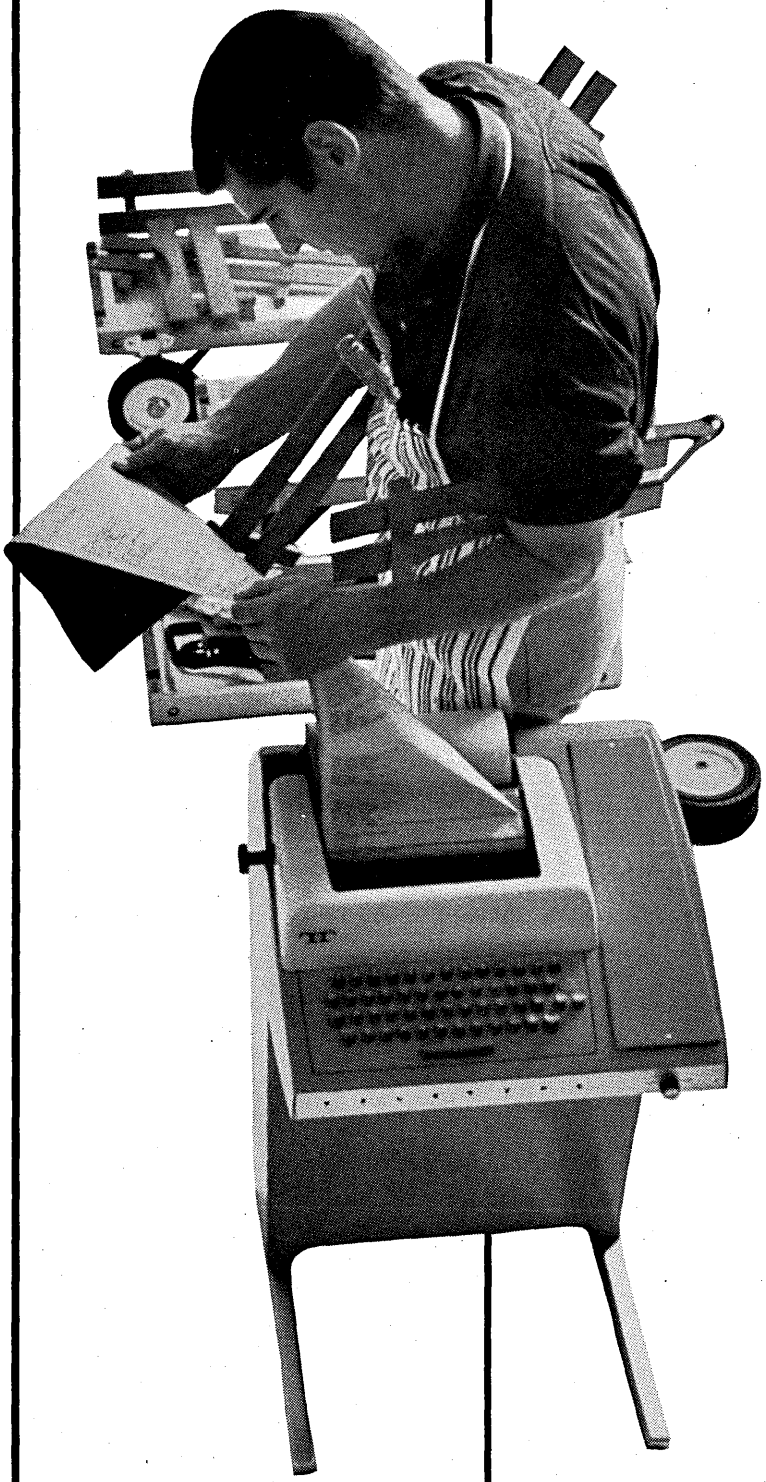
A leading oil refinery has a digital data control system in its Texas facilities that includes Teletype equipment. Because of this system, the demand logging of the current plant status is available and up-to-date at all times.

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

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

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

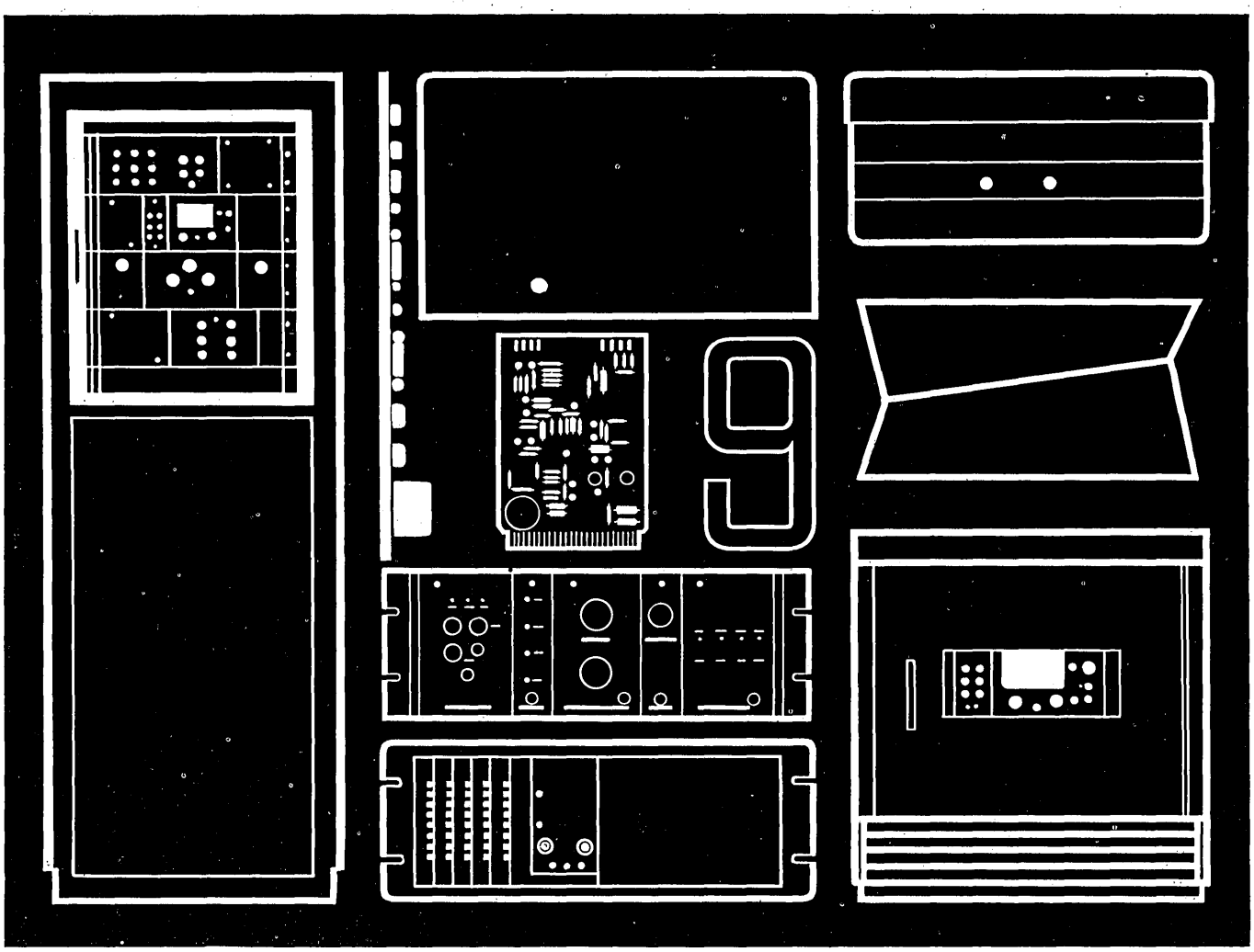
TELETYPE ®



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

machines that make data move

CIRCLE 48 ON READER CARD



three modulation schemes nine modems a million applications

A million applications don't even exist yet. But the data communications applications you do have or are planning you can probably fill with one of Rixon's nine data set models.

You can choose data transmission speeds from 150 to 4800 bits per second. Three different modulation schemes are employed so the modem can be matched to your system. Modular construction of many models permits special control functions and a built-in diagnostic capability to be easily incorporated.

These sets can help you move data faster. Or help you lower costs. Sometimes do both at the same time. One model is ideal for switched communication circuits and systems where stations are polled for data. Another features simultaneous transmission of two independent channels of data over a single circuit.

We've published a bulletin that outlines some typical Rixon modem applications and the economies the users enjoy. Specifications of the nine models are also included. May we send you a copy.

RIXON ELECTRONICS, INC.

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CIRCLE 49 ON READER CARD

new products

time-sharing system

The GE-420 system consists of a 32K 415 processor (1.5 usec access time), a 16K Datanet 30 communications processor, which reportedly relieves the CPU of its communications and servicing overhead, and a disc storage unit. This means current 415 users can upgrade to a 420 t-s system, which is to be followed by larger and compatible models. (There reportedly are about 500 GE-400 users worldwide, but it was announced that GE service bureaus will build their business around the older 265 system.)

The only terminals being used with the 420 are Teletypes. Other peripherals needed are a card reader/punch and a printer. The system is capable of handling up to 30 users at one time, and allows two programs to reside in core.

Software includes Extended BASIC, currently available, and FORTRAN, which is scheduled for release by the first quarter of '68. The 420 leases for $17K per month and sells for $760K. First deliveries are scheduled for the last quarter of '67. GENERAL ELECTRIC INFORMATION SYSTEMS, Phoenix, Ariz. For information:

CIRCLE 100 ON READER CARD

data cell storage

The Susan is a data cell storage and handling device, based on the "lazy Susan" concept. It can accommodate 10 cells in an upright position. If required, the Susan may be stabilized and locked off center, making it impossible to remove the data cells.

The Susans may be housed in Model 5579 Storaways, cabinets available with or without doors. TAB PRODUCTS CO., San Francisco, Calif. For information:

CIRCLE 101 ON READER CARD

data control unit

Digi-Point data control units accept BCD pulse outputs from digital counters and convert them to punch control functions. When added to a system, the units allow on-line recording of data on punched cards or tape. There are currently models for use with punches by IBM, Friden, Tally and Teletype. JANUS CONTROL CORP., DIV. OF TYCO LABORATORIES, INC., Waltham, Mass. For information:

CIRCLE 102 ON READER CARD

system/360 conversion

ACCAP (Autocoder to COBOL Conversion-Aid Program) will translate many Autocoder programs written for the 1400 series and 7010 systems into System/360 COBOL. ACCAP analyzes each Autocoder or SPS statement to determine if there is a compatible 360 COBOL statement. If there is, the statement is translated. If compatibility is questionable, the statement is translated, but flagged for review and possible modification by the programmer. Statements which the program cannot convert are also flagged.

Resulting programs can be run under control of OS/360, or DOS/360. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 103 ON READER CARD

tape station

Included in a tape processor station are a punched code registration gauge, a punched tape splicer, a manual tape punch and two manual winders. The processor can handle 5-, 6-, 7- or 8-channel tape. Optional equipment are attachments for Teletype and for NAB hub and reels. DATA-LINK CORP., Los Altos, Calif. For information:

CIRCLE 104 ON READER CARD

portable terminal

The Mauchly-Dataport is a portable terminal packaged in two luggage-like containers weighing 66 lbs. total. The 110-bps transmission system contains a PC-1 control module, a

PRODUCT OF THE MONTH

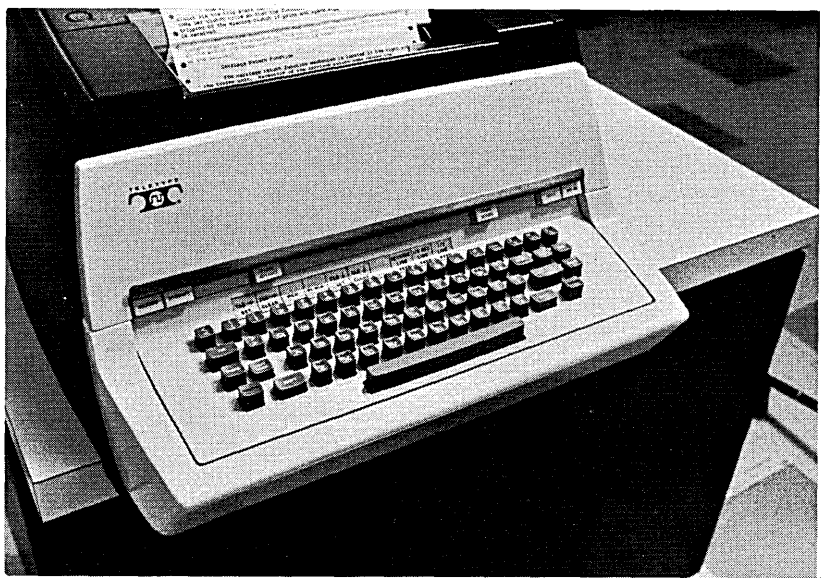
The Teletype model 37 KSR (Keyboard Send-Receive) printer operates at 150 words per minute (15 characters per second) and prints 128 graphics.

Designed to utilize 8-level code with even parity, the unit can also be arranged to operate on 5-, 6-, or 7-level code. The keyboard provides parallel output and, like the printer, can also be modified to meet code requirements up to eight levels.

The machine, which may be used as a computer input and output device, can print in both upper and lower case letters. Letters, numbers and symbols on the keyboard are arranged similarly to those on a standard typewriter. The printer is mounted in a modular-designed console.

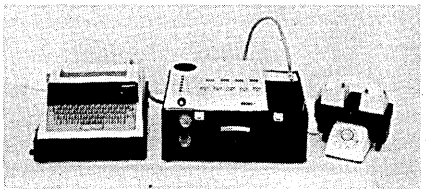
This printer is the first unit in a line that will eventually include receive only sets, automatic send-receive sets, paper tape punches and readers. TELETYPE CORP., Skokie, Ill. For information:

CIRCLE 105 ON READER CARD



new products

modified mod 33 Teletype teleprinter (PT-1), and a TI-1 telephone interface. The acoustic coupler is constructed to fit over the cradle of a conventional phone, a receptacle being internally fitted with a microphone and speaker which couple with the handset of the telephone. Other characteristics are an input

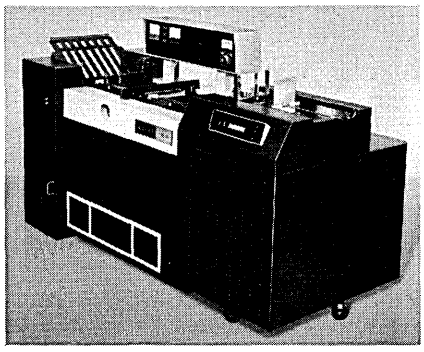


character set of 96 ASCII characters, 10 cps output on the printer, 53-key keyboard, serial and 8-level ASCII transmission and full- or half-duplex load transmission. The two units are each 15¾″ wide, 20″ long and about 10″ high. HONIG TIME-SHARING ASSOC., Hartsdale, N.Y. For information:

CIRCLE 106 ON READER CARD

optical mark reader

The NCS Optical Mark Reader reads pencil marks on documents and response formats from 8½″ × 11″ sheets up to 12-page fan-folded booklets. Both sides of forms up to 42″



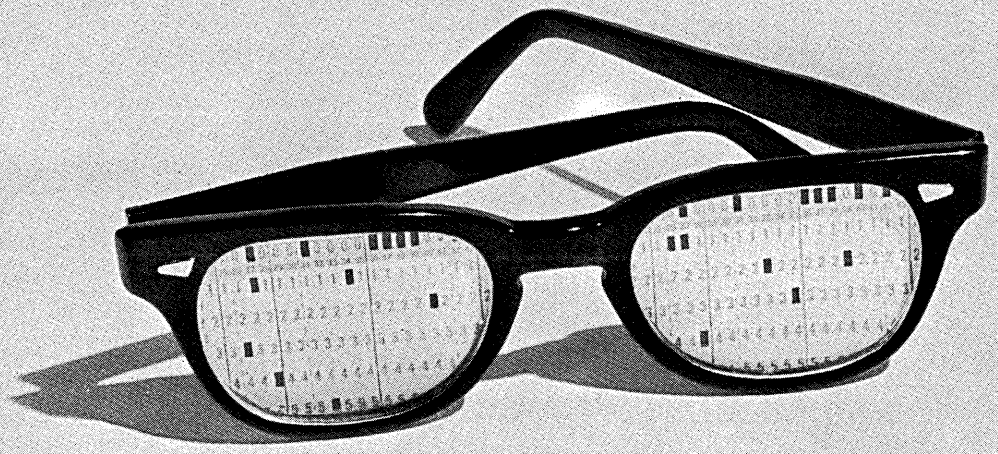
long (15K available mark positions) can be read simultaneously on a single pass through the machine at speeds up to 6,000 sheets an hour. NATIONAL COMPUTER SYSTEMS, Minneapolis, Minn. For information:

CIRCLE 107 ON READER CARD

analog computer

The 200T analog computer can be expandable to 80 computing modules, with up to 64 operational amplifiers (of which 24 may be multiple time-scale integrators with individual electronic mode control), and 60 extended bandwidth manual potentiometers. A master clocking system with thumbwheel timing selectors permits opera-

Like to get rid of data goof-ups caused by those spots before your eyes?



You can with a Control Data Optical Reader

THE LITTLE HOLES IN PUNCH-CARDS NEEDN'T HIDE MISTAKES ANY LONGER. OUR 915 CHARACTER RECOGNITION SYSTEM USES THE TYPEFACE YOU ARE NOW READING ... AND READS IT JUST AS YOU DO.

This means you can get rid of error-prone key punching. You can eliminate the tedious, slow, expensive method that has dominated most data processing up to now.

A 915 system immediately improves the accuracy of input fed to your computer. And your business forms can easily be adapted for direct input. Just type them on the electric typewriter you equip with this font. The change is that simple.

915 reads alphabet characters A to Z; numeric characters 0 through 9; standard punctuation; and special symbols for programmed functions. Takes documents 4 to 12 inches wide, 2½ to 14 inches long, plus continuous fanfold sheets.

Ask for a demonstration. Or write for application reports telling about 915 users in your area.

CONTROL DATA
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CIRCLE 51 ON READER CARD

tion at rates from 10 usec-100 seconds display time. Phase shift of the system is less that 0.03° at 1000 cycles per second. GPS INSTRUMENT CO. INC., Newton, Mass. For information:

CIRCLE 108 ON READER CARD

documentation software

Dopic (Documentation of Programs in Core) generates machine-produced flow diagrams, cross-reference lists and chart indexes for object programs. Available now, the program is a front-end package: the user captures his program on tape or cards, and forwards it to the service bureau for processing. COMRESS, INC., Washington, D.C. For information:

CIRCLE 109 ON READER CARD

document reader

The DRD-200 optical reader reads GE's COC-5 (coded optical characters) 5-bar font at 2,400 cps (about 1,200 check-size documents per minute). The character is made up of five vertical bars or lines, irregularly spaced, and can be read by people as well as machines. The DRD-200 will process documents from 2¾″ × 4″ up to 3⅞″ × 8″, and from .003″ – .0075″ thick. GENERAL ELECTRIC INFORMATION SYSTEMS, Phoenix, Ariz. For information:

CIRCLE 110 ON READER CARD

tape transport

Model SC-1150 is a digital magnetic tape transport that operates at bidirectional tape speeds up to 150 ips at packing densities of 220/556 and 800 bpi. The unit is 7- or 9-channel compatible and can be used with the new ASCII formats, including 1600 bpi phase-modulation recording. POTTER INSTRUMENT CO. INC., Plainview, N.Y. For information:

CIRCLE 111 ON READER CARD

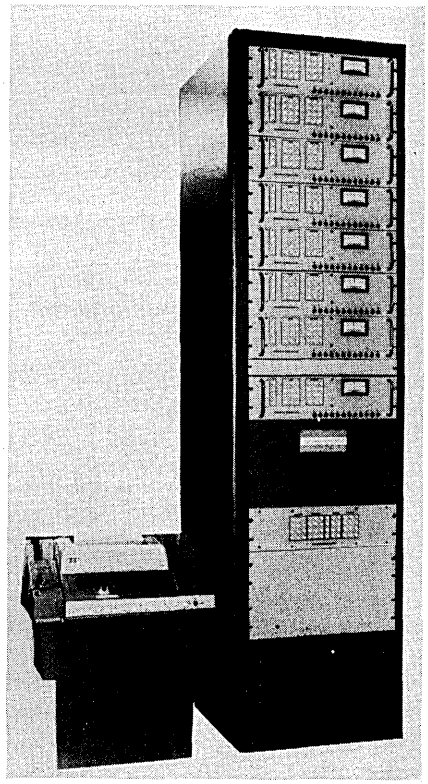
medicare software

The CARES program for determining the reimbursement of federal funds to hospitals, nursing and convalescent homes is available to 315 users or to medical institutions through NCR data centers. The program provides for allocation of non-revenue departments against revenue departments in order to reflect reasonable costs. The differing reimbursable amounts are then calculated by the program. NATIONAL CASH REGISTER CO., Dayton, Ohio. For information:

CIRCLE 112 ON READER CARD

hybrid computer

The model DCS-1010 hybrid computer system has a 12-bit, 1024 word memory with a 5 usec cycle time and eight output channels (eight operational amplifiers per channel) which are expandable to 65 channels. The DCS-1010 accepts input from direct sources, or from remote Teletype printers and tape reader-punch



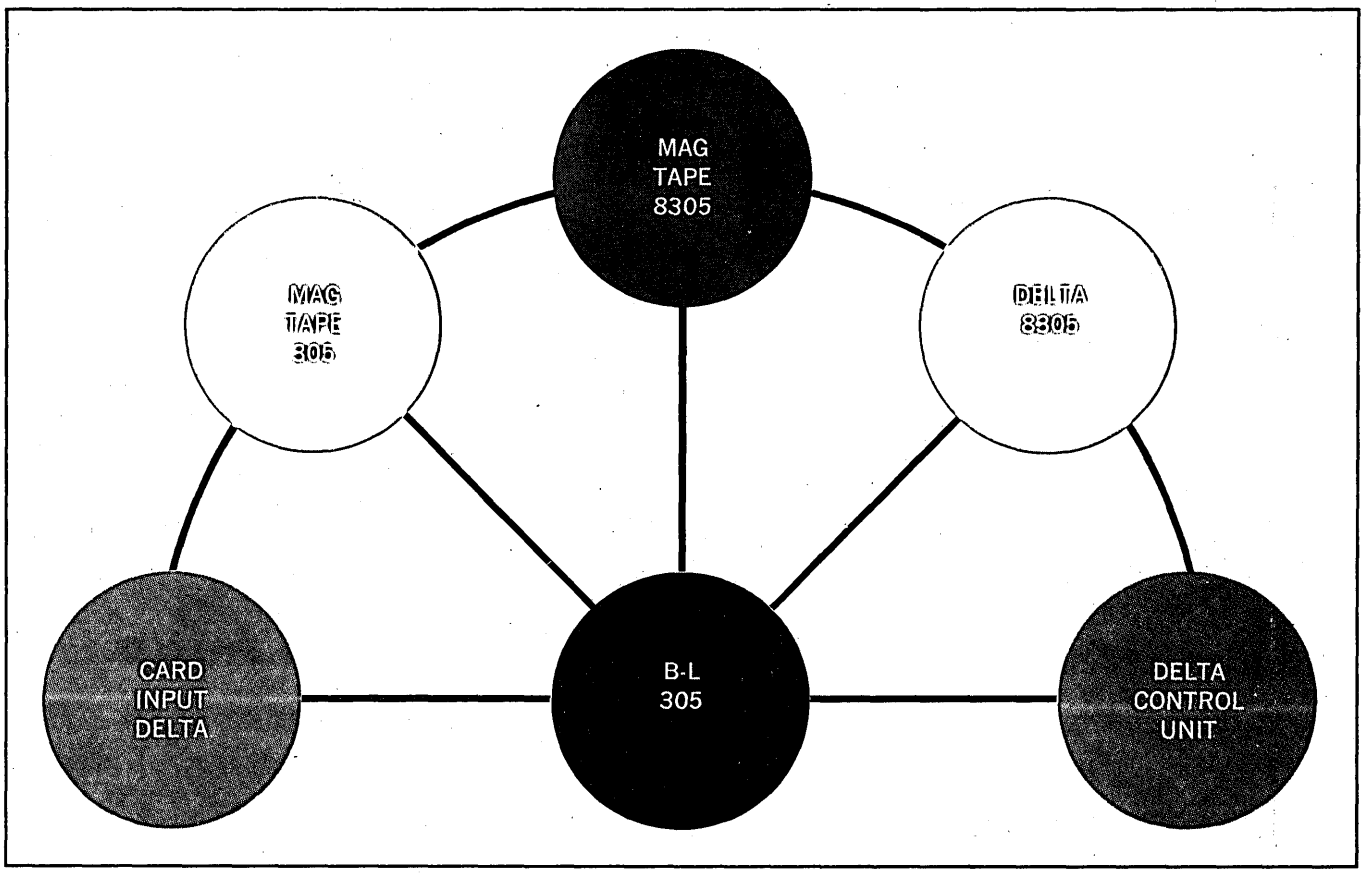
equipment. Digital information is converted to analog output signals by ramp and level generators. Ramp rates are from 100 msec to 999 seconds. Output may be adapted to accommodate any process control equipment functioning within the same response range. Price for the basic system is $45K; no lease arrangements have been made as yet. COMPUDYNE CORP., Hatboro, Pa. For information:

CIRCLE 113 ON READER CARD

education accounting system

The Encumbrance Accounting System includes six basic programs: batch proof, vendor file and account trailers, discs, expense ledger, school-by-school report, sort and district-wide report. Within these programs, the system processes eight types of transactions such as master file deletions, budget adjustments, corrections of original budget amounts.

The system was originally designed to comply with the provisions of New York State's Uniform System of Accounts for School Districts, but can be modified to comply with most



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CIRCLE 53 ON READER CARD

school system requirements. The program can also be extended to include features such as processing of other ledger accounts, preparation of checks to vendors and printing of vendor performance lists. CT DATA PROCESSING, INC., Cleveland, Ohio. For information:

CIRCLE 114 ON READER CARD

short mag tape

Type 616 magnetic tape is available in 600-foot lengths, with total surface testing and certification at 1600 bpi /3200fci. Developed for use with the System/360, it is interchangeable with all IBM-compatible equipment. REEVES SOUNDCRAFT, Danbury, Conn. For information:

CIRCLE 115 ON READER CARD

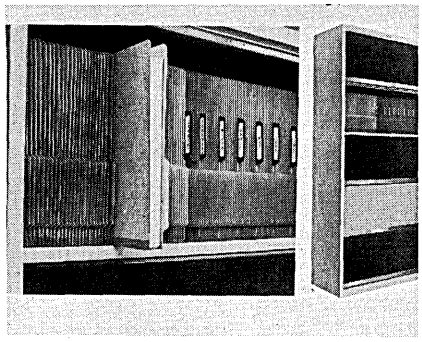
data acquisition

A manual card reader senses a maximum of 264 bits, and accepts plastic identification cards in 10-, 15-, 20- and 22-column sizes. Features include semi-automatic card ejection, means for positive card-to-switch registration and card orientation-sensing interlocks. The reader can be used in applications such as employee identification, process control, test set programming or computer memory entry control. AMP, INC., Harrisburg, Pa. For information:

CIRCLE 116 ON READER CARD

printout report folders

Computer printout report folder measures 12″ × 15¾″, and is available in two models. The .018 Kraft has front score lines to permit 1″ expansion; .025 gray pressboard has cloth expansion of 1″. Both have a plain 4″ side tab. Folders fit laterally into company's large document Spacefinder. TAB PRODUCTS CO., San Francisco, Calif. For information:



CIRCLE 117 ON READER CARD

keyboard crt

Uniscope 300, an outgrowth of alphanumeric crt terminals developed for Univac's United Airlines contract, comes with a basic 61-key keyboard and a single or multiple-station (up to 48) control unit. The 10″ × 5″ screen can display up to 16 lines, 64 characters/line, and, for showing comparison data, may be split into segments. Editing capability is for line insertion and deletion; a special transmission method eliminates non-significant spaces and automatically inserts send and return symbols. Up to 40 special function keys can be added, and by changing overlays it is possible to have up to 122 different combinations for a total of 4,880 special functions. The single control unit comes with 1,000 characters of core, the multiple-station unit with 24K characters. UNIVAC DIV., SPERRY RAND CORP., Philadelphia, Pa. For information:

CIRCLE 118 ON READER CARD

360/20 accessories

A line of 360/20 accessories features a desk with counter height work surface. A flip top on this unit reveals tub storage for vertical trays and guides to hold object decks. Space is also provided for binders and legal or letter size suspended file folders. A schedule board and cork bulletin board are also built into the flip top.

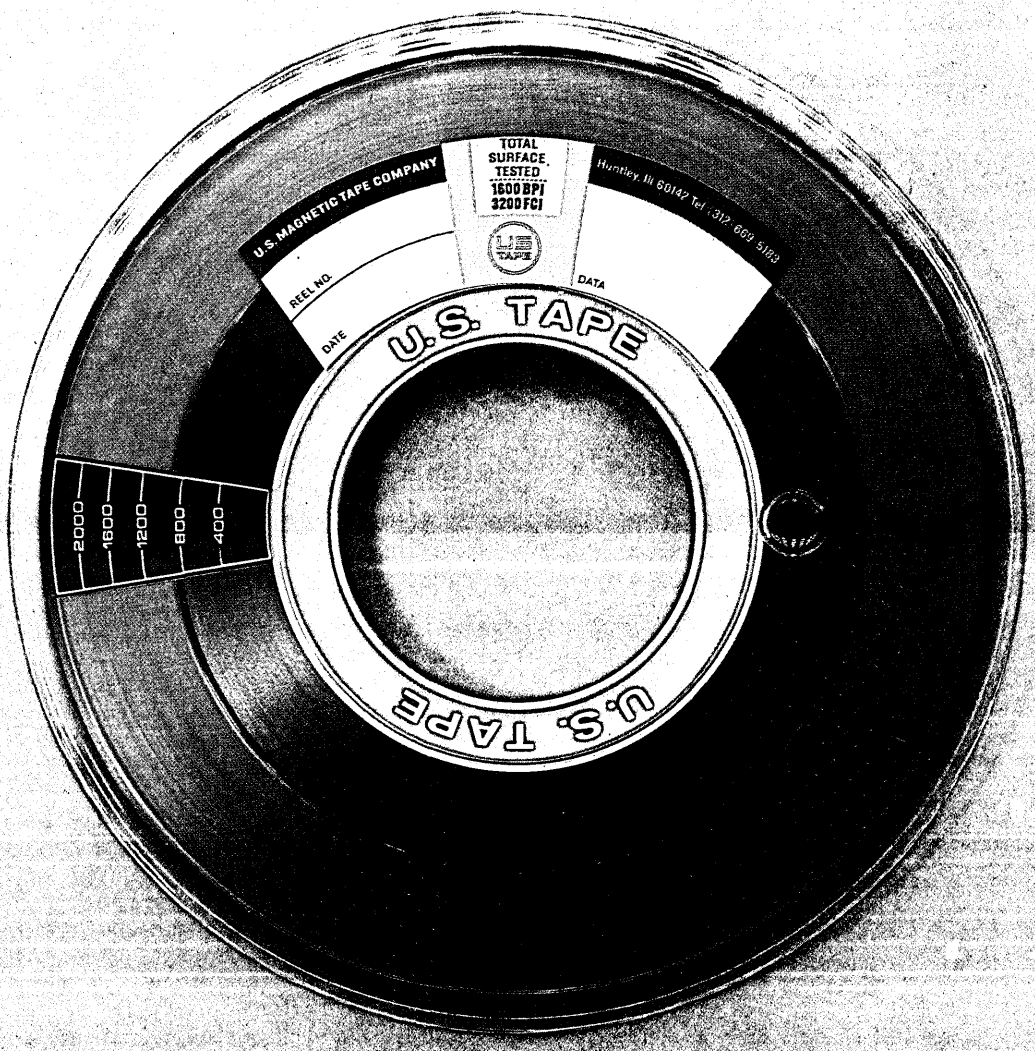
Other accessories in the line include a cross reference file that holds 45,-

000 cards, filed so that the operator can work directly from the drawer to the machine. The card handling equipment has a 56-pocket wall rack used to hold blank cards or to handle overflow on sorts; a 56-pocket sorter rack that gives adequate sorting capacity; and a 28-pocket rack which is for blank cards or small volume jobs. WRIGHT LINE, DIV. OF BARRY WRIGHT, Worcester, Mass. For information:

CIRCLE 119 ON READER CARD

tape punch

The Facit 1500 tape punch is convertible for 5-, 6-, 7- or 8-track tape, and punches up to 150 cps. Some 256 mark combinations are possible, allowing multiple data blocks to be



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

No other tape has.

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

marked off. The unit can handle several types of material, including plain and metallized Mylar. Manufactured by Facit AB of Sweden, the punch is marketed by: POTTER INSTRUMENT CO. INC., Plainview, N.Y. For information:

CIRCLE 120 ON READER CARD

banking software

A demand deposit accounting system for banks operates within 16K characters of memory and handles such functions as MICR reading and entry, service charge updating, and management reporting. An MICR reader-sorter is required in the basic configuration. A feature of the 24-program system is a package posting program that processes bulk check handling by recording one balance on one statement. HONEYWELL EDP, Wellesley Hills, Mass. For information:

CIRCLE 121 ON READER CARD

data channel expanders

The output data channel expander multiplies the data handling capability of Univac 1108 and 418 computers by providing programmable expansion of a single output channel of a computer into a maximum of six separate channels. Basic expander consists of cable terminators for output data and external function lines, channel address decoder logic and six 18-bit output data registers. Output data logic levels of the expanded channels are logic 0=0V and logic 1=±4.5V, DATAMETRICS CORP., North Hollywood, Calif. For information:

CIRCLE 122 ON READER CARD

multi-purpose computer

The VIC (Variable Instruction Computer) has been designed for use aboard aircraft or spacecraft. It weighs 120 pounds and occupies 3.1 cubic feet of space in its basic 8K (36-bit) word version; it can be expanded to 32K (4.4 cubic feet, 175 lbs.). The system has four I/O channels built into a traffic control system with four levels of priority. Variable instruction allows the computer to perform a variety of data processing functions: on a spacecraft, for example, it could compute guidance and navigation data, monitor the control and life support systems, check astronaut performance and process scientific measurements. RCA EDP, Cherry Hill, N.J. For information:

CIRCLE 123 ON READER CARD

mag tape

TVP2 magnetic tape is available in lengths up to 2400 feet, −50 feet, −0 feet, and in two widths: 0.4975 ± 0.001″, or 0.7490 ± 0.001″. The tape will operate under environmental conditions of 60° −90°F and 20%–80% R.H. with a maximum wet bulb of 78°. COMPUTRON, INC., Bedford, Mass. For information:

CIRCLE 124 ON READER CARD

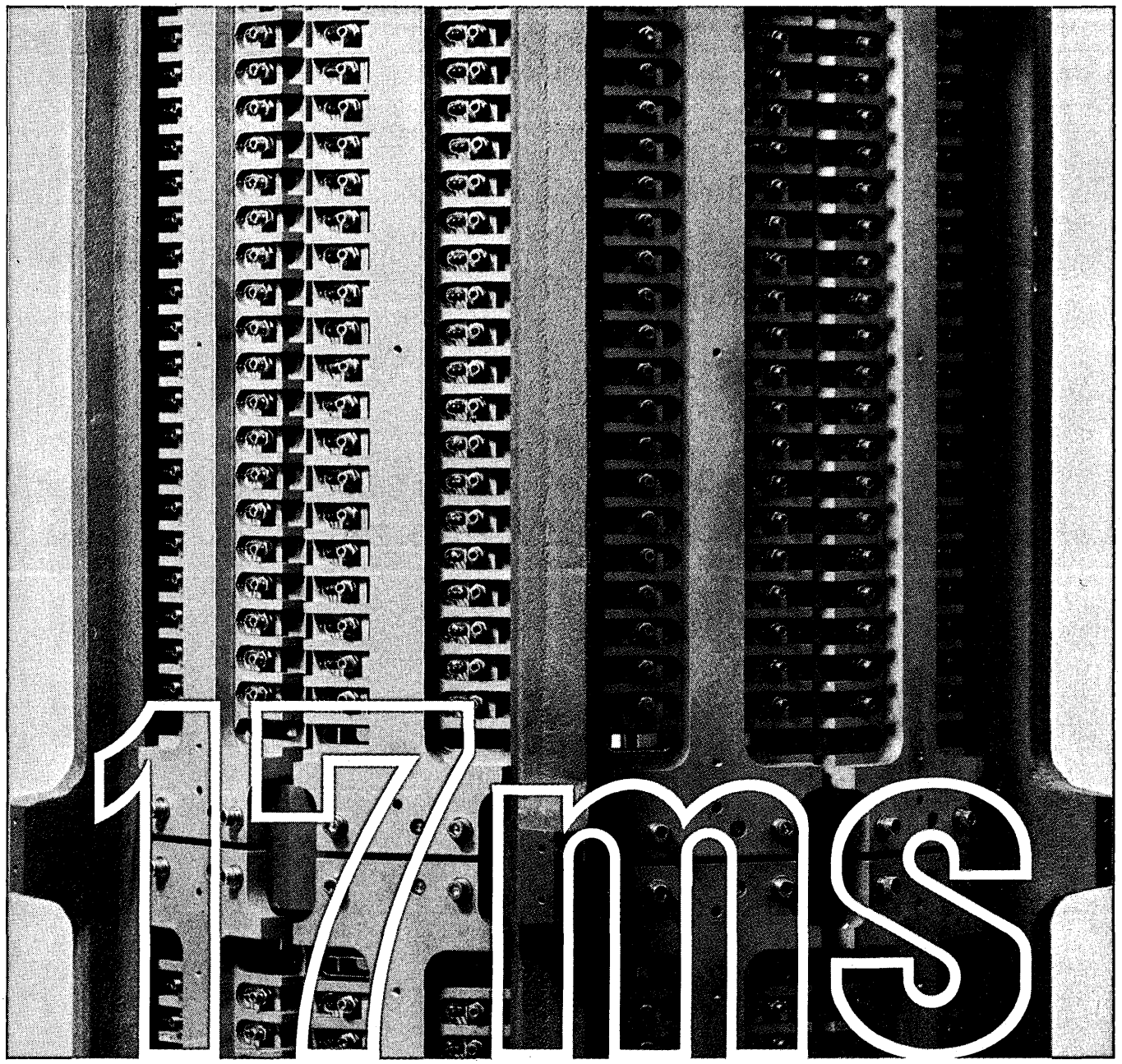
time-sharing system

The Philco 102 communications switching computer and the 4-year-old 212 processor have been combined into a time-sharing system. The combined units will handle up to 96 full-duplex and 192 half-duplex terminals simultaneously and has a maximum 1000-terminal capacity. The 102, made up of an I/O control system and a processor, has a capacity of 16-64K (32-bit) word memory with a 1.5 usec cycle time, .8 usec access. The 212 typically has a 32K (48-bit) memory with a 1.15 usec cycle time, .5 usec add, .2 usec access. The 212 typically has a 32K (48-bit) memory with a 1.15 usec cycle time, .5 usec add, .2 usec multiply, and a 7-instruction look ahead transistorized memory. (More core memory can be added.)

Both computers also share, via an I/O bus, a 32K (48-bit) word memory (1.15 usec cycle), and can share mass memory in the form of 7-million-character Bryant drums and/or 8 to 72-million-word Bryant disc files. Up to 16 drums and 32 disc files can be put on the system, which can access eight of these storage devices simultaneously. The 212 has been modified to include a hardware memory protection scheme, a timer—controllable by the executive system—to time out lengthy instructions, and a switch permitting operation in either time-sharing or batch mode. Among peripherals available are one-inch and IBM-compatible tape units and CRTs with light pen. In addition to the time-sharing executive system (stored in the shared core), the system has available the full library of 212 software, including FORTRAN II and IV, SIMSCRIPT, APT III (version 8), JOVIAL linear programming, report program generator, and a large statistical package. A large-scale mass storage file management system is also being developed for time-sharing and batch use.

Also to be offerred are time-sharing systems composed of two 120's or the 102 and the cpu of other manufacturers. PHILCO-FORD CORP., Philadelphia, Pa. For information:

CIRCLE 125 ON READER CARD



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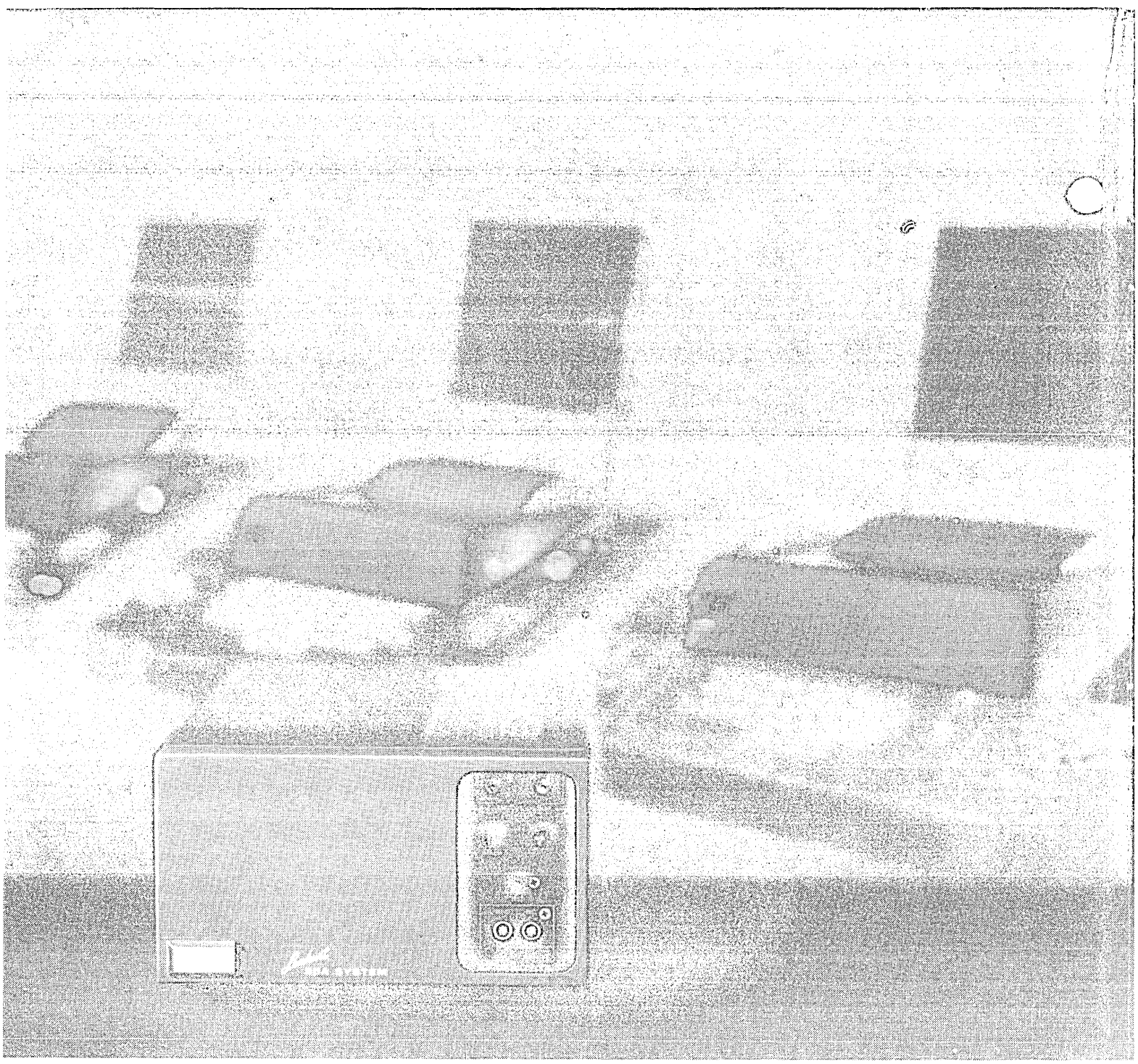

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SOVIET JOURNAL: English translation of Soviet journal, "Automatic Control," a bi-monthly, will provide broad coverage on the particular problems of synthesis, analysis and optimization of complex discrete systems. Price and availability information can be obtained from the publisher. THE FARADAY PRESS, INC., 84 Fifth Avenue, New York, N. Y. 10011.

MAGNETIC TAPE SYSTEMS: 20-page brochure describes Model 7600 magnetic tape system and gives detailed specifications of the 7600 series, including dynamic characteristics for narrow-, medium- and wide-band operation, and push-button selection of the tape recorder's seven bi-directional tape speeds. HONEYWELL TEST INSTRUMENTS DIV., Denver, Colo. For copy:

CIRCLE 141 ON READER CARD

SOFTWARE TECHNIQUES IN HUMAN FACTORS: 175-page report discusses the concept of an operational data management system for storing, processing, and retrieving human factors task data in a government/contractor environment. Cost: $3; microfiche, $.65. AD-647 993. CLEARINGHOUSE, U. S. DEPT. OF COMMERCE, Springfield, Va. 22151.

LOW-SPEED PAPER TAPE READERS: Illustrated 12-page brochure describes low-speed punched paper tape readers that can transmit simple messages as well as whole blocks of data. Built for either serial or parallel signal output, but can be modified to handle both. Various applications covered. TELETYPE CORP., Skokie, Ill. For copy:

CIRCLE 142 ON READER CARD

MODULAR CORE MEMORIES: Eight-page brochure illustrates perfomance, operation and interface of Model RF family of modular core memory systems. AMPEX CORP., Redwood City, Calif. For copy:

CIRCLE 143 ON READER CARD

GRAPHIC PRODUCTS FOR LIBRARIES: Pocket-sized brochure describes microfilm readers, reader-printers, and enlargers for viewing and printing documents stored on 35mm and 16mm roll film, aperture cards, and microfiche. Also describes new electrostatic model of coin-operated photocopier. DASA CORP., Andover, Mass. For copy:

CIRCLE 144 ON READER CARD

AUTOMATIC TYPESETTING TECHNIQUES: This 98-page report, one in a series, is intended to improve cooperation in the fields of information selection, systems development, information retrieval research, and mechanized translation. It describes the current state-of-the-art in automation of graphic arts composition starting from either keyboard entry of manuscript material or mechanized input in the form of available perforated tapes or magnetic tapes. Also contains bibliography and other features. Cost: $.70. National Bureau of Standards Monograph 99. SUPERINTENDENT OF DOCUMENTS, U. S. GOVERNMENT PRINTING OFFICE, Washington, D. C. 20402.

PULSE PATTERN GENERATOR: Bulletin describing Model GP4 "Datamaker," featuring integrated circuits to combine a pulse pattern source with a start-stop teleprinter word generator. WESTERN TELEMATIC, INC., El Monte, Calif. For copy:

CIRCLE 145 ON READER CARD

COMPUTER FAMILY: 16-page brochure describes hardware and software elements, peripheral devices, and specifications for the three machines in the Sigma family of real-time, multi-use small- and medium-size computers. SCIENTIFIC DATA SYSTEMS, Santa Monica, Calif. For copy:

CIRCLE 146 ON READER CARD

SELECTING TAPE PERFORATORS: Comprehensive report details the various criteria involved in perforator selection, including comparison chart specifying the significant characteristics of all popular justifying and nonjustifying keyboards. Supplement to the

3M TASK FORCE Reports: Recent Developments in Dry-Silver Photosensitive Materials

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CIRCLE 61 ON READER CARD

new literature

chart amplifies various aspects of perforator decision-making and cites special features distinguishing each of the various models. COMPOSITION INFORMATION SERVICES, Los Angeles, Calif. For copy:

CIRCLE 147 ON READER CARD

DIGITAL/ANALOG INTERFACE TECHNIQUES: Four-page bulletin in the "Data Handling Notes" series contains general information on analog-digital interface requirements and describes specific high speed and cycle steal procedures and interface equipment to be used with the IBM 1130. REDCOR CORP., Canoga Park, Calif. For copy:

CIRCLE 148 ON READER CARD

PLATED-WIRE MEMORIES: Data sheet describes the latest in woven plated-wire memories, predicted by many to displace magnetic core memories in a variety of new-generation computers. Available in both complete memory planes and multi-plane stacks. LIBRASCOPE GROUP OF GENERAL PRECISION, INC., Glendale, Calif. For copy:

CIRCLE 149 ON READER CARD

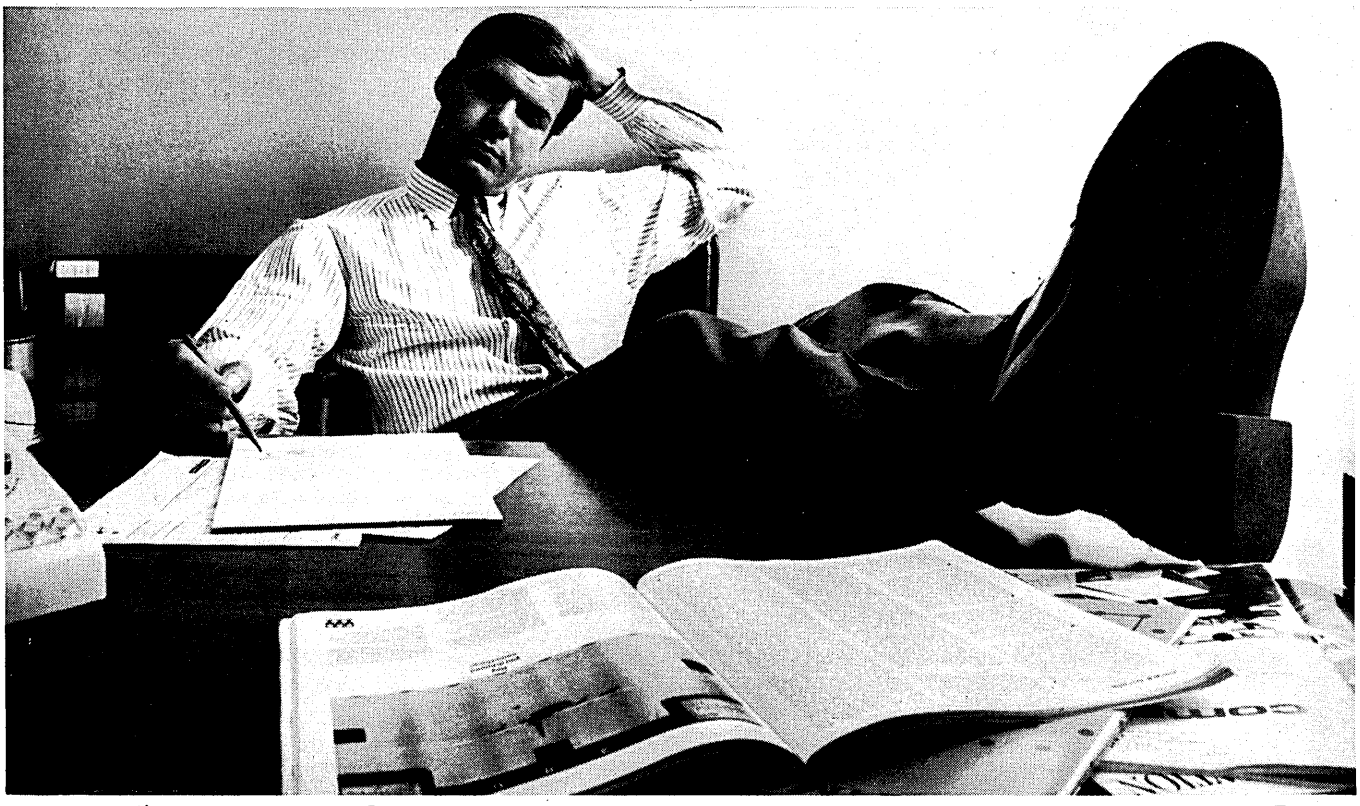
PANELS FOR FLOOR SYSTEMS: Two new technical data sheets describing wood core and aluminum panels for use in Infinite Access floor systems. These are new additions to the line which also includes steel raised floor panels. TATE ARCHITECTURAL PRODUCTS, INC., Jessup, Md. For copies:

CIRCLE 150 ON READER CARD

OP AMPS JOURNAL: Free to interested engineers, "Analog Dialog" aims to educate newcomers to op amp technology and to keep knowledgeable engineers informed about future innovations. Emphasis will be on application considerations, and new products will be virtually the only commercial matter featured. ANALOG DEVICES, INC., Cambridge, Mass. For copy:

CIRCLE 151 ON READER CARD

16-BIT COMPUTER: Eight-page brochure describes SEL 810A general purpose 16-bit parallel computer. Internal memory full cycle time is 1.75 microseconds with a minimum available core storage of 4096 words. Delivered with a Teletype input/output typewriter with paper tape reader and punch, 4K memory, hardware multiply and divide, real-time input/output



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CIRCLE 152 ON READER CARD

IC ANALYZER: Eight-page technical brochure describes new MICA-150 Semi-Automatic Integrated Circuit Analyzer with multiple test capability. Includes detailed analysis of the programming features. Applications include incoming inspection, small run production and laboratory and failure analysis. COMPUTER TEST CORPORATION, Cherry Hill, N. J. For copy:

CIRCLE 153 ON READER CARD

INFORMATION FLOW IN HOSPITALS: Study on how to apply the technique of flow-charting to establish the way in which medical information relating to patients flows through the hospital system. Includes role of computer and other new techniques for making best use of available resources. Cost: $1.40. ENGLISH ELECTRIC COMPUTERS LTD., Portland House, Stag Place, London S. W. 1, England.

REDUCE UNIT RECORD CODING TIME: Two-page brochure on three desk-size Keysort card grooving devices, both electric and manual models, for encoding groups of unit records with common code information. McBEE SYSTEMS DIV. OF LITTON INDUSTRIES, Athens, Ohio. For copy:

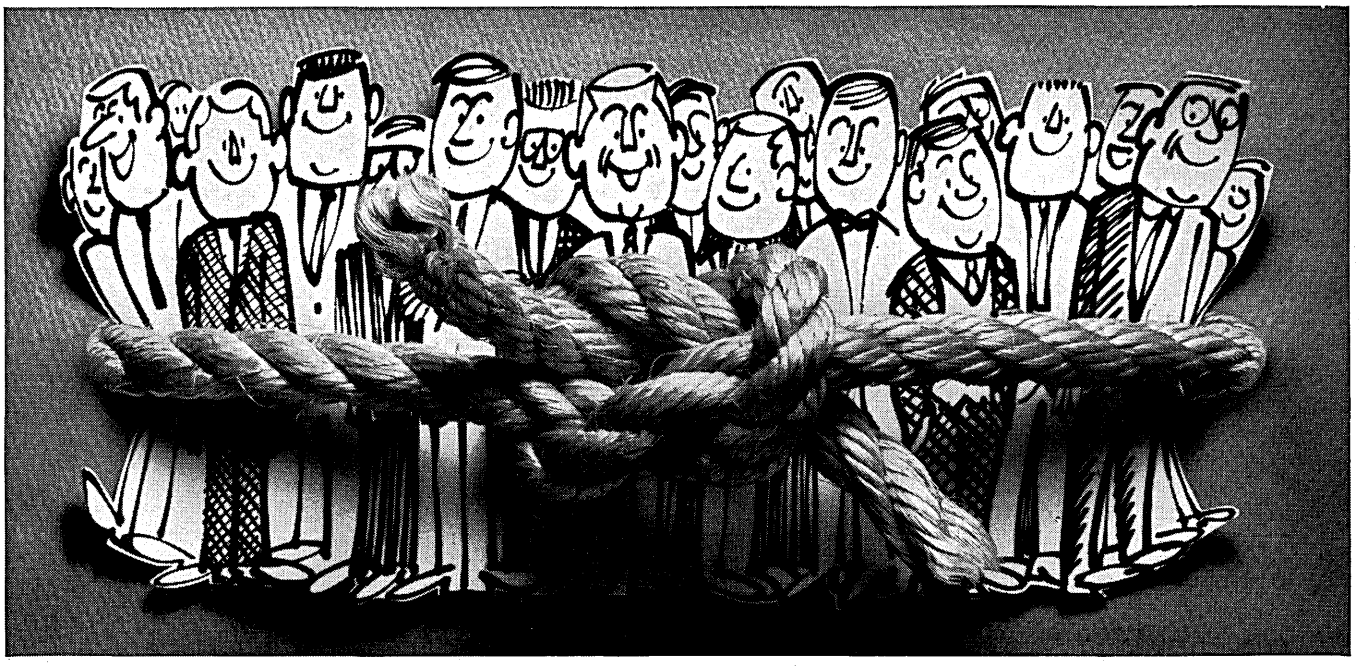
CIRCLE 154 ON READER CARD

MAGNETIC TAPE MAINTENANCE: 32-page booklet combining four other brochures on preventive maintenance deals with tape problems faced by computer tape users and offers a defined program to reduce both operating cost and new tape procurements. GENERAL KINETICS INC., Arlington, Va. For copy:

CIRCLE 155 ON READER CARD

COMPUTERS IN THE LIFE SCIENCES: 32-page brochure describes computer techniques that can be performed with a general purpose laboratory computer while the experiment is taking place. Also contains bibliography of articles on the use of computers in biomedicine and information on other company products. DIGITAL EQUIPMENT CORP., Maynard, Mass. For copy:

CIRCLE 156 ON READER CARD



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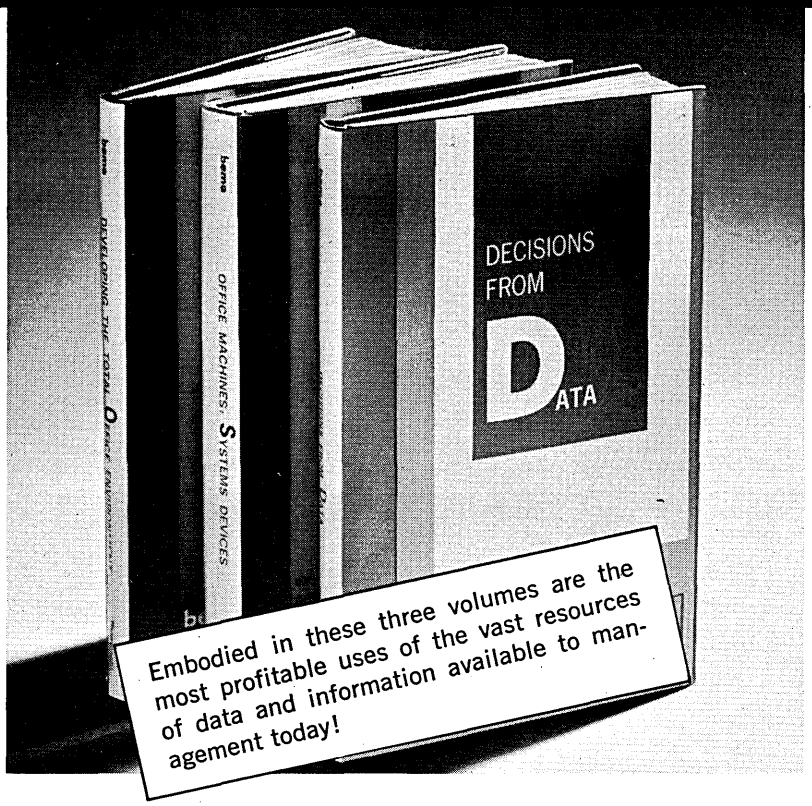

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CIRCLE 309 ON READER CARD

look ahead

(Continued from page 19)

rumored backlog of around 600. It's probable that the 1287 can be developed into several variations on the same basic frame.

This isn't necessarily bad news for other manufacturers -- such as Farrington, Control Data (with its Rabinow reader and Dr. Rabinow himself), Optical Scanning Corp. (with the 288 model, similar to IBM's 1287 but reading one more hand-printed letter for good measure), and Recognition Equipment (with the most ambitious, computer-controlled unit). As one of them said: "It never hurts for IBM to sprinkle holy water on a project."

TWO LOSERS LAST YEAR MAKING COMEBACK

Two companies that dipped into the red for the last fiscal year, Anelex and Wolf Research & Development, have made quick recoveries. Under new president Herb Roth, Anelex stopped its 3-year development program for disc packs -- they weren't IBM-compatible -- and sold a data communications subsidiary. But with billings up 15% over last year, when they lost $5 million, some people laid off have returned. They've turned profits the last two quarters.

For the future, Anelex is directing sales to the end user, plans a high-speed and low-speed (between the Teletype and 300-lpm) printer. Roth figures they can bring in a slow job for PDP-8/Sigma 2 type installations for $6K, versus the $12-20K range of present competition.

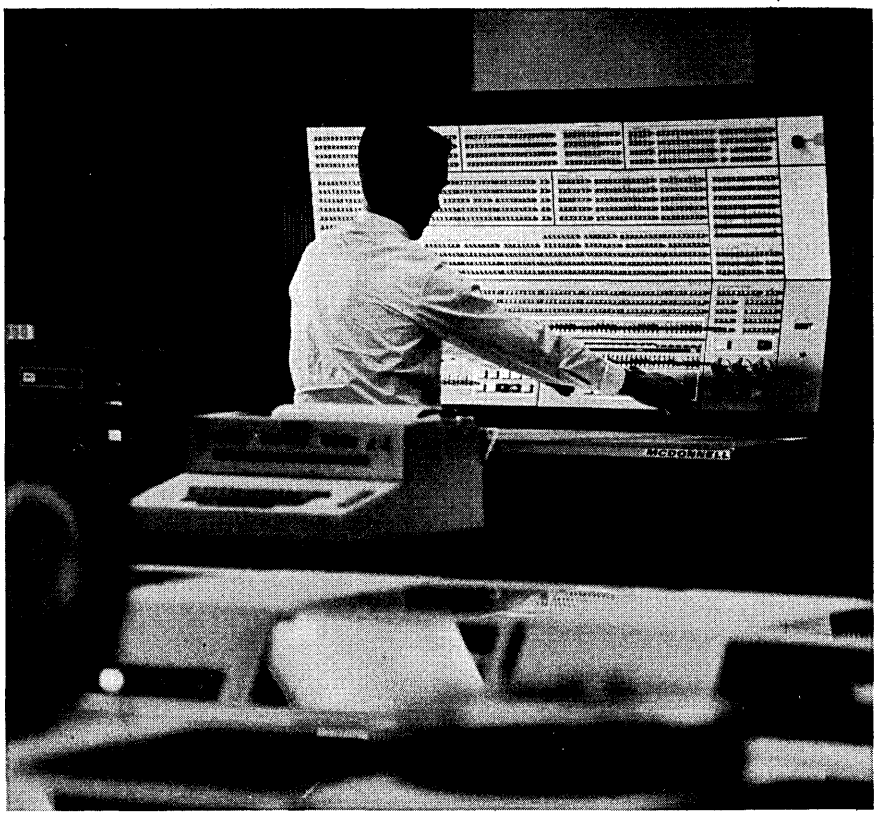
Wolf Research went into the hole $75K last year, but president Bill Wolf will see a net of over $100K for the fiscal year just completed on revenue of over $5 million. To get there, the Los Angeles division is being cut about 50%, will end up with 30-40 people.

WORLD HEADQUARTERS IS WATCHING

IBM is planning an international hook-up to give corporate headquarters instant international management. The long-term project involves permanent data links by satellite. The system, to be called Respond, will have a center in the U.S. and another for Europe, located in the U.K. From its data banks, IBM executives will be able to have push button control to determine the state of any account or development project in its international network of sales offices and laboratories.

RUMORS AND RAW RANDOM DATA

One log jam for time-sharers has apparently been broken. We hear that AT&T has decided it's permissible for terminal users to dial into non-Bell multiplexers, which means it won't be necessary to have a private line. The phone companies seem to be taking each application as a separate case, so far have granted the right to two commercial time-sharing outfits. Result for the phone companies: less long-distance calls, more local calls. For the user: big savings. ... Look for an announcement from the AEC that the boys at Livermore have contracted for a new parallel processor -- a so-called star configuration, we hear, rather than an array processor like the Illiac IV. ... Univac's version of Illiac IV, we're told, was one of the interesting talks at Torrey Pines (see News Briefs). ... One user was sold on changing from Cobol to PL/I, is now sore cuz he can't switch back. ... At Wescon, EAI will announce the 580, a 10-volt, 80-amplifier desktop analog with parallel digital logic. Price: $10K-55K.



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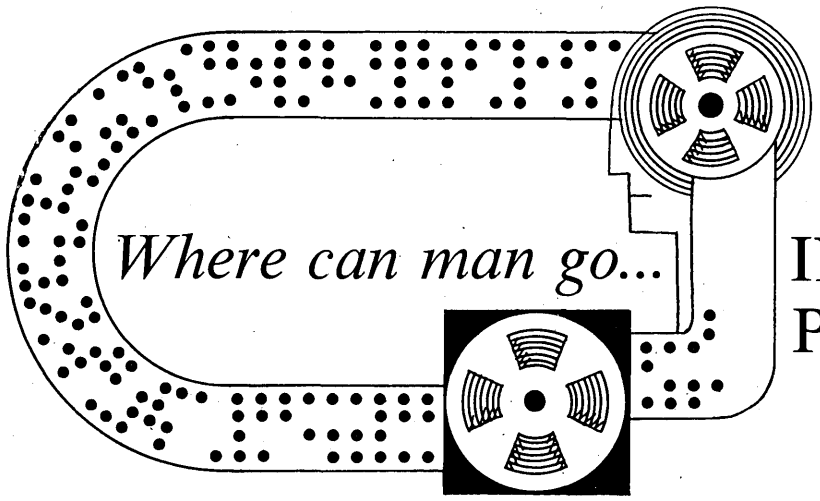

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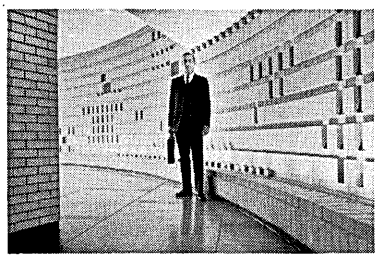

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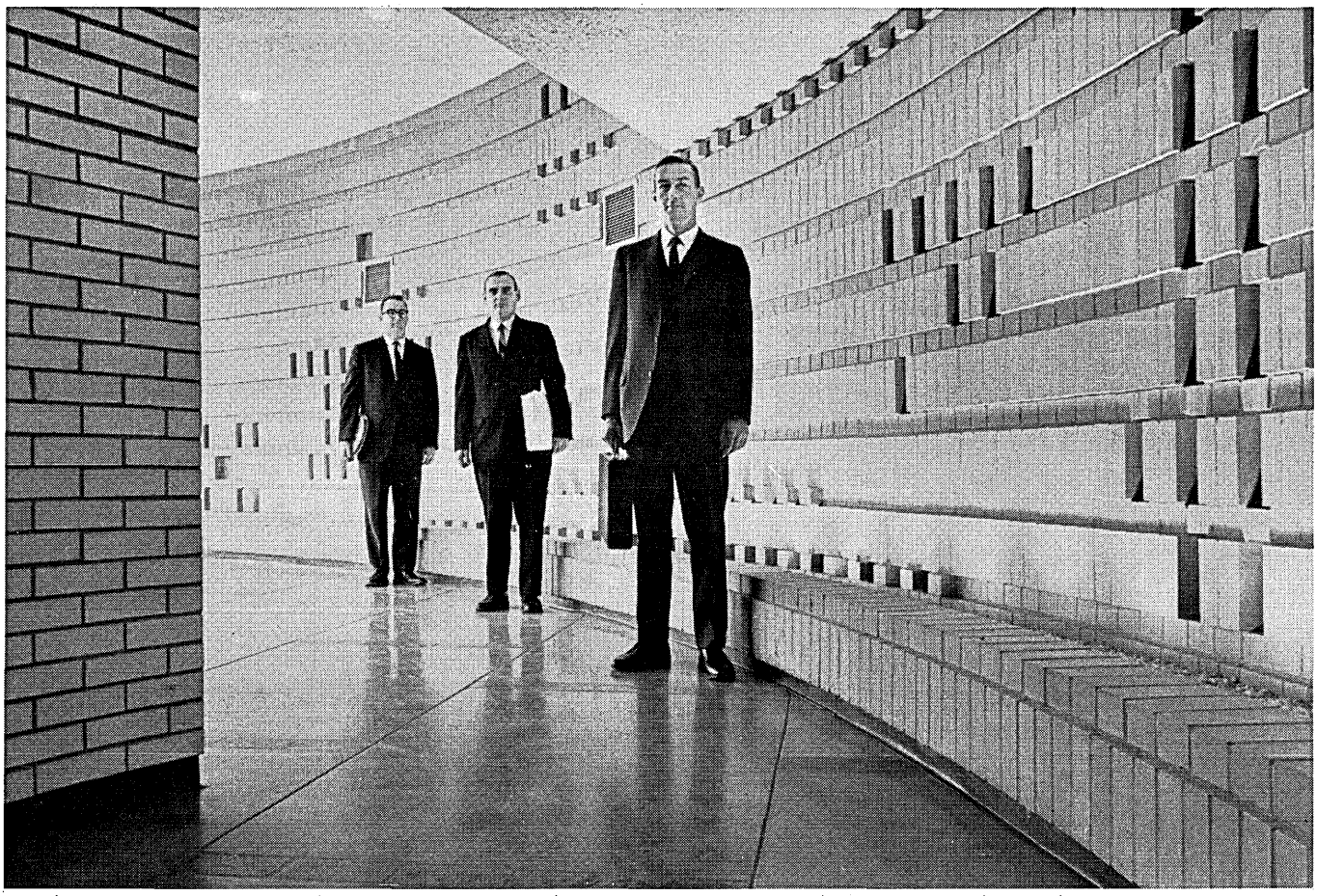

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books

The Computer and the Library, by N. S. M. Cox, J. D. Dews and J. L. Dolby. (Univ. of Newcastle-upon-Tyne Library Publication No. 4, 1966). Archon Books, $4.50.

An American gardener was sent to England by his wealthy employer to find out what made English lawns the envy of the world. When asked, the venerable English gardener replied, "It's very simple. You take the best seed, plant it carefully, and then water it thoroughly for 500 years." With their feet firmly planted on the greensward, the authors cast no eye toward the blue sky and shake no drop from the Dewey leaves.

This slim monograph, written by a computer expert, a librarian, and a statistician, admirably sets forth the ways a computer can be applied to the traditional procedures which librarians have evolved over the years. The book is elementary in the best sense: it scratches the surface in the right direction. Using familiar terms, the major functions of an academic library are outlined and possible computer applications are described. The manual procedures now in use in order routines, in circulation files, in the preparation and filing of cards for catalogs, and in serials records, are shown to be susceptible to machine methods.

The book is replete with comforting warnings.

"Few libraries are blessed with 'extra' funds or staff. The computer, to the extent that it is a labour-saving device, should, in the long run, help with this problem. In the short run (say under five years) it won't — it will make it worse."

". . . Most users of computers find it difficult at first to grasp the true implications of dealing with a device that has absolutely no judgment whatsoever."

". . . The librarian must, of course, be prepared to pay more for output quality than would be the case if low quality work were sufficient. In addition, he must convince the computing centre that the quality of his output is at least as important as the amount of it. In some computing installations this will not be easy."

In some cases, the authors' caution leads them to underestimate the rate of development in the data processing field. ". . . it would be of considerable advantage if there were some machine *interface* between automated booksellers and automated libraries, so that the information could be transferred (in either direction) in machine-readable form. . . . However, although such an interface between bookseller and library may be a possibility for the future, it is more likely that the automated library will be dealing with booksellers using traditional methods, or at best an incompatible computer system." Already in operation, of course, is the system linking the Los Angeles Public Library's order department and Baker & Taylor's warehouse in Reno, Nevada. To be fair, however, the authors are not the first who have been astonished to find that science fiction has turned into fact.

The chapter on automating order procedures is based on the system being developed for the Univ. of Newcastle-upon-Tyne Library; it is straightforward and instructive. The chapter on "Catalogue Maintenance and Quality Control" is perhaps the best in the book; certainly it is the most lucid presentation of the subject known to this reviewer. In the final chapter, the authors put their money on "the printed book catalogue," which "will probably not require much more cost or effort than is at present directed to the card catalogue." There are a number of American librarians who would take that bet.

As a brief introduction to computers for librarians, this book sets a high standard; would there were a companion volume to explain libraries to datamateurs.

—Wm. R. Eshelman

book briefs

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

***Basic Principles of Data Processing*, James A. Saxon, Wesley W. Steyer. Prentice-Hall, Englewood Cliffs, N. J. 1967. 278 pages. $7.50.**

A systems-oriented introduction, organized in sections with review questions, intended for the beginner.

***Computer Dynamics in Public Administration*, B. G. Schumaker. Spartan Books, Washington, D.C. 1967. 195 pages. $9.**

Relationship of computers and public

books

administration from the viewpoint of historical evolution, including scientific management.

Use of Computers in Analysis of Experimental Data and the Control of Nuclear Facilities. **U. S. Atomic Energy Commission 300 pages. Paperbound, $3.**

Proceedings of a symposium at Argonne National Laboratory, May 4-6, 1966. Includes 18 papers and five discussion reports. Areas covered are on-line analysis and system control; pattern recognition and graphics; hardware and software problems.

A Syntax-Oriented Translator, **Peter Zilahy Ingerman. Academic Press, Inc., New York, N.Y. 1967. 132 pages. $5.95.**

Description of a syntax-oriented translator, intended for the writer of compilers, designer of computer languages, professional programmers, and as a supplementary text for computer sciences students.

Computers and Small Manufacturers, **Alexander M. Blanton, Joseph Traut. Computer Research & Publications Assoc. New York, N. Y. 1967. 159 pages. $17.50.**

Survey and analysis of computer operations in small manufacturing companies, intended to help management of such companies now evaluating future use.

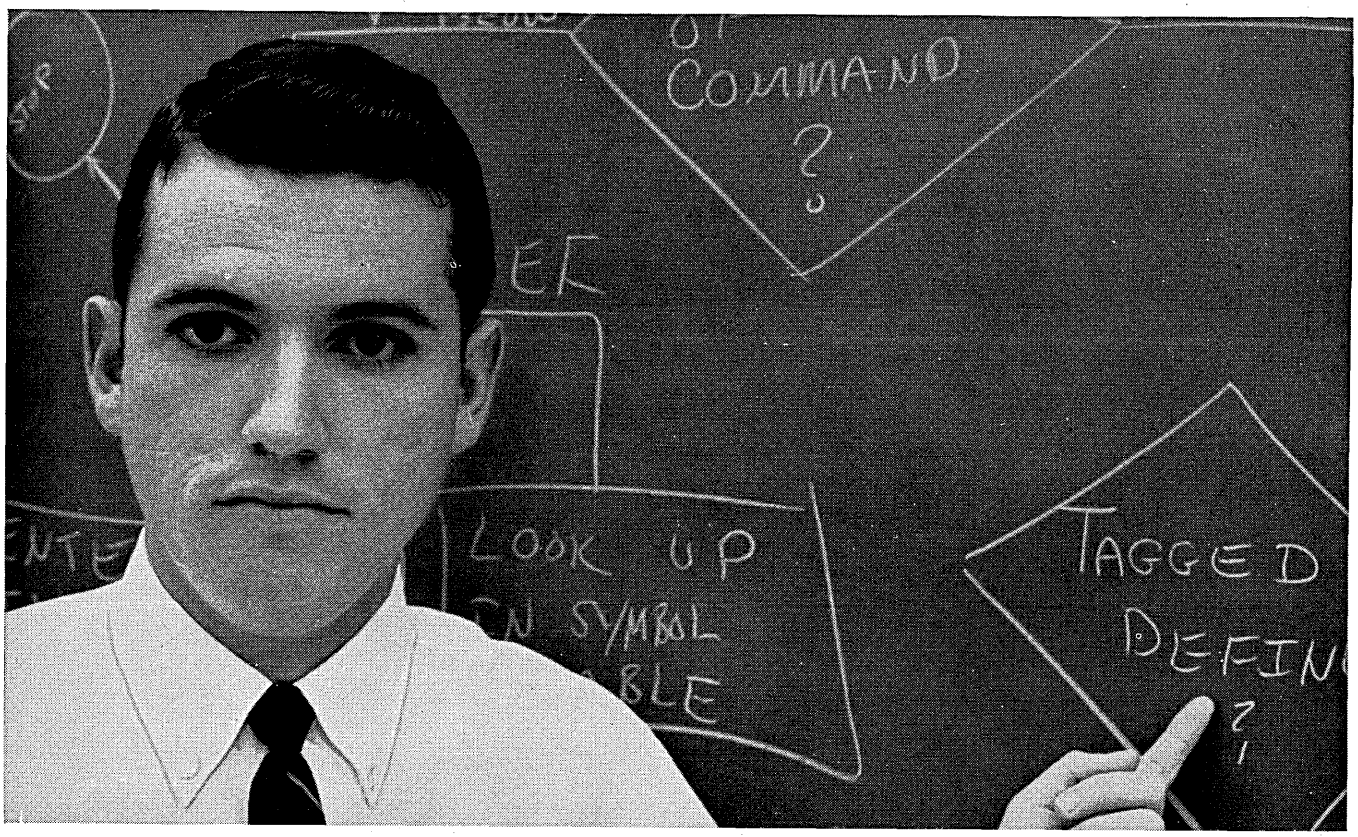
Computer Programming and Computer Systems, **Anthony Hassitt. Academic Press, New York, N. Y. 1967. 374 pages. $10.75.**

An introduction to computer programming, written as an intermediate-level text for seniors or first-year graduates in computer sciences and graduate students in other fields who will use the computer as a research tool.

Nonlinear Programming, **edited by J. Abadie. North Holland Publishing Co., Amsterdam; John Wiley & Sons, New York, N.Y. 1967. 316 pages. $13.**

A collection of lectures given at the NATO Summer School on Nonlinear Programming in Menton, France, in 1964. Intended as a text for scientists, a reference work, or an introduction to research in the field.

This committee is developing a new programming system



Ronny Morris, a programmer with IBM Rochester, is currently engaged in developing specifications for a new programming system.

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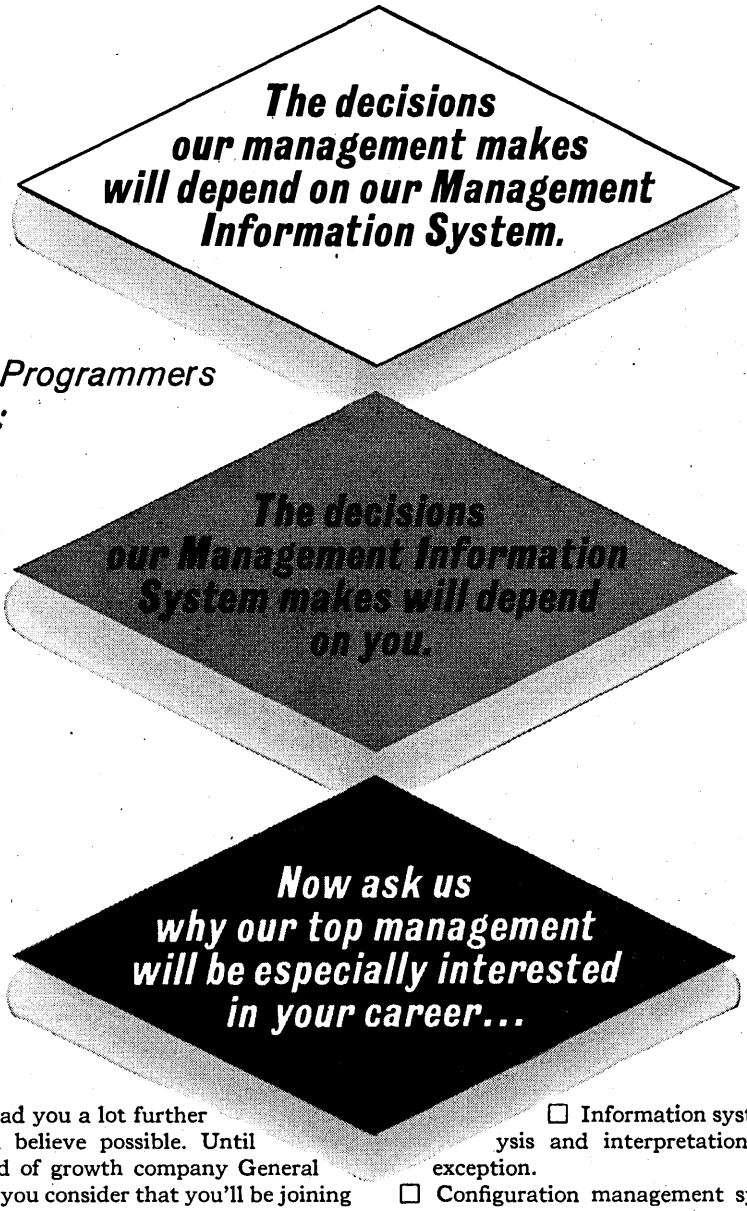

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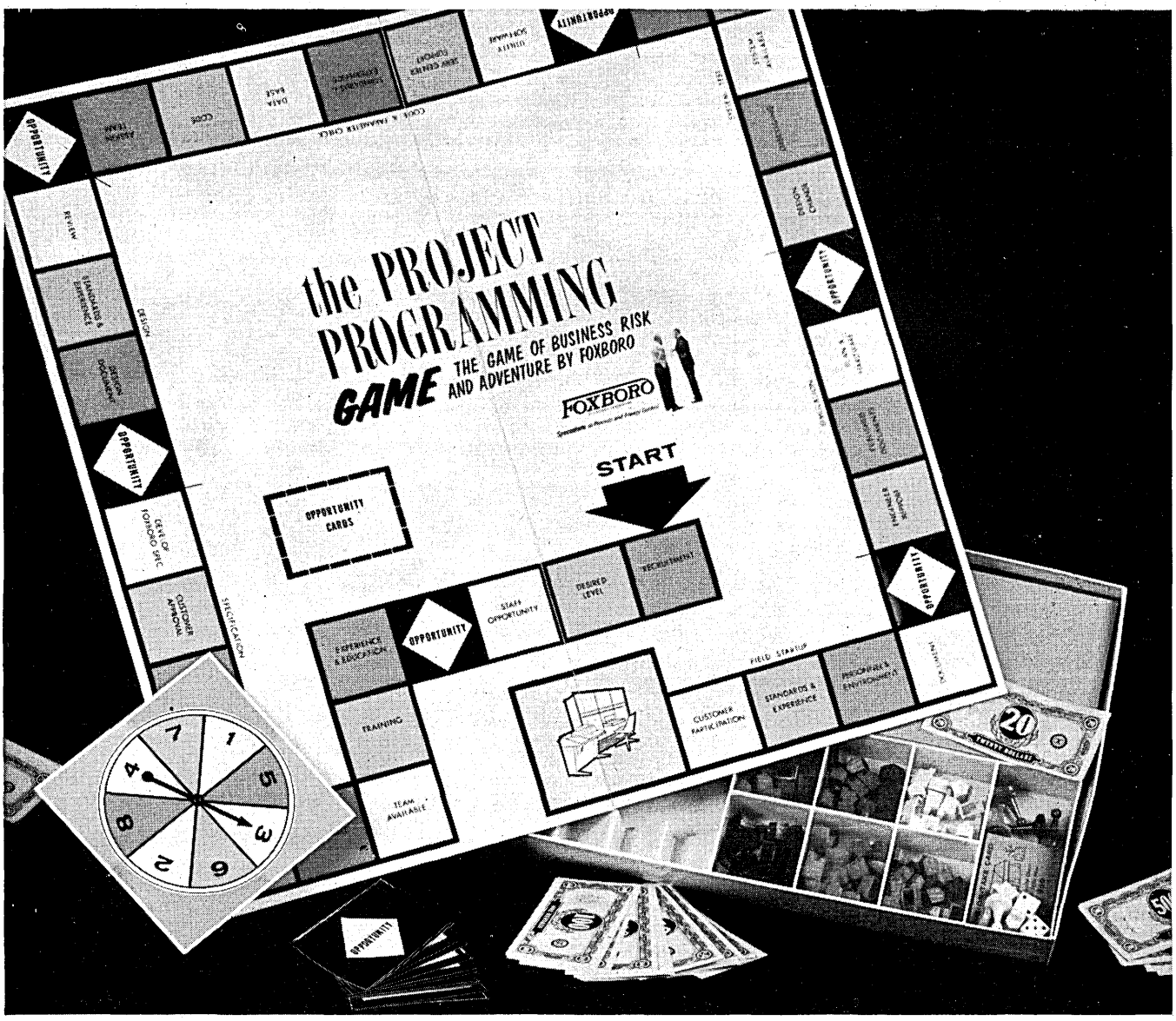

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people

■ Fred Gruenberger, a member of the senior staff at Informatics, Inc., will be associate professor of mathematics at San Fernando Valley State College, Northridge, Calif., beginning September 1.

■ Dr. Arthur G. Anderson, former director of the San Jose research laboratory, has been promoted to director of research, IBM Corp., Armonk, N.Y. He succeeds Dr. Gardiner L. Tucker who will become deputy director, defense research and engineering U. S. Dept. of Defense, Washington, D.C.

■ Robert M. Gordon has been promoted to head of the computer center, Univ. of California at Irvine. Formerly assistant director, he succeeds Dr. Fred M. Tonge, Jr., who will teach full-time as a professor of administration, information and communication science.

■ Ronald A. Backnick has been elected president of Standard Statistics Co. Inc., a subsidiary of Standard & Poor, in New York City. Formerly the vp of marketing, he succeeds H. Russell Morrison, recently named president of Standard & Poor.

■ Earle W. Wallick is now general manager, computer division, Electro-Mechanical Research Inc., Minneapolis, Minn.

■ P. A. Coveney, formerly of University Computing Co., has been elected president of Computers Inc., a subsidiary of Mathematical Engineering Assoc., in Dallas, Tex.

■ Brian W. Pollard has been named manager of engineering for RCA EDP, Cherry Hill, N.J. He was previously manager of product planning.

■ David J. Waks, director of Applied Data Research's research computing center, has been chosen to head the company's new computer control systems div., in Princeton, N.J.

■ Dr. Franz L. Alt has been named director, computer applications, American Institute of Physics, New York City.

■ Theodore Rich of Lincoln Income Life Insurance Co., Louisville, Ky., has been elected international president of the Data Processing Management Assn.

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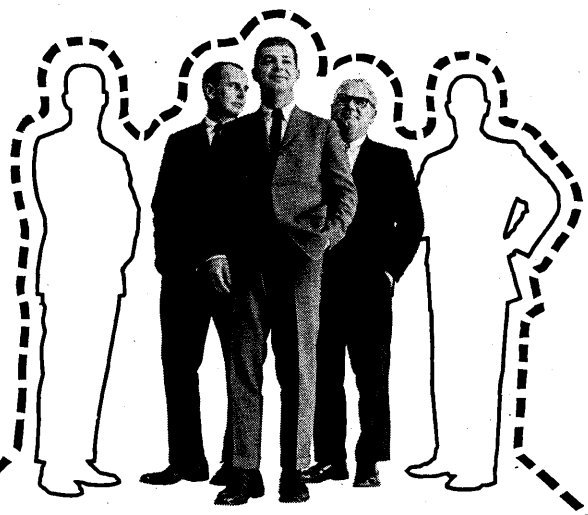

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the forum

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

A SIMPLE TEST

There is one simple test which can be applied to derive answers to questions such as that posed in I. A. Macleod's letter (June, p. 14). He asked why the major computer manufacturers don't include dynamic array bounds, in Fortran, which would be helpful in problems requiring optimum use of core storage. This test (which can be applied to hundreds of other similar suggestions for obvious improvements intended to benefit the user) is simply "Would the over-all growth rate of revenues (or earnings) of the manufacturer be helped or hindered by this improvement?"

Obviously, in this case, the improvement suggested by Mr. Macleod would tend to reduce the core size needed at an installation, or to reduce the running time of some problems, thus reducing the revenues of the manufacturer. As long as a strong marketing organization, using powerful selling techniques, can keep inefficient hardware and software on the customers' premises, there is no need for the large manufacturer to provide a better product.

For an example of this situation in hardware, consider the process of updating a magnetic tape. The number of tape drives needed at an installation could be cut drastically, and the main memory cycles stolen in copying the data from one channel to the other could be greatly reduced, if a record could be rewritten in the middle of a tape, without having to tie up two drives and part of the memory while copying all the rest of the tape. (Think that over!)

Many people in the industry are unaware that it is even possible to rewrite a single record on a tape. The Atlas tapes, DEC tapes, the early Datatron tapes, and others, all have this feature. What prevents this operation in the majority of tape drives now in use is a design feature which provides that the new gap which follows a rewritten record will usually erase about 0.1" of the following record.

It may be claimed that, anyway, it is "unsafe" to rewrite single blocks, and that one might clobber a tape for which no copy exists. This was not a serious problem, in my experience working with such tapes. Furthermore, the present trend toward direct on-line updating of removable disc packs will pose exactly the same situation, and ways will be found to operate the systems "safely" in this regard.

Many more examples could be quoted of inefficiencies remaining in hardware or software, or indeed of actual *retrogression* of capabilities. (Didn't several manufacturers reduce word lengths from 36 bits to 32 bits a few years ago?) I personally sat through a memorable briefing given to systems development managers by a visiting corporate staff economist, when I was working for a large international manufacturer of computers, in 1962. He pointed out, with charts, correlations, and projections, that our company's fabulous growth rate was seriously threatened by the continual improvements being made in machine speeds and power from the first to the second generations. These improvements in performance were far outpacing all the growth in applications and installations which the salesmen's productivity could be projected to generate. Although no one present there came right out and verbalized the thought, it happens that the development and maintenance of inefficient software concepts (such as the lack of flexibility mentioned by Mr. Macleod) is one of the most effective ways of preserving the growth in machine-time consumption. This is particularly so if the software is provided "free," and if the machine architecture is so complicated that no user can afford to develop his own software. (How much time does your third-generation operating system generation process take? Why *should* it take more than a few seconds, in modern computers? How often do you have to repeat the system-generation process, and why? Who pays for this machine time?)

If we further note that many "independent" software houses derive a great deal of their business from turning out software components for the big manufacturers, it seems clear that no software house which hopes to remain successful could wisely dare to let it be known that it produces and sells efficient versions of software (such as a fast Fortran) directly to the users.

A whole issue of this magazine could quickly be filled, I'm sure, with reports from readers of obvious and glaring inefficiencies and limitations in today's software, hardware, and documentation packages, which tend to increase the user's rental or purchase costs to get a given amount of net work done. Evidently the computer industry has completely forsaken the original needs (and dreams) of providing an efficient tool for science and business, and has now turned into another giant industry, like automobiles. There are many parallels which could be adduced, but the trend seems clear enough. (Why *must* collating sequences change so often? Is this a "planned obsolescence" factor?)

Perhaps a few other readers could be encouraged to ventilate their views on this subject. —D. L.

all magnetic tape is not alike

Some of it costs more than MAC tape

Of course there are different levels of quality, but we're talking about price differences for the highest quality level. Specifically, why does one brand of tape cost as much as 40% more than the comparable MAC Tape?

Is the secret in the word "comparable"? No, because when we say "comparable," we mean exactly what we say—that the two perform exactly the same way on your machines.

Is the difference in methods of manufacture? Frankly, we doubt it, because we have to use some pretty expensive methods to achieve perfection. We grind our coating material longer than anybody else, for instance. And that costs more. We've developed our own tape washers—build them in our own plant—to make sure the tape that goes on MAC reels is clean—not almost, but absolutely. Our testing equipment is the best that money can buy. Nobody uses finer raw materials, because there aren't any finer. And so on.

We figured out how much it costs to make tape this way, added the costs of selling and a small but fair profit, and that's our price. How come it's lower?

We don't know, and neither do thousands of computer managers who specify MAC Tape. They just appreciate the difference. Just last month, one company saved $170,000 by writing our name on an order. You don't have to save that much to be a hero, do you? If you want details on our painstaking, expensive methods of making tape before you switch, we've written a booklet that'll tell you all you want to know. If you're ready to be a hero now, a salesman will call if you'll but give the word. Either way, just write MAC Panel Co., Box 5027, High Point, N. C. Our motto: Heroes made to order.

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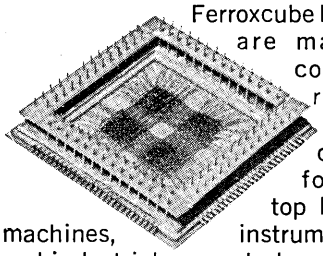

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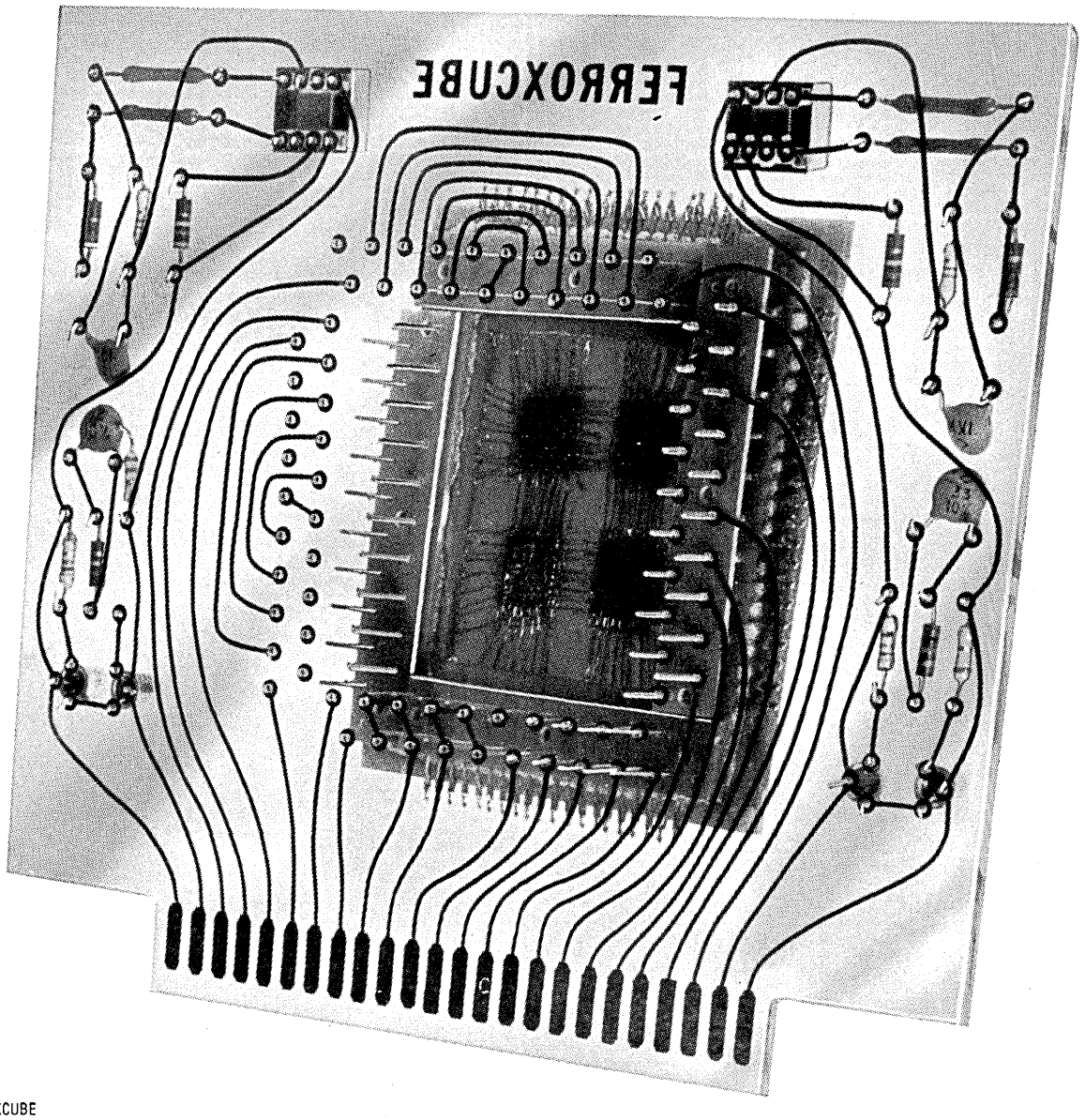

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